Acta Phytopathologica et Entomologica Hungarica 57 (2022) 2, 106–114
DOI: 10.1556/038.2022.00156

AKADÉMIAI KIADÓ

A survey of jumping plant-lice (Hemiptera: Psylloidea) overwintering on conifers in Hungary

Dominika Bodnár[1], Orsolya Viczián[1*], András Juhász[2], József Fodor[1], Péter G. Ott[1] and Emese Mergenthaler[1]

[1] Plant Protection Institute, Centre for Agricultural Research, Budapest, Hungary

[2] Department of Integrated Plant Protection, Plant Protection Institute, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary

RESEARCH ARTICLE

Received: July 24, 2022 • Revised manuscript received: August 28, 2022 • Accepted: August 30, 2022
Published online: September 12, 2022

ABSTRACT

Some jumping plant-lice species are economically important due to their capacity as vectors of phytopathogenic bacteria, for example phytoplasmas. Previous studies have identified 80 jumping plant-louse species from Hungary; however, little is known about their occurrence during winter. To extend our knowledge of overwintering sites of jumping plant-lice in Hungary, we sampled them from conifers in various regions of the country. One of our main objectives was to find *Cacopsylla pruni* (Scopoli, 1763), the vector of '*Candidatus* Phytoplasma prunorum' during winter.

The period of this study extended from 2014 to 2020 in the winter months. Insects were collected at 18 sampling sites from Borsod-Abaúj-Zemplén county to Somogy county, located at Alsótekeres, Balatonvilágos, Boldogkőváralja, Budakeszi, Fenyőfő, Gyöngyöspata, Kecskemét, Martonvásár, Mátra Mountain, Nagykovácsi, Nagyszakácsi, Páty, Piliscsaba, Somogytúr, Soroksár, Sóskút and Verpelét.

A total of 1,600 jumping plant-louse specimens belonging to 20 species and three families (Psyllidae, Aphalaridae and Triozidae) were collected and identified during the study. In the case of plum psyllid (*C. pruni*) four shelter sites were identified as new records for Hungary.

The most common species were *Trioza remota*, *Cacopsylla melanoneura*, *Trioza urticae*, *Bactericera albiventris*, *C. pruni* and *Cacopsylla crataegi*.

* Corresponding author. E-mail: viczian.orsolya@atk.hu

KEYWORDS

Psylloidea, *Cacopsylla pruni*, conifers, overwintering shelter plants, Hungary

INTRODUCTION

Jumping plant-lice (Hemiptera, Psylloidea) are small plant sap sucking insects, feeding mainly on woody plants and leaves of herbaceous plants and shrubs. Adults of many jumping plant-louse species migrate from host plants to conifers as shelter plants for overwintering (Čermák and Lauterer, 2008; Hodkinson, 2009; Gallinger and Gross, 2018). After egg hatching larvae go through five instars to adults. Jumping plant-lice typically feed on a single host plant species (monophagous) or on a few related ones (oligophagous) (Ossiannilsson, 1992). Amongst these insects many species are multivoltine (mostly in tropical to warm temperate regions), while others exhibit univoltine or bivoltine life cycles (Brambila and Hodges, 2008).

Jumping plant-lice include about 4,000 described species so far (Burckhardt and Queiroz, 2020). Some species cause serious economic losses to crop plants (Hodkinson, 2009), either by phloem feeding and honeydew production or indirectly by transmission of phytopathogenic agents like phytoplasmas. For example, the 16SrX or apple proliferation group phytoplasmas are transmitted exclusively by jumping plant-lice from the genus *Cacopsylla* (Jarausch et al., 2019). These pathogens cause serious damage on several fruit trees in Europe and North America (Tedeschi et al., 2002; Frisinghelli et al., 2000; Carraro et al., 1998; Grbic, 1974; Mergenthaler et al., 2017).

To date, 80 species of Psylloidea have been reported from Hungary (Kontschán et al., 2020).

In most cases jumping plant-louse species were collected from their host plants (e. g. Ripka, 2010; Kontschán et al., 2021; Ripka et al., 2018; Ripka and Csóka, 2016; Ripka, 2012). Although Kontschán and Ripka (2019) collected jumping plant-lice also from their winter shelter plants, little is known about the overwintering sites of most jumping plant-louse species in Hungary. Therefore, the objective of this study was to survey coniferous trees during winter for evidence of jumping plant-lice. A better understanding of the Hungarian jumping plant-lice populations provides greater knowledge about their biology, distribution and abundance.

MATERIAL AND METHODS

Jumping plant-lice were collected from conifers in winter months from 2014 to 2020 from 18 different localities in Hungary including the oldest pine stand in Hungary (Fenyőfő) (Fig. 1 and Table 1).

One of our aims was to determine overwintering sites of *Cacopsylla pruni* (Scopoli, 1763) as no data are currently available for Hungary. Insect captures were carried out in various pure and mixed coniferous forests. Because there are very few coniferous forests in our country, insects were also collected from forestry nurseries, botanical gardens and individual conifer trees. A diverse range of habitats was sampled with different altitudes and vegetation types.

Insect samples were collected from the following conifer species: Norway spruce (*Picea abies*), Scots pine (*Pinus sylvestris*), Serbian spruce (*Picea omorika*), Nordmann fir (*Abies*

Fig. 1. Overwintering sites of jumping plant-lice in Hungary. Blue and orange spots indicate known and newly discovered localities, respectively

nordmanniana), giant redwood (*Sequoiadendron giganteum*), Atlas cedar (*Cedrus atlantica*), common yew (*Taxus baccata*), Douglas fir (*Pseudotsuga menziesii*), European black pine (*Pinus nigra*), blue spruce (*Picea pungens*), savin juniper (*Juniperus sabina*), and Leyland cypress (*Cupressocyparis leylandii*).

Insects were collected with an insect net attached to a five-meter telescopic handle or with a garden leaf suction machine equipped with a flexible suction pipe attached to a spliced bamboo rod that can be adjusted to the height of trees (up to 10 m in height). Collected material was preserved in 70% ethanol. Species identification was carried out under an Olympus SZ40 stereomicroscope according to Ossiannilsson (1992), and Hodkinson and White (1979), and their classification/nomenclature was performed according to Burckhardt et al. (2021).

RESULTS

Described in Table 2, a total of 1,600 jumping plant-louse specimens belonging to 20 species and three families (Psyllidae, Aphalaridae and Triozidae) were collected and identified during the study.

The most common species were *Trioza remota* (972 specimens), *Cacopsylla melanoneura* (221), *Trioza urticae* (174), *Bactericera albiventris* (106), *Cacopsylla pruni* (25), and *Cacopsylla crataegi* (17).

Special attention was paid to the plum psyllid (*C. pruni*) that was found in Mátra Mountain, Gyöngyöspata, Nagyszakácsi and in the Budakeszi arboretum on Norway spruce and Douglas fir.

Thirteen of the collected jumping plant-louse species are known to feed on woody plants, while 7 species on herbaceous hosts. Some species feeding on woody host plants have a great importance as vectors of phytoplasmas: *Cacopsylla pruni*, *Cacopsylla melanoneura* (Foerster, 1848), *Cacopsylla pyricola* (Foerster, 1848), *Cacopsylla pyrisuga* (Foerster, 1848).

The following species were identified: *Aphalara avicularis* (Ossiannilson, 1981), *Aphalara calthae* (Linnaeus, 1761), *Aphalara polygoni* (Foerster, 1848), *Bactericera albiventris* (Foerster, 1848), *Bactericera curvatinervis* (Foerster, 1848), *Bactericera femoralis* (Foerster, 1848),

Table 1. Collecting localities, methods of collections and date of collections

Locality	County	GPS coordinates	Altitude	Method	Date of collection
Alsótekeres	Somogy	N46.956295 E18.187529	167 m	net	27/02/2017
Balatonvilágos	Somogy	N46.97982 E18.165774	144 m	net	27/02/2017
Boldogkőváralja	Borsod-Abaúj-Zemplén	48°21′26″N 21°14′19″E	230 m	net	10/03/2017
Budakeszi	Pest	N47.525943 E18.873417	290 m	GLSM*	5/02/2020
Fenyőfő	Győr-Moson-Sopron	N47.354385 E17.762146	275 m	net	19/01/2017
Gyöngyöspata	Heves	N47.839356 E19.727127	250 m	GLSM*	25/02/2020
				net	
Kecskemét	Bács-Kiskun	N46.938928 E19.569771	130 m	net	5/02/2018
Martonvásár	Fejér	47°19′14″N 18°46′53″E	120 m	net	January 2014 and February 2015
Mátra Mountain	Heves and Nógrád	N47.82830 E.19.96375, N47.89482 E.19.86206, N47.90099 E19.94519, N47.89583 E19.95316	365 m	GLSM*	4/03/2019, 20/02/2020 and 25/02/2020
			770 m	net	
			650 m		
			580 m		
Nagykovácsi	Pest	N47.545278 E18.934167	310 m	net	20/12/2015
Nagykovácsi- Júlia-major		N47.54786 E18.93470	316 m	net	20/12/2015
Nagyszakácsi	Somogy	N46.4897 E17.31956	136 m	net	13/03/2020
Páty	Pest	N47.507691 E18.850542	265 m	net	January 2016
Piliscsaba	Pest	N47.617277 E18.891953	290 m	net	29/02/2020
Somogytúr	Somogy	N46.724453 E17.797446	180 m	net	beginning of March, 2015
Soroksár	Pest	N47.40053 E19.15433	109 m	net	19/01/2018
Sóskút	Pest	N47.439378 E18.849831	140 m	net	winter months in 2015, 2016, 2018 and 2019
Verpelét	Heves	N47.801022 E.20.196172	190 m	net	January 2018

*GLSM: garden leaf suction machine

Table 2. Jumping plant-lice species collected at overwintering sites in Hungary during winter months from 2014 to 2020

Collection sites	Plant species	Jumping plant-lice species collected (number of specimens in brackets)	Date of collection
Alsótekeres	Serbian spruce	*A. avicularis* (1), *A. polygoni* (5)	27/02/2017
	Nordmann fir	*B. albiventris* (2), *C. melanoneura* (1), *T. remota* (2)	
	savin juniper	*T. remota* (4), *T. urticae* (1)	
	blue spruce	*B. albiventris* (1), *C. melanoneura* (1), *T. urticae* (1), *T. remota* (7)	
Balatonvilágos	Norway spruce	*A. avicularis* (1), *B. albiventris* (3), *C. melanoneura* (2), *T. remota* (22), *T. urticae* (6)	27/02/2017
	Leyland cypress	*T. urticae* (4), *T. remota* (5)	
	Scots pine	*A. polygoni* (1), *B. albiventris* (1), *C. melanoneura* (1), *T. remota* (9)	
Boldogkőváralja	Scots pine	*A. avicularis* (1), *A. polygoni* (3), *T. remota* (4)	10/03/2017
Budakeszi arborétum	Norway spruce	*B. albiventris* (3), *C. pyricola* (1), *T. remota* (16), *T. urticae* (1)	05/02/2020
	Douglas-fir	*A. avicularis* (1), *A. calthae* (1), *A. polygoni* (1), *B. albiventris* (2), *C. melanoneura* (5), *C. pruni* (2), *T. remota* (28), *T. urticae* (1)	
	giant redwood	*C. melanoneura* (1)	
	Serbian spruce	*C. melanoneura* (3), *T. remota* (7), *B. albiventris* (1)	
	Atlas cedar	*T. remota* (1)	
	Leyland cypress	*T. urticae* (1)	
	Scots pine	*A. avicularis* (1), *B. albiventris* (2), *C. melanoneura* (7), *T. remota* (18)	
Fenyőfő	Scots pine	*B. albiventris* (1), *C. melanoneura* (5), *T. urticae* (82)	19/01/2017
Gyöngyöspata	Norway spruce	*B. albiventris* (4), *C. melanoneura* (1), *C. pruni* (2), *T. remota* (12), *T. rhamni* (1), *T. urticae* (4)	25/02/2020
Kecskemét	Scots pine	*B. albiventris* (12), *T. remota* (31), *T. urticae* (2)	05/02/2018
Martonvásár	Norway spruce	*T. remota* (1)	02/2015
	Scots pine	*T. remota* (1)	01/2014
Mátra Mountain	Norway spruce	*A. calthae* (6), *B. albiventris* (8), *B. curvatinervis* (1), *B, femoralis* (1), *C. crataegi* (4), *C. melanoneura* (18), *C. peregrina* (4), *C. pruni* (12), *C. pyrisuga* (4), *C. rhamnicola* (2), *T. apicalis* (2), *T. remota* (104), *T. rotundata* (1), *T. rhamni* (2), *T. urticae* (10)	04/03/2019

(continued)

Table 2. Continued

Collection sites	Plant species	Jumping plant-lice species collected (number of specimens in brackets)	Date of collection
		A. avicularis (2), *A. calthae* (1), *B. albiventris* (12), *C. crataegi* (5), *C. melanoneura* (108), *C. pruni* (8), *C. pyrisuga* (1), *T. remota* (199), *T. urticae* (22)	20/02/2020
	European black pine	*C. crataegi* (2), *C. melanoneura* (24), *C. pyricola* (2), *C. rhamnicola* (2), *T. remota* (40)	04/03/2019
	Scots pine	*B. albiventris* (2), *C. melanoneura* (4), *T. remota* (141), *T. urticae* (5),	04/03/2019
		A. avicularis (1), *A. polygoni* (1), *B. albiventris* (34), *C. crataegi* (2), *C. melanoneura* (6), *T. neglecta* (1), *T. remota* (34), *T. urticae* (2)	25/02/2020
Nagykovácsi	Norway spruce	*T. remota* (7)	20/12/2015
Nagykovácsi-Júlia-major	Norway spruce	*A. polygoni* (10), *B. albiventris* (1), *C. crataegi* (1), *C. melanoneura* (4), *T. urticae* (8), *T. remota* (87)	20/12/2015
	common yew	*T. urticae* (1)	
Nagyszakácsi	Norway spruce	*C. melanoneura* (1), *C. pruni* (1)	13/03/2020
Páty	Scots pine	*B. albiventris* (8), *C. crataegi* (1), *T. remota* (17), *T urticae* (1)	01/2016
Piliscsaba	Norway spruce	*B. albiventris* (1), *A. calthae* (1)	29/02/2020
Somogytúr	Norway spruce	*T. urticae* (1)	03/2015
	savin juniper	*C. melanoneura* (1)	
	Scots pine	*A. polygoni* (1), *C. melanoneura* (2), *T. urticae* (1), *T. remota* (44)	
Soroksár	European black pine	*A. polygoni* (1), *B. albiventris* (1), *C. melanoneura* (2), *T. urticae* (3), *T. remota* (8)	19/01/2018
	savin juniper	*T. remota* (1)	
	Norway spruce	*A. polygoni* (1), *T. remota* (1)	
Sóskút	Scots pine	*T. urticae* (2)	winter months 2016
		A. polygoni (1), *B. albiventris* (1), *C. melanoneura* (3), *T. remota* (23), *T. urticae* (2)	winter months 2018
		C. melanoneura (1), *T. remota* (9), *T. urticae* (2)	winter months 2019
	Norway spruce	*B. albiventris* (1), *T. urticae* (1), *T. remota* (4),	winter months 2015
Verpelét	Scots pine	*A. polygoni* (2), *B. albiventris* (5), *C. melanoneura* (14), *C. crataegi* (2), *C. saliceti* (3), *T. remota* (88), *T. urticae* (2)	01/2018

Table 3. Jumping plant-louse species found on overwintering/shelter plant species during winter months from 2014 to 2020

Overwintering/ shelter plant species	Number of collected jumping plant-louse species per plant species
Serbian spruce	*5 (A. avicularis, A. polygoni, C. melanoneura, T. remota, B. albiventris)*
Nordmann fir	*3 (A. albiventris, C. melanoneura, T. remota)*
savin juniper	*3 (T. remota, T. urticae, C. melanoneura)*
blue spruce	*4 (B. albiventris, C. melanoneura, T. urticae, T. remota)*
Norway spruce	*18 (A. avicularis, B. albiventris, C. melanoneura, T. remota, T. urticae, C. pyricola, C. pruni, T. rhamni, A. polygoni, C. crataegi, A. calthae, B. curvatinervis, B. femoralis, C. peregrina, C. pyrisuga, C. rhamnicola, T. apicalis, T. rotundata,)*
Leyland cypress	*2 (T. urticae, T. remota)*
Scots pine	*9 (A. polygoni, B. albiventris, C. melanoneura, T. remota, A. avicularis, T. urticae, C. crataegi, T. neglecta, C. saliceti)*
Douglas fir	*7 (A. avicularis, A. calthae, A. polygoni, B. albiventris, C. melanoneura, T. remota, T. urticae)*
giant redwood	*1 (C. melanoneura)*
Atlas cedar	*1 (T. remota)*
common yew	*1 (T. urticae)*
European black pine	*8 (C. crataegi, C. melanoneura, C. pyricola, C. rhamnicola, T. remota, A. polygoni, B. albiventris, T. urticae)*

Cacopsylla crataegi (Schrank, 1801), *Cacopsylla melanoneura*, *Cacopsylla peregrina* (Foerster, 1848), *Cacopsylla pruni* (Scopoli, 1763), *Cacopsylla pyricola* (Foerster, 1848), *Cacopsylla pyrisuga*, *Cacopsylla rhamnicola* (Scott, 1876), *Cacopsylla saliceti* (Foerster, 1848), *Trioza apicalis* (Foerster, 1848), *Trioza neglecta* (Loginova, 1978), *Trioza remota* (Foerster, 1848), *Trioza rhamni* (Schrank, 1801), *Trioza rotundata* (Flor, 1861) and *Trioza urticae* (Linnaeus, 1758).

The number of jumping plant-louse species collected from a certain shelter plant species are presented in Table 3.

DISCUSSION

Jumping plant-lice collected on conifers in Hungary was dominated by *Trioza* and *Cacopsylla* species in agreement with literature data (Ripka et al., 2018 and references therein, Kontschán et al., 2020). Among the *Cacopsylla* species found, *C. pyricola* (Tedeschi and Alma, 2004), *C. pyrisuga* (Grbic, 1974), *C. melanoneura* (Tedeschi and Alma, 2004; Frisinghelli et al., 2000; Tedeschi et al., 2002) and *C. pruni* (Carraro et al., 1998; Mergenthaler et al., 2017) play a pivotal role in transmission of phytoplasmas associated with serious plant diseases.

In this study we recorded 20 out of the 80 jumping plant-louse species reported from Hungary. The new and the previously reported overwintering sites are shown in Fig. 1. One species, *Trioza neglecta* is known as a non-native species in Hungary (Lauterer and Janiček, 1990; Kontschán et al., 2020).

Although *C. melanoneura* was reported to overwinter at Kék in Hungary (Kontschán and Ripka, 2019), we found it at ten new localities.

Four overwintering sites of *C. pruni*, the vector of '*Candidatus* Phytoplasma prunorum' were identified: Mátra Mountain, Budakeszi arboretum, Gyöngyöspata and Nagyszakácsi.

We also found 14 new overwintering sites of *T. urtice* which was previously known only from Budapest, Martonvásár and Kék (Kontschán and Ripka, 2019).

Prior to this study there were no known overwintering sites in Hungary for the following 14 species: *A. avicularis*, *A. calthae*, *A. polygoni*, *C. rhamnicola*, *C. saliceti*, *B. curvatinervis*, *B. albiventris*, *B. femoralis*, *T. neglecta*, *T. remota*, *T. rhamni*, and *T. rotundata*. New overwintering sites (Mátra Mountain) and plant (Norway spruce) was found for *C. peregrina*, *C. pyricola*, *C. pyrisuga* and *T. apicalis.*

The overwintering sites of jumping plant-lice are relatively poorly studied in Hungary, and collection data provided in this work includes additional information about the overwintering sites of jumping plant-louse species in Hungary, which broadens our knowledge of the regional jumping plant-lice fauna.

ACKNOWLEDGEMENTS

Thanks for the participation of Emese Kiss Tibenszkyné, Szilvia Orosz (National Food Chain Safety Office, Food Chain Safety Laboratory Directorate, Plant Health Diagnostic National Reference Laboratory), Balázs Kiss and Gergely Tholt (Plant Protection Institute, Centre of Agricultural Research, Department of Zoology) for their participation in insect collections. Thanks to András Koltay (Forest Research Institute, University of Sopron) and Sándor Lukács (Budakeszi Arboretum) for their permit and technical support.

This project was supported in 2019 and 2020 by (NKFIH) K 128838.

REFERENCES

Brambila, J. and Hodges, G.S. (2008). *Bugs (Hemiptera): Psylloidea (Jumping plant lice) encyclopedia of entomology*, 2nd ed, Springer, pp. 591–611.

Burckhardt, D. and Queiroz, D.L. (2020). Neotropical jumping plant-lice (Hemiptera, Psylloidea) associated with plants of the tribe Detarieae (Leguminosae, Detarioideae). *Zootaxa*, 4733(1): 1–73.

Burckhardt, D., Ouvard, D., and Precy, D.M. (2021). An updated classification of the jumping plant-lice (Hemiptera: Psylloidea) integrating molecular and morphological evidence. *European Journal of Taxonomy*, 736: 137–182.

Carraro, L., Osler, R., Loi, N., Ermacora, P., and Rafetti, E. (1998). Transmission of European stone fruit yellows phytoplasma by *Cacopsylla pruni*. *Journal of Plant Pathology*, 80: 233−239.

Čermák, V. and Lauterer, P. (2008). Overwintering of psyllids in South Moravia (Czech Republic) with respect to the vectors of the apple proliferation cluster phytoplasmas. *Bulletin of Insectology*, 61: 147–148.

Frisinghelli, C., Delaiti, L., Grando, M.S., Forti, D., and Vidimiane, M. (2000). *Cacopsylla costalis* (Flor, 1861), as a vector of apple proliferation in Trentino. *Journal of Phytopathology*, 148: 425–431.

Gallinger, J. and Gross, J. (2018). Unraveling the host plant alternation of *Cacopsylla pruni* – adults but not nymphs can survive on conifers due to phloem/xylem composition. *Frontiers in Plant Science*, 9(484): 1–12.

Grbic, V. (1974). Some injurious species of the family Psyllidae in pear orchards. *Zastita Bilja*, 25: 121–131.

Hodkinson, I.D. (2009). Life cycle variation and adaptation in jumping plant lice (Insecta: Hemiptera: Psylloidea): a global synthesis', *Journal of Natural History*, 43(1): 65—179.

Hodkinson, I.D. and White, I.M. (1979). Homoptera (Psylloidea). In: Watson, A. (Ed.), *Handbooks for the identification of British Insects, II(5a)*, Royal Entomological Society of London, London SW7 5HU, pp. 1–108.

Jarausch, B., Tedeschi, R., Sauvion, S., Gross, J., and Jarausch, W. (2019). Psyllid vectors. In: Bertaccini, A., Weintraub, P.G., Rao, G.P., and Mori, N. (Eds.), *Phytoplasmas: plant pathogenic bacteria – II. Transmission and management of phytoplasma – associated diseases*. Springer Nature, Singapore, pp. 1–258.

Kontschán, J., Kiss, E., and Ripka, G. (2020). Új adatok levélbolhák (Insecta: Psylloidea) hazai előfordulásaihoz. [New data to occurrences of the Hungarian jumping plant lice (Insecta: Psylloidea)]. *Növényvédelem*, 81(5): 197–202. (in Hungarian).

Kontschán, J. and Ripka, G. (2019). Új adatok egyes levélbolhafajok (Insecta: Psylloidae) telelőhelyet biztosító növényeihez városi élőhelyeken. [New data on the overwintering plants of some jumping plant-lice species (Insecta:Psylloidea)]. *Növényvédelem*, 80(6): 261–265. (in Hungarian).

Kontschán J., Ripka G., and Kiss, B. (2021). Jumping plant lice (Hemiptera, Psylloidea) in rest stops of Hungarian highways. *Acta Phytopathologica et Entomologica Hungarica*, 56(1): 69–79.

Lauterer, P. and Janiček, R. (1990). *Trioza neglecta* Logina, Magyarország és Bulgária faunájára új levélbolha (Homoptera, Psylloidea). [*Trioza neglecta* Logina, a new species for the fauna of Hungary and Bulgaria (Homoptera, Psylloidea)]. *Folia Entomologica Hungarica*, 51: 163–165.

Mergenthaler, E., Kiss, B., Kiss, E., and Viczián, O. (2017). Survey on the occurrence and infection status of *Cacopsylla pruni*, vector of European stone fruit yellows in Hungary. *Bulletin of Insectology*, 70(2): 171–176.

Ossiannilsson, F. (1992). *The Psylloidea (Homoptera) of Fennoscandia and Denmark*. Fauna Entomologica Scandinavica, Leiden, New York, Köln, Vol. 26, pp. 1–347.

Ripka, G. (2010). *Levélbolhák. (Psylloids)*. Agroinform Kiadó, Budapest, pp. 1–104.

Ripka, G. (2012). New psyllid records from Hungary (Hemiptera: Psylloidea). *Acta Phytopathologica et Entomologica Hungarica*, 47(1): 75–78.

Ripka, G. and Csóka, Gy. (2016). New records of jumping plant-lice from Hungary (Hemiptera: Psylloidea). *Acta Phytopathologica et Entomologica Hungarica*, 51(2): 219–227.

Ripka, G., Csóka, Gy., and Érsek, L. (2018). Recent data to the jumping plant-lice fauna of Hungary (Hemiptera: Psylloidea). *Acta Phytopathologica et Entomologica Hungarica*, 53(1): 1–16.

Tedeschi, R. and Alma, A. (2004). Transmission of apple proliferation phytoplasma by *Cacopsylla melanoneura* (Homoptera:Psylloidea). *Journal of Economic Entomology*, 97(1): 8–13.

Tedeschi, R., Bosco, D., and Alma, A. (2002). Population dynamics of *Cacopsylla melanoneura* (Homoptera: Psyllidae), a vector of apple proliferation phytoplasma in Northwestern Italy. *Journal of Economic Entomology*, 95(3): 544–551.