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Coccinellidae on native and introduced spruce in central Europe: conservation implications in urban areas

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The abundance and species composition of adult ladybird communities (Coleoptera: Coccinellidae) were investigated on two congeneric trees, native Norway spruce (*Picea abies*) and the introduced blue spruce (*Picea pungens*), at four locations in Slovakia (central Europe). For two years (2021–2022), coccinellid adults were sampled using a standard method involving beating branches at monthly intervals from April to November. Although the species composition of the communities on both spruce species was similar, the abundance of the entire coccinellid community as well as the abundance of individual species was significantly greater on Norway spruce than on blue spruce. With the current decline of Norway spruce as a result of several negative factors, blue spruce has emerged as a suitable substitute host plant for coccinellid communities in urban areas.

KEYWORDS
ladybirds, conifers, congeneric plants, urban ecosystems, *Picea abies*, *Picea pungens*

1 Introduction

Norway spruce (*Picea abies* (L.) H. Karst) is a coniferous species with a wide distribution range across central Europe, not only in naturally colonised mountain areas but also in large areas where it has been intensively planted in the past two hundred years. Due to ongoing climate change, Norway spruce, a species highly sensitive to summer droughts and warm temperatures, is currently experiencing dieback (Kolář et al., 2017; Boczoń et al., 2018; Krejza et al., 2021) and frequent pest outbreaks (i.e., bark beetles), leading to the periodic decline of large, forested areas (Jactel et al., 2012; Marini et al., 2017; Netherer et al., 2019; Kamińska et al., 2021; Nardi et al., 2022). Stress factors such as air pollution, heat, water deficiency, and drought have even more intensive impacts on trees in urban environments (Lüttge and

Buckeridge, 2023), resulting in the disappearance of many Norway spruce trees from urban plantings (Anonymous, 2023).

With the dieback of Norway spruce stands, insect communities associated with this host plant, including communities of coccinellids (Coleoptera, Coccinellidae), have also become threatened. Coccinellids play a crucial role in limiting the abundance of phytophagous insects (Hodek, 1973; Majerus, 2016), and their absence puts host plants in urban stands at greater risk. The preservation of diverse coccinellid fauna in towns and cities has both ecological and cultural significance (Soares et al., 2022). Norway spruce is a coniferous tree in which coccinellid communities have rarely been studied (Reddersen and Jensen, 2002; Selyemová et al., 2007; Kenis et al., 2020). This tree species is reported as a host of diverse coccinellid communities (Selyemová et al., 2007; Kenis et al., 2020). In central Europe, the coccinellid communities on Norway spruce include species similar to those of communities on other trees, mainly the dominant native *Coccinella septempunctata* Linnaeus, 1758 and invasive *Harmonia axyridis* (Pallas, 1773) (Stathas et al., 2011; Latibari et al., 2016; Kempkens and Gruppe, 2018; Kenis et al., 2020; Zach et al., 2020; Farrow et al., 2022), as well as coccinellids typically occurring on conifers such as *Aphidecta obliterata* (Linnaeus, 1758) (Burmeister et al., 2007; Timms et al., 2008; Banfield-Zanin and Leather, 2016) and *Exochomus quadripustulatus* (Linnaeus, 1758) (Stathas et al., 2011; Holecová et al., 2018; Nedvěd, 2020).

Therefore, in our study, we aimed to determine whether there are suitable substitute conifer species capable of replacing the role of the disappearing Norway spruce in the survival of these coccinellid communities. A suitable substitute species for Norway spruce, at least in urban habitats, may be the introduced blue spruce (*Picea pungens* Engelm). This species, which is native to North America (Fechner, 1990), can withstand drought better than other spruce species and is resistant to high insolation (Fechner, 1990). Since blue spruce is also resilient to high levels of air pollution (Qin et al., 2014; Bukharina et al., 2016), after its introduction to Europe, it was planted as a replacement for Norway spruce stands damaged by industrial emissions (Slodičák and Novák, 2008; Kula et al., 2016). Due to its aesthetic qualities, blue spruce can replace Norway spruce in park stands. This tree species has been widely planted in urban parks for approximately the past 160 years (Pagan and Randuška, 1988; Kulfan et al., 2010), and its entomofauna can therefore be studied in most cities in central Europe. Blue spruce is known to be a host for numerous insect groups in Europe: xylophagous beetles (Coleoptera) (Kršiak et al., 2009; Kula et al., 2012, 2013), ladybirds (Coleoptera) (Jauschová et al., 2024), moths (Lepidoptera) (Kulfan et al., 2010), sawflies (Hymenoptera, Symphyta) (Kula et al., 2016) and aphids (Homoptera) (Fryč, 2016; Wojciechowski et al., 2016).

Can blue spruce function as a host for insect communities hosted by the native Norway spruce? To answer this question, we investigated and compared the diversity of coccinellid communities on Norway spruce and blue spruce grown together in urban areas. Given their close congeneric relationships, we expected similar coccinellid communities on both spruce species in urban environments. For our study, over a two-year period, we sampled adult coccinellid communities (including Scymninae and Coccidulinae subfamilies) monthly on both spruce species in four Slovak towns representing diverse climatic regions. We then evaluated the qualitative and quantitative differences in the adult coccinellid communities occurring concurrently during the growing season on both spruce species.

2 Materials and methods

2.1 Study sites

Coccinellids were sampled from urban plantings (parks, alleys, cemeteries, housing estates, etc.) in four towns in Slovakia, where Norway spruce and blue spruce are planted together in sufficient numbers: Žilina (49.19805 N, 18.73806E, 363 m a.s.l.), Sliač (48.61125 N, 19.15655E, 302 m a.s.l.), Zvolen (48.57933 N, 19.14886E, 321 m a.s.l.) and Levice (48.21743 N, 18.60141E, 160 m a.s.l.). The towns are located in different geographical regions: northern (Žilina), central (Sliač, Zvolen) and southern (Levice) (Figure 1). At the sites, other deciduous trees (*Tilia* spp., *Acer* spp., *Quercus* spp.), conifers (*Pinus* spp., *Pseudotsuga menziesii*, *Abies* spp., *Taxus* spp.) and shrubs (*Forsythia* × *intermedia*, *Juniperus* spp., *Sambucus nigra*, *Ligustrum* spp.) occurred widely. The ground surface was covered with mown lawn and ornamental plants and, to a lesser extent, with asphalt and concrete.

2.2 Sampling of coccinellid communities

At each location, sampling was carried out at monthly intervals from April to November (8 total sampling sessions per year) in two consecutive years, 2021 and 2022 (16 total sampling sessions for the entire research period at each site). In each month, beetles from all locations were collected within 5-day intervals. Coccinellids were beaten from lower branches (1–3 m above the ground) with wooden sticks into a circular tray with a diameter of 1 m (Roy et al., 2011; Roy and Brown, 2018). All sampled trees were taller than 5 m and older than 15 years. At each sampling session, ten different Norway spruce trees and ten different blue spruce trees were sampled for ladybirds. A total of 10 branches were beaten per sampled tree. The samples were collected around the entire circumference of the tree crown. The maximal distance among the sampled trees was 100 m. Adult coccinellids were identified at the species level according to Nedvěd (2020). Coccinellid species were classified as “conifer specialists” according to their preference for coniferous trees following Koch (1989), Holecová et al. (2018) and Nedvěd (2020). The representation of “conifer specialists” was calculated as the relative abundance of “conifer specialists” among all ladybirds.

2.3 Statistical analysis

Differences in ladybird communities on Norway spruce and blue spruce were examined separately at individual sites. Qualitative differences were determined by the strength of the correlation of the relative abundance of individual species of coccinellids (the quantity of individuals of a species expressed as a proportion of the total number of coccinellid individuals) on Norway spruce and blue spruce. The calculations were performed for (i) all species for the

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FIGURE 1
Locations of towns where sampling was carried out (•). Source: Adapted from https://commons.wikimedia.org/wiki/File:Slovensko_hranice.svg (public domain).

entire research period at individual sites, (ii) species of the tribe Coccinellini (aphidophagous species), (iii) species belonging to all other tribes (non-Coccinellini, species readily accepting food other than aphids) and (iv) the 7 most abundant species [*Exochomus quadripustulatus*, *Aphidecta obliterata*, *Harmonia quadripunctata* (Pontoppidan, 1763), *Rhyzobius chrysomeloides* (Herbst, 1792), *Adalia conglomerata* (Linnaeus, 1758), *Coccinella septempunctata*, *Harmonia axyridis*]. Quantitative differences were investigated in a randomised block pattern without replicates, where samples collected at one location and date formed blocks and the spruce species represented the treatment. If the distribution of the experimental data passed the normality test, we used the pairwise multiple comparison procedure with the Holm-Sidak method. If the distribution of the experimental data failed the test of normality or equal variances, we used the Friedman repeated measures analysis of variance on ranks. This method was used because the abundance of ladybirds changed significantly during the growing season, and we were interested in the overall difference in the abundance of coccinellids on Norway spruce and blue spruce. All analyses were performed using SigmaStat 3.5 (Systat Software Inc, 2006).

3 Results

3.1 Qualitative structure of the adult coccinellid communities

The community structure of coccinellids on both spruce species in all four towns was similar. The correlation of the relative abundance of coccinellid species on Norway spruce and blue spruce was high at all locations: Levice (R^2 = 0.991; P ≤ 0.001), Sliač (R^2 = 0.920; P ≤ 0.001), Žilina (R^2 = 0.903; P ≤ 0.001) and Zvolen (R^2 = 0.975; P ≤ 0.001). The correlation of the relative abundance of species across all sampling sites was high (R^2 = 0.986; P ≤ 0.001), which further indicated that both species host the same coccinellid communities (Figure 2).

3.2 Quantitative differences in the community composition of adult coccinellids

In contrast to the species composition of the coccinellid community, we found significant differences in the abundance of coccinellids on Norway spruce and blue spruce (Table 1, Appendix 1). At each site, there was a significantly greater abundance of ladybirds on Norway spruce than on blue spruce.

The abundance of coccinellids was significantly greater on Norway spruce at the whole-community level, as was that of the coccinellids of the tribe Coccinellini and of other tribes, with the exception of that at the Žilina location. Some of the seven most abundant species (*E. quadripustulatus*, *A. obliterata*, *H. quadripunctata*, *R. chrysomeloides*, *A. conglomerata*, *C. septempunctata*, and *H. axyridis*) were significantly more abundant on Norway spruce than on blue spruce at individual locations (Table 1). The total abundance of the coccinellid community (both years and all locations) was 2.88-fold greater on Norway spruce than on blue spruce.

Additionally, the total number of species found at individual sites on Norway spruce (mean 21.5 ± 2.66 species) was greater than that found on blue spruce (mean 17.8 ± 1.49 species). However, this difference was only marginally significant (F=8.133, P=0.065) due to the small number of locations sampled. For the whole research period at all locations, a total of 34 coccinellid species were recorded on Norway spruce, and 27 species were recorded on blue spruce. Among them, *Exochomus quadripustulatus* and *Aphidecta obliterata* were eudominant (> 10%) on both spruce species. The invasive harlequin

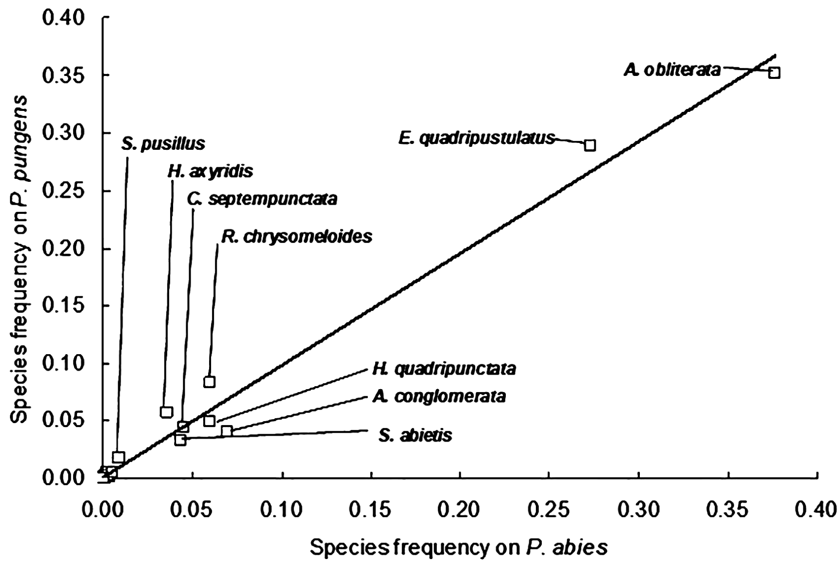

FIGURE 2
Frequency of coccinellid species on blue spruce plotted against the frequency of coccinellid species on Norway spruce. Data for the total sample of coccinellids from the Levice, Sliač, Žilina and Zvolen locations (average values from frequencies at individual locations). The black line indicates the same species frequency on Norway spruce and blue spruce.

TABLE 1 **Comparison of the coccinellid abundance on Norway spruce (*Picea abies*) and Blue spruce (*Picea pungens*) in locations in Slovakia.**

Locality	Species	*Picea abies*				*Picea pungens*				Difference
		Nsp	Ni	Mean ± SE	Median	Nsp	Ni	Mean ± SE	Median	P
Levice	Coccinellidae	22	2322	145.1 ± 20.04	141.5	17	744	46.5 ± 11.63	37	≤0.001
	Coccinellini	12	836	52.3 ± 13.40	33.5	9	212	13.3 ± 3.42	9.5	≤0.001
	non-Coccinellini	10	1486	92.9 ± 12.53	98.5	8	532	33.3 ± 9.98	23	≤0.001
	Aphidecta obliterata (Linnaeus, 1758)		209	13.1 ± 5.43	5.5		62	3.9 ± 2.43	0	0.004
	Coccinella septempunctata (Linnaeus, 1758)		202	12.6 ± 3.93	4		61	3.8 ± 1.19	2.5	0.077
	Exochomus quadripustulatus Linnaeus, 1758		1361	85.1 ± 12.70	76.5		470	29.4 ± 9.56	20.5	≤0.001
	Harmonia axyridis (Pallas, 1773)		143	8.9 ± 7.22	1		26	1.6 ± 0.63	1	0.077
	Harmonia quadripunctata (Pontoppidan, 1763)		217	13.6 ± 3.67	9.5		49	3.1 ± 0.78	2.5	0.021
Sliač	Coccinellidae	28	1443	90.2 ± 24.63	51	22	533	33.3 ± 10.50	22	≤0.001
	Coccinellini	17	1066	66.6 ± 24.02	29	14	382	23.9 ± 10.52	10.5	≤0.001
	non-Coccinellini	11	379	23.7 ± 5.43	13	8	151	9.4 ± 1.94	6.5	0.004
	Adalia conglomerata (Linnaeus, 1758)		264	16.5 ± 4.97	10		64	4.0 ± 1.71	1.5	≤0.001
	Aphidecta obliterata (Linnaeus, 1758)		587	36.7 ± 16.07	11.5		192	12.0 ± 5.95	2	≤0.001
	Exochomus quadripustulatus Linnaeus, 1758		244	15.3 ± 3.32	12.5		103	6.4 ± 1.25	5	0.007
	Rhyzobius chrysomeloides (Herbst, 1792)		100	6.3 ± 2.13	3		12	0.8 ± 0.35	0	0.021
Žilina	Coccinellidae	15	1445	90.3 ± 29.43	53.5	15	579	36.2 ± 6.09	36	0.005
	Coccinellini	9	962	60.1 ± 26.15	35.5	7	362	22.6 ± 4.68	20	0.021

(Continued)

TABLE 1 Continued

Locality	Species	*Picea abies* Nsp	Ni	Mean ± SE	Median	*Picea pungens* Nsp	Ni	Mean ± SE	Median	Difference P
	non-Coccinellini	6	483	30.2 ± 7.20	23.5	8	217	13.7 ± 2.42	13.5	0.077
	Aphidecta obliterata (Linnaeus, 1758)		824	51.5 ± 24.89	25		302	18.9 ± 4.29	14	0.077
	Exochomus quadripustulatus Linnaeus, 1758		141	8.8 ± 2.41	6		68	4.3 ± 0.86	3.5	0.454
	Rhyzobius chrysomeloides (Herbst, 1792)		133	8.3 ± 7.55	7		125	7.8 ± 6.91	6	0.757
Zvolen	Coccinellidae	21	1632	102.0 ± 23.86	49	17	513	32.1 ± 5.23	25	0.004
	Coccinellini	11	1065	66.6 ± 18.80	27.5	10	324	20.3 ± 3.74	13	0.004
	non-Coccinellini	10	567	35.4 ± 7.79	27	7	189	11.8 ± 2.59	10	0.004
	Adalia conglomerata (Linnaeus, 1758)		142	8.9 ± 2.42	6		16	1.0 ± 0.41	0	≤0.001
	Aphidecta obliterata (Linnaeus, 1758)		714	44.6 ± 14.73	15.5		226	14.1 ± 3.64	9	0.004
	Exochomus quadripustulatus Linnaeus, 1758		388	24.3 ± 5.52	16		108	6.8 ± 1.76	5.5	0.002
	Harmonia quadripunctata (Pontoppidan, 1763)		124	7.8 ± 3.82	1.5		34	2.1 ± 0.72	1	0.210
	Rhyzobius chrysomeloides (Herbst, 1792)		124	7.8 ± 2.46	4		47	2.9 ± 0.78	2	0.21

Coccinellidae – total number of individuals of all species; Coccinellini – a total number of individuals of the tribe Coccinellini; non-Coccinellini – total number of individuals of other tribes, and total number of individuals of the most abundant species at localities.
Nsp, number of species; Ni, number of individuals; Mean ± SE, average number of individuals in 16 samples obtained during the study period ± standard error; Median, median number of individuals in 16 samples obtained during the study period; P, probability of difference between the number of individuals on *P. abies* and *P. pungens*.

ladybird (*Harmonia axyridis*) was slightly more dominant on blue spruce (5.45%) than on Norway spruce (3.86%). Conifer specialist coccinellids strongly dominated communities on both spruce species [Norway spruce 87.66% (10 species), blue spruce 84.76% (9 species)].

4 Discussion

The absence of qualitative differences in coccinellid communities between Norway spruce and blue spruce was mainly determined by the similar relative abundance of dominant species and the low relative abundance of rare species.

As a result, the relative abundances of coccinellid species on Norway spruce and blue spruce were similar across locations, although the dominant species across locations differed (Table 1), with the exception of *Aphidecta obliterata* and *Exochomus quadripustulatus*, which were abundant across all locations. Since the relative abundance of rare species was very low, it did not affect the correlation between the relative abundance of rare coccinellid species and that of either spruce species.

The species of spruce did not affect the relative abundance of coccinellid species in the total population that were established on the species. Additionally, Norway spruce and blue spruce have different species-specific properties that affect the attraction or repulsion of particular coccinellid species.

The invasive eurytopic coccinellid *Harmonia axyridis* (Roy et al., 2016) is known to dominate coccinellid communities on broadleaved trees (Honek et al., 2015; Viglášová et al., 2017). This ladybird species occurs on Norway spruce as well but usually in lower abundances (Kenis et al., 2020), which is in accordance with our results. Among conifers, *Harmonia axyridis* seems to prefer *Scots pine* (*Pinus sylvestris*) (Holecová et al., 2018; Kenis et al., 2020).

While no qualitative differences were found in the coccinellid communities on either spruce species, there were significant quantitative differences. All coccinellids (the community of all species), species of the tribe Coccinellini, species of other tribes (with the exception of the Žilina location) and some of abundant species were significantly more abundant on Norway spruce than on blue spruce. We can speculate about the reasons for these differences in the abundance of coccinellids between both spruce species. Possible causes include trophic factors, such as differences in the abundance or species composition of the arthropod complex serving as the prey for coccinellids. The aphid communities on Norway spruce and blue spruce seem to consist of similar aphid species (see, for example, Fryč, 2016; Wojciechowski et al., 2016). Trophic differences can be quantitative – the abundance of aphids on blue spruce seems to be lower than that on Norway spruce (pers. observation TJ, PZ). Other groups of phytophagous insects, as possible alternative food sources for coccinellids (Hodek and Evans, 2012; Majerus, 2016), seem to occupy both spruce species similarly, such as the larvae of moths (Kulfan et al., 2010) and sawflies (Kula et al., 2016).

Another biotic difference is the quality of the host plant (Goßner and Ammer, 2006; Bezemer et al., 2014). Differences in plant architecture, structural heterogeneity and plant surface, e.g., foliage shape and density, may aid or hinder coccinellid movement and searching and foraging behaviour (Shah, 1982; Grevstad and Klepetka, 1992; Pervez and Yadav, 2018). Little is known about whether there are differences in needle chemicals between blue spruce and Norway

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spruce (Soukupová et al., 2001). A comparison of the needles of Norway spruce and blue spruce with regard to their resistance to emissions revealed similar concentrations of chlorophyll and carotenoids but showed differences in phenolic compound accumulation between the two spruce species (Soukupová et al., 2001). The effects of chemical differences in the needles of both spruce species on coccinellids and their prey are not known.

How would coccinellid communities change if Norway spruce trees completely disappeared? For example, we can consider the replacement of the spruce by deciduous trees in the Děčínský Sněžník locality (Czech Republic, 50.79 N, 14.11E, 700 m a.s.l.), which has resulted in a shift in the composition of insect communities (Kula and Tryner, 2003a, b), including those of aphidophagous syrphids (Diptera) (Kula, 1997). A similar shift in the species composition of the local coccinellid fauna could also occur in the urban habitats in which this study was conducted.

Unlike the native Norway spruce, blue spruce is expected to be able to withstand unfavourable environmental conditions (Fechner, 1990; Qin et al., 2014; Bukharina et al., 2016). Our results suggest that in the absence of Norway spruce in urban environments, the coccinellid community inhabiting congeneric blue spruce will likely survive with no changes in composition, i.e., a decrease in species richness will not occur. In our study, the abundance of most coccinellid species was greater on Norway spruce than on blue spruce when coccinellids had the option to select Norway spruce and selection did not require migration to distant habitats. When such an option is not available, an increase in the abundance of coccinellids on blue spruce can be expected since the community of coccinellids adapted to conifers may find refuge there. However, confirmation of this assumption requires a more detailed study.

In conclusion, both native Norway spruce and introduced blue spruce host similar coccinellid communities in urban areas. Blue spruce was introduced to Slovakia more than 150 years ago (Pagan and Randuška, 1988), and in the time period since its introduction, it has recruited a coccinellid community with a species composition similar to that of the native Norway spruce. Closely related nonnative blue spruce seems to be a useful substitute host for spruce-associated insect fauna in the case of Norway spruce extinction in urban areas. A long-term study of coccinellid communities on spruces would be beneficial since the abundance of this insect is known to fluctuate interannually (this study; Selyemová et al., 2007).

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Ethics statement

The manuscript presents research on animals that do not require ethical approval for their study.

Author contributions

TJ: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. LS: Conceptualization, Project administration, Writing – original draft, Writing – review & editing. PZ: Conceptualization, Investigation, Methodology, Supervision, Writing – original draft. MS: Funding acquisition, Investigation, Project administration, Writing – review & editing. ZM: Funding acquisition, Methodology, Project administration, Writing – review & editing. AH: Software, Supervision, Validation, Writing – original draft, Writing – review & editing. JS: Formal analysis, Methodology, Software, Writing – review & editing. MH: Funding acquisition, Investigation, Project administration, Writing – review & editing. JK: Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Appendix 1

Total numbers of individuals of coccinellid species recorded at all locations in this study on Norway spruce (*Picea abies*).

Adalia bipunctata (Linnaeus) 1; *Adalia conglomerata* (Linnaeus) 426; *Adalia decempunctata* (Linnaeus) 12; *Anatis ocellata* (Linnaeus) 9; *Aphidecta obliterata* (Linnaeus) 2334; *Calvia decemguttata* (Linnaeus) 3; *Calvia quatuordecimguttata* (Linnaeus) 2; *Chilocorus bipustulatus* Linnaeus 9; *Clitostethus arcuatus* (Rossi) 1; *Coccinula quatuordecimpustulata* (Linnaeus) 1; *Coccinella quinquepunctata* Linnaeus 1; *Coccinella septempunctata* Linnaeus 343; *Exochomus quadripustulatus* Linnaeus 2134; *Halyzia sedecimguttata* (Linnaeus) 1; *Harmonia axyridis* (Pallas) 264; *Harmonia quadripunctata* (Pontoppidan) 442; *Hippodamia variegata* (Goeze) 3; *Myrrha octodecimguttata* (Linnaeus) 2; *Myzia oblongoguttata* (Linnaeus) 24; *Nephus quadrimaculatus* (Herbst) 5; *Oenopia conglobata* (Linnaeus) 3; *Platynaspis luteorubra* (Goeze) 4; *Propylea quatuordecimpunctata* (Linnaeus) 11; *Psyllobora vigintiduopunctata* (Linnaeus) 3; *Rhyzobius chrysomeloides* (Herbst) 362; *Scymnus abietis* (Paykull) 258; *Scymnus ferrugatus* (Moll) 6; *Scymnus frontalis* (Fabricius) 11; *Scymnus interruptus* (Goeze) 24; *Scymnus rubromaculatus* (Goeze) 16; *Scymnus subvillosus* (Goeze) 1; *Scymnus suturalis* Thunberg 7; *Stethorus pusillus* (Herbst) 77; *Vibidia duodecimguttata* (Poda) 42.

Total numbers of individuals of coccinellid species recorded at all locations in this study on blue spruce (*Picea pungens*).

Adalia conglomerata (Linnaeus) 87; *Adalia decempunctata* (Linnaeus) 11; *Anatis ocellata* (Linnaeus) 4; *Aphidecta obliterata* (Linnaeus) 782; *Calvia quatuordecimguttata* (Linnaeus) 2; *Chilocorus bipustulatus* Linnaeus 6; *Coccinella septempunctata* Linnaeus 113; *Exochomus quadripustulatus* Linnaeus 749; *Harmonia axyridis* (Pallas) 129; *Harmonia quadripunctata* (Pontoppidan) 120; *Hippodamia variegata* (Goeze) 1; *Myrrha octodecimguttata* (Linnaeus) 1; *Myzia oblongoguttata* (Linnaeus) 3; *Oenopia conglobata* (Linnaeus) 6; *Platynaspis luteorubra* (Goeze) 1; *Propylea quatuordecimpunctata* (Linnaeus) 6; *Psyllobora vigintiduopunctata* (Linnaeus) 3; *Rhyzobius chrysomeloides* (Herbst) 184; *Scymnus abietis* (Paykull) 78; *Scymnus auritus* Thunberg 1; *Scymnus ferrugatus* (Moll) 2; *Scymnus frontalis* (Fabricius) 5; *Scymnus haemorrhoidalis* Herbst 1; *Scymnus interruptus* (Goeze) 11; *Scymnus rubromaculatus* (Goeze) 8; *Stethorus pusillus* (Herbst) 43; *Vibidia duodecimguttata* (Poda) 12.