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Ruderalisation of the community *Arrhenatheretum elatioris* in area of gudrons waste sites at locality Predajná (Central Slovakia)

HANA OLLEROVÁ

Katedra environmentálneho inžinierstva, Fakulta ekológie a environmentalistiky so sídlom v Banskej Štiavnici Technickej univerzity vo Zvolene, Kolpašská 9/B, 969 01 Banská Štiavnica, Slovenská republika, e-mail: ollerova@fee.tuzvo.sk

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Abstract: This paper shows the state of species diversity and intrusion of synanthropic species into natural community *Arrhenantheretum elatioris* at locality Predajná (district Brezno). The locality is influenced by running of two hazardous waste landfills (with gudrons). They belong to Petrochema Dubová, which is located in geomorphological part Lopejská dolina.

Keywords: ruderalisation, community *Arrehenatheretum elatioris*, gudrons waste sites.

Introduction

Ruderalisation of natural communities is influenced and depended on man activity. Industry, building activities, non-exploiting the meadows and pastures, developing the agriculture and travelling caused the intrusion of synanthropic plant species to the natural biotopes. At the locality Predajná (district Brezno) the grassed meadows communities of alliances *Arrhenatherion elatioris, Cynosurion* and *Bromion erecti* were been destroyed and synanthropisated by genesis and running of two waste sites of dangerous waste in sixties and seventies years of the last century. This paper`s aim is to show on differences between communities *Arrhenatheretum elatioris* from nearby of waste sites and

farther areas which had not been influenced by gudrons waste sites. The emphasis is put on comparisons of species diversity and on intrusion of synathropic species.

Material and methods

Vegetations relevés were made in vegetation seasons in years 1999 –2002 at plot of 25 m^2 in sence of Zürich-Montperlier School with using seven degrees of the combined scale of the abundance and dominance according to BRAUN-BLANQUET (1964). Prospective variances in plot magnitude are written in the phytocoenological table. Species constancy in community is written in Table 1 by Roman numerals. Nomenclature is written according to MARHOLD & HINDÁK (1998) and ecologic characterisation of sites is according to JURKO (1990).

Vegetation and phytocoenological research was made on two waste sites, namely Predajná I and II, it means on shores and embankment slopes of filled up depressions, which were 40 m off. Because gudrons are semiliqiud waste, which genesis by refining of mineral oils with sulphuric acid, the waste sites look like basins. Waste sites of dangerous waste belong to the company Petrochema Dubová, which is located in district Brezno. The waste site Predajná I (the plot no. 1) is located 800 m in the east from Predajná on south - eastern foot Hôrka`s slope with the altitude 520 m a.s.l. and it was been building in the years 1962-1964 on the area 10.921 m^2 with the capacity 100.000 m^3. The filling was finished in 1974 (Fig. 1). The waste site Predajná II (the plot no.2) is situated 200 m in the west from the waste site Predajná I, in the altitude 520 m a.s.l. and it was been building in years 1973-1974. It takes area 12.000 m^2 with the capacity 60.000 m^3 (Fig.2). The filling was finished in 1983 (HALAJOVÁ, 1995). Several relevés were made further from waste sites (50 –250m), where communities had not been so influenced by waste.

For adjudication the similarity representative groups of relevés, the Sörensen index of qualitative floristic similarity was used.

$$IS = \frac{2c}{A+B} * 100,$$

where *c* is the number of common species, *A* is the number of species in relevé A, *B* is the number of species in relevé B (Moravec te al. 1994). The first group makes relevés from locality Predajná I - 40 m off, the second one makes relevés from Predajná II - 40 m off and the third group the relevés from both localities but from further.

Results and discussion

The community *Arrhenantheretum elatioris* was described by seven relevés in distance 10-40 m from both gudrons waste sites on embankment slopes, which have inclination in the range from 20° to 30°. The s lopes are orientated in south or east. Stands come up to cover from 60 to 100%. There are 62 species in association with average number of species 18,6 in a relevé. In upper layer of

the herbaceous floor is dominated *Arrhenatherum elatius*, which makes stand with the height 1 m. There are species which have higher both constancy and cover in the stands, such as *Achillea millefolium, Daucus carota, Festuca rubra, Leontodon hispidus, Lotus corniculatus, Leucanthemum vulgare, Taraxacum officinale agg.*

In the community unambigulous predominate hemicryptophytes over other life forms. According to visual appraisal, the soil substrate is clayed and very dry. From the point of view of soil humidity there are species which are undemanding for content of water in soil. There are *Securigera varia, Tithymalus cyparissias, Salvia pratensis, Sanqguisorba minor, Scabiosa ochroleuca* from more xerophyte species. The community is characterized by species to which suit soils with slighty acid up to slighty alkaline soil reaction. There are *Alyssum alyssoides, Galium verum, Medicago falcata, M. lupulina, Potentilla heptaphylla, Sanguisorba minor, Scabiosa ochroleuca* as alcalophilic species. The content of soil nitrogen is not so important for majority species. Nitrophobic species are *Alyssum alyssoides, Securigera varia, Galium vrulm, Genista tinctoria, Pilosella bauhinii, Potentilla heptaphylla, Pseudolysimachion spicatum, Scabiosa ochroleuca, Thesium linophyllon.* Markedly nitrophilic species are not included in the community. The community is well-developed in May and June.

In the community are quite abundant species of class *Festuca-Brometea* and order *Brometalia* and typical is also considerable occurrence of calciphile species (*Sanguisorba minor, Tithymalus cyparissias, Vicia tenuifolia, Cardaminopsis arenosa, Malampyrum cristatum, Securigera varia, Verbascum chaixii, Lathyrus tuberosus, Potentilla heptaphylla, Silene viscosa*). They intruded to the community from surrounding hillsides, which spread in north from waste sites. In these communities, it is possible to speak about intrusion of some ruderal species, especially from class *Artemisietea vulgaris* (*Picris hieracioides, Melilotus officinalis, Arthemisia vulgaris* and *Tanacetum vulgare*), what is the proof of gradual ruderalisation of this meadow community.

In the literature is community *Arrhenatheretum elatioris* described very often. Continuous stands were noted by BALÁTOVÁ-TULÁČKOVÁ (1969) and also VALLOVÁ-ŠTOLOCOVÁ (1965) from the Libuňka valley near Trutnov. Detailed synecological research of meadows and community *Arrhenatheretum elatioris* made AMBROŽ & BALÁTOVÁ-TULÁČKOVÁ (1962 in the valley of Opava river and BALÁTOVÁ-TULÁČKOVÁ (1968) its described from south Morava.

More detailed phytocoenological characterisation of the community *Arrhenatheretum elatioris* from Košická, Popradská and Ľubovnianska kotlina was presented by ŠPÁNIKOVÁ & ZALIBEROVÁ (1982) and ŠPÁNIKOVÁ (1985). TÜXEN (1937), SCHNEIDER (1954), HUNDT (1958) and KRAUSE (1963) wrote about its spreading in Germany. The occurrence of the community *Arrhenatheretum elatioris* was booked also on various areas with the influence the industry immisions. In Žiarska kotlina it was described by KONTRIŠOVÁ (1980).

The community is documented with four relevés from further from both waste sites, which were located in the plain part from the slopes foot and hillsides eastward to alluvial floodplain of Hron. Communities of alliance *Arrhenatherion*

elatioris are spread on places with upper humidity and they are characterised by high cover (100%) and goodly species diversity. The average number of species is 35 in a relevé. The highest constancy accomplish species like *Arrhenatherum elatius, Trifolium pratense, Plantago lancolata, Achillea millefolium, Medicago lupulina, Lotus corniculatus* and *Taraxacum officinale agg.* Higher cover accomplish only species *Trifolium pratense, Achillea millefolium, Medicago falcata* and *M. lupulina*. Besides characteristic species from class *Molinio-Arrhenatheretea*, there are also numerous species from class *Festuco-Brometea*. Species of the investigative community are mesophilic with wider range of ecological claims to the soil humidity, soil pH and amount of nitrogen in soil.

Sörensen`s index results confirm relatively low similarity between chosen groups of relevés. Similarity between relevés from locality Predajná I (40 m off) with communities from further is 41,44%, and from locality Predajná II (40 m off) with further communities is 45,87%. Higher similarity was expected between communities of localities Predajná I and Predajná II (40 m off). But it accomplish only 48,78%.

Conclusions

There were typical oatgrass meadows on locality Predajná and the area was agriculturally used (cutting down and grazing). Some changes beginning in natural phytocoenosis because of waste sites of dangerous waste were built and run.

The comparison of communities from further localities with those ones nearby waste sites shows that communities occurring places nearby waste sites have less both cover and species diversity. In some cases, they occur less area and have more ruderal species than communities from further localities. On the base of occurrence of synanthropic species from the class *Artemisietea vulgaris* is possible to certify gradual synanthropisation of the natural community. There are more frequent characteristic species from alliance *Arrhenatherion elatioris* and *Cynosurion* but also from order *Arrhenatheretalia* and classes *Molinio-Arrhenathretea* and *Festuco-Brometea* in communities further from the waste sites.

In a sense of MUCINA et al. (1993), an anthropogenic activity, gradually eroding and abandoning of areas can come up to the change of the community *Arrhenatheretum elatioris* to the community *Tanaceto-Arrhenatheretum*, prospectively to *Tanaceto-Artemisietum vulgaris*.

Acknowledgement

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Tab. 1. Community *Arrhenatheretum elatioris*

Relevé no.	1	2	3	4	5	6	7	8	9	10	11	
Locality	2	2	2	1	1	1	1	2	2	1	1	
Year	99	99	99	99	99	99	99	02	02	02	02	
Month	6	5	6	7	7	7	7	6	6	6	6	
Day	7	7	7	19	22	22	22	5	13	14	14	
Area (m^2)	25	4	9	25	16	25	25	25	25	25	25	
Cover E_1 (%)	100	80	70	100	60	70	100	100	100	100	100	
Number of species	12	13	26	21	15	21	22	46	33	29	30	
Inclination (°)	20		20		30	30	30					
Orientation	S		S		E	E	E					
												const ancy
Arrhenatherion elatioris												
Arrhenatherum elatius	4	3	3	4	3	4	3	3	3	3	3	V
Euphrasia rostkoviana	.	.	.	+	.	.	.	.	.	.	.	I
Tragopogon orientalis	.	.	.	.	.	r	.	r	.	r	+	II
Campanula patula	.	.	.	.	.	.	r	r	.	.	r	II
Pastinaca sativa	.	.	.	.	.	.	.	+	+	.	.	I
Knautia arvensis	.	.	.	.	.	.	.	+	.	.	+	I
Jacea pratensis	.	.	.	.	.	.	.	+	.	.	.	I
Crepis biennis	.	.	.	.	.	.	.	+	.	.	.	I
Vicia sepium	.	.	.	.	.	.	.	.	+	.	+	I
Cynosurion												
Scabiosa ochroleuca	.	+	.	.	.	.	+	.	.	.	.	I
Tithymalus cyparissias	.	4	.	.	.	.	.	.	.	.	.	I
Pilosella officinarum	.	.	+	.	2	2	1	.	.	.	.	II
Pilosella bauhinii	.	.	r	.	.	.	.	.	.	.	.	I
Prunella vulgaris	.	.	.	.	.	.	.	r	.	.	.	I
Briza media	.	.	.	.	.	.	.	+	.	.	.	I
Leontodon autumnalis	.	.	.	.	.	.	.	+	.	.	.	I
Agrimonia eupatoria	.	.	.	.	.	.	.	+	+	.	.	I
Trifolium repens	.	.	.	.	.	.	.	2	+	.	.	I
Veronica prostrata	.	.	.	.	.	.	.	.	.	+	.	I
Trifolium montanum	.	.	.	.	.	.	.	.	.	+	.	I
Polygala major	.	.	.	.	.	.	.	.	.	+	+	I
Fragaria viridis	.	.	.	.	.	.	.	.	.	+	r	I
Arrhenatheretalia												
Achillea millefolium	+	3	+	2	1	1	1	2	+	+	2	V
Lotus corniculatus	.	+	.	1	.	.	1	1	+	+	+	IV
Taraxacum officinale agg.	.	+	.	+	.	.	.	+	+	1	+	III
Leontodon hispidus	.	1	+	+	.	.	.	+	.	.	+	III
Daucus carota	.	.	+	+	+	+	1	+	+	.	r	IV
Leucanthemum vulgare	.	.	2	.	.	.	.	+	.	.	r	I
Veronica chamaedrys	.	.	.	.	.	.	.	+	.	.	.	I
Dactylis glomerata	.	.	.	.	.	.	.	+	+	.	.	I
Molinio-Arrhenatheretea												

Festuca rubra	2	.	2	2	.	.	.	1	.	2	1	III
Plantago lanceolata	.	+	r	.	.	.	.	1	+	+	r	III
Poa pratensis agg.	.	.	+	.	.	.	.	.	1	+	+	II
Festuca pratensis	.	.	.	.	.	.	1	+	1	.	.	II
Lathyrus pratensis	.	.	.	.	.	.	+	.	.	.	.	I
Trifolium pratense	.	.	.	.	.	.	.	2	1	+	2	II
Valeriana officinalis	.	.	.	.	.	.	.	r	.	.	.	I
Bromion erecti												
Tithymalus esula	+	.	.	.	.	.	.	+	.	.	.	I
Cardaminopsis arenosa	.	+	.	.	.	.	.	.	.	.	.	I
Vicia tenuifolia	.	.	+	.	.	+	.	+	1	r	r	III
Erigeron acris	.	.	+	.	.	.	.	.	.	.	.	I
Trifolium medium agg.	.	.	1	.	.	.	.	.	.	.	.	I
Pseudolysimachion spicatum	.	.	.	r	.	.	+	.	.	r	r	II
Carlina acaulis	.	.	.	.	.	r	.	.	.	.	.	I
Prunella laciniata	.	.	.	.	.	.	.	r	.	.	.	I
Lathyrus sylvestris	.	.	.	.	.	.	.	.	.	r	.	I
Festuco-Brometea a Brometalia												
Sanguisorba minor	r	+	+	+	.	.	+	.	.	+	+	IV
Hypericum perforatum	r	.	+	+	.	+	.	r	+	.	.	III
Medicago lupulina	.	.	r	+	.	+	.	2	1	+	1	IV
Senecio jacobaea	.	.	r	.	1	+	+	+	.	.	.	III
Galium verum	.	.	1	r	.	.	.	+	1	.	+	III
Medicago falcata	.	.	1	.	2	+	.	.	1	3	2	III
Thesium linophyllon	.	.	+	.	.	.	.	.	.	+	.	I
Salvia pratensis	.	.	+	.	.	.	.	r	.	+	+	II
Potentilla heptaphylla	.	.	1	.	.	.	.	.	.	.	.	I
Origanum vulgare	.	.	.	.	+	+	1	.	.	.	.	II
Securigera varia	.	.	.	.	+	r	.	.	.	.	.	I
Plantago media	.	.	.	.	.	.	.	r	.	+	r	II
Silene nutans	.	.	.	.	.	.	.	+	.	+	+	II
Ranunculus bulbosus	.	.	.	.	.	.	.	+	.	.	.	I
Bromus erectus	.	.	.	.	.	.	.	.	.	1	.	I
Phleum phleoides	.	.	.	.	.	.	.	.	.	r	.	I
Dianthus carthusianorum	.	.	.	.	.	.	.	.	.	+	r	I
Dauco-Melilotion												
Tanacetum vulgare	+	+	.	.	.	.	.	.	+	.	.	II
Oenothera biennis agg.	.	.	+	.	.	.	.	.	.	.	.	I
Picris hieracioides	.	.	.	r	1	+	3	.	+	.	.	III
Melilotus officinalis	.	.	.	.	2	+	1	.	.	1	+	III
Onopordetalia												
Armoracia rusticana	.	.	.	r	.	.	.	.	.	.	.	I
Linaria vulgaris	.	.	.	.	+	.	.	.	.	.	.	I
Verbascum thapsus	.	.	.	.	.	r	r	.	.	.	.	I
Artemisietea vulgaris												
Cirsium arvense	1	.	.	+	.	.	.	+	+	.	.	II
Artemisia vulgaris	.	.	+	+	+	+	+	r	+	.	.	IV

Elytrigia repens	.	.	.	.	.	.	.	.	+	.	.	.	I
Others													
Lathyrus tuberosus	r	.	.	.	.	.	.	1	+	.	.	II	
Rubus hirtus	+	.	.	.	.	.	.	.	.	.	.	I	
Fragaria vesca	r	.	.	.	.	.	.	.	.	.	.	I	
Calamagrostis epigejos	+	.	.	.	.	.	.	.	.	.	.	I	
Cirsium sp.	.	r	.	.	.	.	+	.	.	.	.	I	
Trifolium hybridum	.	+	.	.	.	r	+	.	.	.	.	II	
Alyssum alyssoides	.	.	+	.	.	.	.	.	.	.	.	I	
Myosotis arvensis	.	.	r	.	.	.	.	.	r	.	.	I	
Melampyrum cristatum	.	.	.	+	1	1	+	.	.	.	.	II	
Equisetum arvense	.	.	.	1	.	.	.	.	.	.	.	I	
Agrostis stolonifera	.	.	.	+	.	.	.	.	.	.	.	I	
Genista tinctoria	.	.	.	+	.	.	.	.	.	.	.	I	
Silene viscosa	.	.	.	.	+	.	.	.	.	.	.	I	
Astragalus glycyphyllos	.	.	.	.	+	.	.	.	1	.	.	I	
Verbascum chaixii	.	.	.	.	.	r	+	.	.	.	.	I	
Hieracium umbellatum	.	.	.	.	.	.	r	.	.	.	.	I	
Trisetum flavescens	.	.	.	.	.	.	.	2	.	.	.	I	
Potentilla arenaria	.	.	.	.	.	.	.	+	.	.	.	I	
Raphanus raphanistrum	.	.	.	.	.	.	.	r	.	.	.	I	
Veronica arvensis	.	.	.	.	.	.	.	r	.	.	.	I	
Convolvulus arvensis	.	.	.	.	.	.	.	r	+	.	.	I	
Potentilla reptans	.	.	.	.	.	.	.	.	+	+	+	II	
Cichorium intybus	.	.	.	.	.	.	.	.	r	.	.	I	
Sedum acre	.	.	.	.	.	.	.	.	+	.	.	I	
Poa trivialis	.	.	.	.	.	.	.	.	+	.	.	I	
Erysimum odoratum	.	.	.	.	.	.	.	.	.	+	r	I	

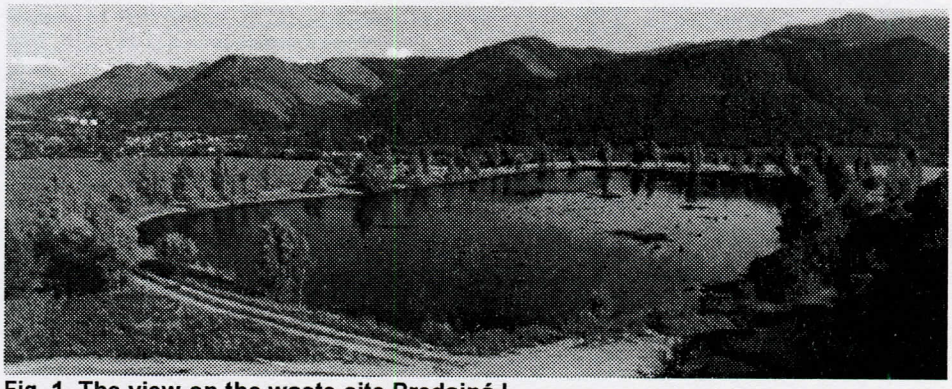

Fig. 1. The view on the waste site Predajná I.

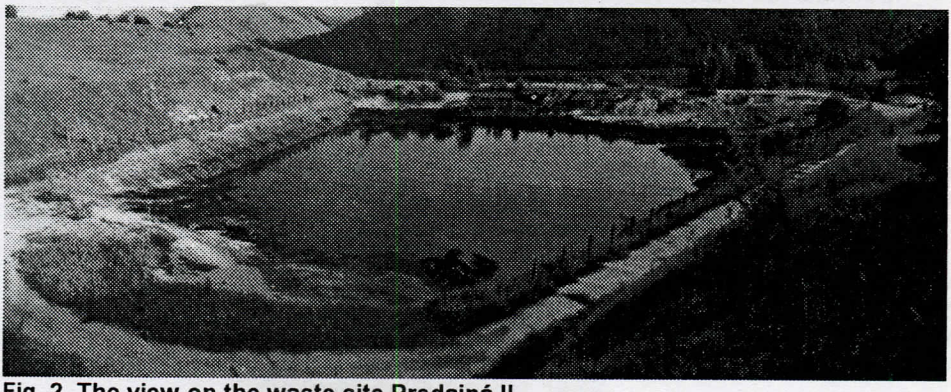

Fig. 2. The view on the waste site Predajná II.