Preslia, Praha, 55 : 63–81, 1983

Notes on the syntaxonomy and synecology of some ruderal plant communities in Praha-Holešovice with special attention to winter-salted habitats

Poznámky k syntaxonomii a synekologii některých ruderálních společenstev v Praze–Holešovicích se zvláštním zřetelem na stanoviště, solená v zimě

Emil Hadač, Hana Rambousková and Roman Valach

Hadač E.[1)], H. Rambousková[1)] et R. Valach[2)] (1983): Notes on the syntaxonomy and synecology of some ruderal plant communities in Praha-Holešovice with special attention to winter-salted habitats. — Preslia, Praha, 55 : 63–81.

Ruderal plant communities in Praha-Holešovice have been studied. Two of them, namely *Hordeo-Puccinellietum distantis* and *Lactuco serriolae-Sisymbrietum loeselii* were described as new ones. It is suggested that besides NaCl, fluoride salts are also important in the ecology of halophytic plant communities.

[1)] *Institute of Landscape Ecology, Czechoslovak Academy of Sciences, Malá plynární 2, 170 00 Praha 7 — Holešovice, Czechoslovakia.* [2)] *Institute of Landscape Ecology, Czechoslovak Academy of Sciences, Kralická 3, 100 00 Praha 10 — Strašnice, Czechoslovakia.*

INTRODUCTION

In a modern city, changing its appearance from day to day, a mosaic of varied biotopes invaded by ruderal plant communities is formed. Those of the classes *Chenopodietea* Br.-Bl. 1951 em. Lohmeyer, J. et R. Tx. et Matuszkiewicz 1962 and *Artemisietea vulgaris* Lohmeyer et al. in Tx. 1950 em. Kopecký 1979 are the most common.

Synanthrophic plant communities in Holešovice (Praha 7) may be found in various habitats, starting from quite loose substrata, dumps etc. and ending with trampled soils.

Poetum annuae Gams 1927 in shaded trampled places along houses and walls, and *Lolio-Plantaginetum majoris* Beger 1930 in open, relatively sunny places belong to the very common synanthropic plant communities in Holešovice as well as elsewhere. In dry habitats, *Plantago major* disappears nearly quantitatively from the latter community, but other components remain. Another relatively frequent community is *Arctio-Artemisietum vulgaris* (R. Tx. 1942) Brandes 1980 (alliance *Arction lappae* (Tx. 1942) em. Gutte 1972), but usually in fragments only (see Tab. 1) Although our material is fragmentary, we can identify it with the community described by Brandes (1980 — Tab. 3) under the name *Arctio-Artemisietum vulgaris* (R. Tx. 1942) Oberd. 1967. Our material has, with Tab. 3 in Brandes, the following species in common: *Artemisia vulgaris, Arctium minus, A. lappa, Agropyron repens, Ballota nigra, Matricaria maritima, Calystegia sepium, Urtica dioica, Sisymbrium officinale, Rumex crispus, Dactylis glomerata* and *Chenopodium album,* i.e. practically all the dominant and frequent species.

Tab. 1. — *Arctio-Artemisietum vulgaris* (R. TX. 1942, OBERD. 1967) BRANDES 1980

Relevé No.	1	2
Exposure/Slope (°)	–/0	–/0
Area analysed (m^2)	5	5
Coverage (%)	100	100
Number of species	16	14
Artemisia vulgaris	7	7
Arctium minus	4	5
Agropyron repens	5	5
Ballota nigra	5	5
Matricaria inodora	2	3
Taraxacum officinale	2	2
Arctium lappa	5	.
Calystegia sepium	4	.
Urtica dioica	4	.
Chaerophyllum temulum	3	.
Conyza canadensis	2	.
Crepis biennis	2	.
Sisymbrium officinale	2	.
Melilotus alba	1	.
Rumex crispus	1	.
Sonchus oleraceus	1	.
Cichorium intybus	.	4
Achillea millefolium	.	3
Dactylis glomerata	.	3
Sisymbrium loeselii	.	3
Chenopodium album	.	2
Poa trivialis	.	2
Polygonum aviculare	.	2
Polygonum lapathifolium subsp. *lapathifolium*	.	2

Localities:

1 — Holešovice, at the building of Merkuria, 16. 9. 1980.
2 — Holešovice, belov the railway bridge, 19. 9. 1980.

According to the Code, the publications of this association by TÜXEN (1942) and by OBERDORFER (1967) are invalid, so BRANDES (1980) has to be cited as the validation of this name.

We have mainly studied four types of communities; namely *Bromo-Hordeetum murini*, *Hordeo murini-Puccinellietum distantis* (both belonging to the alliance *Bromo-Hordeion murini* HEJNÝ 1978), *Atriplicetum nitentis* and *Lactuco serriolae-Sisymbrietum loeselii* (both from the alliance *Sisymbrion officinalis* TX. et al. in TX. 1950 em. HEJNÝ 1979). Whilst the former two communities are found especially along roads (roadsides, margins of pavements, fences, walls), the latter two communities prefer dumping places (waste deposits, rubble and rubbish heaps etc).

METHODS

In describing the communities we have used the 11-grade scale by Domin and Hadač (cf. HADAČ 1978). Plant nomenclature is according to ROTHMALER (1976).

Soil samples were analysed by the following methods. Chlorides were titrated with mercury as $Hg(NO_3)_2$ using the indicators diphenylcarbazone and bromophenol blue. Fluorides were

Tab. 2. — *Bromo-Hordeetum murini* (ALLORGE 1922) LOHMEYER in TX. 1950

Relevé No.	1	2	3	4	5	K	∅
Exposure/Slope (°)	–/0	–/0	–/0	–/0	–/0		
Area analysed (m^2)	5	5	5	4	5		
Coverage (%)	75	90	90	95	90		
Stand height (m)	0.5	0.3 –0.4	0.5	0.5 –0.8	0.4		
Number of species	13	10	11	10	11		
Hordeum murinum	7	9	8	8	8	V	8.0
Artemisia vulgaris	4	3	4	3	2	V	3.2
Taraxacum officinale	1	1	2	3	2	V	1.8
Poa annua	4	3	.	2	2	IV	2.2
Sisymbrium loeselii	2	3	1	1	.	IV	1.4
Bromus hordeaceus subsp. *hordeaceus*	.	.	1	5	4	III	2.0
Capsella bursa-pastoris	.	1	1	3	.	III	1.0
Convolvulus arvensis	6	.	3	.	.	II	1.8
Lolium perenne	.	.	4	3	.	II	1.4
Chenopodium album	2	.	.	.	1	II	0.6
Poa trivialis	.	1	.	.	1	II	0.4
Polygonum aviculare	1	.	.	.	1	II	0.4
Puccinellia distans	1	1	.	.	.	II	0.4
Bromus sterilis	.	.	.	.	4	I	0.8
Symphoricarpos rivularis	.	3	.	.	.	I	0.6
Trifolium repens	.	.	.	3	.	I	0.6
Agropyron repens	2	.	.	.	.	I	0.4
Arctium sp.	.	.	1	.	.	I	0.2
Chamomilla suaveolens	1	.	.	.	.	I	0.2
Conyza canadensis	.	.	.	1	.	I	0.2
Lepidium ruderale	.	.	1	.	.	I	0.2
Matricaria inodora	1	.	.	.	.	I	0.2
Plantago major	1	.	.	.	.	I	0.2
Secale cereale	.	.	.	.	1	I	0.2
Sonchus oleraceus	.	1	.	.	.	I	0.2
Vitis vinifera	.	.	1	.	.	I	0.2

Localities:

1 — Holešovice, the crossing Argentinská — Plynární, at the concrete panel wall exposed to the north-east, 10. 6. 1980.
2 — Holešovice, the crossing Argentinská — Plynární, at the concrete panel wall exposed to the east, near the petrol station, 10. 6. 1980.
3 — Holešovice, along a fence of boards along the railway station close by the street Argentinská — South, 12. 6. 1980.
4 — Holešovice, at a fence of boards near the garage No. 6 close by the street Argentinská — South, 12. 6. 1980.
5 — Holešovice, ruins between Štvanice and the railway bridge on the left bank of the Vltava river, 13. 6. 1980.

determined by means of the fluoride specific electrode with TISAB buffer. Magnesium, calcium and sodium were determined by atomic absorption spectrometry, pH was measured with a pH-meter and a glass electrode.

PLANT COMMUNITIES

Bromo-Hordeetum murini (ALLORGE 1922) LOHMEYER in TX. 1950

The association *Bromo-Hordeetum murini* (ALLORGE 1922) LOHMEYER in Tx. 1950 (Tab. 2) is characterized by the presence of *Hordeum murinum* (dominant) and *Bromus hordeaceus* subsp. *hordeaceus* as characteristic species and by the combination *Hordeum murinum, Taraxacum officinale, Artemisia vulgaris, Sisymbrium loeselii* and *Poa annua*. Characteristic species of the order *Sisymbrietalia* J. Tx. 1962 em. Görs 1966 in our association table are *Artemisia vulgaris, Chenopodium album, Sisymbrium loeselii, Capsella bursa-pastoris* and *Conyza canadensis*. On the other hand, there are also several

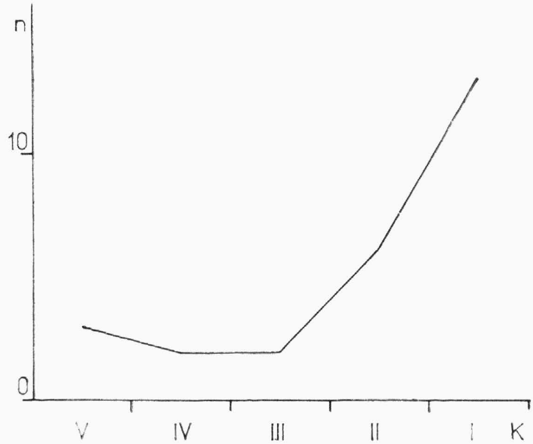


Fig. 1. — Constancy curve of *Bromo-Hordeetum murini* (Allorge 1922) Lohmeyer in Tx. 1950 (K — constancy, n — number of species)

species of the order *Plantaginetalia majoris* Tx. et Preising in Tx. 1950 resp. *Polygonion avicularis* Br.-Bl. 1931, e.g. *Polygonum aviculare, Lolium perenne, Poa annua, Chamomilla suaveolens, Matricaria inodora* and *Plantago major*. Their occurrence indicates the subassociation *Lolietosum perennis* Knapp 1961. The constancy curve of the community is given in Fig. 1. *Bromo-Hordeetum murini* has a broad distribution. It was found e.g. in Malacky (Krippelová 1972) and in Trnava (Eliáš 1978).

Bromo-Hordeetum murini occupies pavement margins further off the road (2—5 m), preferring sunny, warm and arid habitats e.g. along board fences or concrete walls, with slightly acid to alkaline soils (pH 6.7—8.0) (see Plate I.). Full light plants with moderate demands on soil moisture (which leads to the fact that almost 50 % of the species in our table have a scleromorphic anatomic structure) are the most common. A large number of associated species usually grow in soils rich in nitrogen. Almost 40 % of species are therophytes; the remainder belongs predominantly to hemicryptophytes. The community consists of one single layer, its height is about 50 cm. The growth climax is reached in the second half of June; in July the dominant species ripens, and becomes dry.

The community has been studied by many authors e.g. from Poland (Misiewicz 1971, Fabierkowicz 1971, Rostański et Gutte 1971), France, the Netherlands, Belgium, the F.R.G., the G.D.R. (Tüxen 1950, Gutte et Hilbig 1975), Jugoslavia (Markovič 1978). In our country it was observed in south Moravia (Grüll 1978, Grüll et Vaněčková 1978, Hejný, Husák et

Tab. 3. — *Hordeo murini-Puccinellietum distantis* HADAČ et RAMBOUSKOVÁ

Relevé No.	1	2	3	4	5	K	○
Exposure/Slope (°)	—/0	—/0	—/0	—/0	—/0		
Area analysed (m^2)	6	7	6	5	3		
Coverage (%)	90	85	80	80	95		
Stand height (m)	0.5	0.5	0.3	0.4	0.35		
Number of species	11	11	11	11	9		
Puccinellia distans	8	8	7	6	8	V	7.4
Hordeum murinum	5	3	6	4	2	V	4.0
Polygonum aviculare	3	4	2	3	1	V	2.6
Lolium perenne	2	2	2	1	3	V	2.0
Taraxacum officinale	.	1	1	4	3	IV	1.8
Poa annua	4	4	4	.	.	III	2.4
Chenopodium album	.	.	1	1	3	III	1.0
Artemisia vulgaris	1	.	1	1	.	III	0.6
Agropyron repens	1	.	.	.	1	II	0.4
Bromus hordeaceus subsp. *hordeaceus*	.	1	1	.	.	II	0.4
Capsella bursa-pastoris	.	.	.	1	1	II	0.4
Conyza canadensis	.	1	1	.	.	II	0.4
Hordeum vulgare	1	1	.	.	.	II	0.4
Secale cereale	.	1	.	1	.	II	0.4
Atriplex patula	.	.	.	.	2	I	0.4
Chamomilla suaveolens	.	.	.	1	.	I	0.2
Holcus lanatus	.	.	1	.	.	I	0.2
Matricaria inodora	.	.	.	1	.	I	0.2
Phleum pratense	1	.	.	.	.	I	0.2
Sisymbrium loeselii	.	1	.	.	.	I	0.2
Triticum aestivum	1	.	.	.	.	I	0.2
Plantago major	+	.	.	.	.	I	0.1

Localities:

1, 2 — Holešovice, the Plynární street, close by the crossing Argentinská — Plynární, 10. 6. 1980.
3 — Holešovice at the crossing Argentinská — Plynární near the petrol pump, 10. 6. 1980 (typus).
4 — Holešovice, the Argentinská street, opposite the house number 6, 12. 6. 1980.
5 — Holešovice, the Argentinská street, at the water pump opposite the Tovární street, 12. 6. 1980.

PYŠEK 1978), in west Bohemia (PYŠEK 1975, 1978) and in Slovakia (KRIPPELOVÁ 1972, ELIÁŠ 1974, 1979).

Hordeo murini-Puccinellietum distantis HADAČ et RAMBOUSKOVÁ, ass. nova

The environmental conditions for the rise of *Hordeo murini-Puccinellietum distantis* (Plate I, II)are formed by the long-term use of winter chemical sprinklers. Chemical treatment of roads in Prague has been carried out for over 20 years. According to the data given by the office in charge of Prague communications, about 8.5 t salt per 1 km road is used in Prague-Holešovice every year (1—5 kg/m^2 according to the analyses made by HORKÝ et al. 1980). It is well-known that most plants are not able to tolerate high concentrations of salt in soil; only a few species thrive on such places. The dominant species of this new association, *Puccinellia distans*, a halophytic grass, naturally occurring in saline meadows, is in fact the species spreading expansively over such habitats.

Hordeo murini-Puccinellietum distantis HADAČ et RAMBOUSKOVÁ (Tab. 3) is characterized by the species combination: *Puccinellia distans* (char. and dom.), *Hordeum murinum, Polygonum aviculare, Lolium perenne, Taraxacum officinale*. The constancy curve is given in Fig. 2. It is relatively frequent in our area of investigation on sunny habitats along heavily salted roads, on

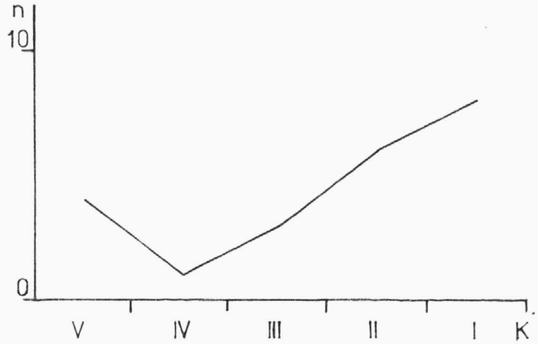


Fig. 2. — Constancy curve of *Hordeo murini-Puccinellietum distantis* HADAČ et RAMBOUSKOVÁ (for explanation, see Fig. 1)

slightly acid to alkaline soils (pH 6.7—8.2), rich in nitrates. Therophytes (45 %) and hemicryptophytes (36 %) prevail. The optimum development of the community is approximately in the middle of June; *Puccinellia* ripens and dries up in July. The dominant and constant species belong to the alliance *Hordeion murini*, but there are also several species of the alliance *Polygonion avicularis* or *Sisymbrion officinalis*. On the basis of Jaccard's index the described community should be placed in the vicinity of *Bromo-Hordeetum murini* (Jacc. index 33), i.e. in the alliance *Hordeion murini*.

Soil analyses of samples from this community indicate that the development of this halophytic community can be influenced not only by the high concentration of NaCl, but also by the increase of fluorine readily available to plants, contained in the chemicals used for winter sprinkling of roads. The contents of secondary components Ca, Mg, F etc. in sprinklers vary according to the origin of the material used. In 1980—1981 a mixture of sand and 10—50 % salt has been used for winter sprinkling in Prague. The fluoride content in this material is about 5—50 mg/kg. Even if it is a small amount it is soluble and available to plants. This topic will be discussed in another paper.

In soils contaminated with sprinklers, the soil reaction, especially the content of sodium and chlorides which are easily extractible from soil, have been studied. Thus e.g. the summary review by HORKÝ et al. (1980) shows that chlorides added to the soil in a form of salt used for winter sprinkling are extracted very quickly (ERNST et FELDERMANN, cf. HORKÝ et al. (l.c.) have found that even in heavily salted soils — 4 kg/m^2 — the concentration of Cl^- in the depth of 60 cm declined to its original value after 4 months, RUGE et STACH, cf. HORKÝ et al. (l.c.) have observed the Cl^- leaching as early as in

Tab. 4. — pH values, chloride and sodium concentrations in water extracts from the soil sampled in various distances from the roadside salted in winter (the Argentinská street Praha 7). — (100 g soil rid of skelet was extracted with 150 ml distilled water, the assessment of concentration of a certain element in samples taken on a certain day was always done in one series 3—5 days after the start of the extraction. Control samples No. 1, 2, 3 i.e. from the stand of *Bromo-Hordeetum murini* (Allorge 1922) Lohmeyer in Tx. 1950 were taken roughly 5 m from the roadside and the samples No. 4, 5, 6 i.e. from the stand of *Hordeo murini-Puccinellietum distantis* 10—20 cm from the roadside. a — the top soil layer 0—10 cm, b — the lower soil layer 10—20 cm)

The type of values	Absolute (mg/l)								Relative				
The component of an extract	Cl			Na		pH			Cl			Na	
The date of sampling (1980)	5.	11.7.	4.12.	11.7.	4.12.	5.	11.7.	4.12.	5.	11.7.	4.12.	11.7.	4.12.
Sample No.													
1a	23					7.2			1.0				
2a	16					8.0[2])			0.7				
3a	23.5[1])	35[1])	33	10	13	7.0	6.75	7.0	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
3b		49		10			7.0			1.4			
4a	93	47				8.0	7.6		4.0	1.3			
5a	30.5	47	47	68	47	7.9	7.55	6.7	1.3	1.3	1.4	6.8	2.5
5b		135					7.6			3.9		23	
6a	108	27	800[3])	100	455[3])	8.2	7.65	7.6	4.6	0.8	24	10	35
6b		655	538				7.65			18		56	

[1]) The skelet was not separated so properly during the first sampling as during further sampling. This explains higher concentrations of chlorides and fluorides during further sampling.

[2]) High pH value of the control sample 2a indicates it contamination (with salt or dust) or its unrepresentativness.

[3]) 445 mg Na and 800 mg Cl correspond to 19.8 grammolecules Na and 22.5 grammolecules Cl i.e. roughly 21 ± 1.4 grammolecules NaCl.

Tab. 5. — The concentration of fluorides, calcium and magnesium in extracts from the soil sampled in various distance from the road salted in winter (the Argentinská street, Praha 7; for detailed explanation see Tab. 4)

The type of values	Absolute (mg/l)						Relative					
The component of an extract	F			Ca		Mg	F			Ca		Mg
The date of sampling (1980) Sample No.	5.	11.7.	4.12.	11.7.	4.12.	4.12.	5.	11.7.	4.12.	11.7.	4.12.	4.12.
1a	0.76											
2a	1.35											
3a	0.58	0.74		41	60	5.6	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
3b		0.66		60				0.9		1.5		
4a	2.35						4.05					
5a	4.3	2.85	1.2	150	110	7.8	7.4	3.85	1.5	3.7	1.8	1.4
5b		2.35		140				3.2		3.4		
6a	3.9	3.25	1.2	110	120	7.8	6.7	4.4	1.5	2.7	2.0	1.4
6b		8.4		100				11.3		2.4		
Mean (4a, 5a, 6a)							6.06	4.12	1.5	3.17	1.9	1.4

May). Sodium is extracted from the soil at an evidently lower rate than chlorides; its residue remains in the soil even in the autumn. The pH of the soil extracts having a higher content of sodium mostly increases (to roughly 8.0 in our case, an extreme is 9.3). Two groups of authors observed an increase of an extractible calcium in salted soils (even 30× more when compared with the control). On the other hand, ERNST et FELDERMANN have mentioned a decrease of extractible calcium in heavily salted soils.

Our observations (Tab. 4) correspond in general to results reported by the above mentioned authors. We have found a decrease of Cl^- concentration in the top soil layer (10 cm) almost approaching the control (1.3 : 1) as early as May 1980 in one case, while in the other cases the quantity of Cl^- was 4× higher than the control. In June 1980 the content of Cl^- was equal to that of the control in the top soil layer while in the lower soil layer (10—20 cm) it was still 4—20× higher than the control.

Sodium concentrations in the top soil layer, even in June 1980, were higher (ca. 8×) than the control and this tendency was even more evident in the lower soil layer (20—60×). The soil extracts in the close proximity of the road reached a higher pH both in May 1980 and in June than the control and they contained 3× more extractible calcium in June resp. December 1980 than the control samples (see Tab. 5).

Relatively quick Cl^- extraction from soil caused by infiltrating rainfalls is connected with the low Cl^- sorption on soil minerals. On the other hand calcium and sodium sorption is quite high. These facts explain the often observed increase in pH, when chlorides have been already extracted and sodium still remains. Unfortunately this cannot be said in general (see the extract of the sample 5a taken 4. 12. 1980 containing a little more chlorides than sodium, reaching pH 7.6 even if it should be about 6.6).

Tab. 6. — The chloride and fluoride concentrations in the extracts from the soil sampled 11. 7. 1980 using various ways of extraction and products of molar concentrations $c_{Ca} . c_F^2 = P'$ compared with the solubility product $P = c_{Ca} . c_F^2$ characterising the solubility of little soluble CaF_2 in water solutions (for explanation see Tab. 4)

The type of values	mg/l						$10^{11}P'$		P'/P	
The component of an extract	Cl			F						
The type of extraction	A	B	A/B	A	B	A/B	A		A	
The soil weight (g)	100	20	5	100	20	5	100		100	
The volume of dist. water (ml)	150	150	1	150	150	1	150		150	
Sample No.										
3a	35	10	3.5	0.74	0.74	1.0	0.15		0.042	
3b	49	12	4.0	0.66	0.76	0.87	0.18		0.051	
5a	47	10	4.7	2.85	1.95	1.46	8.4		2.4	
5b	135	35	3.8	2.35	1.95	1.20		5.3		1.5
6a	27	6.5	4.2	3.25	1.6	2.03	8.1		2.3	
6b	655	126	5.2	8.4	5.6	1.5		4.9		1.4
The mean 3a, 3b			3.75			0.93	0.165		0.046	
The mean 5a, to 6b			4.47			1.55				
resp. 5a, 6a or 5b, 6b							8.25	5.1	2.35	1.45
The solubility product P							3.5		1.00	

The Ca-content in sample from both top and lower soil layers taken on 11. 7. 1980 differ only slightly. The Ca-content in the extracts from the soil close to the road was evidently higher than that from the control samples (roughly 3× when sampled 11. 7. 1980 and 2× when sampled 4. 12. 1980). Calcium is absorbed in the soil complex stronger than is sodium which is gradually extracted by infiltrating water from the top soil layer (see control samples).

The higher calcium concentration in the top soil layer along the road, when compared with the lower soil layer, indicates that calcium is added to the soil from the sprinklers. It is either purposely added to the sprinklers (in the form of $CaCl_2$) or it is already contained in the technical rock salt. The second explanation is more probable. This is also evidenced by the presence of other trace components of the salt in the soil along the road, i.e. by the increased content of magnesium and mainly fluorides which are not purposely added to the salt.

The connection between the state of plant injury and the sodium content in its tissues is not so obvious. The correlation between Cl^- content in trees and shrubs and their damage is much closer (Horký et al. l.c.). This fact usually contributes to the conclusion that chlorides are responsible for the harmful effects of sprinkled salt on plants. The decisive explanation of physiological causes of tree damage by salt has not yet been given (only slight attention is paid to this problem — see Horký et al. l.c.). A phytotoxic effect of salt seems to be connected with an unfavourable osmotic effect of NaCl (although the total quantity of NaCl in the plant does not grow considerably) or with the shift of ionic balance in the ratio of biogenic elements to "balast" elements. The positive effect of plant fertilization on the increased plant resistence to the negative effects of sprinklers is indisputable. But somewhat increased Cl^- uptake and a little increased sodium uptake by the plant does not mean that such changes in the ratio of biogenic elements to "balast" elements are able to explain the observed negative effect of sprinklers.

According to the review by HORKÝ et al. (l.c.) the possibility of the presence of some admixture in the salt, the incorporation of which would be proportional to the Cl^- incorporation and the negative effects of which could be checked by the state of plant nutrition, has not been sufficiently studied. As the fluoride compounds have a more toxic effect on plants than on animals (see e.g. GUDERIAN 1977) and as fluoride added to the soil together with phosphate fertilizers is extracted very slowly, a more detailed comparison of fluoride and chloride movement in soil along salted roads has been made.

Tab. 4 and 5 show that even one single road sprinkling (see the sample 6a 4. 12. 1980) can lead to the substantial increase in extractible Na^+ and Cl^- in soil, but it does not lead to the marked increase in extractible F^- (contained in rock salt as a trace element). After intensive winter sprinkling in spring (May 1980) and even later however a relative excess of extractible F^- in soil along roads was evidently higher than the relative excess od Cl^- when compared with the control. The different behaviour of Cl^- and F^- when penetrating through the soil is explained in Tab. 6. Five times the lower quantity of Cl^- (4.5× in average) was extracted by the same quantity of distilled water from five times the lower quantity of the soil contaminated with salt in comparison with the uncontaminated soil. On the contrary the F^- concentration in solution extracted from the soil quantities differing five times was roughly the same. From the above mentioned experiments we can conclude that while the quantity of Cl^- in solution is given by the quantity of easily soluble NaCl and other soluble chlorides in soil, the quantity of F^- in the solution probably depends on how much F^- can be extracted into the solution.

The F^- solubility is expected to be limited by the solubility product of fluorite (CaF_2) i.e. $P = c_{Ca} \, . \, c_F^2 = 3.5 \, . \, 10^{-11}$ (valid for 20° C — SÝKORA et ZÁTKA 1956; c_{Ca} and c_F are analytical concentrations of Ca^{2+} and F^- in saturated solution expressed in grammolecules. The exact definition is $F = a_{Ca} \, . \, a_F^2$ where a are activities to which the following equation applies in diluted solutions: $a_{Ca} = f \, . \, c_{Ca}$, where f approaches 1 and so in diluted soil extracts activities can be substituted for concentrations). Therefore the products of molar concentrations $c_{Ca} \, . \, c_F^2 = P'$ were counted, i.e. the products of concentrations of Ca and F in soil extracts from control places and along roads. After several days of static extraction of soil samples by distilled water corresponding approximately to a gradual infiltration of rain water through the soil, the extracts from control samples contained such low concentrations c_{Ca} and c_F that they corresponded to the value $P'/P \doteq 0.05$. Due to the slow kinetics of soluting of natural minerals with fluoride, water infiltrating through the soil is practically always unsaturated concerning the fluoride CaF_2 solubility product. It is always obvious from the fact that mineral continental waters (with the exception of mineral waters with a long-term turnover) contain almost always less than 1 mg/l fluorides. In samples of contaminated soils the value P'/P was higher than 1; indicating that fluorides from the sprinklers kept in soil are extracted into the water infiltrating through the soil much more readily than natural fluorides. Even if fluorides absorbed in soil from the salt used for sprinkling are extracted much easier than the natural fluorides, the quantity of fluorides able to pass to the soil extract from the contaminated soil is limited by the solubility product of slightly soluble compounds (i.e. CaF_2) in contrast to the quantity of chlorides.

Some values found for P′/P are considerably higher than the theoretically maximal value for a saturated solution of CaF_2, i.e. higher than 1. This may be caused by the concentration of free ions Ca^{2+} (in many cases equal to the analytical concentration of the total quantity of calcium in the solution) in the solubility product and not by the analytical concentration of the total quantity of calcium in solution used in our calculation. In solutions with higher concentration of e.g. humic acids a part of the dissolved calcium enters the complex with these acids. The analytical concentration of calcium in the solution is in this case equal to the sum of the concentrations c_{Ca} + + c_{CaHum}, where the concentration of calcium fixed in humic acids c_{CaHum} can be even higher than the concentration c_{Ca}. Humic acids are usually present in larger quantities in extracts from the top soil layer than in those from the lower soil layer, where the soil is poor in litter. This results in increasing values P′/P in extracts from the top soil layer when compared with the lower soil layer (2.4 and 2.3 compared with 1.5 and 1.4).

On the basis of values given in Tab. 4 and 5 we can conclude that supplies of fluorides which are relatively easily soluble in soil water are found in soil along salted roads. In such contaminated soils, soil solutions contain apparently higher concentration of fluorides than solutions of uncontaminated soil during the growing season. Ven Katerswarlu et al. (1965) and others have shown that plants (or at least barley used for their experiment) take up fluorides from soil by diffusion i.e. in linear proportion to the quantity of fluorides in the solution where the plant is placed. On the other hand, chlorides and other halides are taken up actively by the plant by means of carriers because the chloride uptake at the high chloride concentrations is little dependent on the increase of their concentration in "soil" solution. Similarly sodium, calcium and other biogenic elements are carried through the biological membranes actively by means of carriers i.e. the cell takes them up according to its biological needs (unless the supply of nutrients is limited by the factors acting outside the cell).

Our results of preliminary plant analyses confirm a different mechanism of the uptake of fluorides by diffusion, and chlorides and sodium by carriers by plants. Both halophytic and nonhalophytic plants sampled at the end of the growing season contained practically the same quantities ($\pm$ 10 %) of Cl^- but different quantities of F^-.

A different mechanism of the entry of fluorides on one hand and of chlorides, sodium and other elements on the other hand into the cell under the conditions of apparent increase in concentration of chlorides, sodium and fluorides in soil solution could be of great importance from the point of view of phytotoxicology. Therefore future studies have to pay more attention to the phytotoxicological and phytoecological significance of the fact that the plant can get more fluorides from the soil solution contaminated with salt than from the solution uncontaminated with salt during practically the entire growing season.

It is well-known from the regions polluted with fluorine emissions that only a few species can withstand an increased concentration of fluorine (Kontrišová 1974, cf. Holub 1978). The most resistant species are those from the family of *Daucaceae* and *Poaceae* especially *Calamagrostis epigeios*,

Tab. 7. — *Atriplicetum nitentis* KNAPP 1945, GUTTE 1972

Relevé No.	1	2	3	4	5	K	∅
Exposure/Slope (°)	–/0	–/0	–/0	–/0	–/0		
Area analysed (m^2)	6	15	8	10	4		
Coverage (%)	85	75	75	95	95		
Stand height (m)	1	0.8 –1	1	1	1		
Number of species	20	27	26	23	22		
Atriplex nitens	8	8	7	7	8	V	7.6
Chenopodium album	7	5	6	4	5	V	5.4
Chenopodium ficifolium	1	3	3	3	3	V	2.6
Matricaria inodora	2	3	3	3	1	V	2.4
Artemisia vulgaris	1	1	3	3	2	V	2.0
Galinsoga parviflora	1	3	3	1	2	V	2.0
Polygonum aviculare	1	3	3	1	2	V	2.0
Urtica urens	4	3	1	1	1	V	2.0
Sisymbrium loeselii	1	1	1	3	2	V	1.6
Capsela bursa-pastoris	1	2	3	.	2	IV	1.6
Viola arvensis	1	3	3	.	1	IV	1.6
Plantago major	1	2	3	.	1	IV	1.4
Poa annua	1	2	3	.	1	IV	1.4
Thlaspi arvense	1	1	1	3	.	IV	1.2
Urtica dioica	.	2	1	1	1	IV	1.0
Fallopia convolvulus	.	1	1	1	1	IV	0.8
Oxalis europaea	1	3	2	.	.	III	1.2
Chamomilla recutita	.	1	2	.	1	III	0.8
Conyza canadensis	.	1	1	1	.	III	0.6
Descurainia sophia	1	1	1	.	.	III	0.6
Tanacetum vulgare	1	.	1	.	1	III	0.6
Lolium perenne	.	3	3	.	.	II	1.2
Sinapis arvensis	.	1	.	5	.	II	1.2
Poa trivialis	.	.	1	.	3	II	0.8
Chamomilla suaveolens	.	.	2	.	1	II	0.6
Agrostis stolonifera	.	1	.	1	.	II	0.4
Galium aparine	.	.	.	1	1	II	0.4
Medicago lupulina	.	1	.	1	.	II	0.4
Stellaria media	1	.	1	.	.	II	0.4
Tussilago farfara	.	.	1	1	.	II	0.4

In one relevé only: 1 — *Epilobium adenocaulon* 1, *Sonchus oleraceus* 1; 2 — *Achillea millefolium* 1, *Pimpinella saxifraga* 1, *Trisetum flavescens* 1; 4 — *Erysimum cheiranthoides* 3, *Fumaria officinalis* 3, *Lamium purpureum* 2, *Papaver somniferum* 1, *Polygonum lapathifolium* subsp. *pallidum* 1; 5 — *Amaranthus retroflexus* 1, *Calystegia sepium* 1.

Localities:

1 — Holešovice, the Plynární street by the west side of the house No. 27, rubble heap, 20. 6. 1980.
2 — Holešovice, close by the right side of the street Argentinská — North in the direction from Prague, 20. 6. 1980.
3 — Holešovice, on the stripe between the 4th and 5th street lamp of the street Argentinská — North, 20. 6. 1980.
4 — Holešovice, behind the bridge Barikádníků, on the rubble heap under the viaducts, 20. 6. 1980.
5 — Holešovice, on the rubble heap between the 5th and 6th street lamp of the street Argentinská — North.

Agropyron repens and *Puccinellia distans*, each of which forms characteristic stands. Therefore it is possible that the dominance of *Puccinellia distans* in our community is also supported by the increased content of fluorine in soil.

Besides the natural halophytic communities of the alliance *Puccinellion distantis* Soó ap. MÁTHÉ 1933, an anthropogeneous community with

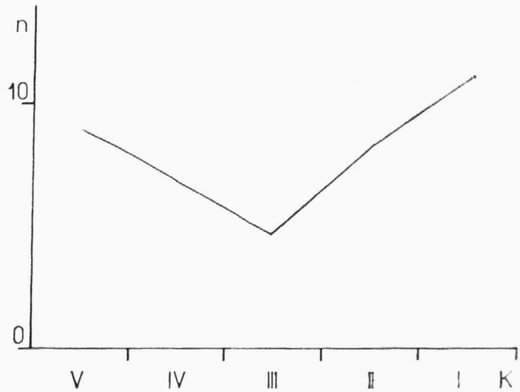


Fig. 3. — Constancy curve of *Atriplicetum nitentis* KNAPP 1945, GUTTE 1972 (for explanation, see Fig. 1)

dominant *Puccinellia distans* was described by KRIPPELOVÁ (1971) under the name *Puccinellio-Chenopodietum glauci;* this association grows on soils with a high content of magnesium salts. The *Puccinellio-Chenopodietum glauci* belongs to the alliance *Polygonion avicularis* and has little in common with our association. PYŠEK (1977) mentions "stands of *Puccinellia distans*" with *Chenopodium glaucum, Ch. rubrum* etc. GUTTE et HILBIG (1975) have observed a community they call "*Puccinellia distans* — Trittrasen", resulting from trampling natural halophytic meadow communities with *Puccinellia distans, Spergularia salina, Plantago maritima* etc. It is clear that the above mentioned communities or stands have nothing to do with our association. *Hordeo-Puccinellietum distantis* is probably not unknown in other localities along salted roads, as far as we can judge from scattered notes in various papers, but it has not been hitherto described as a distinct association.

Atriplicetum nitentis KNAPP 1945

The association *Atriplicetum nitentis* KNAPP 1945 (see Tab. 7, Plate II.) is characterized by the absolute dominancy of *Atriplex nitens* and by the characteristic combination of the following species: *Atriplex nitens, Chenopodium album* s.l., *Matricaria inodora, Artemisia vulgaris, Urtica urens* and *Sisymbrium loeselii.* It is a multi-layered community occupying fresh loose substrata of building sites, dumps etc. In comparison to the *Lactuco serriolae-Sisymbrietum loeselii* it prefers rather more moist habitats with loamy or clayey-loamy soil; soil reaction in this community was 7.0—7.4. The optimum

Tab. 8. — *Lactuco serriolae- Sisymbrietum loeselii* HADAČ et RAMBOUSKOVÁ

Relevé No.	1	2	3	4	5	K	∅
Exposure/Slope (°)	–/0	–/0	S/25	–/0	W/50		
Area analysed (m²)	15	4	4	8	10		
Coverage (%)	30	90	70	100	90		
Stand height (m)	1.2	1 –1.2	1	1	1.1		
Number of species	18	23	23	23	23		
Sisymbrium loeselii	5	8	7	8	8	V	7.2
Matricaria inodora	3	4	4	6	3	V	4.0
Chenopodium album	4	1	3	5	3	V	3.2
Lactuca serriola	4	3	2	2	3	V	2.8
Capsella bursa-pastoris	4	3	2	1	3	V	2.6
Sonchus oleraceus	1	1	2	1	3	V	1.6
Conyza canadensis	4	1	3	.	3	IV	2.2
Artemisia vulgaris	.	1	1	3	4	IV	1.8
Hordeum murinum	2	2	2	.	1	IV	1.4
Senecio vulgaris	1	1	1	.	1	IV	0.8
Polygonum aviculare	2	.	2	3	.	III	1.4
Malva neglecta	.	1	4	.	1	III	1.2
Carduus acanthoides	1	3	1	.	.	III	1.0
Poa annua	2	1	2	.	.	III	1.0
Convolvulus arvensis	2	1	1	.	.	III	0.8
Medicago lupulina	.	1	1	.	1	III	0.6
Atriplex nitens	.	.	3	2	.	II	1.0
Ballota nigra	.	.	2	.	3	II	1.0
Chaenarrhinum minus	.	.	2	.	3	II	1.0
Lolium perenne	1	.	.	4	.	II	1.0
Fallopia convolvulus	1	.	2	.	.	II	0.6
Tussilago farfara	.	1	.	2	.	II	0.6
Epilobium adenocaulon	.	1	.	.	1	II	0.4
Poa compressa	.	1	.	1	.	II	0.4
Poa trivialis	.	1	1	.	.	II	0.4
Senecio viscosus	.	.	1	.	1	II	0.4
Taraxacum officinale	1	1	.	.	.	II	0.4
Triticum aestivum	1	.	.	1	.	II	0.4

In one relevé only: 1 — *Bromus hordeaceus* subsp. *hordeaceus* 1; 2 — *Chamomilla suaveolens* 3, *Atriplex hastata* 1, *Solanum decipiens* OPIZ 1; 3 — *Trifolium hybridum* 1; 4 — *Oenothera biennis* 2, *Rumex crispus* 2, *Agrostis tenuis* 1, *Apera spica-venti* 1, *Chaerophyllum temulum* 1, *Cirsium vulgare* 1, *Melilotus albus* 1, *M. officinalis* 1, *Phalaris arundinacea* 1, *Thlaspi arvense* 1; 5 — *Bidens tripartita* 3, *Urtica urens* 3, *Sambucus nigra* 2, *Epilobium angustifolium* 1, *Galinsoga ciliata* 1, *Parthenocissus inserta* 1, *Polygonum lapathifolium* subsp. *lapathifolium* 1.

Localities:

1 — Holešovice, close by the left side of the street Argentinská — North in the direction from Prague, 10. 6. 1980.
2 — Holešovice, between the bridge Barikádníků and a new railway bridge, 20. 6. 1980 (typus).
3 — Holešovice, in a yard west from the railway bridge near Štvanice, 13. 6. 1980.
4 — The south part of the Hlávka's bridge in a middle green stripe of the highway, 25. 6. 1980.
5 — Holešovice, opposite 25. 6. 1980.

development of the community takes place about in the second half of August and in September when *Atriplex nitens* is flowering and fruiting. Towards the second half of September it begins to wilt and the community vanishes.

Atriplicetum nitentis, as may be found in our table, has 11 from 16 species with the constancy IV and V (Fig. 3) in common with the association table of *Atriplicetum nitentis* in GUTTE (1972); therefore its classification is clear enough. It is known from the G.D.R. (GUTTE 1972, GUTTE et HILBIG 1975), Poland (FALIŃSKI 1971, ROSTAŃSKI et GUTTE 1971) west Bohemia (PYŠEK 1975, 1976, 1978), south Moravia (HEJNÝ, HUSÁK et PYŠEK 1978, GRÜLL 1978) and Slovakia (ZALIBEROVÁ 1978, ELIÁŠ 1978).

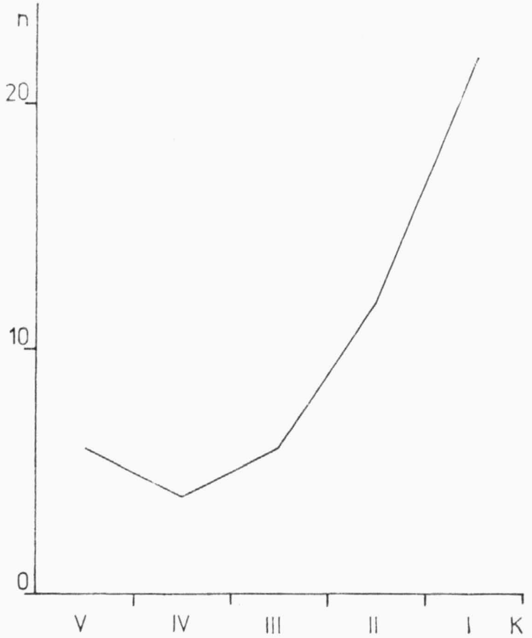


Fig. 4. — Constancy curve of *Lactuco serriolae-Sisymbrietum loeselii* HADAČ et RAMBOUSKOVÁ (for explanation, see Fig. 1)

Lactuco serriolae-Sisymbrietum loeselii HADAČ et RAMBOUSKOVÁ, ass. nova

This association of the alliance *Sisymbrion officinalis* is dominated by *Sisymbrium loeselii*. As stated by HEJNÝ (HEJNÝ et al. 1979), the name "*Sisymbrietum loeselii*" by GUTTE 1972 is a nomen novum for *Sisymbrietum sophiae* KREH 1935 and hence invalid. Our community (Tab. 8) can be hardly identical with *Sisymbrietum sophiae* KREH 1935 for it is short of *Descurainia sophia*, *Sisymbrium altissimum* and *Lepidium ruderale*, i.e. 3 from 5 diagnostically characteristic species are lacking. Jaccard's index of floristic similarity of our community e.g. with GUTTE's "*Sisymbrietum loeselii*" (GUTTE 1972) with regard to constancy is only 25; that means that these two communities cannot belong to the same association. It is thus necessary to describe a new syntaxon: *Lactuco serriolae-Sisymbrietum loeselii* HADAČ et RAMBOUSKOVÁ.

It is characterized by the combination of the following species: *Sisymbrium loeselii, Capsella bursa-pastoris, Chenopodium album, Matricaria inodora, Lactuca serriola* and *Sonchus oleraceus*. Differential species against *Atriplicetum nitentis* are *Lactuca serriola, Carduus acanthoides, Chaenarrhinum minus Ballota nigra, Poa compressa, Solanum decipiens* OPIZ etc. The constancy curve is in Fig. 4. Our association differs from the community, described by GUTTE (1973) by the presence of *Senecio vulgaris, Convolvulus arvensis, Carduus acanthoides, Malva neglecta, Poa compressa* etc. and by the absence of *Lepidium ruderale, Daucus carrota, Trifolium repens, Bromus tectorum* etc.

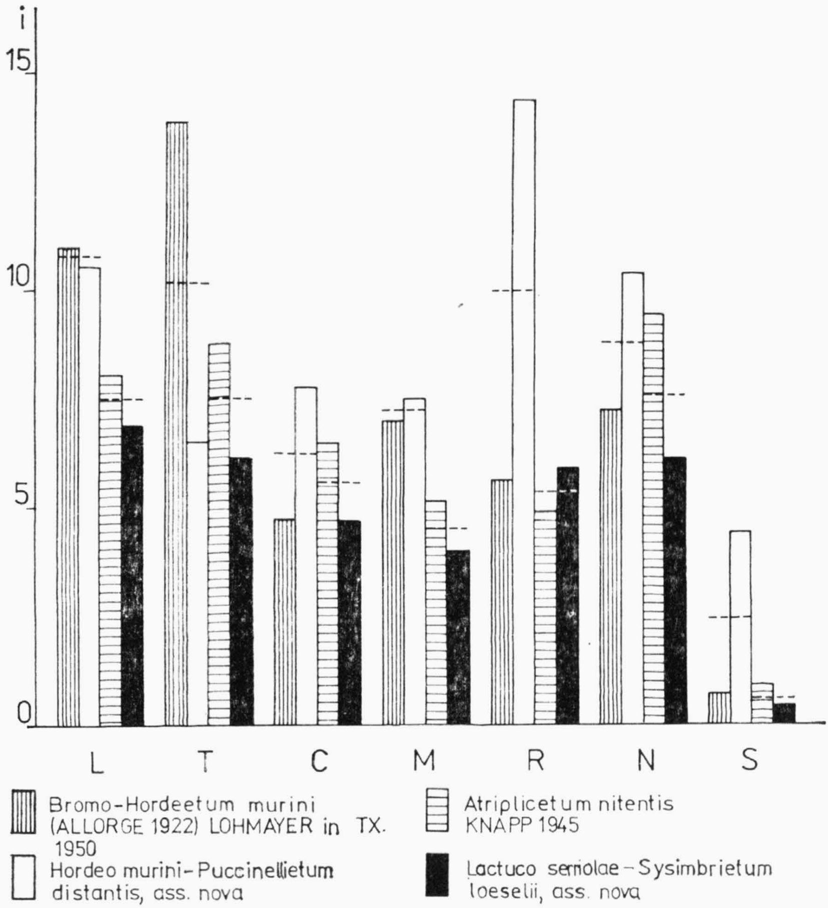


Fig. 5. — The average indicator values (i) of light (L), temperature (T), continentality (C), soil moisture (M), soil reaction (R), nitrogen supply (N), soil salt concentration (S) (according to ELLENBERG 1974; with the respect to the coverage of plant species in the relevé) for four types of ruderal communities (— — — the average for the appropriate alliances to which given associations belong)

Lactuco serriolae-Sisymbrietum loeselii is a more-layered community, the stand being about 1 m high, and occupies sunny, more or less arid sites on loose substrata. It prefers soils with a higher content of sand and gravel, with the reaction 7.2—7.5 in our case, rich in nitrogen. Therophytes for about 50 % of the community. The association reaches its development climax in June and July.

Similar, but not identical communities are known e.g. from Poland (ROSTAŃSKI et GUTTE 1971), the G.D.R. (GUTTE et HILBIG 1975), west Bohemia (PYŠEK 1975, 1978) and Slovakia (ELIÁŠ 1978). The community described by KOPECKÝ (1980) in the south-west part of Prague under the name "*Sisymbrium loeselii* (-*Sisymbrion*) Basalgesellschaft" resembles our community floristically as well as ecologically. They are perhaps identical.

We have tried to compare our observations on the ecology of the studied communities with the average indicator values of plant demands on light, temperature, continentality, soil moisture, soil reaction, nitrogen and salt concentration in soil according to ELLENBERG (1974) taking into account also the dominance of individual species in our association tables (see Fig. 5).

According to the indicator values, our *Hordeo-Puccinellietum distantis and Bromo-Hordeetum murini* have slightly higher demands on soil moisture and light than *Atriplicetum nitentis* and *Lactuco serriolae-Sisymbrietum loeselii*; the latter two communities have a higher cover than the former ones and thus their soil is more protected against draught. The association *Hordeo-Puccinellietum distantis* and *Atriplicetum nitentis* have more continental character than *Bromo-Hordeetum murini* and *Lactuco serriolae-Sisymbrietum loeselii*. The salt concentration in the soil, as well as pH is the highest in *Hordeo-Puccinellietum* (*distantis*). The comparison of our observations and measurements with the indicator values of ELLENBERG show a fairly good coincidence.

SOUHRN

V článku se věnuje pozornost ruderálním společenstvům v Praze-Holešovicích, a to především těmto svazům a asociacím:

Bromo-Hordeion murini HEJNÝ 1978
  Bromo-Hordeetum murini (ALLORGE 1922) LOHMEYER in TX. 1950
  Hordeo murini-Puccinellietum distantis HADAČ et RAMBOUSKOVÁ
Sisymbrion officinalis TX. et al. in TX. 1950, em. HEJNÝ 1979
  Atriplicetum nitentis KNAPP 1945
  Lactuco serriolae-Sisymbrietum loeselii HADAČ et RAMBOUSKOVÁ
Arction lappae (TX. 1942) em. GUTTE 1972
  Arctio-Artemisietum vulgaris (R. TX. 1942) (OBERD. 1967) BRANDES 1980.

Dále byla zaznamenána společenstva *Poetum annuae* GAMS 1927 a *Lolio-Plantaginetum majoris* BEGER 1930 (sv. *Polygonion avicularis* BR.-BL. 1931).

Byla porovnána ekologie jednotlivých typů společenstev se zřetelem zejména na společenstva s dominantní *Puccinellia distans*, která osidlují okraje ulic, v zimě silně zasolených. Na základě provedených chemických rozborů půd a rostlin a na základě porovnání se stanovišti nezasolenými se zdá, že při formování halofytního společenstva hraje roli nejen zvýšená koncentrace NaCl, ale také přítomnost fluoru, obsaženého v posypových materiálech.

REFERENCES

BRANDES D. (1980): Ruderalgesellschaften des Verbandes Arction Tx. 1937 im östlichen Niedersachsen. — Braunschw. Naturk. Schr., Braunschweig, 1 : 77—104.

ELIÁŠ P. (1974): Niektoré synantropné spoločenstvá Horného Požitavia. — Acta Inst. Bot. Acad. Sci. Slov. ser. A, Bratislava, 1 : 197—211.

— (1978): Sambucetum ebuli a iné ruderálne spoločenstvá v meste Trnave. — Preslia, Praha, 50 : 225—252.
— (1979): Über die Verbreitung und Variabilität des Hordetum murini in der Westslowakei. — Folia Geobot. Phytotax., Praha, 14 : 337—353.
ELLENBERG H. (1974): Zeigerwerte der Gefässpflanzen Mitteleuropas. — Scr. Geobot., Göttingen, 9.
FABIERKOWICZ I. (1971): Roślinność synantropijna miasta Torunia. — Mater. Zakł. Fitosoc. Stosowanej U. W., Warszawa-Białowieža, 27 : 133—144.
FALIŃSKI J. B. (1971): Flora i roślinność synantropijna wsi i miast — próba analizy porównawczej. — Mater. Zakł. Fitosoc. Stosowanej U. W., Warszawa-Białowieža, 27 : 15—37.
GRÜLL F. (1978): Die Vegetation der Eisenbahnstrecken und ihre Pflanzengesellschaften im Areal der Stadt Brno. — Acta Bot. Slov. Acad. Sci. Slov., ser. A, Bratislava, 3 : 245—249.
— (1980): Výskyt a charakteristika méně známých ruderálních společenstev svazů Sisymbrion officinalis a Arction v širším areálu města Brna. — Preslia, Praha, 52 : 269—278.
GRÜLL F. et VANĚČKOVÁ L. (1978): Vorkommen und Ausbreitung der synantropen Pflanzenarten im Schutzgebiet des Mährischen Karstes. — Acta Bot. Slov. Acad. Sci. Slov. ser. A, Bratislava, 3 : 421—429.
GUDERIAN R. (1977): Air pllution. — Berlin, Heidelberg, New York.
GUTTE P. (1972): Ruderalpflanzengesellschaften West- und Mittelsachsens. — Feddes Repert., Berlin, 83 : 11—122.
GUTTE P. et HILBIG W. (1975): Übersicht über die Pflanzengesellschaften des südlichen Teiles der DDR. XI. Die Ruderalvegetation. — Hercynia, ser. n., Leipzig, 12 : 1—39.
HADAČ E. (1978): Ruderal vegetation of the Broumov Basin, NE. Bohemia. — Folia Geobot. Phytotax., Praha, 13 : 129—163.
HEJNÝ S. (1974): Příspěvek k charakteristice ruderálních společenstev v jižních Čechách. — Acta Inst. Bot. Acad. Sci. Slov., ser. A, Bratislava, 1 : 213—232.
— (1978): Zur Charakteristik und Gliederung des Verbandes Sisymbrion Tx., Lohmeyer et Preising in Tx. 1950. — Acta Bot. Slov. Acad. Sci. Slov., ser. A, Bratislava, 3 : 265—270.
HEJNÝ S., HUSÁK Š. et PYŠEK A. (1978): Vergleich der Ruderalgesellschaften in erwählten Gesamtheiten südböhmischer und südmährischer Dörfer. — Acta Bot. Slov. Acad. Sci. Slov., ser. A, Bratislava, 3 : 271—281.
HEJNÝ S. et al. (1979): Přehled ruderálních rostlinných společenstev Československa. — Rozpr. Čs. Akad. Věd, ser. math.-nat., Praha, 89/2 : 1—100.
HOLUB Z. (1978): Fluórové zlúčeniny v pletivách rastlín. — Biol. Pr., Bratislava 23': 5—106.
HORKÝ J. et al. (1980): Problematika zimního solení komunikací ve vztahu k zeleni a technologie zimní údržby komunikací. — Praha.
KOPECKÝ K. (1980): Die Ruderalpflanzengesellschaften im Südwestlichen Teil von Praha (1). — Preslia, Praha, 52 : 241—267.
KRIPPELOVÁ T. (1971): Puccinellio-Chenopodietum glauci, ass. nova. — Environ. Poll., London, 1 : 185—189.
— (1972): Ruderálne spoločenstvá mesta Malaciek. — Biol. Pr., Bratislava, 18 : 5—117.
KÜHNBERGER R. et MAHN E.-G. (1978): Untersuchungen zum ökologischen Verhalten von Puccinellia distans (Jacq.) Parl. und Lolium perenne L. gegenüber der im Strassenwinterdienst eingesetzten $MgCl_2$-Sole. — Acta Bot. Slov. Acad. Sci. Slov., ser. A, Bratislava, 3 : 149—156.
MARKOVIČ L. (1978): Übersicht der Ruderalpflanzengesellschaften in Jugoslawien. — Acta Bot. Slov. Acad. Sci. Slov., ser. A, Bratislava, 3 : 305—309.
MISIEWICZ J. (1971): Flora i zbiorowiska synantropijne Gorzowa Wlkp. i okolicy. — Mater. Zakł. Fitosoc. Stosowanej U. W., Warszawa—Białowieža, 27 : 65—79.
PYŠEK A. (1975): Vegetace chemického závodu Lachema, n. p. Brno, závod Julia Fučíka v Kaznějově, okres Plzeň. — Zpr. Muz. Západočes. Kraje, — Přír., Plzeň, 18 : 5—15.
— (1976): Vegetation auf dem Gelände des VEB Chemische Betriebe Sokolov, (Westböhmen). — Fol. Mus. Rer. Natur. Bohem. Occid., ser. bot., Plzeň, 8 : 7—19.
— (1977): Sukzession der Ruderalpflanzengesellschaften von Gross-Plzeň. — Preslia, Praha, 49 : 161—169.
— (1978): Ruderální vegetace Velké Plzně 1507—9. — Ms. [Depon. in Bot. Inst. Czechoslovak Acad. Sci., Průhonice by Praha.]
— (1978): Grundlegende Charakteristik der Westböhmischen Siedlungsvegetation. — Acta Bot. Slov. Acad. Sci. Slov., ser. A, Bratislava, 3 : 339—345.
ROSTAŃSKI K. et GUTTE P. (1971): Roślinność ruderalna miasta Wrocławia. — Mater. Zakł. Fitosoc. stosowanej U. W., Warszawa—Białowieža, 27 : 165—215.
ROTHMALER W. (1976): Exkursionsflora für die Gebiete der DDR und der BRD. — Berlin.
SÝKORA V. et ZÁTKA V. (1956): Příruční tabulky pro chemiky. — Praha.

Tüxen R. (1950): Grundriss einer Systematik der nitrophilen Unkrautgesellschaften in der Eurosibirischen Region Europas. — Mitt. Florist.-Soziol. Arb.-Gem., Stolzenau/Weser, N. F., 6/7 : 170—171.

Ven Kateswarlu P. et al. (1965): Absorption of fluoride and chloride by barley roots. — Pl. Phys., London, 40 : 255—261.

Zaliberová M. (1978): Die Vegetation in den Abfall-Sammelbecken einer Zuckerfabrik. — Acta Bot. Slov. Acad. Sci. Slov., ser. A, Bratislava, 3 : 363—369.

Received 10 March, 1981

See also plates I—II in the Appendix.

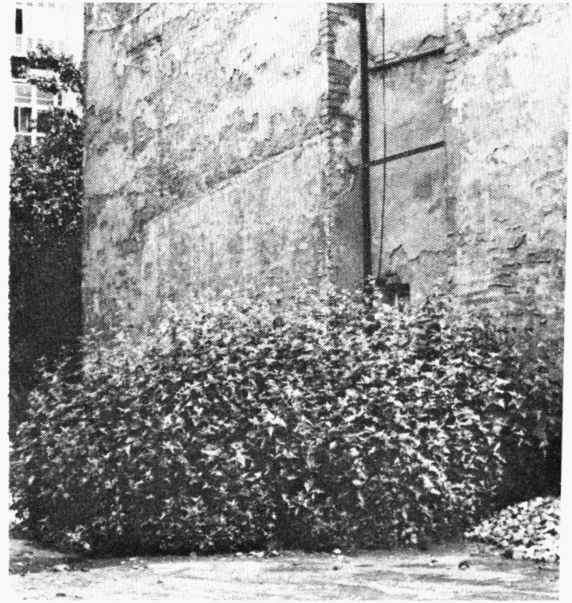
1

2

Plate I. — 1. — *Bromo-Hordeetum murini* (ALLORGE 1922) LOHMEYER in TX. 1950 (E. HADAČ). — 2. — *Hordeo-Puccinellietum distantis* HADAČ et RAMBOUSKOVÁ (E. HADAČ).

E. Hadač, H. Rambousková and R. Valach:
Notes on the syntaxonomy and synecology of some ruderal plant communities in Praha–Holešovice with special attention to winter–salted habitats

3



4

Plate II. — 3. — *Hordeo-Puccinellietum distantis* HADAČ et RAMBOUSKOVÁ — detail (E. HADAČ). — 4. — *Atriplicetum nitentis* KNAPP 1945 (Z. LINHARTOVÁ).

E. Hadač, H. Rambousková and R. Valach:
Notes on the syntaxonomy and synecology of some ruderal plant communities in Praha–Holešovice with special attention to winter–salted habitats