Agricultura 4: 9-22 (2006)

Grass communities in intensive and extensive orchards

Andrej VOGRIN

University of Maribor, Faculty of Agriculture, Vrbanska 30, 2000 Maribor, Slovenia

The composition of weed-herbal plant communities in several apple orchards grown around Maribor was investigated. In an intensive apple orchard, plant species were documented separately in the green cover between rows of trees, within the herbicide zones under canopies, and on the areas of extreme soil compaction such as cart tracks. Due to intensive mowing and treading, the following plant communities were established in the studied plantations: *Lolietum multiflorae* Dietl et Lehmann 1975, *Lolio perennis – Cynosuretum* Br. – Bl. et De Leeuw 1936 nom. Inv. and *Lolietum perennis* Gams 1927. In cart tracks, the most common was the community *Lolietum perennis* Gams 1927, whereas in the herbicide zone the communities could not be defined because of insufficient number of species needed for a reliable differentiation. In extensive apple plantations, the grass and herbal communities were classified as *Pastinaco – Arrhenatheretum* Passarge 1964.

Key words: apple, *Malus domestica* apple plantations, plant comununites weed control

INTRODUCTION

The territory around Maribor, where nowadays there are orchards, in the past was overgrown with woods, which were the primary vegetation in most of the Middle Europe. Taking into account the type of the soil, in natural conditions it would be covered with both deciduous and coniferous woods. After disafforestation, instead of various natural phytocenoses which changed due to human intervention, pastures and meadows were formed as secondary communities. The majority of plant species adapted to plantation ground cover need a lot of light. The upper plant layer of a meadow is mainly composed of grasses which grow in dense groups. Other herbage plants are mainly lower and grow more scattered about. In the lowest layer of meadow communities there are plants adapted to worse exposure that can live also in the shadow of other plants. Numerous abiotic factors, such as the basic rock, soil composition, quantities of individual mineral and organic substances, underground waters, quantities and forms of precipitations, air, light and warmth can influence all plants. Also important for plants are the topographic conditions on the habitat, above all the height above the sea level, relief and inclination of the grounds. Biotic factors also have an influence on plants. The influence of an individual outside factor is evident in variegation of plant communities.

The major part of plants grow in nature together with other plants of the same or different species in plant communities. Cohabitation of plants in a community is never entirely coincidental. Every phytocenosis develops according to some principles. Only those plant species for which the conditions in an environment are as satisfactory as possible can participate in its origin and development. Every plant community is composed of plant species which need similar conditions to grow and develop. In some phytocenoses the predominating species in the habitat can create characteristically changed conditions which enable vegetation for only some other plant species, which are specially adapted to these changed conditions.

It is only possible to ascertain all the different shades of relations and the competitive abilities of individual plant species in a plant community by a thorough analysis in the field and by statistical comparisons of floristic documentations. We chose more intensive and extensive orchards, in which we made more documentations and processed the data after they were completed.

Different ways of cultivation have a great influence on the floristic composition of species. In extensive orchards, where the mowing is done two or three times per year, the floristic composition is similar to those in the nearby meadows. By increasing the number of mowings the plant composition is changing and is becoming similar to the one in pastures. The most important difference between the floristic composition of extensive and intensive orchards is that due to constant mowings in intensive orchards those plants prevail, which are being reproduced vegetatively or can flourish and develop seeds in a very short time. Most meadow plants can be entirely developed with two mowings, but when they are more frequent they get replaced be pasture plants.

METHODS

The purpose of our experiment was to find out which kind of vegetation is to be found in intensive and which in extensive orchards. In order to be able to process the results adequately, we chose 50 intensive orchards in the vicinity of Maribor. In all the orchards the soil is cultivated in the way

Correspondence to:
Andrej VOGRIN
Tel.: ++386 2 25 05 823
Fax.: ++386 2 22 96 071
e-mail: andrej.vogrin@uni-mb.si

that the zone under tree canopies is treated with herbicides and kept more or less free of weeds, while the zone between rows where the tractors drive is covered with grass and mowed regularly.

In every orchard we randomly chose a row not close to the border to get as few influences from the nearby phytocenoses as possible on those in the orchard. In this row we randomly chose a 100 m^2 plot in the zone between rows covered with grass. As the width of this zone is approximately 2 m, we documented all plant species in the length of 50 m. We were also interested to find out which weeds can be found under tree canopies so we documented those, too. Because the width of the herbicide zone is approximately 1 m we had to make documentations on both sides in order to get a 100 m^2 big experimental plot. After documenting plant species in the zone between rows we found out that on tractor tracks a different composition of this community appears. So this area was documented separately. In this way three different documentations were done.

In every chosen orchard documentations were done in three different seasonal aspects. The spring documentation was done until the middle of May, the summer one from June to August and the autumn one in October. With these documentations we wanted to observe the dynamics of changing of plant species, if it exists at all in orchards.

We had some problems in choosing the extensive orchards for our experiment. While we had no trouble in choosing 50 intensive orchards, the number of extensive orchards which would be at least to some extent well kept, is minimal. Thus we documented plant species in only 4 such orchards, but they manage to give us a well enough picture of phytocenological communities, which can be found there. Those documentations were also done in all three seasons.

Documentations in the chosen orchards were done since 1994 to 1997.

The documentation was done according to the phytocenological methods of the Swiss – Montpellier school (J. Braun – Blanquet). We chose it for the following reasons:

- it is most commonly used in this kind of experiments in Middle Europe and as such it enables a comparative analysis with similar foreign and domestic herbological experiments;
- by using it a greater experimental plot is taken than with the counting method and the variabilitiy;
- when there is a great number of documentations it gives an exact number of dominance, abundance and also frequency of a certain species.

The combined scale to determine the abundance has 6 levels:

5 – the species covers 75 to 100 % of the experimental plot not regarding the number of individual plants
4 – the species covers 50 to 75 % of the experimental plot
3 – the species covers 25 to 50 % of the experimental plot
2 – the species covers 10 to 25 % of the experimental plot
1 – the species covers 1 – 10 % of the experimental plot
+ – the species is represented with very few samples, or it covers less than 1 % of the experimental plot.

For analytical processing, documentations of the same or related phytosenoses were united in regular phytocenological tables.

Documentations are equipped with elementary standard data. The height above the sea level (m), the size of an experimental plot (m^2), abundance of an individual species (%) and the serial number of the documentation are listed. Data about the location of the orchards are listed at the end of the tables.

In determining the species we used some basic floristic works as Hegi (1965-1979) and Garcke (1972), and keys to determine: Martinčič and Sušnik (1984), Domac (1979), Halfiger (1980, 1981, 1982), Kojič (1986). In order to name the species we used the book called Mala flora Slovenije (Martinčič et al. 1999).

In finding adequate systematics for the syntaxonomic classification of the communities taking part of our research we studied the works of different authors, such as Tuxen (1950), Oberdorfer (1957), Rodwell (1992) and Mucina (1993) and finally chose the work of the latter.

RESULTS AND DISCUSSION

There are more different systematics for the syntaxonomic classification of communities. Many important phytocenologists introduced their views and opinions in their works. It is especially evident in classification in lower syntaxonomic units. Because of different locations of documentations, it is understandable that the documentators, due to natural variability, noticed different compositions. To show the communities found in apple plantations we used the systematics of an Austrian phytocenologist Ladislav Mucina (Mucina 1993).

CLASS: *MOLINIO – ARRHENATHERETEA* R. TX. 1937 EM. R. TX. 1970

ORDER: *ARRHENATHERETALIA* R. TX. 1931

Alliance: *Arrhenatherion* **Koch 1926**

Association: *Pastinaco - Arrhenatheretum* Passarge 1964
Association: *Lolietum multiflorae* Dietl et Lehmann 1975

Alliance: *Cynosurion* R. Tx. 1947

Association: *Lolio perennis – Cynosuretum* Br. – Bl. et De Leeuw 1936 nom. inv.
Association: *Lolietum perennis* Gams 1927
Pastinaco - Arrhenatheretum Passarge 1964

This community appears all over Europe, from river terraces to mountain slopes. It can only develop and survive in the soil rich with minerals or in the regularly fertilized soil. It usually appears on cultivated meadows, so it is no wonder that we found it in extensive apple plantations. On such meadows the most characteristic community is Arrhenatherum elatius, after which this phytocenological community is called. Due

to the method of cultivation very various communities are developed. On non-fertilized meadows the flora is most variegated, but with fertilization the number of communities diminishes. The number of mowings also has a great influence on the community composition. As the intensity of fertilization and the number of mowings are usually connected, we can say that by intervening intensively in such a community, its variegation is reduced. Larger quantities of nutritive substances encourage the development of some grasses, which by growing exuberantly obstruct the development of some other plants. The plant species which take part of this community are of different heights, so layerness is well-defined. The upper layer is composed of grasses up to 1 m in height, as e.g. *Arrhenatherum elatius, Dactylis* glomerata, and some broad-leaved grass species as *Pastinaca sativa* and others. Lower we can find: *Poa pratensis, Holcus lanatus, Anthoxanthum odoratum, Geranium pratense, Alopecurus pratensis* and others. Closer to the ground there are *Trifolium repens* and *Trifolium pratense, Taraxacum officinale, Bellis perenis* and others.

Around Maribor, in the past there were a lot of apple plantations, where trees were planted in distances 10 x 10 m. The space between trees was either mowed or used as pastures. But most of these orchards were cleared, so today it is very difficult to find an orchard which would have all the characteristics of an extensive plantation. In our phytocenological documentations we were able to find only 4. Because they are old and because both fertilization and mowing are not done the same way, the variety of communities is different. All the plantations, however, have one thing in common, namely that the frequency of appearing and the abundance of Arrhenatherum elatius is elevate, so we classified it in the same plant community (Table 1).

Table 1. The community *Pastinaco - Arrhenatheretum* Passarge 1964

Height a. s. l.	**320**	**350**	**360**	**350**
Abundance (%)	**100**	**100**	**100**	**100**
Serial numb. of the documentation	**1**	**2**	**3**	**4**
Characteristic of association *Pastinaco-Arrhenatheretum* Passarge 1964				
Arrhenatherum elatius	2	2	2	2
Geranium pretense	1	1	1	+
Pastinaca sativa	1	1	1	1
Characteristic of alliance *Arrhenatherion Koch* 1926				
Campanula patula		+	+	
Crepis biennis	1		+	+
Galium album	+			+
Pimpinella major	+	1		+
Characteristic of order *Arrhenatheretalia* R. Tx. 1931				
Avenula pubescens		+		+
Cynosurus cristatus		+	+	+
Knautia arvensis	+			+
Lolium perenne		+		
Phleum pretense	+			+
Poa pratensis		1	+	+
Rumex acetosa			+	+
Veronica arvensis		+	+	
Veronica serpyllifolia			+	
Vicia sepium	+		+	
Characteristic of class *Molinio – Arrhenatheretea* R. Tx. 1937 em. R. Tx. 1970				
Achillea millefolium	1		1	
Alopecurus pratensis	+	1	1	1
Anthriscus sylvestris	+		1	+
Bellis perennis	+			+
Centaurea jacea	+	+	+	

Cerastium holosteoides	+			+
Dactylis glomerata	1	+	+	
Festuca pratensis		1	+	+
Festuca rubra	+	+		1
Heracleum sphondylium	+	+	+	
Holcus lanatus	+	+	+	+
Lathyrus pratensis			+	
Leontodon autumnalis		+		1
Leontodon hispidus	+	+	+	
Leucanthemum ircutianum		+		
Lychnis flos-cuculi	+	+		+
Lysimachia nummularia	+		+	
Plantago lanceolata	+		1	1
Poa trivialis	1	2	+	1
Ranunculus acris	+			1
Ranunculus repens	+	+	1	1
Taraxacum officinale	+	1	1	+
Trifolium pretense	1	+		+
Trifolium repens	+	+	+	1
Trisetum flavescens	+	+		+
Viccia cracca	+		+	
Companion species:				
Agropyron repens	+		+	
Ajuga reptans	+	+		
Anthoxanthum odoratum		1	+	1
Armoracia lapathifolia	+			
Atriplex patula			+	
Bromus mollis	+		+	1
Calystegia sepium	+		+	
Carex hirta		+	+	
Chenopodium album	+		+	+
Chenopodium polyspermum		+	+	
Cichorium intybus			+	
Cirsium oleraceum	+			+
Clematis vitalba		+	+	
Digitaria sanguinalis			+	+
Erigeron annuus	+			+
Erigeron Canadensis	+			
Euphorbia helioscopia			+	
Galinsoga parviflora	+			+
Galium mollugo	+	+		
Glechoma hederacea	+		+	1
Hypericum perforatum		+	+	
Lamium purpureum	+	+	+	
Malva neglecta			+	
Medicago lupolina		+	+	
Medicago sativa	+			
Melandrium album	+			+
Mentha arvensis		+	+	

Mentha polegium			+	
Oxalis stricta			+	
Salvia verticillata			+	
Scrophularia nodosa			+	+
Setaria glauca		+	+	
Setaria viridis	+		+	+
Silene vulgaris	+			
Solanum nigrum	+		+	
Sonchus asper	+			+
Sonchus oleraceus	+		+	
Symphytum officinale	+			
Urtica dioica	+	+		+

Documentations' locations:

1. Metava, eutric cambisol
2. Zimica, eutric cambisol…
3. Jareninski vrh, eutric cambisol…
4. Slatinski dol, eutric cambisol….

Lolietum multiflorae Dietl et Lehmann 1975

The vegetation in three different intensive apple plantations was classified into this community. Its main characteristic is, that it is composed of relatively low number of species, among which *Lolium multiflorum* plays a dominating part. This community supposedly appeared as a consequence of sowing grass-clover mixtures or of intensifying the mowing. In all three cases this community was documented in the part of the orchard, which had recently been renovated. It is our assumption that the community appeared after sowing grass-clover mixtures. In other, older parts of the orchards, other communities appeared. In other plantations other than in the vicinity of the ones just mentioned, *Lolium multiflorum* was rarely seen and its abundance was elevate. For this community low species are characteristic, such as *Plantago maior, Poa annua, Stellaria media, Achilea millefolium, Ranunculus acris, Taraxacum officinale, Trifolium repens* and others (Table 2). In all three orchards we documented more species than is characteristic for this community. Because all parts of the orchards when this community was seen are relatively narrow, the invasion of other plant species into this community is considerate. We assume that in a few years *Lolium multiflorum* will loose its dominance and that other species will take its place. So this community will most probably gradually change to Lolietum perennis Gams 1927.

Table 2. The community Lolietum multiflorae Dietl et Lehmann 1975

Height a. s. l.	**280**	**320**	**290**
Abundance (%)	**100**	**100**	**95**
Serial numb. of the documentation	**1**	**2**	**3**
Characteristic of association *Lolietum multiflorae* Dietl et Lehmann 1975			
Lolium multiflorum	3	3	2
Characteristic of alliance *Arrhenatherion* Koch 1926			
Arrhenatherum elatius	+	+	
Campanula patula			+
Crepis biennis		+	
Galium mollugo		+	+
Pastinaca sativa	+		
Pimpinella major	+	+	
Characteristic of order *Arrhenatheretalia* R. Tx. 1931			
Avenula pubescens			+
Cynosurus cristatus	+		
Knautia arvensis	+	+	+

Lolium perenne	+	+	1
Phleum pratense	+	+	+
Poa pratensis		+	
Rumex acetosa		+	+
Stellaria graminea			+
Veronica arvensis		+	+
Veronica serpyllifolia		+	
Vicia sepium	+	+	
Characteristic of class *Molinio – Arrhenatheretea* R. Tx. 1937 em. R. Tx. 1970			
Achillea millefolium	1	+	+
Alopecurus pratensis	+	+	
Bellis perennis	+		+
Dactylis glomerata	+	+	
Festuca pratensis	+		+
Festuca rubra	+	+	+
Heracleum sphondylium	+		
Plantago lanceolata		+	+
Poa trivialis	1		+
Ranunculus acris	1	1	+
Ranunculus repens	+	1	+
Taraxacum officinale	1	2	2
Trifolium hybridum		+	
Trifolium pratense	+		+
Trifolium repens	2	2	2
Viccia cracca	+		
Companion species:			
Achillea millefolium	+	+	
Agropyron repens			+
Equisetum arvense	+		
Lamium purpureum	1	+	
Plantago major	1	+	+
Poa annua	1	+	1
Senecio vulgaris		+	
Stellaria media	+	+	+
Urtica dioica	+	+	

Documentations' locations:

1. Bresternica, eutric cambisol
2. Bresternica, eutric cambisol…
3. Vajgen, eutric cambisol….

Lolio perennis – Cynosuretum Br. – Bl. et De Leeuw 1936 nom. inv.

In contrast to meadow communities in which higher plants are prevailing, in areas of intensive mowing lower plants can survive, as for them intensive mowing is not harmful. Mowing is also the reason why less plant species can be found in such communities. The floral composition depends mostly on the geological basis and on the elevation (height above the sea level). From lowlands to the montanic zone the communities belonging to the alliance *Cynosurion* can be found.

In this community which we found in 8 intensive plantations, *Lolium perenne* is dominating. Other than appearing frequently, it also has high abundance. It is accompanied by *Cynosurus cristatus*. Because of several annual mowings hemicriptophytes prevail. The most frequently found are: *Poa pratensis and Poa trivialis, Taraxacum officinale, Achillea millefollium, Plantago major* and *Plantago lanceolata,*

Ranunculus acris and *Ranunculus repens, Trifolium pretense* and other low plants. Field and ruderal species also appear. *Glechoma hederacea*, which was documented in all the plantations, is also characteristic for this community. *Capsela bursa – pastoris*, which can also be called characteristic for this community, can be found, too (Table 3). The number of species in this community is not large, but it is definitely larger than in *Lolietum multiflorae*. In Europe this community can be found up to 800 m above the sea level, on brown and rich soil. The soil where the plantations around Maribor are situated is brown, and for apple plantations it is characteristic to have the soil well provided with nutrition.

Table 3. The community *Lolio perennis – Cynosuretum* Br. – Bl. et De Leeuw 1936 nom. inv.

Height a. s. l.	**320**	**350**	**280**	**360**	**360**	**330**	**380**	**310**
Abundance (%)	**100**	**85**	**90**	**85**	**95**	**100**	**100**	**85**
Serial numb. of the documentation	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Characteristic of association *Lolio perennis – Cynosuretum* Br. – Bl. et De Leeuw 1936 nom. inv.								
Lolium perenne	1	2	2	2	1	1	2	1
Cynosurus cristatus	+	+	+	1	1	1	+	+
Trifolium repens	1	+	1	1	1	1		1
Characteristic of alliance *Cynosurion* R. Tx. 1947								
Bellis perennis		1	1	+				
Leontodon autumnalis	+	+					+	
Phleum pratense			+		1	+		
Prunella vulgaris	+	+						+
Veronica serpyllifolia	1		+				+	
Characteristic of order *Arrhenatheretalia* R. Tx. 1931								
Achillea pratensis		+				+		
Arrhenatherum elatius			+	+	+			+
Campanula patula						+		
Crepis biennis	+		+	+			1	+
Knautia arvensis		+		1				
Poa pratensis	1	1		1	1	1	1	1
Rumex acetosa		+	+				+	
Stellaria graminea				+			+	
Veronica arvensis	+	+				+		
Vicia sepium	+	1	+	+				+
Characteristic of class *Molinio – Arrhenatheretea* R. Tx. 1937 em. R. Tx. 1970								
Achillea millefolium	2	+	1	1	1	1	+	1
Agrostis capillaris						+		
Agrostis stolonifera					+			
Ajuga reptans		+						
Alchemilla vulgaris							+	
Alopecurus pratensis		+	+	+	+	+		
Anthriscus sylvestris							+	
Carum carvi				1	+			
Centaurea jacea	+		+	+		+	+	
Cerastium holosteoides		+						
Dactylis glomerata	+	1	1	1		+	1	
Deschampia caespitosa					+			
Euphrasia rostkoviana						+		
Festuca pratensis	+	+	+	+			1	

Festuca rubra		+				+	1	
Heracleum sphondylium	+	1	+	+	+			
Holcus lanatus	+	+						
Lathyrus pratensis		+	1	+				
Leontodon hispidus	+						+	
Leucanthemum ircutianum				+	+		+	+
Lychnis flos-cuculi				+	+		+	
Lysimachia nummularia							+	+
Pimpinella major	+		+	+		+		
Plantago lanceolata	1		1	+	1	1		
Poa trivialis	+		1	1				1
Ranunculus acris		1	1	1		+		+
Ranunculus repens	2	1	1	1	1	1		1
Taraxacum officinale	2	2	1	+	2	2	1	2
Trifolium pratense	1	+	1	1	1	1		1
Viccia cracca	+		+					
Companion species:								
Aegopodium podagraria	+	+	1		1	+		1
Agropyrum repens			1		1	1	1	+
Agrostis canina			1					+
Amaranthus retroflexus							+	+
Capsela bursa-pastoris	+	+	+	1	1	+	1	+
Cardamine hirsuta			1			+	+	+
Cardamine pratensis	1	+						
Centaurium erythraea					+			
Cerastium brachypetalum	+		+			+		
Cerastium glomeratum	+							+
Chenopodium album							+	+
Chenopodium polyspermum							1	
Cichorium intybus						+		
Cirsium arvense		+					1	1
Cirsium oleraceum						+		
Convolvolus arvensis				+		+		
Digitaria sanguinalis							+	
Echinochloa crus-galli							1	
Equisetum arvense					+			
Euphorbia cyparissias						+		
Euphorbia helioscopia	+	+	+					
Galium molugo				+		1	+	1
Geranium dissectum			+					
Geranium pyrenaicum								+
Glechoma hederacea	+	+	+	1	1	1	+	1
Hypericum perforatum			+					
Lamium purpureum	+	+		+			+	+
Medicago luppolina						1		1
Oxalis stricta							+	+
Plantago major	1	1	1	1	1	1	+	1
Plantago media		+	+					
Poa annua	+	+	+				1	+

Polygonum aviculare					+	1		
Potentilla reptans	1					1		+
Prunella grandiflora								+
Rubus caesius		+			+			+
Rumex crispus					+	1	+	
Rumex obtusifolius	+			+		1	1	+
Senecio vulgaris	1	+	+				1	
Setaria glauca			+			+		
Setaria viridis		+				1	+	
Sonchus oleraceus	+	+					1	
Stellaria media	+		1		+	1	1	+
Symphytum officinale				1	+			1
Tanacetum vulgare	+							
Trifolium dubium					+			
Tussilago farfara					+			
Urtica dioica	+			+		+	+	1
Urtica urens	+							
Veronica chamaedrys		+				1	+	
Veronica hederifolia	1							
Veronica persica		+		+		+		1
Vicia hirsuta	+		+				+	

Documentations' locations:

1. Pesnica pri Mariboru, eutric cambisol
2. Šentilj v Slovenskih goricah, eutric cambisol
3. Trate, eutric cambisol
4. Bresternica, eutric cambisol
5. Limbuš. eutric cambisol
6. Pekre, distric cambisol
7. Trčova, eutric cambisol
8. Vosek, eutric cambisol

Lolietum perennis Gams 1927

This is one of the most common ruderal communities and appears in disturbed areas, where there is a lot of treading. It can be found on sport grounds, lawns, green plots, along roadsides, and on humid, well drainaged brown soils. It appears where the soil is rich in nitrogen. Because of frequent rides with machines and treading, it is very common also in intensive plantations. In cart tracks, where there is the highest intensity of treading, this community definitely appears, as all the species characteristic for it are here or appear as companions. These species are: *Lolium perenne, Plantago major, Achillea millefolium, Dactylis glomerata, Plantago lanceolata, Poa annua* and *Poa pratensis, Taraxacum officinale, Trifolium pretense* and *T. repens.* In the remaining part of the area covered with grass there is a lot more different plant species than in cart tracks. But mostly they do not appear in great numbers, and their abundance is not very high. Because of frequent mowing hemicriptophytes prevail in this community, both in frequency and for its abundance.

In Table 4 the frequency of appearance of some species and their abundance for 15 chosen apple plantations are shown.

In 15 plantations we documented 127 different species. !6 species, or less than 13 %, appear in more than 70 % of plantations. These species also have high abundance. They are all low and easily tolerate rides and treading. But on the other hand there are more than 60 % of the species which appear only in 20 % of the orchards. Usually these species do not have a high abundance in an individual orchard. Despite the fact that we documented 127 different species, a much lower number of them can be found in an individual orchard. In one orchard we documented averagely 35 species. It is also characteristic for the community *Lolium perennis* that in it there are not many different species.

Table 4. The community *Lolietum perennis* Gams 1927

Height a. s. l.	280	320	270	260	340	360	300	280	360	270	270	300	310	280	290
Abundance (%)	100	90	100	85	100	90	100	85	95	100	100	85	95	85	100
Serial numb. of the documentation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Characteristic of association *Lolietum perennis* Gams 1927															
Lolium perenne	1	2	2	1	1	2	1	2	1	2	2	1	2	2	2
Plantago major	1	1	+	1	1	1	1	1	+	1	1	1	1	1	1
Achillea millefolium	1	1	1	1	1			1	1	1		1	1		1
Dactylis glomerata		1	+			+		+	1	+	+	1	1	1	1
Trifolium repens	1			1	1	1	1	1		1	1	1	1	1	1
Characteristic of alliance *Cynosurion* R. Tx. 1947															
Bellis perennis	1	1	1	1	1	+	1	1	+	+	+	1	1	+	1
Cynosurus cristatus	+			+		1			+		+				
Phleum pratense									+	+	+			+	+
Prunella vulgaris					+			+		+					
Veronica serpyllifolia		+												+	+
Characteristic of order *Arrhenatheretalia* R. Tx. 1931															
Arrhenatherum elatius	+			+					1						
Campanula patula											+				
Crepis biennis		1							+	+					
Knautia arvensis								+		+	+				
Poa pratensis	1	1	+	1	1	1	1	1	2	1	1	2	+	1	+
Rumex acetosa		+			+			1		+					
Stellaria graminea				+					+		+				
Veronica arvensis		+				+								+	
Vicia sepium			+		1	+		+	+			+			
Characteristic of class *Molinio – Arrhenatheretea* R. Tx. 1937 em. R. Tx. 1970															
Agrostis capillaris				+				+	+				+		
Agrostis stolonifera					+	+						+			
Ajuga reptans	+	+		+	+		+				+				
Alchemilla vulgaris								+	+			+			
Alopecurus pratensis						+		+		1					
Anthriscus sylvestris				+											
Carum carvi	+									+					
Centaurea jacea					+						+				
Cerastium holostoides			+						+						
Deschampia caespitosa				+							+				
Euphrasia rostkoviana				+			1	+						+	
Festuca pratensis		1						1			1	1	1		
Festuca rubra		1										1		1	+
Heracleum sphondylium	1					+	+	+							
Holcus lanatus						+		+					+		
Lathyrus pratensis			+						+					+	+
Leucanthemum ircutianum	+						+								
Lotus corniculatus					+										

Lychnis flos-cuculi			+							+					
Lysimachia nummularia	+		+												
Pimpinella major													+		
Plantago lanceolata	+		+		+	1	+		+	+					
Poa trivialis	+		1			1	2	2	1	1	2		+	1	+
Ranunculus acris	1		1	+	+	+	1	1	+	1	+			1	1
Ranunculus repens	1		1	1	1	2	1	1	1	1	1	+		2	2
Taraxacum officinale	1	2		2	2	2	2	1	1	2	2	2	1	2	1
Trifolium hybridum					+				+						
Trifolium pratense	1			1	1	1						1	1	1	+
Trisetum flavescens	+		+								+				
Viccia cracca											+	+			
Companion species:															
Aegopodium podagraria		1	1		+			1	1			1			
Agropyrum repens	1		2	1	1	1		1	1		1	1	1	1	
Agrostis canina		1													
Alchemilla arvensis			+							+			+		
Amaranthus retroflexus	+														+
Anagallis arvensis				1			+					+			
Anthemis arvensis		+													
Armoracia lapathifolia									+	+					
Artemisia vulgaris								+							
Bromus mollis									1				+		
Calystegia sepium	+						+	+			+		+		
Capsella bursa-pastoris		1		1	+					+	+	+			
Cardamine hirsuta	+					+									
Carex hirta										1	1	+			
Cerastium arvensa					+			1							
Cerastium brachypetalum		1		+											
Cerastium glomeratum						+				1					
Chenopodium album	+	+	+		1								+		
Cichorium intybus					+										
Cirsium arvense	1		1								1	+	1		1
Cirsium oleraceum	+													+	
Convolvolus arvensis			+		+	+		+		+	+	+	+		+
Conyza canadensis						+									
Crepis capillaris			+	+											
Crepis setosa					+										
Digitaria ischaemum										+					
Digitaria sanguinalis				+			+	+						+	
Echinochloa crus - galli				1	1	+			+	+	+				1
Epilobium hirsutum							+								
Equisetum arvense			+										+		
Erigeron annuus				+				+	+						
Erigerum canadensis	+										+				
Euphorbia helioscopia		+	+		+		+	+						+	
Euphorbia verrucosa					+										
Galinsoga parviflora				+											
Galium aparine														+	

Galium mollugo	1	1	1		1	1	+		1	+			1	+	+
Glechoma hederaceum			1			+	+		+	+				1	+
Hypericum perforatum			+												
Lamium album												+			
Lamium purpureum	+	1		1	1	1	+	+	1	1	+		1	+	1
Leontodon hispidus	+														
Linaria vulgaris										+					
Lysimachia vulgaris												+			
Malva neglecta							1	1							+
Medicago lupolina	1				1		+					1		1	+
Medicago sativa													+		
Melandrium album	+														
Mentha polegium										+					
Persicaria hydropiper							1					+			
Persicaria lapathifolia													1	+	1
Plantago media					+	+			+			+			
Poa annua	1	+		1		+		+		1	+	+	+	1	+
Polygonum aviculare				1	+	1			1		+				
Polygonum persicaria			+												
Potentilla reptans						1		+		+			+	+	+
Raphanus raphanistrum					+										
Rubus caesius			+						+						
Rumex acetosella													+		
Rumex obtusifolius		1		1	1		+				1	1	+	1	
Scrophularia nodosa												+			
Senecio vulgaris		1	+	1		+	1		+	+	+	1	+	+	+
Setaria glauca	+	+	+		+		1	+	1	+			+		
Setaria viridis	1	1	+	1	+	1		1	+	1		+	+		
Sinapis arvensis					+										
Solanum nigrum	+														
Sonchus asper											+				
Sonchus oleraceus				+									+		
Stellaria media		1	+	1		+		1	1	1		1	+		+
Symphytum officinale										+					1
Tragopogon orientalis											+				
Urtica dioica	+	1			+		+	1				+		1	
Urtica urens												+			
Veronica chamaedrys	+														
Veronica hederifolia						+	+								
Veronica persica		+				+	+	+				+	+	+	1
Vicia hirsuta	+	+				+									
Viola arvensis			+	+											

Documentations' locations:

1. Bresternica, eutric cambisol
2. Selnica ob Dravi, eutric cambisol
3. Pesnica pri Mariboru, eutric cambisol
4. Zgornji Duplek, eutric cambisol
5. Spodnji Slemen, eutric cambisol
6. Vosek, eutric cambisol
7. Črešnjevec pri Dravi, eutric cambisol
8. Šentilj v Slovenskih goricah, eutric cambisol
9. Pohorski dvor, eutric cambisol
10. Limbuš, eutric cambisol
11. Pekre, distric cambisol
12. Trete, eutric cambisol
13. Zimica, eutric cambisol
14. Gačnik, eutric cambisol
15. Svečina, eutric cambisol

CONCLUSION

- Pastinaco – Arrhenatheretum Passarge 1964

The community appears in extensive orchards. It is characterised by a diverse botanical composition which gets reduced by mineral fertilization. The plants usually form three layers. The upper layer is composed of the species like *Arrhenatheretum elatius, Dactylis glomerata* and *Pastinaca sativa*, lower we find *Poa pratensis, Holcus lanatus, Anthoxanthum odoratum, Geranium pratense, Alopecurus pratensis* and others, while nearest to the ground there are Trifolium repens, *Trifolium pratense, Taraxacum officinale* and *Bellis perennis.*

- Lolietum multiflorae Dietl *et* Lehmann 1975

The community appears as a consequence of sowing grass-clover mixtures. It is usually found in newer plantations where a few years earlier mixtures with a great share of *Lolium multiflorum* were sowed. In other intensive plantations *Lolium multiflorum* was rarely seen. Where it was found, it was gradually losing its dominance. The community is composed of a relatively low number of species. The diversity usually increases after the sowing because of the invasion of other species from nearby communities. According to our observations, we can assume that this community will, in most habitats, gradually change to *Lolietum perennis* Gams 1927.

- Lolio perennis – Cynosuretum Br. – Bl. *et* De Leeuw 1936 nom.inv.

It appears in intensive plantations. Because of intensive mowing and frequent rides with heavy machines, there are relatively few species in this community. Hemicryptophytes prevail. The floral composition depends mostly on the geological basis and on the elevation (height above the sea level). The characteristic species are: *Lolium perenne, Cynosurus cristatus, Capsela bursa – pastoris, Poa pratensis and Poa trivialis, Achillea millefolium, Plantago major, Plantago lanceolata, Ranunculus acris and Taraxacum officinale.*

- Lolietum perennis Gams 1927

It develops in intensive plantations. Intensive mineral fertilization and frequent treading is causing the decline of floral diversity. Regarding its botanical composition, it is similar to *Lolium perennis – Cynosuretum* (they both belong to the unit Cynosurion R. Tx. 1947). They can be distinguished by some specific characteristics. It is one of the most frequent rural communities and appears in areas with a very high level of treading (on sport grounds, lawns, green plots). Beside the characteristic species such as *Lolium perenne, Plantago major, Achillea millefolium, Dactylis glomerata, Plantago lanceolata, Poa annua, Poa pratensis, Taraxacum officinale, Trifolium pratense and T. repens,* other species may also be present although they appear to be less important.

In areas between rows in intensive plantations, the following species appear to be the most frequent: *Achillea millefolium, Agropyrum repens, Lolium perenne, Poa pratensis, P. trivialis, Taraxacum officinale, Trifolium repens, Ranunculus repens, R. acris, Echinochloa crus–galli, Galium mollugo, Lamium purpureum, Plantago maior, Senecio vulgaris* and *Stellaria media.* The first eight species are the most frequent.

The most frequent species in the herbicide zone of the examined intensive plantations are: *Agropyrum repens, Galium mollugo, Lamium purpureum, Lolium perenne, Ranunculus repens, Senecio vulgaris, Stellaris media, Taraxacum officinale and Echinochloa crus – galli.* The first eight species are the most frequent. Among relatively frequent species are also: *Achillea millefolium, Aegopodium podagraria, Cirsium arvense, Polygonum aviculare* and *P. persicaria.*

The lowest diversity of plant species was determined on the areas characterised by extreme compaction of soil (cart and tractor tracks). The most frequently found are: *Agropyrum repens, Lolium perenne, Plantago major, Poa pratensis, Ranunculus repens, Taraxacum officinale and Trilolium repens.* The first five species are the most frequent. Among relatively frequent species are also *Poa annua, Poa trivialis and Ranunculus acris.*

In extensive plantations we determined, on average, the highest number of different plant species. With the intensification of the apple tree production, the level of the diversity of the plant species is decreasing. At the same time the proportion of the species tolerant to treading is increasing.

REFERENCES

1. Domac R. Mala flora Hrvatske i susjednih područja. Zagreb, 1979;543.
2. Garcke A. Ilustrierte Flora. Berlin/Hamburg, Verlag P. Parey, 1972;1608.
3. Hafliger E, Scholz H. Grass weeds 1. Basel, Documenta Ciba – Geigy, 1980;142.
4. Hafliger E., Scholz H. Grass weeds 2. Basel, Documenta Ciba – Geigy, 1981;137.
5. Hafliger E., Scholz H. Grass weeds 3. Basel, Documenta Ciba – Geigy, 1982;132.
6. Hegi H. Ilustrierte flora von Mitteleuropa, I – VII, Munchen/Wien, Carl Hanser Verlag in Paul Parey Verlag, 1965–1979;50.
7. Kojić M. Mala korovska flora, Beograd, 1986;515.
8. Martinčič A, Sušnik F. Mala flora Slovenije. Ljubljana, 1984;793.
9. Martinčič A, Wraber T, Jogan N, Ravnik V, Podobnik A, Turk B, Vreš B. Mala flora Slovenije, Ključ za določanje praprotnic in semenk, Tretja dopolnjena in spremenjena izdaja. Ljubljana, 1999;845.
10. Mucina L, Grabherr G, Ellmauer T. Die Pflanzengesellschaften Österreichs (Teil I., Antropogene Vegetation). Stuttgart – New York, 1993;201.
11. Oberdorfer E. Süddeutsche Pflanzengesellschaften: Teil III. 2. stark bearbeitete Auflage, Jena, 1983;455.

12. Rodwell JS. Grassland and montane communities. Cambridge, 1992;78.

13. Tuxen R. Grundriss einer Systematik der nitrophillen Unkrautgesellschaften in der eurosibirischen Region Europas, Mitt. Der flor. – soc. Arbeitsgem., 2, Stolzenau, 1950;175.

Received: December 6, 2005
Accepted in final form: February 14, 2006