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Soil-ecological properties and plant communities in the Nature Reserve Chynoriansky luh

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Abstract

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The edaphotope of the Nature Reserve Chynoriansky luh is formed by Pleistocene gravel sands overlaid in Holocene with very heavy clayey 2.5 to 3 m thick carbonate alluvial sediments. During year the ground water level ranged between 1.69–2.33 m. The closest to the soil surface was in April and in the first decade of May when the water levels in Bebrava and Nitra rivers were high. The redox processes are manifested in a depth of 50 cm and more. Luvi-Calcaric Fluvisols are neutral, clayey to clay, with maximum content of coarse clay in a depth of 20–30 cm and physical clay usually in a depth of 50–70 cm. The humus content ranges between 3.2–4.2%, carbonate content 0.1–0.4%. The layers below 80 cm have up to 1.5% carbonates and are mildly alkaline. The content of plant available P in topsoil is 2–3 times higher and of available K 1.2–1.6 times higher than the limits for rich or very good reserves in neutral clayey soils. Amount of available P in lower soil layers is in general insufficient, of available K good. The maximum amount of available P was found near a forest edge (possible impact of field fertilisation in surroundings). The content of exchangeable cations ranges between 128–208 mmol kg^{-1}, from which 66–74% are Ca^{2+}, 21–26% Mg^{2+}, 3–6% K^{+} and 1–4% Na^{+} ions. The dominant herb species of the heminitrophilous group of types of geobiocoens *Ulmi-Fraxineta carpini superiora* belonging to the wetted edaphic-hydric order of geobiocoens is *Allium ursinum* accompanied by the other heminitrophilous species mainly *Mercurialis perennis*, *Glechoma hederacea, Galeobdolon luteum, Alliaria petiolata.* From lianas locally occurs *Hedera helix* and allochtonous North American species *Parthenocissus quinquefolia.*

Key words

floodplain forest, fluvisols, heminitrophilous phytocoenoses, Nature Reserve Chynoriansky luh

Introduction

Forests, one of the biggest natural treasures of Slovakia, covered the whole territory of the land in the past. However, development of agriculture was connected with progressive reduction of the forest area, primarily in lowlands with favourable climate and soil conditions. The Nature Reserve Chynoriansky luh is a last remnant of waterlogged, originally coherent forests of the Bebravská niva floodplain. It has been preserved in spite of intensive human activities in Slovak lowlands primarily of agricultural character. From the more recent human impacts are noticeable activities connected with intensification of agriculture, primarily with the effort to drainage grounds regularly waterlogged in the springtime, application of mineral fertilisers in high amounts, and abundant visitation of inhabitants from the close villages. Differences in frequency, intensity and duration of floods are considered being the most important factors determining differences in species composition and structure of floodplain forest vegetation (Lockaby et al., 1997; Dubová, 1998; Burke et al.,

2003; Maděra, 2001; Penka et al., 1985; Kuklová and Kukla, 2006).

The objective of this study was to assess the impact of soil-ecological conditions in the relation to structure and composition of the phytocoenoses growing in the Nature Reserve Chynoriansky luh floodplain.

The study site

The Nature Reserve (NR) Chynoriansky luh is situated in the lower part of the Bebrava floodplain (Mazúr et al., 1986), NW from the Chynorany village, district Partizánske (48º37'15" N, 18º15'58" E), at an altitude of 175 m a.s.l. The territory has prolonged N-S form, with an area of 46.2592 ha. It is situated in lowland and surrounded with intensively managed agricultural land. The parent rock consists of young, argillic, slightly carbonaceous alluvia of the rivers Bebrava and Nitra, and it is deposed on more ancient gravel-sand terraces of the same water-flows. Basic characteristics of studied phytocoenoses are described in Table 1.

The climate of NR is primary determined by its geographic position. According to the Miklós et al. (2002) the NR territory belongs to the warm climatic region with a number of summer days (with a maximum temperature ≥25 °C) in a year ≥50. The climate sub-region is warm, moderately dry with moderately cold winters (temperature in January >–3 °C). The mean annual temperature in the NR is 8.4 °C and mean annual precipitation total 600–650 mm. The mean temperature in January is –2 to –3 °C, in July 18 to 19 °C. The number of days with snow cover is 50.

Material and methods

Geobiocoenoses of NR Chynoriansky luh were studied on three established monitoring plots (MP 1 to MP 3; Fig 1). Macromorphological characteristics of soils were described and soil sampling was made in 1997 according to Šály and Ciesarik (1991). The soils were classified according to ISSS-ISRIC-FAO (1994, in Collective, 2000).

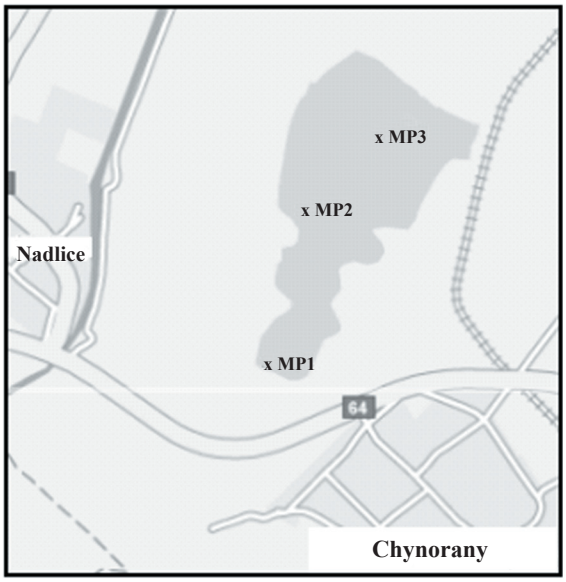

Fig 1. Localisation of the monitoring plots in Nature Reserve Chynoriansky luh

The soil samples were air dried and sieved with a mesh 2 × 2 mm. The contents of dry matter and hygroscopic water were determined gravimetrically, the carbon content oxidimetrically, following Ťurin, the particle size-distribution by laser analyser (FRITSCH analysette 22) using supersound and sodium hexametaphosphate. The values of active and exchange acidity (ratio of fine earth to water and 1 M KCl 1 : 2.5) were obtained using glass and calomel electrodes of a digital pH-meter, the type 08211/1 Radelkis, and the carbonate content using a Janko´s volumetric calcimeter. The amounts of accessible phosphorus and potassium were determined using the methods by Bray-Kurz and Schachtschabel (Hraško et al., 1962; Šály and Ciesarik, 1991).

Table 1. Basic characteristics of studied phytocoenoses

Monitoring plot	MP 1	MP 2	MP 3
Soil	Luvi-Calcaric Fluvisol		
Ground water level [cm]	–155 (–140)	–190 (–170)	–130 (–115)
Edaphic-hydric order	Wetted		
Edaphic-trophic interorder	Heminitrophilous		
Group of types of geobiocoens	*Ulmi-Fraxineta carpini superiora pannonica*		
Type of geobiocoens	953 Garlic elm-ash forest with hornbeam		
Stocking	0.7	0.6–0.7	0.6–0.7
Canopy [%]	80	80	70
Cover of herb layer [%]	90–100	60	90–100

The phytocoenological reléves were made in 1997 according to principles given in Zlatník (1976a) and the classification of geobiocoenoses was made in the sense of Hančinský (1972) and Zlatník (1976b). The plant taxa names are given according to Dostál (1989).

Results and discussion

Soil properties

The NR territory is formed by Pleistocene gravel sands overlaid in Holocene with very heavy clayey 2.5 to 3 m thick carbonate alluvial sediments. The macro-morphology of the soils on the monitoring plots (MP) is following:

MP 1 – Luvi-Calcaric Fluvisol, humus form a typical mull
Ool 1–2 cm layer consisting mostly of oak leaves
Oof +
Aoq 0–6 cm, black-brown, clay-loam, moderately compact, with coarse crumbs to lumped, moist, medium penetrated by roots, without skeleton
Bt 6–60 cm, yellow-brown, clayey, compact, lumpy, moist, medium penetrated by roots, without skeleton, beginning with 25 cm from the soil surface heavier, polyedric and lumpy
Bgt 60–85 cm, grey-brown, clayey with rusty spots on polyedric walls, very compact, lumpy, moist, roots rare, without skeleton
Go 85–155 cm, grey with rusty spots, clayey, very compact, lumpy, moist, roots rare, without skeleton
Ground water was found at a depth of 155 cm, the groundwater level was stabilised at a depth of 140 cm.

MP 2 – Luvi-Calcaric Fluvisol, humus form a typical mull
Ool 1 cm thin layer consisting mostly of oak and hornbeam leaves
Oof +
Aoq 0–6 cm, black-brown, clay-loam, moderately or medium compact, with coarse crumbs to lumped, moist, medium penetrated by roots, without skeleton
Bt 6–50 cm, brown, clayey, very compact, lumpy, moist, medium penetrated by roots, without skeleton
Bgt 50–75 cm, brown, with a light grey hue, clayey, very compact, moist, medium to low penetrated by roots, without skeleton
Go1 75–118 cm, grey with light rusty spots, clayey, very compact, polyedric to platy, moist, with few roots, without skeleton
Go2 118–180 cm, grey, with more conspicuous rusty spots, clayey, very compact, lumpy, moist, with rare roots, without skeleton
Ground water was found at a depth of 190 cm, the groundwater level was stabilised at a depth of 170 cm.

MP 3 – Luvi-Calcaric Fluvisol, humus form a typical mull
Ool + – l cm incoherent layer consisting mostly of oak leaves
Aoq 0–7 cm, black-brown, clay-loam, moderately compact, with coarse crumbs, moist, medium penetrated by roots, without skeleton; through passages after the roots penetrate to 15 cm, rarely up to 30 cm from the soil surface
Bt 7–45 cm, yellow-brown, clayey, compact, polyedric and lumpy, moist, moderately or medium penetrated by roots, without skeleton,
Go 45–70 cm, grey with light grey and rusty spots, clayey, compact, polyedric and lumpy, moist, low or medium penetrated by roots, without skeleton
Gor 70–140 cm, grey, with rusty spots, clayey, very compact, lumpy, moist to wet, little penetrated by roots, without skeleton
Ground water was found at a depth of 130 cm, the groundwater level was stabilised at a depth of 115 cm.

Particle-size analyses point out an extremely high proportion of clay fraction, and, on the other hand, a very low amount of fine and coarse sand, in general quartz (Table 2). Physical clay content throughout the soil profile is the most uniform on MP 3, ranging within a relatively narrow interval 39–49%, with a maximum at a depth of 20–40 cm. Similar profile pattern of physical clay was found in soil on MP 2, however, its amount fluctuated in considerably greater range (32–56%), and the maximum was at a depth of 50–70 cm. Maximum content of physical clay (40–63%) was found on MP 1 where the clay content increased with the depth up to 50–70 cm, similar to MP 2.

Accumulation of the physical clay in the central parts of the soil profiles was a result of coupled influence of processes of illimerisation and colmatation (argillization caused by periodical percolation of turbid flood water). Gleying in the medium parts of the soil profiles is associated with waterlogging and argillization of soil layers.

Maximum amounts of less mobile coarse clay were on all plots found already at a depth of 20–40 cm. Having reached a maximum, the coarse clay content in general decreased with increasing depth, with exception of MP 3 where the minimum was already found at 50–70 cm. On this plot was also found the different (in comparison with MP 1 and MP 2) profile course of dust fraction, decreasing only to 20–40 cm and reaching its absolute maximum (44%) at a depth of 50–70 cm.

The content of soil clay, humus and soluble salts is close connected with the content of dry matter and hygroscopic water making 94–96%, and 3–5%, respectively (Table 3). Important factor in nutrient cycling in floodplain forest ecosystems is soil humus. Its amount in surface A-horizons of the studied soils ranged between

3.2–4.2%, with a maximum on MP 2. The profile course of soil humus is well balanced.

Active reaction in the upper soil layers was on all the plots within range 6.4–6.9, i.e as a rule in neutral interval (Table 3). These values indicate presence of the heminitrophilous edaphic-ecological interorder of geobiocoens limited by pH_{H_2O} values 6.0–7.2 within 5 cm topsoil mineral layer (KUKLA, 1993). The presence of carbonates (to 1.5%) increases values of the soil reaction turning to mild alkaline (pH_{H_2O} > 7.2) at about 80 cm depth.

Table 2. Particle size analysis of soils

Monitoring Plot	Subcompartment	Horizon	Sample	Fine earth fraction [mm]					Soil kind
				Clay		Dust	Sand		
				Physical	Coarse		Fine	Coarse	
				<0.002	<0.01	0.01–0.05	0.05–0.1	0.1–2.0	
			[cm]			[%]			
MP 1	2,379	Aoq	1–6	39.96	67.64	22.00	5.46	4.90	Clayey
		Bt	20–30	55.88	82.90	11.00	4.80	1.30	Clay
		Bt/Go	50–70	63.20	78.84	8.36	6.00	6.80	
		Goc1	80–100	56.36	69.96	13.48	7.64	9.10	Clayey
		Goc2	120–140	57.48	71.84	12.12	6.74	9.30	
MP 2	2,378	Aoq	1–6	38.64	65.96	26.40	5.06	2.06	Clayey
		Bt	20–30	48.00	78.08	17.12	3.80	1.00	Clay
		Bt/Go	50–70	56.12	76.28	12.88	6.84	4.00	
		Goc1	80–100	45.72	58.72	20.56	12.12	8.60	Clay loam
		Goc2	120–140	31.96	44.64	33.48	14.28	7.60	Loam
MP 3	2,380	Aoq	1–6	40.80	69.72	23.24	4.64	2.40	Clayey
		Bt	20–30	49.36	79.48	16.12	3.40	1.00	Clay
		Go	50–70	38.68	46.88	44.20	4.92	4.00	Clay loam
		Groc1	80–100	48.64	65.00	21.72	7.58	5.70	Clayey
		Groc2	120–140	38.68	54.60	30.84	10.26	4.30	Clay loam

Table 3. Results of some soil analyses

Monitoring Plot	Sample		Dry matter	Hygr. water	Cox	Humus	$pH_{H_2O} - pH_{KCL}$		Eqv. $CaCO_3$
	Horizon	[cm]	[%]		[%]				[%]
MP 1	Aoq	1–6	94.94	3.50	2.16	3.72	6.89	6.04	0.3
	Bt	20–40	95.05	3.75	2.33	4.02	6.37	5.56	0.1
	Go	50–70	94.27	4.32	2.21	3.81	6.86	5.92	0.4
	Goc1	80–100	94.19	4.57	2.18	3.76	7.42	6.24	0.7
	Goc2	120–140	93.81	4.81	1.78	3.07	7.34	6.55	1.4
MP 2	Aoq	1–6	96.24	2.81	1.88	3.24	6.44	5.45	0.3
	Bt	20–30	95.48	3.43	2.15	3.71	6.71	5.85	0.2
	Go	50–70	94.95	3.87	2.11	3.64	6.88	5.85	0.3
	Goc1	80–100	95.79	3.23	1.91	3.29	7.09	6.37	0.4
	Goc2	120–140	95.33	3.47	1.98	3.41	7.20	6.35	1.5
MP 3	Aoq	1–6	95.62	3.18	2.45	4.22	6.44	5.71	0.1
	Bt	20–30	95.69	3.39	2.23	3.84	6.77	5.53	0.1
	Go	50–70	94.54	4.20	1.96	3.38	6.87	5.44	0.2
	Groc1	80–100	95.27	3.54	2.08	3.59	7.33	6.28	1.2
	Groc2	120–140	95.96	3.08	1.86	3.21	7.16	6.15	0.5

Physiological state of plants is close connected with nutrient content in the soil. The decisive factor is the amount of so called plant accessible or releasable nutrients supposed to be accepted by plants. The most important plant nutrients in soils of the NR Chynoriansky luh are nitrogen, phosphorus and potassium. Favourable course of nitrification depends on the optimum – for nitrification bacteria, reaction values in the upper layers of Fluvisols (pH_{H_2O} 6.0–6.5), and on a favourable ratio of acid and basic components in litter of so called valuable broadleaved species, primarily in the NR dominating ashes.

Nutrient reserves in neutral clayey soils are considered rich or very good if the concentration of accessible P is higher than 26 mg kg^{-1} and the concentration of accessible K is above 154 mg kg^{-1}. The contents of accessible P found in humus horizon A of the studied fluvisols are 2–3 times higher and the contents of accessible K are 1.2–1.6 times higher than the limits for rich or very good reserves in neutral clayey soils (Hraško, 1962). Because the amounts of accessible phosphorus found in lower situated mineral layers are in general insufficient and the phosphorus could be in the upper soil layers accumulated by bioaccumulation, the role of fertilisation of the surrounding agricultural land in the topsoil accumulation of P is not entirely clear. Partly can be the impact of fertilisation assumed from the fact that the maximum amount of accessible phosphorus was found on MP 1 situated near a forest edge.

Reserves of accessible K in medium and lower situated layers of the fluvisols can not be in general evaluated as good. Bioaccumulation of K is considerably lower compared to P bioaccumulation. This is no surprise when we consider the possible fixation of K by clay minerals and rare occurrence of more potassium accumulating grass species in the herb layer.

The sorption complex of the fluvisols has evident prevalence of bivalent ions over monovalent ones (Table 4). By mass ratio is the amount of calcium 4.2–5.8 times higher compared to magnesium, by molar ratio it is 2.6–3.5 times more calcium compared to magnesium. The actual content of exchangeable cations ranges between 128–208 mmol kg^{-1}, from which 66–74% are Ca^{2+}, 21–26% Mg^{2+}, 3–6% K^+ and 1–4% Na^+ cations. There has not been found salinization of the soil profile.

The described soils have transition character assembling features of fluvisols (formation from alluvial sediments), luvisols (translocation of physical clay in the medium part of the soil profile) and gleys (redox processes caused by ground water), according to Collective (2000). However, the fluvisols are defined as soils with an ochric A-horizon without other diagnostic horizons except G horizons. Consequently, considerably extent brown alluvial soils of the Vega type (Kubiena, 1953; Šály, 1978, 1982) have been excluded from the classification. According to ISSS-ISRIC-FAO (1994) can be studied soils classified as Luvi-Calcaric Fluvisols.

Dynamics of ground water level

Existence of floodplain forests primarily depends on the ground water level, supplied continually or periodically, by means of capillary elevation, to the physiologically effective part of the soil profile. The finer is the soil grain, the higher is the point of capillary elevation. If there is a permanent decrease of ground water level

Table 4. Content of exchangeable cations

Sample [cm]		1–6	20–30	50–70	80–100	100–120
Monitoring plot	Adsorbed cations			[mg kg^{-1}]		
MP 1	Ca^{2+}	4,875.0	4,625.0	5,250.0	5,250.0	5,875.0
	Mg^{2+}	922.5	797.5	960.0	1,022.5	1,210.0
	K^+	355.0	240.0	288.0	264.0	269.0
	Na+	21.5	15.0	28.5	71.0	103.5
MP 2	Ca^{2+}	3,625.0	4,375.0	4,875.0	4,500.0	3,500.0
	Mg^{2+}	797.5	847.5	847.5	822.5	772.5
	K^+	329.0	259.0	250.0	187.0	142.0
	Na^+	111.0	51.0	53.5	48.5	113.5
MP 3	Ca^{2+}	4,125.0	4,125.0	4,750.0	4,875.0	4,500.0
	Mg^{2+}	797.5	897.5	1,022.5	1,060.0	1,062.5
	K^+	342.0	208.0	250.0	208.0	187.0
	Na^+	66.0	83.5	61.0	91.0	141.0

under 3 m from the soil surface, the influence of ground water on the moisture of the soil profile geobiocoenoses is in general low; and in the case of greater as 5–6 m depth entirely disappear.

The results of the ground water level change observations on monitoring plot M 1 are presented in Table 5. We can see that the ground water level in 1998 ranged between 1.69–2.33 m. The closest to the soil surface was in April and in the first decade of May when the water levels in Bebrava and Nitra rivers were high. At about mid-May to the end of August followed a decrease connected with lower precipitation and increasing of evapotranspiration. Abundant precipitation in September and October caused increase of water levels in streams followed by elevation of the water table in the NR.

The decisive importance for the water supply to floodplain forests has the ground water level in the summer when the water loss from the soil is the highest and the amount of water accessible for plants in the surface soil layers decreases considerably. Over the whole period of study, the ground water table did not decrease to such a depth in order to could be assumed the possibility of origination of an acute shortage of water accessible for plants. The highest ground water level – 1.3 m below the soil surface, was observed in the spring l997 (digging soil pits). In years where the precipitation amount is above normal values, can the ground water level (according to data of the local inhabitants) reach even the soil surface.

The intensity of flood events in the past is documented by a network of oxbows developed mainly in the northern half of the NR. Because of temporary or permanent lack of air, the clay layer is interfered by redox processes of various intensities manifested already in middle part of the soil profile (in a depth >50 cm). In terms of geobiocoenology, the studied geobiocoenoses belong to the wetted edaphic-hydric order of geobiocoens.

Plant communities

The NR Chynoriansky luh is one of the last remnants of the original vegetation of floodplain forests with rather well preserved species composition of the phytocoenoses. Moderately disturbed is only the age, diameter, height and spatial structure of the forest stands. Immediate contact of the NR with the surrounding agricultural land is reflected on the ecotone effect in which elements of the forest flora mixed with elements of the open land.

In the spring aspect of the phytocoenoses is evident a considerable vertical differentiation in woody plant complex of geobiocoenoses. Together with ash (*Fraxinus angustifolia* subsp. *danubialis*) and oak (*Quercus robur*), significantly assert oneself maple (*Acer campestre*) on MP 1, hornbeam (*Carpinus betulus*) on MP 2 and evidently dominant ash with a smaller admixture of oak on MP 3.

Higher transparency of ash crowns (in comparison with other tree species) can be documented on MP 3, with more abundant of *Corylus avellana* and especially dominant *Padus avium* in the undergrowth. From rare species occur in the main storey *Tilia cordata*, subdominant is *Acer pseudoplatanus* and solitarily also *Ulmus laevis*. MP 1 is characterised by local openings with the most intensive natural regeneration of ash trees. Lateral light is utilized by *Crataegus monogyna* and *Sambucus nigra*. The liana *Hedera helix* mounts the trees only rarely while mass occurrence of this phenomenon was registered in the NE part of the NR, also near the forest edge. An allochtonous North American liana *Parthenocissus quinquefolia* occurs on MP 2. The seeds have probably brought by birds from nearby gardens.

The spring aspect of the NR herb layer is characterised by a very high total cover reaching up to 90–100%. The absolute dominance has everywhere the hemi-nitrophilous to nitrophilous species *Allium ursinum*. Coming of a warmer and drier period in mid-June with lower light supply under the fully developed leaves of crown canopy respond this species by gradual decline. On MP 1 was during the just discussed period observed considerably lower total cover of the herb layer.

The species diversity of the NR phytocoenoses is quite low. Abundant to dominant occur only other hemi-nitrophilous to nitrophilous species as *Galeobdolon luteum*, *Glechoma hederacea, Hedera helix* and *Mercurialis perennis*. Solitarily there is also present *Lamium maculatum* subsp. *maculatum*, eventually *Galium aparine* and *Alliaria petiolata* species. From rare species was on MP 3 recorded *Arum alpinum* and on MP 1

Table 5. Dynamics of ground water level

Month	April				May			June		
Day	15	20	25	30	10	20	30	10	20	30
Depth [cm]	1.69	1.64	1.62	1.62	1.60	1.68	1.78	1.69	1.79	1.94
Month	July		August		September		October		November	
Day	10	25	10	25	10	30	12	30	15	30
Depth [cm]	1.94	2.02	2.12	2.33	2.23	2.04	1.85	1.65	1.65	1.60

Acquilegia vulgaris. All phytocoenoses show conspicuously heminitrophilous character in the spring aspect.

From geobiocoenological point of view, the analysed phytocoenoses belong to the group of forest types *Ulmeto-Fraxinetum carpineum*, forest type 953 Garlic elm-ash forest with hornbeam (Hančinský, 1972). According to a more resent classification (Zlatník, 1976b) it is the group of types of geobiocoens *Ulmi-Fraxineta carpini superiora pannonica* representing the driest communities of the wetted edaphic-hydric order of geobiocoens (floodplain forests).

The tree species composition has been relatively well preserved; however, there has been a considerable shift of edificators of the original biocoenoses (*Quercus robur, Fraxinus angustifolia* subsp. *danubialis, Ulmus laevis*) in favour of the ash. Locally occur *Carpinus betulus* and *Acer campestre* in groups elsewhere these species of lower growth are absent. *Ulmus laevis, Tilia cordata, Acer pseudoplatanus* and *Acer platanoides* are only rare, occurring in general in the understorey where their vitality is suppressed because of the lack of light and competitive pressure by higher woody plants. Rarely also occurs *Cerasus avium*, on the other hand, *Padus avium* is abundant to dominant in the NE part of the NR, however, often in a dense shrub layer only.

The actual stocking of the oak-ash stands aged in the dominant layer up to 160 year range in general between 0.6–0.7. The woody plant complex as a whole, however, provides a relatively shade environment, thanks to a well-developed crown layer connected both horizontally and vertically. In effect, natural regeneration (primarily in *Fraxinus angustifolia* subsp. *danubialis*) has only been limited to open micro-localities. Totally insufficient at the current stage of the stand development is the natural regeneration of pedunculate oak – the species providing and also tolerating the biggest shadow from all tree species on the site. This reality will probably have been maintained up to the beginning of natural disintegration of the main stand.

Conclusions

The paper deals with impact of soil-ecological conditions on the structure and composition of the phytocoenoses of the Nature Reserve Chynoriansky luh. The NR is one of the last remnants of the original vegetation of floodplain forest with rather well preserved species composition of the phytocoenoses and belongs to unique ecosystems.

Particle-size analyses of fluvisols point out an extremely high proportion of clay fraction, and, on the other hand, a very low amount of fine and coarse sand. The profile course of soil humus is well balanced. Its amount in surface A-horizons of the studied soils ranged between 3.2–4.2% and carbonate content 0.1–0.4%. The active reaction in the upper soil layers was on all the plots within range 6.4–6.9, ie as a rule in neutral interval. The most important plant nutrients in soils of the NR Chynoriansky luh are nitrogen, phosphorus and potassium. The contents of accessible P found in humus horizon A of the studied fluvisols are 2–3 times higher and the contents of accessible K are 1.2–1.6 times higher than limits for rich or very good reserves in neutral clayey soils. Amount of available P in lower soil layers is in general insufficient, of available K good.

In the phytocoenoses is evident a vertical differentiation in woody plant complex. In a function of the edificator – together with *Fraxinus angustifolia* and *Quercus robur*, significantly assert oneself *Acer campestre* (on MP 1), *Carpinus betulus* (on MP 2) and evidently dominant ash with a smaller admixture of oak (on MP 3). The species diversity in the herb layer is quite low. All phytocoenoses show conspicuously heminitrophilous character with absolute dominance of *Allium ursinum* species.

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Pôdno-ekologické vlastnosti a rastlinné spoločenstvá Prírodnej rezervácie Chynoriansky luh

Súhrn

Územie PR je tvorené pleistocénnymi štrkopieskami prekrytými v holocéne zrnitostne ťažkými slabo karbonátovými ílovými aluviálnymi sedimentmi hrubými 2,5–3 m. Frekvencia záplav klesla po odvodnení okolitých poľnohospodárskych pozemkov rúrkovou drenážou. V súčasnosti sa hladina podzemnej vody pohybuje v hĺbke 1,69–2,33 m. Najbližšie k pôdnemu povrchu bola v apríli a v prvej dekáde mája, keď bola veľmi vysoká hladina vody v riekach Bebrava and Nitra. Redox procesy nastupujú v 50 cm hĺbke. Fluvizem luvizemná karbonátová je neutrálna, ílovitohlinitá až ílovitá, s maximálnym obsahom hrubého ílu v hĺbke 20–30 cm a fyzikálneho ílu spravidla v hĺbke 50–70 cm. Obsah humusu kolíše medzi 3,2–4,2 %, karbonátov 0,1–0,4 %. Hlbšie vrstvy (< 80 cm) obsahujúce do 1,5 % karbonátov sú mierne alkalické. Obsah rastlinám prístupného P vo vrchnej časti fluvizeme je 2–3-krát vyšší a prístupného K 1,2–1,6-krát vyšší ako limity pre bohaté alebo veľmi dobré zásoby v neutrálnych ílových pôdach. V nižších pôdnych vrstvách je obsah prístupného P spravidla nedostatočný, prístupného K dobrý. Maximálne množstvo prístupného P bolo zistené v blízkosti lesného okraja (možný vplyv hnojenia okolitých polí). Obsah výmenných katiónov sa pohyboval v rozpätí 128–208 mmol kg^{-1}. Z toho bolo 66–74 % Ca^{2+}, 21–26 % Mg^{2+}, 3–6 % K^{+} a 1–4 % Na^{+} iónov. Dominantným bylinným druhom heminitofilnej skupiny typov geobiocénov *Ulmi-Fraxineta carpini superiora* patriacej do zamokreného edaficko-hydrického radu geobiocénov je *Allium ursinum* sprevádzaný inými heminitofilnými druhmi, najmä *Mercurialis perennis*, *Glechoma hederacea,* G*aleobdolon luteum* a *Alliaria petiolata.* Z lian sa lokálne vyskytuje *Hedera helix*, na MP 2 aj alochtónny severoamerický druh *Parthenocissus quinquefolia.*

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