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Original Paper

SEASONAL DYNAMICS OF THE EXOTIC CHERRY PLUM APHID *BRACHYCAUDUS DIVARICATAE* (HEMIPTERA, STERNORRHYNCHA: APHIDIDAE) ON *PRUNUS CERASIFERA* IN LATVIA, WITH NOTES ON LOCAL PREDATORS

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* In memory of Valentīna Petrova (1941–2015), who did all field research

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Brachycaudus divaricatae *Shaposhnikov has spread in many European countries over the last decades, where it causes intensive damage to* Prunus cerasifera*. Forty* P. cerasifera *trees were monitored in 2013 at Dārziņi, on the outskirts of Riga city (Latvia), to obtain data on seasonal dynamics of an exotic aphid species,* B. divaricatae*.* Brachycaudus divaricatae *was predominant on its only known host plant species,* P. cerasifera*. Other aphid species were found on monitored trees:* Brachycaudus *sp.,* Hyalopterus pruni *(Geoffroy) and* Rhopalosiphum nymphaeae *(L.). The target species,* B. divaricatae *was the most abundant, followed by* H. pruni*, but only B. divaricatae reached the highest infestation level. The latest date of registered* B. divaricatae *colonies was 31 October 2013. Many predatory arthropods belonging to Acari, Araneae, Coleoptera, Diptera, Hymenoptera, and Neuroptera were registered in* B. divaricatae *colonies. The most abundant predators were dipteran larvae from the families Cecidomyiidae and Syrphidae. Predatory dipterans most abundant were only at the beginning of the season (June). Later in the season, the number of spiders increased in aphid colonies, and of 365 spiders, 43.8% were members of the Linyphiidae family. Five ant species were caught in* B. divaricatae *colonies, and* Formica cinerea *Mayr was the most abundant.*

Keywords: *alien hosts, Coccinellidae, Diptera, Formicidae, Neuroptera, natural enemies.*

INTRODUCTION

Brachycaudus divaricatae Shaposhnikov is an aphid species closely related to the species group *Brachycaudus lychnidis/lychnicola/populi* (Rakauskas and Turčinavičienė, 2006; Emmanuelle *et al.*, 2010), which has spread in many European countries over the last decades: Belarus, Bulgaria, Czech Republic; Denmark; Estonia; Latvia; Lithuania; Poland; Romania; Slovakia and territories in Ukraine outside Crimea (Cichocka and Lubiarz, 2003; Rakauskas, 2004; 2011; 2015; Rakauskas and Turčinavičienė, 2006; Bašilova *et al.*, 2012; Wilkaniec and Wilkaniec, 2013; Rakauskas *et al.*, 2015; Havelka *et al.*, 2017). In the original distribution area, the winter host of *B. divaricatae* is *Prunus cerasifera s. l.* (syn. *Prunus divaricata*), and the summer host is *Silene latifolia s. l.* (syn. *Silene alba, Lychnis alba* and *Melandrium album*) (Andreev and Mamontova, 1998). Outside its natural distribution area, *B. divaricatae* is a monoecious holocyclic on *P. cerasifera*, and does not migrate to the principal summer host plants (Rakauskas and Turčinavičienė, 2006; Wilkaniec and Wilkaniec, 2013; Rakauskas, 2015; Havelka *et al.*, 2017).

Since the first identification of *B. divaricatae* in Latvia in 2008 (Bašilova *et al.*, 2012), only preliminary information on damage to *P. cerasifera* in Latvian conditions has been published (Stalažs, 2014). Valentīna Petrova (the first author of the current publication) monitored aphids on 40

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P. cerasifera trees in 2013 to obtain more information on *B. divaricatae* in Latvia. Unfortunately, due to illness, she was not able to continue these studies. She wished to publish the results obtained in 2013 (personal communication to third author in January 2015), but shortly after she passed away. Here we present results obtained by Valentīna Petrova from field studies carried out by her in 2013. In the discussion we also provide additional information from observations about the influence of *B. divaricatae* on its host plant *P. cerasifera* in Latvia.

MATERIALS AND METHODS

In this article, we collected and analysed the results of monitoring conducted by Valentīna Petrova, which were found on her computer after her death. Since Valentīna Petrova consulted with the third author before starting the monitoring, additional information about the methodology was known to the third author, which made it easier to analyse results obtained by her.

Research was carried out in 2013 from 17 May until 31 October in a locality at Dārziņi (Rīga, Latvia) (Fig. 1). The tree placement scheme shown in Figure 1 is shown according to the notes left by Valentīna Petrova on her computer, but the exact GPS coordinates for the monitoring site are unknown. Aphid populations were monitored on 40 *P. cerasifera* trees. All plums were planted in lines on both sides of a 6 m wide road (Fig. 1, Table 1). Tree infestation by *B. divaricatae* was evaluated on a scale from 1–4 according to Rakauskas (1980), where the fourth level is the highest level of infestation, as follows: level 1 (initial settlements), one to three aphid colonies per plant comprising of one to five adults together with up to 60 progeny per colony; level 2 (moderate infestation), two to four aphid colonies per plant comprising of 6 to12 adults together with up to 120 progeny per colony; level 3 (strong infestation), three to ten aphid colonies per plant of 13 to 25 adults together with numerous progeny, definitely exceeding 120 larvae, per colony; and level 4 (heavy infestation), twenty or more percent of plant surface suitable for aphid feeding covered by aphids.

The trees were monitored approximately every ten days: 15 and 30 May; 10 and 20 June; 1, 10 and 20 July; 1, 10, 20 and 30 August; 1, 20 and 30 September; and 10, 20 and 31 of October. Infestation level was calculated for the target species, *B. divaricatae* and for *Hyalopterus pruni*, a non-target aphid species, which was the second most abundant. In addition to study of aphid infestation levels, all visible potential predatory arthropods were collected and identified.

Identification of arthropods was provided by Valentīna Petrova who passed away before manuscript of this article was written, in cooperation with colleagues (see also Acknowledgements) for some arthropod groups. Beetles were identified by Dmitry Telnov, ants were identified by Jānis Dreimanis, and spiders were identified by Inese Cera. Aphids and mites were identified by the first author. Proba-

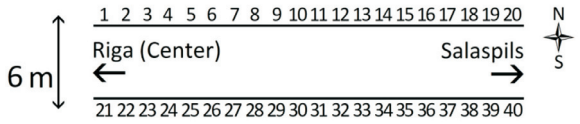


Fig. 1. Schematic arrangement of trees at the monitoring site on both sides of the street at Dārziņi, Rīga (Latvia).

Table 1. Characteristics of monitored *Prunus cerasifera* trees in monitoring site **zxz**

Tree number	Tree height, m	Volume of trunks, cm	Number of trunks	Remarks
Right side of street				
1	7.5	50.5	1	isolated, marginal, canopy, large-sized
2	3.3	9.5	6	isolated, normal tree
3	3.6	8.8	2	isolated, scattered
4	4.2	10.0	3	isolated, scattered
5	4.1	12.2	1	isolated, normal
6	7.2	24.0	1	normal
7	5.3	36.5	1	normal
8	4.1	12.6	8	isolated
9	2.2	16.0	1	isolated
10	2.3	27.0	7	isolated, scattered
11	4.0	10.0	3	isolated, scattered
12	3.5	16.0	6	isolated
13	4.1	38.0	3	isolated
14	3.5	21.0	8	isolated
15	4.0	23.0	6	isolated
16	2.5	22.0	7	isolated
17	1.7	14.0	2	isolated
18	2.5	4.3	11	isolated
19	1.0	1.2	1	isolated
20	2.5	4.0	2	isolated
Left side of street				
21	7.2	45.0	3	normal, crowded
22	4.0	53.0	3	normal, crowded
23	5.5	45.0	3	normal, large-sized
24	6.1	22.0	2	normal, crowded
25	6.5	52.0	4	normal, crowded
26	6.8	42.0	3	normal
27	5.5	24.0	1	normal, crowded
28	5.1	45.0	2	normal, crowded
29	5.3	44.0	1	normal, crowded
30	2.6	31.2	2	crowded
31	6.2	17.5	5	normal, crowded
32	5.0	19.0	1	normal, crowded
33	5.2	21.0	3	normal, crowded
34	5.5	29.0	3	normal, crowded
35	5.3	10.0	1	normal, crowded
36	5.2	31.0	5	normal, crowded
37	4.0	33.0	1	normal, crowded
38	4.0	30.0	1	normal, crowded
39	3.9	30.0	1	normal, crowded
40	2.4	14.0	2	normal, crowded
Average:	4.4	25.0	3	

bly somebody helped to Valentīna Petrova to identify also dipterans, but she had not left this information in her computer files. In the same way she did not leave information about identification keys used.

RESULTS

In total, four aphid species were registered on the monitored *P. cerasifera* trees: *B. divaricatae, Brachycaudus* sp., *H. pruni* and *Rhopalosiphum nymphaeae*. The most abundant aphid species was *B. divaricatae*, followed by *H. pruni*.

The target species, *B. divaricatae* was registered throughout the monitoring period, but the number of infested trees (Fig. 2) and levels of infestation (Fig. 3) differed on each monitoring day. The number of infested trees increased until 10 June, when 28 from 40 trees were with aphid colonies. After 10 June, the number of infested trees slowly decreased, with only 12 trees infested on 1 August. At the beginning of September, *B. divaricatae* were only found on two trees, but after the 20 September, only on one tree (see Fig. 1, tree number 24). On this tree, aphids were recorded beginning with 30 May, and infestation remained high during most of the monitoring period (Fig. 4). On 10 June, many new aphid colonies were registered on other trees, but on this particular tree, the infestation level rapidly decreased after 30 May, and on 10 June, 60% of aphids in colonies were dead, but after 10 June, the infestation level rapidly increased back to the highest level (Fig. 4). On each monitoring day, aphids were counted in a selected number of aphid colonies. The highest number of aphid colonies was on 10 June, when many new colonies were registered. The highest average number of aphids per colony was observed after 10 June, reaching 280 aphids per colony. On tree number 24, a rapid increase of aphid numbers in colonies was also recorded after 10 October (Fig. 5), reaching an average of 455 aphids per colony. On 10 July, 16 parasitised aphids were found in seven *B. divaricatae* colonies (parasites were not reared for further identification).

The non-target species *H. pruni* was identified at a low infestation level on monitored trees during two periods — from 15 May until 10 July and from 10 September until 31 October (Fig. 4). The number of *H. pruni* aphids per colony was counted only from 15 May until 10 July (Fig. 6).

Predatory arthropods belonging to several arthropod groups were registered in aphid colonies (Tables 2, 3), but the most dominant were larvae of dipterans from the families Cecidomyiidae and Syrphidae (Tables 2, 3). The highest number of Cecidomyiidae larvae were found from 15 May until 20 June, and the highest number of Syrphidae larvae on 30 May and 10 June (Table 2; Fig. 7). Larval stage ladybirds were identified in aphid colonies only from 10 June until 1 July (Table 2). The abundance of predator larvae (Cecidomyiidae + Chamaemyiidae + Coccinellidae + Syrphidae) partially coincided with the abundance of *B. divaricatae* at the beginning of the season (30 May until 20 June), but the number of predator larvae decreased after

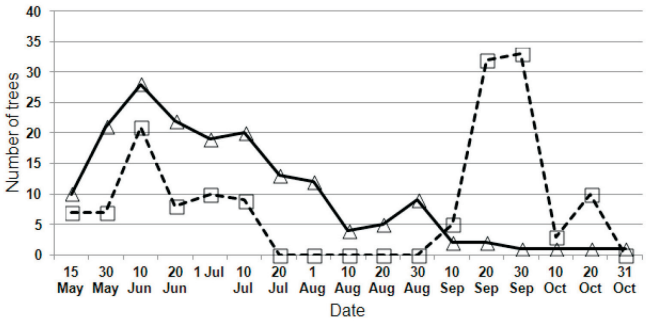


Fig. 2. Dynamics of the number of infested *Prunus cerasifera* trees for the two most abundant aphid species during 2013. Solid line – *Brachycaudus divaricatae* colonies, dashed line – *Hyalopterus pruni* colonies.

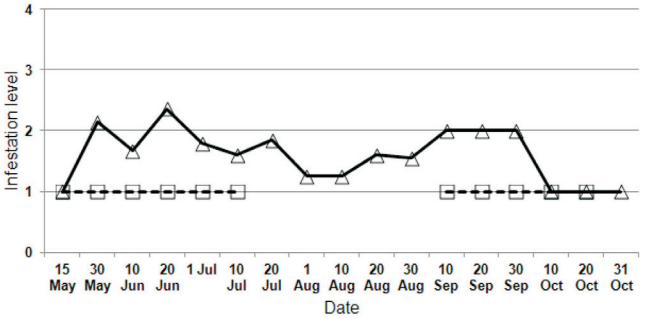


Fig. 3. Dynamics of average infestation levels for the two most abundant aphid species during 2013. Solid line – *Brachycaudus divaricatae* colonies, dashed line – *Hyalopterus pruni* colonies.

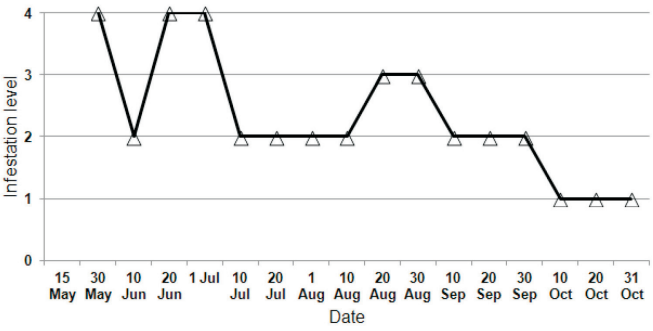


Fig. 4. Dynamics of *Brachycaudus divaricatae* infestation levels for tree No. 24, where aphid colonies occurred until 31 October 2013.

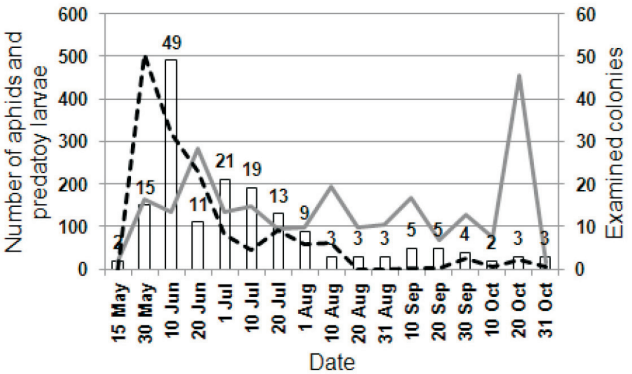


Fig. 5. Average dynamics of the total number of *Brachycaudus divaricatae* per colony, and dynamics of number of predatory dipteran and ladybird larvae in 2013. Solid line (grey) – average number of *B. divaricatae* per colony; dashed line – dynamics of larvae of predatory dipterans and ladybirds, Cecidomyiidae + Chamaemyiidae + Coccinellidae + Syrphidae.

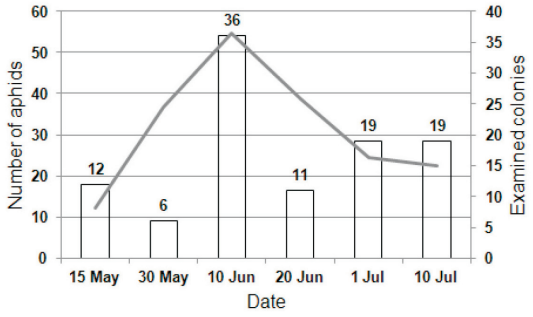


Fig. 6. Average dynamics of the total number of *Hyalopterus pruni* per colony (May–July 2013).

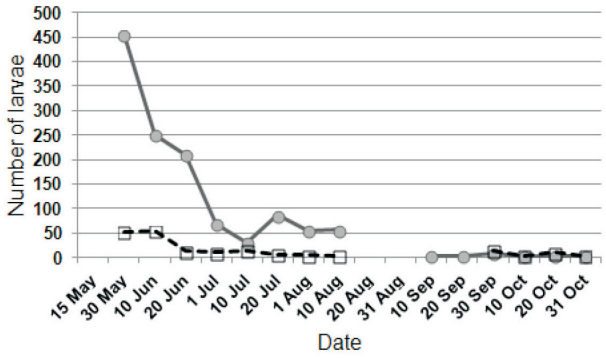


Fig. 7. Dynamics of dominant predator larvae in 2013. Dashed line: Syrphidae, solid line: Cecidomyiidae.

30 May, and the number of aphid colonies increased around 10 June (Fig. 5). Five ant species were found in aphid colonies, and the highest number of sampled specimens belonged to *Formica cinerea* Mayr (Table 3). The highest number of spiders in aphid colonies was in the second part of the season (from 10 July), with the most abundant number of spiders found on 10 October. The most abundant spider species were from the Linyphiidae family, with 160 specimens caught in total (Table 4). During the monitoring period, 24 species of predatory arthropods were identified at the generic or species level in *B. divaricatae* colonies: Acari (1 species), Araneae (5), Coleoptera (6), Diptera (5); Hymenoptera (5) and Neuroptera (2) (Tables 3–5). Only adult ladybird specimens were identified. Only one species of predatory mites, *Anystis baccarum* (Linnaeus), was registered on 10 June, when two specimens were caught in one *B. divaricatae* colony.

Additional phytophagous plant sucker arthropods (spider mite species *Panonychus ulmi* (C. L. Koch) and scale insect species *Lepidosaphes ulmi* (Linnaeus)), potential competitors of aphids and additional prey for predators, were found on monitored trees. Several beetle species, which used curled leaves in *B. divaricatae* colonies as shelter, were found: Subcoccinella vigintiquatuorpunctata (Linnaeus), Bruchus loti Paykull, Crioceris duodecimpunctata (Linnaeus) and Labidostomis tridentata (Linnaeus).

DISCUSSION

Rakauskas *et al.* (2015) reported *B. divaricatae* Shaposhnikov as an "invasive aphid species" in Lithuania. This opinion is not acceptable, as the only known host plant species (*P. cerasifera*) is not native to Lithuania or the entire Baltic region, and the native species *Prunus padus* is not a host of *B. divaricatae* (Rakauskas *et al.*, 2015; Danilov *et al.*, 2016). In Lithuania, aphid guild structure has been compared with the situation 40 years ago, and no negative effects on aphid guild structure have been found (Rakauskas

Table 2. Aphidophagous insect species in pre-imago stages caught in *Brachycaudus divaricatae* colonies on *Prunus cerasifera* trees in 2013.

	Cecidomyiidae		Syrphidae		Coccinellidae		Chamaemyiidae		
Date	eggs	larvae	eggs	larvae	eggs	larvae	eggs	larvae	pupae
15 May									
30 May		453		53					
10 June	93	250	16	54		15			
20 June	100	209	1	13	13	2		6	
1 July	7	68		10		3		2	
10 July		30		14					
20 July	7	86	1	6					
1 August		54		5				1	
10 August		56		4				2	
20 August									
31 August									
10 September		2							
20 September	9	3							
30 September		9		15				1	
10 October		3	3	4					
20 October		4	20	10			27	7	3
31 October		3		3					
Total	216	1230	41	191	13	20	27	19	3

Table 3. Ant species sampled in *Brachycaudus divaricatae* colonies on *Prunus cerasifera* trees in 2013

Species	Number of specimens	General behaviour of species*
Formica cinerea Mayr, 1853	142	predatory
Formica cunicularia Latreille, 1798	1	predatory
Formica fusca Linnaeus, 1758	3	predatory
Formica rufa Linnaeus, 1761	22	predatory
Lasius niger (Linnaeus, 1758)	25	frequently predatory
Total:	193	

*J. Dreimanis, personal communication

Table 4. Spider species sampled in *Brachycaudus divaricatae* colonies on *Prunus cerasifera* trees in 2013

Family	Species	10 July	20 August	10 October	Total:
Anyphaenidae	juv. indet.			3	3
Araneidae	juv. indet.	1	3	18	22
Araneidae	*Araneus diadematus* Clerck, 1757			4	4
Clubionidae	juv. indet.	2	2	10	14
Dictynidae	juv. indet.		1	17	18
Linyphiidae	*Hylyphantes graminicola* (Sundevall, 1830)	8	2	47	57
Linyphiidae	juv. indet.	15	2	86	103
Lycosidae	juv. indet.			1	1
Philodromidae	juv. indet.	4	10	30	44
Tetragnathidae	juv. indet.	8		15	23
Tetragnathidae	*Metellina segmentata* (Clerck, 1757)			45	45
Tetragnathidae	*Tetragnatha obtusa* C. L. Koch, 1837		1		1
Theridiidae	juv. indet.	3		23	26
Theridiidae	*Phylloneta sisyphia* (Clerck, 1757)	1			1
Thomisidae	juv. indet.			2	2
	Total	41	21	302	365

Table 5. Summary of other identified predaceous arthropod species caught in *Brachycaudus divaricatae* colonies on *Prunus cerasifera* trees in 2013

Taxonomic group	Species	Family
Neuroptera	*Chrysoperla carnea* (Stephens, 1836)	Chrysopidae
Neuroptera	*Hemerobius humulinus* Linnaeus, 1758	Hemerobiidae
Diptera	*Aphidoletes aphidimyza* (Rondami, 1847)	Cecidomyiidae
Diptera	*Lestodiplosis* sp.	Cecidomyiidae
Diptera	*Leucopis* sp.	Chamaemyiidae
Diptera	*Pipizella virens* (F. 1805)	Syrphidae
Diptera	*Syrphus ribesii* (Linnaeus, 1758)	Syrphidae
Coleoptera	*Adalia bipunctata* (Linnaeus, 1758)	Coccinellidae
Coleoptera	*Adalia decempunctata* (Linnaeus, 1758)	Coccinellidae
Coleoptera	*Anatis ocellata* (Linnaeus, 1758)	Coccinellidae
Coleoptera	*Coccinella septempunctata* Linnaeus, 1758	Coccinellidae
Coleoptera	*Propylea quatuordecimpunctata* (Linnaeus, 1758)	Coccinellidae
Coleoptera	*Scymnus ater* Kugelann, 1794	Coccinellidae
Acari	*Anystis baccarum* (Linnaeus, 1758)	Anystidae

et al., 2015). Since the first record of this exotic aphid species in Latvia in 2008 (Bašilova *et al.*, 2012), *B. divaricatae* has become the most dominant aphid species inhabiting *P. cerasifera* in Latvia. In the Baltic region, the same situation has also been reported in Lithuania (Danilov *et al.*, 2016). As in Lithuania (Danilov *et al.*, 2016), in Latvia the second most abundant aphid species on plums is *H. pruni*, but only *B. divaricatae* reaches the highest infestation levels. As observed in this study, infestation level depended on the particular *P. cerasifera* tree. It was confirmed, that outside its natural area, *B. divaricatae* does not migrate to alternate host plants, but occurs as a monoecious holocyclic on *P. cerasifera* only (Rakauskas *et al.*, 2015; Danilov *et al.*, 2016), sometimes on alternative hosts — plum cultivars (Rakauskas and Juronis, 2006) of hybrid origin, probably inaccurately described as '*Prunus domestica*'.

Rakauskas and Juronis (2006) predicted that *B. divaricatae* could pose a potential threat to the plum growing industry. As *B. divaricatae* is associated only with *P. cerasifera*, no threat to commercial fruit-growing industry has been observed in Latvia. During recent observations (2013–2023) (A. Stalažs, unpublished data) it was found that in Latvia, *B. divaricatae* is only a problem on ornamental *P. cerasifera* plants, which have been regularly pruned. Although *P. cerasifera* usually gives an abundant yield, in Baltic countries this plum species is not a common commercial fruit crop. In Latvia, *P. cerasifera* have mostly been cultivated as an ornamental plant, especially in hedgerows. Before *B. divaricatae* appeared in Latvia, there were no problems with regularly pruned *P. cerasifera* hedgerows. Due to the monoecious holocyclic life style of *B. divaricatae* (Rakauskas *et al.*, 2015; Danilov *et al.*, 2016), winged aphids migrate to other suitable shoots or to other *P. cerasifera* plants, reaching many generations per year (Wilkaniec and Wilkaniec, 2013). This is why *B. divaricatae* has the potential to be highly harmful to regularly pruned *P. cerasifera* plants. *Brachycaudus divaricatae* requires young and soft shoots, and therefore migrating aphids are able to find suitable places on regularly pruned plants, which produce new twigs after every cutting. On these plants, *B. divaricatae* usually produces abundant populations until late in the season and, as in Lithuania (Rakauskas and Turčinavičienė, 2006), in Latvia *B. divaricatae* populations can be found on host plants until late October. In this study, *B. divaricatae* was found only on one tree late in the season, and was not registered on the other 39 monitored trees. The reason for this is that on unpruned *P. cerasifera* trees, late in the season twigs already are wooden and not as suitable for aphids. Aphids can colonise regularly or semi-regularly pruned

plants later in the season, which also produce new shoots later in the season. This probably explains why during a recent study in Poland *B. divaricatae* infestations on plants were registered only until the beginning of August (Wilkaniec and Wilkaniec, 2013). Although heavy damage to *P. cerasifera* in pruned hedgerows is not commercially significant, aphids practically affect household gardens, as the quality and health of *P. cerasifera* hedgerows rapidly decreases, and if hedgerows have been intensively pruned, can result in plant death during winter. In the commercial fruit-growing industry, *P. cerasifera* is one of the rootstocks used for plum grafting, and is widely used in the Baltic region, Belarus, and the Russian Federation (Dēķena *et al.*, 2017; Eremin *et al.*, 2017). In the experimental orchard of the Institute of Horticulture, Latvia University of Life Sciences and Technologies (located near Dobele town), large populations of *B. divaricatae* have been observed on root sprouts produced by *P. cerasifera* rootstocks. However, *B. divaricatae* has never been found on cultivars originating from other *Prunus* species grafted onto *P. cerasifera* rootstocks. Heavy infestations of *B. divaricatae* usually result in the death of all or part of infested shoots or root sprouts during the same season or over winter. As mentioned previously, intensively pruned hedgerows are most susceptible, as heavy infested plants are weakened. On intensively pruned hedgerows *B. divaricatae* colonies can infest more than 90% of the plant crown, and damage caused by aphids noticeably disturbs plant photosynthesis and affects plant winter readiness.

Colonies of *B. divaricatae* attract different local insect predators (Danilov *et al.*, 2016). In Lithuania not only native, but also an alien and for Baltic countries potentially invasive ladybird species, *Harmonia axyridis* Pallas, has been found in *B. divaricatae* colonies (Havelka *et al.*, 2015; Danilov *et al.*, 2016). This study confirms that exotic *B. divaricatae* is valuable prey for native predator species also in Latvia.

All ladybird species collected in aphid colonies in this study are known to be aphidophagous (Rupais, 1961; Klausnitzer and Klausnitzer, 1979). Three ladybird species, *Adalia bipunctata*, *Coccinella septempunctata* and *Propylea quatuordecimpunctata* are the most common in Latvia (Stalažs, 2016). Feeding on *B. divaricatae* has been confirmed for *A. bipunctata* in Latvia (A. Stalažs, unpublished data) and for *C. septempunctata* in Turkey (Aslan and Uygun, 2005). Although alien *H. axyridis* have also been reported in Latvia (Barševskis, 2009; Telnov *et al.*, 2016), this species was not found in the area of this study. In addition to aphids, *A. bipunctata* and *C. septempunctata* can feed also on the spider mite species *P. ulmi* (Collyer, 1953), which was also found on monitored trees.

Although a large number of aphid colonies were found on monitored *P. cerasifera* trees, only a very small number of larval stage ladybirds were found in colonies. In 2013, the most important aphidophagous insects were larvae of predaceous dipterans, dominantly Cecidomyiidae, followed by Syrphidae. Dipterans identified to species level, *Aphidoletes aphidimyza* [Cecidomyiidae] and *Syrphus ribesii* [Syrphidae] have also been reported from *B. divaricatae* colonies in Lithuania (Danilov *et al.*, 2016). Larvae of Lestodiplosis, depending on species, are known to prey on various invertebrate hosts, also on scale insects (family Coccidae), mites, moth caterpillars and larvae of other Cecidomyiidae (Harris, 1997, 2004). Another cecidomyid species, *Aphidoletes aphidimyza* is a common predator in the wild and is used as a commercial bio-control agent against aphids (Harris, 2004).

Identification of two specimens of *Anystis baccarum* indicates that this predatory mite is also attracted by *B. divaricatae*, as potential prey. This mite species is known as a generalist predator and preys on aphids, psillids, moth larvae and other mites (Cuthbertson and Murchie, 2007; Cuthbertson *et al.*, 2014). As *A. baccarum* is a large predator and generally more mobile, it cannot be easily sampled, as mites quickly disperse if vegetation is disturbed, and for monitoring of *A. baccarum*, appropriate traps should be used (Cuthbertson *et al.*, 2014).

Of 365 spiders caught in aphid colonies in this study, 43.8% (160 specimens) belonged to the Linyphiidae family, and the number of spiders increased late in the season. Members of this spider family are generalist predators preying on different hosts, including aphids (Chiverton, 1987; Nyffeler, 1999). Increase in the number Linyphiidae spiders in the late season has been reported previously in Finland (Huhta and Viramo, 1979) and in the canopy of *Aesculus hipocastaneum* in Latvia (Petrova *et al*., 2013). The species *Hylyphantes graminicola* is common in forests, including pine forests on sandy soils (Cera *et al*., 2010). Linyphiidae spiders are potential alternative predators late in the season, when the number of larvae of predaceous dipterans is low. In Latvia, from 2013 to 2017, spider webs have been observed in crowns of *Crataegus* spp., *Hippophae rhamnoides* and *Syringa* (*josikaea-villosa* Group), and different sucker insects are recognised as prey by spiders: aphids, *Cacopsylla* spp., *Centrotus cornutus*, and members of the family Cicadellidae, including the exotic *Vilbasteana oculata* (syn. *Igutettix oculatus*), now a common species in Latvia (A. Stalažs, unpublished data).

It is known that aphids usually attract ants. Interactions between *B. divaricatae* and ants found in this study were not studied in more detail. The most abundant species of ants in this study was *Formica cinerea*, which commonly is associated with sandy habitats, where ants produce dense populations (Markó and Czechowski, 2004; Czechowski and Markó, 2005). The location of this study was in a sandy area with in-land dunes, which explains the numerous findings of *F. cinerea* in colonies of *B. divaricatae*. Although generally *Formica* species are predators, these ants also tend aphid colonies and provide protection against other predators (Breton and Addicott, 1992; Novgorodova and Gavrilyuk, 2012). Another ant species, Lasius niger, provides only partial protection of aphids (Novgorodova and Gavrilyuk, 2012). The presence of ants undoubtedly has an influence on aphidophagous predators, but further studies

are necessary about interactions between ants and *B. divaricatae*.

CONCLUSIONS

The aphid species *B. divaricatae*, an exotic species in Latvia, was predominant on its only known host plant species, *P. cerasifera*. In 2013, local aphidophagous and other predatory arthropods belonging to the taxonomic groups Acari, Araneae, Coleoptera, Diptera, Hymenoptera and Neuroptera were found in *B. divaricatae* colonies. The most abundant predators were dipteran larvae from the families Cecidomyiidae and Syrphidae. In *B. divaricatae* colonies, five ant species were registered and *F. cinerea* was the most abundant. The relationship between *B. divaricatae* aphids and ants should be studied in the future. In 2013, *B. divaricatae* colonies were found on host plants until the end of October, and similar observations were also made in other places outside the monitoring area in Latvia, especially on intensively pruned *P. cerasifera* hedgerows, which produce fresh late season shoots.

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EKSOTISKO ĶIRŠPLŪMJU LAPUTU *BRACHYCAUDUS DIVARICATAE* (HEMIPTERA, STERNORRHYNCHA: APHIDIDAE) UZ *PRUNUS CERASIFERA* LATVIJĀ SEZONĀLĀ DINAMIKA AR PIEZĪMĒM PAR VIETĒJIEM PLĒSĒJIEM

Ķiršplūmju laputis (*Brachycaudus divaricatae* Shaposhnikov) pēdējo dekāžu laikā ir izplatījušās daudzās Eiropas valstīs, kur tās intensīvi barojas uz Kaukāza plūmēm (*Prunus cerasifera*). Lai iegūtu datus par svešās laputu sugas *B. divaricatae* sezonālo dinamiku, Dārziņos, Rīgas pilsētas (Latvija) pievārtē, 2013. gadā tika novērotas 40 *Prunus cerasifera* koki. *Brachycaudus divaricatae* dominēja uz vienīgā šeit zināmā saimniekauga sugas, *P. cerasifera*. Uz monitoringa kokiem tika konstatētas arī citas laputu sugas: *Brachycaudus* sp., *Hyalopterus pruni* (Geoffroy) un *Rhopalosiphum nymphaeae* (L.). Mērķa suga, *B. divaricatae*, bija visizplatītākā, kam sekoja *H. pruni*, bet tikai *B. divaricatae* sasniedza augstāko invāzijas līmeni. Vēlākais *B. divaricatae* koloniju reģistrācijas laiks bija 31. oktobris. *Brachycaudus divaricatae* kolonijās tika reģistrēti daudzi plēsīgie posmkāji, kas pieder pie Acari, Araneae, Coleoptera, Diptera, Hymenoptera un Neuroptera. Visizplatītākie plēsēji bija divspārņu kāpuri no Cecidomyiidae un Syrphidae dzimtas. Plēsīgie divspārņi visvairāk izplatīti bija vienīgi sezonas sākumā (jūnijā). Vēlāk sezonā laputu kolonijās palielinājās zirnekļu skaits, un no 365 zirnekļiem 43,8% bija Linyphiidae dzimtas pārstāvji. *Brachycaudus divaricatae* kolonijās konstatētas arī piecas skudru sugas, no tām visbiežāk bija *Formica cinerea* Mayr.