Evaluation of the occurrence of weeds in orchard

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Abstract: The aim of this study was classification of weed species diversity in a chosen orchard in the company ZEAS Lysice in Blansko region. Exploration took place in an apple orchard by means of phytocoenology relevé in tracks and in strips at ten specific locations. The relevé was carried out during three terms - in spring, summer and autumn. The results were processed with statistical analysis DCA and CCA. The research was done during year 2012. The following plant species had the highest coverage in tracks: *Taraxacum officinale*, *Poa pratensis, Plantago major, Poa trivialis, Lolium perene*. The highest coverage in strips had following plant species: *Taraxacum officinale, Stellaria media, Urtica dioica, Capsela bursa pastoris, Poa annua* and *Triforium hybridum*. 69 plant species were observed and recorded in total.

Key-Words: orchards, weeds, species diversity

Introduction

Orchards have always created the countryside atmosphere and its harmonious character. The villages would not look so picturesquely without these gardens [1].

Currently we realize that the orchard is part of ecosystem. It is therefore necessary to include it as part of environment that can stabilize the landscape. The importance of grassed inter-row was identified in the context of the above-mentioned treatment of inter-row soil cover. Among other things it forms the soil protective functions. However we must realize that weedy species except negative effects have also positive influences. One of them is their importance to increase the species diversity of environments called biodiversity [2].

Mitchem [3] mentioned competition in the struggle for light as another possibility of weed harmfulness. Viny weeds are the biggest threat on orchards, because these species are able to wrap the entire tree. The competitiveness of weeds within the nutrients exploitation brings reduction of crop yield. Intensive growth in early developmental stage, production of large quantities of seeds belong among the other influences of weed harmfulness.

Lipecki [4] argues that machines are still moving in same tracks in modern orchards. Vegetative cover helps to protect soils against the excessive compaction. The ability of weeds to bind toxic compounds and heavy metals is one of the other benefits of weeds for orchards and environment. Weeds by their presence also prevent problems associated with the cultivation of monocultures.

According to Falta and Prazak [5] occur both annual and perennial weeds species in growths of trails. Control of perennial weeds is difficult not only for seeds reproduction (generative) but also for roots, stolons and rhizomes (vegetative reproduction). Perennial weeds create massive root system. If the root system is not removed, usually by chemical means, becomes a source of further weed infestation [6].

Taraxacum officinale, Cirsium arvense, Epilobium montanum, Agropyron repens, Convolvulus arvensis, Urtica dioica, Equisetum arvense and *Rumex* sp. are the most occurred weed species [5].

Material and Methods

Characteristic of Experimental Location

Agricultural enterprise ZEAS Lysice a. s. owns the monitored orchard. Experimental location is situated in cadastre of city Lysice in Blansko district (GPS 49.4515975N, 16.5371575E), Czech Republic.

Blansko district is located in central Moravia in the northern part of South Moravian region. The area belongs to the geomorphological Czech Highlands [7]

Lysice lies in mildly warm climate area, namely MT 7, where is normally long summer and winter. The climate allows successful cultivation of fruit

trees, apricots and grapes in protected locations as well. According to Culka [8] precipitation are generally low because Lysice lies in the rain shadow of the highlands.

Climatic and meteorological data were obtained from website of ČHMÚ, meteorological station Brno – Tuřany (Table 1 – Table 2).

Characterisation of agricultural company

ZEAS Lysice, a.s. was established in Decemeber, 1996. The company employes approximately 100 people and operates on a total area of 2200 ha in 14 village cadastres in Blansko district and partly in Brno-contryside. The lands are situated at an altitude of 350 to 650 m a.s.l.

Fruit cultivation is a special part of crop production, which focuses not only on apple production, but additionally on planting strawberries and currants. Intensive orchards have a total area of 90 ha. Currently 38 ha of apple orchards and 36 ha of red currant are in full fertility. Other areas are planted with new plantings.

Weeds are regulated mechanically and chemically in strips next to roots. Their vegetation cover is maintained below 10 % at the time of sprouting to development of intensive growth.

Methodology of evaluation of the vegetation

Measurement was conducted by phytocenological scanning in selected orchard. Relevé were set in strips next to roots and in inter-rows at ten stands. Scanning was performed in three repetitions. The first term was made in spring, from May 9 to 11, 2012. Second repetition was acquired in summer, from July 9 to 10, 2012. Last term took place in autumn, from September 16 to 17, 2012. Size of scanned area was 15 m^2. After the identification of the species, it was possible to estimate the area, which is covered by particular species. Czech and Latin terms of each weed species were used according to Kubat [9].

Table 1 Data of weather conditions from the meteorological station Brno – Tuřany, in period 1961-1990

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	average
Average temperature (°C)	-2.5	-0.3	3.8	9.0	13.9	17.0	18.5	18.1	14.3	9.1	3.5	-0.6	8.7
Precipitation (mm)	24.6	23.8	24.1	31.5	61.0	72.2	63.7	56.2	37.6	30.7	37.4	27.1	490.1

Table 2 Data of weather conditions from the meteorological station Brno – Tuřany, based on data from 2012

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	average
Average temperature (°C)	0.0	-4.5	5.7	9.2	15.5	18.3	19.7	19.8	14.4	8.4	5.9	-2.5	9.2
Precipitation (mm)	44.2	9.9	2.8	11.7	54.6	74.4	43.2	19.1	55.4	59.4	21.8	16.0	412.5

A multivariate analysis of ecological data was used to determine the effect of environment factors on weed species, which were found in selected lands. Selection of the optimal analysis followed the length of the gradient (*Lengths of Gradient*), which was detected by segment analysis DCA (*Detrended Correspondence Analysis*). Furthermore, Canonical Correspondence Analysis CCA was used. A total number of 499 permutations were calculated in Monte-Carlo test. Collected data were processed by a computer program Canoco 4.0 [10].

Table 3 The sum of vegetation cover of found weed species in orchard

Weed species	Stands	
	Inter-row	Strip next
Agropyron repens	64	12
Achillea millefolium	29	3
Ajuga reptans	29	0
Amaranthus retroflexus	0	2
Anagallis arvensis	0	3
Bellis perennis	0	1
Bromus mollis	1	0
Bromus sterilis	0	3
Bromus tectorum	0	1
Calamagrostis epigejos	0	2
Capsella bursa-pastoris	23	44
Carex rostrata	0	1
Carlina acaulis	1	0
Cerastium vulgatum	2	3
Cirsium arvense	2	1
Conyza canadensis	0	1
Crepis biennis	7	0
Dactylis glomerata	4	1
Echinocloa crus-galli	0	12
Fallopia convolvulus	5	5
Festuca pratensis	32	4
Fragaria moschata	0	2
Fragaria vesca	0	1
Fumaria officinalis	0	1
Galeopsis tetrahit	0	2
Galium aparine	3	11
Galium odoratum	0	5
Geranium pratense	1	0
Geranium pusillum	0	1
Geranium robertianum	0	1
Geum urbaneum	4	1
Holcus lanatus	2	9
Holosteum umbellatum	9	30
Chenopodium album	10	22
Chenopodium hybridum	1	3
Lamium album	1	1
Lamium purpureum	1	0
Leontodon autumnalis	2	0
Leontodon hispidus	2	2
Lolium perene	202	0
Malus domestica	1	23
Myosotis arvensis	3	12
Pastinaca sativa	2	4
Picris hieracioides	24	10
Plantago lanceolata	18	0
Plantago major	412	4
Poa annua	92	38
Poa pratensis	443	19.5
Poa trivialis	370	6
Polygonum aviculare	25	12
Ranunculus acris	0	1
Rosa canina	27	26
Sambucus nigra	0	1
Senecio vulgaris	0	7
Silene vulgaris	2	0
Solanum nigrum	0	1
Sonchus arvensis	0	2
Sonchus asper	0	3
Stellaria media	29	307
Taraxacum officinale	540	752
Trifolium dubium	3	2
Trifolium hybridum	46	36
Trifolium medium	57	2
Trifolium pratense	5	0
Trifolium repens	46	5
Urtica dioica	49	68
Urtica urens	13	9
Veronica hederifolia	2	1
Veronica persica	0	2

Results and Discussion

69 of plant species were found within the observation in total. The sums of vegetation cover are listed in Table 3.

Results were evaluated by DCA analysis, which set the length of gradient (*Lengths of Gradient*), 3.594. Based on this calculation was for further processing chosen CCA analysis. Analysis CCA

defines the spatial arrangement of individual weed species, variants of stands and term. This is then graphically expressed using the ordination diagram. Weed species, stands and dates are displayed in a different shapes and colors.

Results of CCA analysis, which evaluated the influence of stands on weed occurrence are significant at the significant level $\alpha = 0.002$ for all canonical axes. Based on the analysis CCA (Fig. 1) is possible found weed species divided into 2 groups.

Ajuga reptans, Poa trivialis, Plantago lanceolata, Poa pratensis, Plantago major, Lolium perene, Achillea millefolium, Trifolium medium, Festuca pratensis, Agropyron repens, *Picris hieracioides*, *Polygonum aviculare*, *Trifolium repens* and *Poa annua* are weeds of first group, which occurred mainly in inter-rows.

Second group of weeds were found mainly in strips next to roots: *Malus domestica, Echinocloa crus-galli, Myosotis arvensis, Galium aparine, Stellaria media, Rosa canina, Urtica dioica, Chenopodium album, Urtica urens, Trifolium hybridum, Fallopia convolvulus, Taraxacum officinale, Capsella bursapastoris, Holcus lanatus* and *Holosteum umbellatum.*

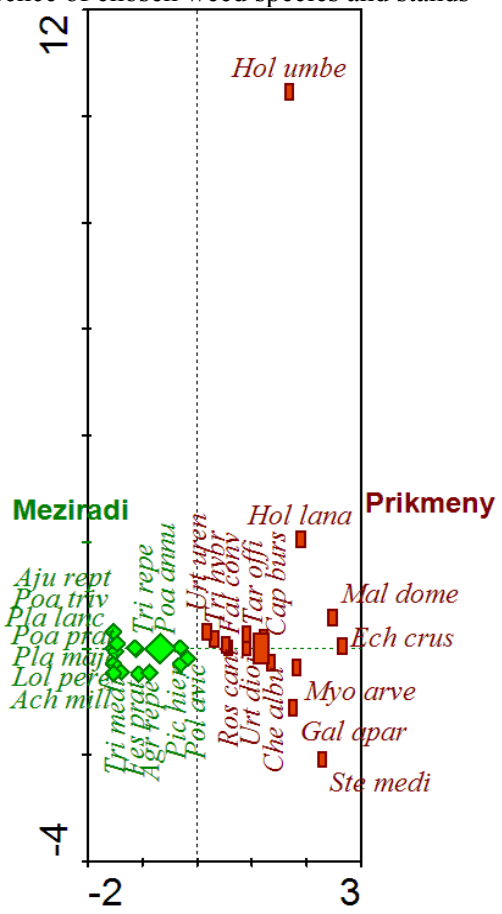
48 plant species occurred in inter-rows, which are grassy. Due to the fact that some species occurred only once within entire observation period, for diagram processing were used 14 species. Most of them were species of *Taraxacum officinale* 20 %, *Poa pratensis* 17 %, *Plantago major* 15 % and *Poa trivialis* 14 %. The largest representation of *Taraxacum officinale* in inter-rows, stated Stratilova [11].

In my opinion the greatest importance for inter-rows have grass. Apart from the above mentioned species of family Poaceae, there were also other monocot species as *Lolium perene*, *Festuca pratensis* and *Dactylis glomerata*. The significance of these species according to Hejduk [2] is especially in their soil protect erosion control function.

58 plant species were observed in strips next to roots within the monitored period. 15 of them with greatest representation we can find in the diagram. *Taraxacum officinale* 49% and *Stellaria media* 20% were recorded in strips next to roots as the most common.

Given to the current development of global climate can be expected from the hottest area of our country, gradual emergence of these species: *Arhenatherum elatius*, *Calamagristis epigejos* and *Robinia pseudacacia* and other species, which states PYŠEK [12]. Together with these species we can assume pest pressure, which are tied to these species (aphids).

Fig. 1 Ordination diagram expressing relations of occurrence of chosen weed species and stands



Legend: Explanatory notes of used abbrevations in ordination: Meziradi – inter-rows, Prikmeny – strips next to roots.

Weeds: *Agr repe - Agropyron repens, Ach mill - Achillea millefolium, Ach mille – Achillea millefolium, Aju rept - Ajuga reptans, Cap burs - Capsella bursa-pastoris, Ech crus - Echinocloa crus-galli, Fal conv - Fallopia convolvulus, Fes prat - Festuca pratensis, Gal apar - Galium aparine, Hol lana - Holcus lanatus, Hol umbe – Holosteum umbellatum, Che albu - Chenopodium album, Lol pere - Lolium perene, Mal dome - Malus domestica, Myo arve - Myosotis arvensis, Pic hier - Picris hieracioides, Pla lanc - Plantago lanceolata, Pla majo - Plantago major, Poa annu - Poa annua, Poa prat - Poa pratensis, Poa triv - Poa trivialis, Pol avic - Polygonum aviculare, Ros cani – Rosa canina, Ste medi - Stellaria media, Tar offo - Taraxacum officinale, Tri hybr – Trifolium hybridum, Tri medi - Trifolium medium, Tri repe - Trifolium repens, Urt dioi – Urtica dioica, Urt uren - Urtica urens.*

Conclusion

A total of 69 plant species was found during the observation. Most plants occurred in strips next to roots, a total of 58 plant species and 48 species in inter-rows. Among the species at all stands was the most represented species *Taraxacum officinale*.

Taraxacum officinale, Poa pratensis, Plantago major, Poa trivialis, Lolium perene, Poa annua, Agropyron repens, Trifolium medium, Urtica dioica and *Trifolium repens* were the most occurred species in inter-rows.

Taraxacum officinale, Stellaria media, Urtica dioica, Capsella bursa-pastoris, Poa annua, Trifolium hybridum, Holosteum umbellatum, Rosa canina and *Chenopodium album* were the most observed species in strips next to roots within the monitored period.

Each plant growing in nature has its unique importance, sometimes even this meaning is not detected and therefore not appreciated. Significance of weeds is both positive and negative. Weeds are artificially created group of plants, which in every way interferes humans. It is important to find limit when weed is harmful and when is not in the agricultural landscape. It certainly will have a different effect on weed infestation of inter-rows in apple orchard, than in the wheat field. Depending on the situation it is necessary to plan their regulation or maintaining them at the stands.

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