

Aphid species (Hemiptera, Sternorrhyncha: Aphididae) alien and invasive to Lithuania

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ABSTRACT

The study aims at providing a list of the Aphididae alien to Lithuania, including comments on their invasiveness. A total of 42 species and one subspecies recently (2001-2010) added to the species list of aphid fauna of Lithuania have been taken into account. Two of them – *Aphis (Bursaphis) holoenotherae* Rakauskas, 2007 and *Brachycaudus divaricatae* Shaposhnikov, 1956 – appear to be invasive species based on the criteria given by ESTOUP & GUILLEMAUD (2010). In consequence, the list of the Aphididae of Lithuania has been extended to include 343 taxa.

KEY WORDS: Aphididae, Lithuania, invasive species, alien species

INTRODUCTION

Biological invasions might have an enormous effect on public health, agriculture and local biodiversity (MOONEY & HOBBS, 2000; SAX *et al.*, 2005; LOCKWOOD *et al.*, 2005). Therefore, studying the causes and mechanisms of biological invasions appears to be of special interest among biologists (CADOTTE *et al.*, 2006; FACON *et al.*, 2006). This has resulted in the emergence of local and regional lists, databases and inventories of alien and/or invasive species (COEUR D'ACIER *et al.*, 2010, <http://www.invasivespeciesinfo.gov>; <http://www.invasive>.

org; <http://www.issg.org/database/welcome>; <http://tncinvasives.ucdavis.edu>). Furthermore, specialised journals (e.g. *Biological Invasions*) have been launched. The global changes have stimulated species distribution and invasiveness processes, making the problem of biological invasions even more important. In Lithuania, the national database of invasive species was established in 2002 (<http://www.ku.lt/lisd/index.html>), but appeared to be of minor informative value due to the absence of the properly organised expert team. Since the appearance of the database, little (if any) information has been added; the most recent information featured in the database being from the year 2001 and mostly concerning plants and fungi.

The aim of this study is to discuss the list of recent (2001-2010) additions to the aphid fauna of Lithuania and ponder on the possible invasiveness of alien species.

MATERIAL AND METHODS

The present study has been based on the reference data published since the last checklist of Lithuanian aphid species (RAKAUSKAS *et al.*, 1992). The data has mostly been that provided by Lithuanian aphid researchers, as well as the Fauna Europaea database (NIETO NAFRIA *et al.*, 2004) and the Host Plant Catalogue of Aphids (Palearctic region) (HOLMAN, 2009). In consequence, 20 reference sources have been used. Another source of information was the unpublished material available at the Department of Zoology of the Vilnius University based on the recent faunistic collections and experimental aphid rearing studies of certain species.

While pondering on the possible invasiveness of aphid species alien for Lithuania, the definition of invasive species by ESTOUP & GUILLEMAUD (2010) has been preferred. The authors consider an “invasive population to be a set of individuals that has been introduced into a new area, in which these individuals have established themselves, increased in numbers and spread geographically”. Thus, for the purpose of this study, an aphid species is taken for an invasive one if it meets the following characteristics. 1) It is apparently alien for the fauna of Lithuania; 2) it has been established in Lithuania, the repetitive findings being evidenced; 3) it has been reported as a numerous one in three years at least. Conformity of every species to these particular requirements is given in Table 1.

The aphid material has been deposited at the Department of Zoology, Vilnius University.

Table 1. List of aphid species alien to Lithuania (in alphabetic order), based on the reference data and original data (RAKAUSKAS, unpubl.), with available information on their invasiveness

Species name*	Reference	Invasiveness		
		Alien	Established	Numerous
<i>Aphis euphorbiae</i> Kaltenbach, 1843	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Aphis hederæ</i> Kaltenbach, 1843	KUDIRKAITĖ-AKULIENĖ & RAKAUSKAS 2009; RAKAUSKAS, unpubl.	?	+	+
<i>Aphis hieracii</i> Schrank, 1801	RAKAUSKAS <i>et al.</i> , 2008; RAKAUSKAS, unpubl.	?		
<i>Aphis holoenotheræ</i> Rakauskas, 2007	RAKAUSKAS, 2004, 2006, 2007, 2008; RAKAUSKAS <i>et al.</i> , 2008; RAKAUSKAS & TRUKŠINAITĖ, 2011; RAKAUSKAS <i>et al.</i> , 2011; RAKAUSKAS, unpubl.	+	+	+
<i>Aphis nepetae</i> Kaltenbach, 1843	JURONIS & RAKAUSKAS, 2004; RAKAUSKAS, unpubl.	?	+	-
<i>Aphis psammophila</i> Szelegiewicz, 1967	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Aphis valerianæ</i> Cowen ex Gillette & Baker, 1895	RAKAUSKAS & TRUKŠINAITĖ, 2011	+	-	-
<i>Aulacorthum knautiae</i> Heie, 1960	RAKAUSKAS, unpubl.	?	?	?
<i>Brachycaudus divaricatae</i> Shaposhnikov, 1956	RAKAUSKAS, 2004; RAKAUSKAS & CICHOCKA, 2005; RAKAUSKAS & JURONIS, 2006; RAKAUSKAS & TURČINAVIČIENĖ, 2006; RAKAUSKAS <i>et al.</i> , 2008; RAKAUSKAS & TRUKŠINAITĖ, 2011; RAKAUSKAS, unpubl.	+	+	+
<i>Chaitophorus mordvilkoii</i> Mamontova ex Szelegiewicz, 1961	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Cinara pinihabitans</i> (Mordvilko, 1895)	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Coloradoa rufomaculata</i> (Wilson, 1908)	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Cryptomyzus maudamanti</i> Guldemon, 1990	BAŠILOVA, 2010	?	?	-
<i>Cryptomyzus ulmeri</i> Börner, 1952	BAŠILOVA & RAKAUSKAS, 2007	?	?	?
<i>Diuraphis calamagrostis</i> (Ossiannilsson, 1959)	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Diuraphis frequens</i> (Walker, 1848)	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Dysaphis leefmansii</i> (Hille Ris Lambers, 1954)	RAKAUSKAS & TRUKŠINAITĖ, 2011	?	-	-
<i>Dysaphis pyri</i> (Boyer de Fonscolombe, 1841)	RAKAUSKAS, 1996, 2004; RAKAUSKAS <i>et al.</i> , 2008; RAKAUSKAS & TRUKŠINAITĖ, 2011; RAKAUSKAS, unpubl.	+	?	+
<i>Dysaphis tulipæ</i> (Boyer de Fonscolombe, 1841)	JURONIS & RAKAUSKAS, 2004	?	-	-
<i>Eulachnus rileyi</i> (Williams, 1911)	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Hydaphias hofmanni</i> Börner, 1950	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Hydaphias molluginis</i> Börner, 1939	RAKAUSKAS, unpubl.	?	-	-
<i>Lachnus roboris</i> (Linnaeus, 1758)	RAKAUSKAS, unpubl.	+	-	-
<i>Laingia psammae</i> Theobald, 1922	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Macrosiphoniella hillerislambersi</i> Ossiannilsson, 1954	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Macrosiphoniella jankei</i> Börner, 1939	RAKAUSKAS <i>et al.</i> , 2008	?	-	-

Species name*	Reference	Invasiveness		
		Alien	Established	Numerous
<i>Macrosiphoniella sejuncta</i> (Walker, 1848)	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Macrosiphoniella tapuskae</i> (Hottes & Frison, 1931)	RAKAUSKAS <i>et al.</i> , 2008; RAKAUSKAS, unpubl.	?	-	-
<i>Macrosiphum ptericolens</i> Patch, 1919	RAKAUSKAS <i>et al.</i> , 2008	+	-	-
<i>Megoura litoralis</i> F.P. Müller, 1952	RAKAUSKAS <i>et al.</i> , 2008	?	+	+
<i>Metopolophium festucae</i> (Theobald, 1917)	RAKAUSKAS <i>et al.</i> , 2008	?	+	+
<i>Myzus ascalonicus</i> Doncaster, 1946	JURONIS & RAKAUSKAS, 2004	?	-	-
<i>Panaphis juglandis</i> (Goeze, 1778)	JURONIS & RAKAUSKAS, 2004; KUDIRKAITĖ-AKULIENĖ & RAKAUSKAS, 2009	+	+	-
<i>Periphyllus singeri</i> (Börner, 1952)	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Schizaphis muhlenbergiae</i> (Phillips & Davis, 1912)	RAKAUSKAS <i>et al.</i> , 2008	+	-	-
<i>Schizolachnus obscurus</i> Börner, 1940	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Smynthuroides betae</i> Westwood, 1849	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Tuberculatus quercus</i> (Kaltenbach, 1843)	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Uroleucon campanulae</i> (Kaltenbach, 1843)	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Uroleucon cichorii leontodontis</i> (Hille Ris Lambers, 1939)	RAKAUSKAS & TRUKŠINAITĖ, 2011	?	-	-
<i>Uroleucon hypochoeridis</i> (Fabricius, 1779)	KUDIRKAITĖ-AKULIENĖ & RAKAUSKAS, 2009	?	-	-
<i>Uroleucon pilosellae</i> (Börner, 1933)	RAKAUSKAS <i>et al.</i> , 2008	?	-	-
<i>Volutaphis schusteri</i> (Börner, 1939)	KUDIRKAITĖ-AKULIENĖ & RAKAUSKAS, 2009; RAKAUSKAS, unpubl.	+	+	?

* Invasive species are featured in bold

RESULTS AND DISCUSSION

As many as 300 aphid species were listed in the last checklist of the Lithuanian Aphidodea (RAKAUSKAS *et al.*, 1992). A subsequent research resulted in featuring 42 additional species and one subspecies (Tab. 1). Out of them, just two species (*A. holoenotherae* and *B. divaricatae*) might be taken for the invasive ones while applying the above given criteria of invasiveness. These species are definitely alien for Lithuania, have already established there and are numerous. *B. divaricatae* is replacing the local species *Brachycaudus cardui* (Linnaeus, 1758) on cherry plums. The latter species has been the most common species of the genus *Brachycaudus* inhabiting cherry plums in Lithuania (RAKAUSKAS, 1983), whilst *B. divaricatae* has been reported as the most common one following its first occurrences from 2002 (RAKAUSKAS & CICHOCKA, 2005; RAKAUSKAS & JURONIS, 2006). Our field studies in 2010 revealed the existence of flourishing populations of *B. divaricatae* in ten out of twenty researched regions of central and eastern

Lithuania. Field studies conducted in 2011 have revealed that up to 70% of cherry plums investigated in the Vilnius district were infested by *B. divaricatae* compared to 10% of *B. cardui*.

Proper evaluation of the invasiveness is impossible without the complex studies of the local invasive populations. Namely, *Dysaphis pyri* (Boyer de Fonscolombe, 1841) is apparently alien for Lithuania, because it has never been recorded here despite a thorough research of pear-inhabiting aphids which has been conducted for decades (RAKAUSKAS, 1978; RAKAUSKAS & STRUMSKYTE, 1982). Although it might seem an apparently established species in Lithuania, showing population outbreaks in several years, (RAKAUSKAS *et al.*, 2008; RAKAUSKAS & TRUKŠINAITĖ, 2011; RAKAUSKAS, unpubl.), the actual overwintering of this species in Lithuania has not been documented as yet in spite of undertaking special research efforts (RAKAUSKAS, 1996; RAKAUSKAS, unpubl.). Therefore, this species does not conform to the invasiveness criterion of being established in Lithuania.

Invasiveness of most aphid species is difficult to evaluate because some species are difficult to find due to their life cycle and ecological features. For example, it is impossible to know whether *Aulacorthum knautiae* Heie, 1960 is really a new species for Lithuania, or it has just been overlooked for decades. Specimens of *Knautia arvensis* – (L.) J.M. Coult. have been thoroughly studied for the presence of macrosiphine aphids in Lithuania in the course of the research focusing on the *Macrosiphum knautiae-silvaticum* complex (RAKAUSKAS, 2003). As a result of the rearing experiments in 2005 (RAKAUSKAS, unpubl.) it was discovered that *A. knautiae* used k-strategic reproductive behaviour producing very few progeny in comparison with *Macrosiphum knautiae* Holman, 1972. Sparse aphid colonies on the undersides of basal leaves of *K. arvensis* plants are not easy to find in the field, and we have failed to find any more samples despite undertaking special efforts to search them out. The same concerns a majority of other species marked with “?” in the “alien” column of Table 1.

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Obce i inwazyjne gatunki mszyc (Hemiptera, Sternorrhyncha: Aphididae) na Litwie

STRESZCZENIE

Praca podsumowuje dziesięcioletnie (2001-2010) badania fauny mszyc Litwy. 42 nowe dla fauny Litwy gatunki i 1 podgatunek z rodziny Aphididae przeanalizowano pod względem ich inwazyjności zgodnie z kryteriami podanymi przez ESTOUPA & GUILLEMAUDA (2010). Dwa gatunki – *Aphis* (*Bursaphis*) *holootherae* Rakauskas, 2007 and *Brachycaudus divaricatae* Shaposhnikov, 1956 – uznano za gatunki inwazyjne. Lista fauny mszyc Litwy powiększyła się do 343 gatunków.

