

Cynodonto-Plantagineum in East Slovakia.

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Mochnacký, S. (1991): *Cynodonto - Plantagineum* in the East Slovakia. - Thaiszia, Košice, 1:95-106. ISSN 1210-0420.

ABSTRACT: Synmorphological, synecological, syntaxonomical, syndynamical and synchorological characteristics of the association *Cynodonto - Plantagineum* Gams 1927 from the territory of East Slovakia are given. Two sub-associations have been distinguished: *Cynodonto - Plantagineum typicum* and *Cynodonto - Plantagineum junctosum*.

KEYWORDS: synantropic vegetation, phytosociology, numerical methods, East Slovakia, Czecho-Slovakia

Introduction

Cynodonto-Plantagineum is a three-layer association of xerophilous and mesophilous herbs that is poor or moderately rich in species. It has its symphenological optimum in the second half of summer. Associations with *Cynodon dactylon*, with regard to wide ecological amplitude of the main dominant and edificator (*Cynodon dactylon*), occupy a large distribution range. From the point of view of syntaxonomy, associations are well documented from southern and Central Europe, having the distribution centre in Pannonian region. In Czecho-Slovakia, the following phytocenological works dealing with *Cynodon dactylon* have appeared: ELIÁŠ (1974, 1978, 1979), JEHLÍK (1989), KRIPPELOVÁ (1972). Outside Czecho-Slovakia, the following studies have been published: BOJKO (1933, 1934) BRUN-HOOL (1962), FELFÖLDY (1942), SOÓ (1961, 1971) and TIMÁR (1957) etc. The association inhabits trampled, periodically inundated semi-natural to ruderal habitats on the banks of water pools and streams. In the East Slovakian region, associations with *Cynodon dactylon* have not been investigated so far, and that is why I would like to summarize briefly

its characteristics.

For the synthetic processing of relevés the SYNTAX package (PODANI 1984) was used. Names of taxa are used after DOSTÁL (1982) and syntaxonomical classification is carried out according to MUCINA and MAGLOCKÝ (1985). Characteristics of climatic conditions of the studied territory are presented on the Fig. 1.

Characteristics of the association.

SYNMORPHOLOGY.

The area of Cynodonto-Plantaginetum stands ranges from 25 to 100m². They are mostly three-layered and reach up to 30 cm in height. They usually are thick, carpet-like, with the coverage of 80-100%. In the association, hemicryptophytes predominate over terophytes. In the lower layer main dominants are concentrated, e.g. *Cynodon dactylon*, *Lolium perenne*, *Plantago major*, *Taraxacum* sect. *Palustria* and *Juncus bufonius*. The upper layer is formed by *Achillea millefolium*, *Conyza canadensis*, *Xanthium strumarium*, *Rumex crispus* and *Amaranthus retroflexus*. In the ground layer, a moss formation occurs with *Fumaria hygrometrica* and *Bryum* sp. reaching the coverage of 40%.

SYNECOLOGY

The association occurs at sunny but humid habitats. The stands are situated near the water-level of the pools in eulittoral and epilittoral zone. The zone also has a recreation function and is considerably trampled, predominantly in the main recreation period in July and August. At that time the stands of the association are intensely invaded by the holiday-makers. Predominantly, *Cynodon dactylon* and *Lolium perenne* do not suffer too much from the heavy anthropic influence. In this period, they represent 90% of the overall coverage. The beach zone is sporadically denuded at the most exposed places for some time, a mosaic structure is formed and, later on, the secondary succession begins. Such places are gradually colonized by *Juncus bufonius*, *Potentilla anserina*, *Chenopodium rubrum*, *Oxalis europaea* agg., etc. Subsequently, *Cynodon dactylon*, *Plantago major* and *Lolium perenne* are spread. Other species (Tab. 1) occur in the association sporadically with low frequency. Development optimum with rich species diversity and high density comes in June, i.e. before recreation season. *Cynodon dactylon* is most resistant to the disturbance. It dominates not only heavily trampled habitats but occurs in pavements chinks and along paths as well.

Among the substrates there are gravelly, sand-and-clay skeletal soils. Soils have acid reaction, sometime it has a high salt content. Its rootage is very rich up to the depth of 5 -10 cm. Water regime of the soils is stable and repeats every year. In spring months and at the beginning of summer, the soils are humid. Later on they are getting dry and in the second half of summer they are dry to extremely dry. Ecological niches can be distinguished along transects through the association stands. They are formed on the places with specific hydrobiological conditions, including the mineral reserve and nutrition situation. It is indicated by presence of certain species, e.g. *Potentilla anserina*, *Juncus bufonius*, *Potentilla argentea*, *Galium verum*, *Medicago lupulina* and others.

SYMFENOLOGY.

Association development and formation during the vegetation period can be divided into three phases. In spring season, when the substrate is provided with sufficient amount of water, light conditions are positive and trampling intensity is low, ephemeral species, which form spring aspect of the association, are found there. They are represented by *Arabidopsis thaliana*, *Arenaria serpyllifolia*, *Cerastium dubium*, *Erophila verna*, *Myosotis micrantha* and *Poa bulbosa*. Vegetation of this composition can be included into the ephemeral association *Erophilo-Arabidopsietum* Kropáč in Krippelová 1981. Period of the association occurrence lasts from the middle April to the end of May. In the second phase ephemeral species are gradually eliminated and mostly substituted by hemicryptophytes. In this period there are optimum conditions for the development of *Taraxacum* sect. *Palustria*, *T.* sect. *Ruderalia*, *Trifolium repens*, *Plantago major*, *Lolium perenne* and *Achillea millefolium*. *Cynodon dactylon* dominates the phenological stage before flowering. Stands are not disturbed anthropically, and that's why the species diversity is very high. In the third phase, in July to September, typical trampled association of *Cynodonto - Plantaginetum* is formed structurally. In the association, *Cynodon dactylon*, *Lolium perenne*, *Plantago major* and *Taraxacum* sect. *Ruderalia* predominate. Other species cease to develop due to higher stress intensity (trampling) and they are present at lower number. Main association dominants and edificators are in the phase of flowering or seed ripening, respectively. Gradual selection in the species composition takes place. Only the species that are most adapted to permanent human attack, e.g., *Cynodon dactylon*, *Lolium perenne* and *Plantago major* survive.

Tab. 1. *Cynodonto-Plantaginietum* Gams 1927

	subas. typicum												subas. juncetosum																										
Relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	φ				
Number of species	6	6	5	4	4	7	5	4	6	5	7	6	11	8	7	9	7	7	8	8	9	9	9	8	7	6	7	8	13	12	13	13	16	11					
Characteristic species of association																																							
<i>Cynodon dactylon</i>	4	4	3	3	4	2	2	3	4	4	4	4	3	4	3	4	3	3	4	3	4	4	4	4	5	4	4	4	3	3	4	3	4	4	3	4	3	V-5	
Differential species of subassociation																																							
<i>Juncus bufonius</i>	.	.	.	.	.	.	.	.	.	.	.	.	1	2	1	1	1	2	1	1	2	1	3	3	2	2	1	1	1	+	+	1	+	1	+	1	H-3	
<i>Trifolium repens</i>	3	2	2	3	3	2	2	3	3	2	1	1	1	1	3	1	2	1	1	1	+	+	1	+	+	+	H-3
<i>Leontodon autumnalis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Medicago lupulina</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Oxalis europea</i> agg.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Plantago lanceolata</i>	1	H-1
<i>Polygonum avicularis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
Polygonion avicularis et Potentillo - Polygonetalia avicularis et Plantaginetea majoris																																							
<i>Lolium perene</i>	4	4	3	3	3	4	2	2	3	4	4	4	3	4	3	4	3	3	4	3	4	4	4	4	5	4	4	4	3	3	4	3	4	3	4	4	3	V-5	
<i>Taraxacum officinale</i> agg.	1	2	1	1	1	1	1	3	2	+	+	+	2	2	2	1	1	1	1	1	1	1	1	1	1	2	3	2	1	1	1	2	1	1	1	1	1	1	V-3
<i>Plantago major</i>	+	+	1	1	1	2	3	2	2	2	2	2	2	2	3	2	1	1	2	1	2	2	2	1	+	V-3
<i>Achillea millefolium</i>	.	.	.	.	.	+	.	1	+	2	1	1	1	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V-3
<i>Potentilla anserina</i>	2	V-3
Companion species																																							
<i>Conyza canadensis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Rumex crispus</i>	R	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Galium verum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Chenopodium rubrum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Potentilla argentea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Potentilla heptaphylla</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Ranunculus repens</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Amaranthus retroflexus</i>	R	R	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Carex vulpina</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1
<i>Xanthium strumarium</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H-1

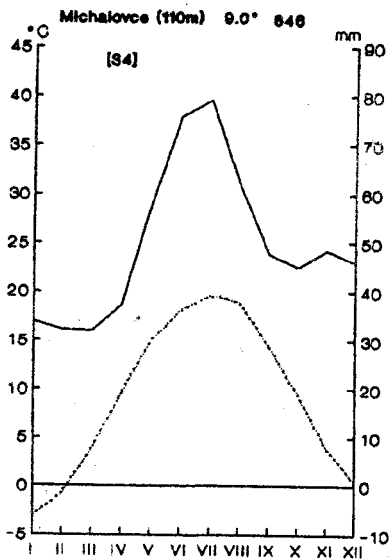


Fig. 1. Climatic diagram of the Michalovce meteorological station.

SYNTAXONOMY.

In synthetic processing of phytocoenological relevés with *Cynodon dactylon* as a dominant from the territory of ČSFR it was evident that the material gained from the territory of Zemplínska Šírava differs from phytocoenological relevés analysed hitherto (Fig. 3, Tab. 2). It is caused by localization of the territory, which is situated near the northern border of the Pannonian region, the way of exploitation and habitat form, and the character of anthropic influences on the vegetation. In phytocoenological relevés of some authors (KRIPPELOVÁ 1972, ELIÁŠ 1979, 1987 and JEHLÍK 1989) ruderal species and specific habitat conditions are presented in more detail. In the material from Zemplínska Šírava, for instance, the species of *Agropyretalia intermedii - repentis* Oberdorfer, Th. Müller et Görs ap. Oberdorfer et al. 1967 and *Convolvulo-Agropyron repentis* Görs 1966 are absent. Associations that are known from railways, vineyards (ELIÁŠ 1978, 1979 and JEHLÍK 1989) have a different character. They are not exposed to such a heavy anthropic influence as *Cynodonto - Plantaginetum* Gams 1927. Phytocoenological relevés from the territory studied are most similar to the material of Krippelová (KRIPPELOVÁ 1972). They differ by the absence of segetal species and species of xerothermic habitats in the

material from the analysed territory. In the association structure, species of trampled associations of *Polygonion avicularis* Br. - Bl. 1931 dominate.

At the table synthesis of phytocoenological material from the territory of Zemplínska Štrava (Tab. 1, Fig. 2) the existence of two subassociations emerged: *Cynodonto - Plantaginietum typicum* and *Cynodonto - Plantaginietum juncetosum*. The former settles drier habitats on elevated places with more intensive trampling. In *Cynodonto - Plantaginietum juncetosum* more hygrophilous species that are found in depressions and small shallow mikrodepressions are represented. *Juncus bufonius*, *Potentilla anserina* and *Taraxacum* sect. *Palustria* are diagnostic taxa. On such places, disturbance intensity is lower and association is richer in species.

Cynodonto - Plantaginietum Gams 1927 belongs syntaxonically to *Plantaginietea majoris* R. Tx. 1950 em. Oberd. in Oberd. et al. 1967, alliance of *Polygonion avicularis* Br. - Bl. 1931. In the East - Slovakian region it represents disappearing antropogenous termophilous association.

SYNCHOROLOGY.

Associations with *Cynodon dactylon* in East-Slovakian region occur in the warm territory close to the northern border of the Pannonian region. In comparison with associations from vineyards and railways, they have a more natural character. *Cynodonto - Plantaginietum* Gams 1927 is distributed over the northern and northeastern part of East-Slovakian Lowlands on anthropically influenced habitats. In northern parts of East Slovakia the occurrence of associations with *Cynodon dactylon* has not been recorded so far (DOSTÁL, personal communication).

Localities of relevés.

1. Kamencec, SE, near the dock of P.J.Šafárik University, area between pavement and asphalt road. 26.7.1989, relevé area (m²) 10, altitude (m a.s.l.) 120, coverage E1 (%) 60, coverage E0 (%) 20.
2. The same as 1., E, 50 m, margin of asphalt road. 26.7.1989, 12, 120, 60, 20.
3. The same as 1., SE, free camping area, 26.7.1989, 12, 120, 60, 10.
4. Kamencec, SE, beach, 26.7.1989, 10, 120, 80, 0.
5. The same as 4., SE, beach, about 20 m distant from locality 4. 26.7.1989, 16, 120, 80, 0.
6. The same as 4., S, beach, about 20 m distant from locality 5. 26.7.1989, 7, 120, 60, 0.
7. The same as 4., S, beach, near Children Camp, 26.7.1989, 7, 120, 80, 0.
8. Kamencec, E, beach near tent camp of SMZ Spišská Nová Ves, 26.7.1990, 10, 120, 80, 0.
9. The same as 8., E, beach, about 50 m distant from locality 8 in the direction of

- water, 26.7.1990, 10, 120, 80, 0.
10. The same as 8., SE, free camping area, about 20 m distant from locality 9, 26.7.1990, 12, 120, 60, 0.
 11. The same as 8., SE, beach, westwards from locality 10., near the water. 26.7.1990, 5, 120, 60, 10.
 12. Kamenec, S, beach near the tent camp of state enterprise Vitkovice. 28.7.1990, 10, 120, 80, 20.
 13. The same as 12., S, beach about 30 m distant from the locality in the direction of restaurant establishment. 28.7.1990, 15, 120, 80, 20.
 14. The same as 12, S, beach near the water level. 28.7.1990, 6, 120, 80, 20.
 15. Kamenec, SE, beach near the tent camp of VEZ Vojany. 28.7.1990, 6, 120, 80, 10.
 16. The same as 15., SE, beach about 50 m westwards from locality 15. 28.7.1990, 12, 120, 80, 5.
 17. The same as 15., SE, beach, about 100 m distant from locality 16. in the direction of water. 28.7.1990, 10, 120, 90, 5.
 18. The same as 15., S, beach, free big-tent area. 28.7.1990, 10, 120, 80, 5.
 19. Kamenec, S, beach near children playground. 28.7.1990, 10, 120, 60, 10.
 20. The same as 19, S, beach about 20 m distant from locality 19. in the direction of pavement. 28.7.1990, 8, 120, 60, 10.
 21. The same as 19., S, beach, margin of the pavement about 30 m long. 28.7.1990, 8, 120, 80, 20.
 22. The same as 19., S, beach, near the water. 28.7.1990, 8, 120, 80, 20.
 23. The same as 19., SE, beach about 50 m westwards from the locality 22. 28.7.1990, 15, 120, 80, 0.
 24. Kamenec, SE, beach near the chalet Vihorlat - Snina. 29.7.1990, 12, 120, 80, 0.
 25. The same as 24., SE, beach, near the water. 29.7.1990, 10, 120, 80, 0.
 26. The same as 24., SE, beach, about 20 m westwards from locality 25. 29.7.1990, 10, 120, 80, 0.
 27. The same as 24.,SE, beach, near the pavement. 29.7.1990, 10, 120, 80, 0.
 28. The same as 24., SE, beach, about 20 m westwards from locality 27. 29.7.1990, 8, 120, 60, 10.
 29. Kamenec, SE, beach near the centre of SMZ Spišská Nová Ves. 11.8.1991, 15, 120, 90, 10.
 30. The same as 29, SE, beach, about 20 m westwards from locality 29. 11.8.1991, 10, 120, 90, 10.
 31. The same as 29., SE, beach, near the sand-pit. 11.8.1991, 10, 120, 90, 20.
 32. The same as 29., S, beach, margin of the pavement, 11.8.1991, 10, 120, 80, 20.
 33. The same as 29., S, beach near to water. 11.8.1991, 8, 120, 90, 10.
 34. The same as 29., SE, beach, about 20 m westwards from locality 33. 11.8.1991, 8, 120, 90, 10.

Tab. 2. Comparison of phytocoenological material of *Plantagini - Cynodontetum* in various localities and habitats within the Pannonian region (SE, W Slovakia, partly Hungary).

Column	1	2	3	4	5	6
Number of relevés	28	16	6	12	5	5
Number of species	17	54	37	25	11	31
	V ³⁻⁵	V ²⁻⁵	V ⁴⁻⁵	V ⁴⁻⁵	V ¹⁻⁴	V ³⁻⁵
<i>Cynodon dactylon</i>	V	III	I	III	.	IV
<i>Lolium perenne</i>	.	II	.	III	.	.
<i>Taraxacum officinale</i>	V	I	.	.	.	r
<i>Plantago major</i>	IV	I	.	II	.	III
<i>Achillea millefolium</i>	III	.	.	.	.	.
<i>Juncus bufonius</i>	III	I	.	.	.	r
<i>Trifolium repens</i>	I	II	III	II	V	r
<i>Amaranthus retroflexus</i>	I	III	V	III	.	III
<i>Conyza canadensis</i>	I	III	.	I	.	IV
<i>Plantago lanceolata</i>	I	II	.	.	.	.
<i>Potentilla argentea</i>	I	I	.	.	.	.
<i>Potentilla anserina</i>	.	III	.	I	.	.
<i>Lepidium ruderae</i>	.	II	.	.	.	.
<i>Hordeum murinum</i>	.	II	.	.	.	.
<i>Berteroa incana</i>	.	II	.	.	.	.
<i>Malva neglecta</i>	.	I	.	I	I	.
<i>Capsella bursa - pastoris</i>	.	I	I	II	III	IV
<i>Chenopodium album</i>	.	I	I	I	III	r
<i>Setaria viridis</i>	.	I	I	.	I	r
<i>Bromus tectorum</i>	.	I	.	.	.	II
<i>Apera spica - venti</i>	.	I	.	I	.	.
<i>Lactuca serriola</i>	.	I	.	.	.	II
<i>Dactylis glomerata</i>	.	I	.	.	.	II
<i>Artemisia vulgaris</i>	.	I	V	III	.	II
<i>Ballota nigra</i>	.	I	.	.	.	II
<i>Tripleurospermum inodorum</i>	.	I	I	II	.	.
<i>Stellaria media</i>	.	I	.	I	.	.
<i>Agropyron repens</i>	.	.	II	.	.	I
<i>Convolvulus arvensis</i>	.	.	II	III	V	IV
<i>Calamagrostis epigejos</i>	.	.	II	.	.	.
<i>Cirsium arvense</i>	.	.	II	.	.	.
<i>Galium aparine</i>	.	.	II	.	.	.
<i>Polygonum persicaria</i>	.	.	II	.	.	.
<i>Atriplex tatarica</i>	.	.	.	III	.	.
<i>Carduus acanthoides</i>	.	.	.	.	II	r
<i>Falcaria vulgaris</i>	.	.	.	I	I	.

Tab. 2. (continued)

<i>Sonchus oleraceus</i>	.	.	.	II	.	.
<i>Atriplex patula</i>	.	.	.	II	.	.
<i>Polygonum aviculare</i>	.	.	.	II	.	IV
<i>Taraxacum officinale</i>	.	I.	.	III	.	IV
<i>Reseda lutea</i>	.	.	.	.	II	.
<i>Hordeum murinum</i>	.	.	.	.	.	IV
<i>Anchusa officinalis</i>	.	.	.	.	.	II

Species with C I. only the one column: **column 1** - *Chenopodium rubrum*, *Oxalis europea* agg., *Ranunculus repens*, *Rumex crispus*, *Xanthium strumarium*; **column 2** - *Poa annua*, *Chamaepilium officinale*, *Galinsoga parviflora*, *Digitaria sanguinalis*, *Poa pratensis*, *Medicago lupulina*, *Geranium pusillum*, *Erodium cicutarium*, *Lotus corniculatus*, *Trifolium arvense*, *Erysimum cheiranthoides*, *Trifolium campestre*, *Solanum nigrum*, *Rumex acetosella*, *Eragrostis minor*, *Portulaca oleracea*, *Fumaria officinalis*, *Festuca pseudovina*, *Galium mollugo*, *Medicago sativa*, *Daucus carota*, *Chamomilla recutita*, *Trifolium hybridum*, *Malva pusila*, *Senecio vulgaris*, *Raphanus raphanistrum*, *Urtica urens*, *Descurainia sophia*; **column 3** - *Alliaria petiolata*, *Arrhenatherum elatius*, *Bromus sterilis*, *Calystegia sepium*, *Carex hirta*, *Chelidonium majus*, *Fallopia dumentorum*, *Festuca rubra*, *Heracleum sphondylium*, *Hordeum distichon*, *Kochia scoparia*, *Linaria vulgaris*, *Poa trivialis*, *Polygonum arenastrum*, *Rosa* sp., *Saponaria officinalis*, *Senecio viscosus*, *Sisymbrium loeselii*, *Urtica dioica*; **column 4** - *Cardaria draba*, *Poa angustifolia*, *Fallopia convolvulus*, *Diploaxis muralis*; **column 5** - *Eragrostis minor*, *Reseda lutea*; **column 6** - *Chondrilla juncea*, *Berteroia incana*, *Atriplex oblongifolia*, *Echium vulgare*, *Medicago lupulina*.

A list of syntaxons

- column 1 - *Cynodonto* - *Plantaginetum* Gams 1927 in the East Slovakia. Mochnacký (1991).
 column 2 - *Cynodonto* - *Plantaginetum* Gams 1927. Krippelová (1974).
 column 3 - *Conyzo canadensis* - *Cynodontetum dactyloni* Eliáš 1978. Jehlík (1989).
 column 4 - *Conyzo* - *Cynodontetum dactyloni* W Slovakia. Eliáš (1979).
 column 5 - *Cynodon dactylon* - ass. Felföldy (1942).
 column 6 - *Convolvulo* - *Cynodontetum dactyli* Ubriszý 1967. Ubriszý (1967).

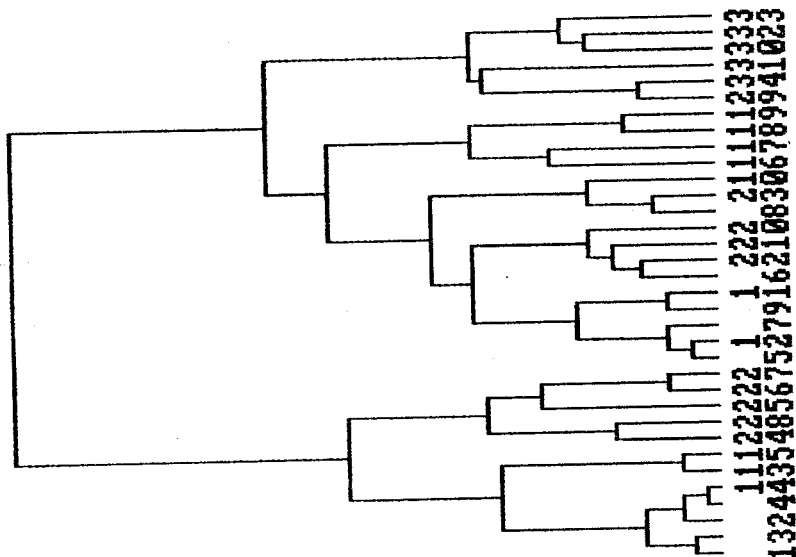


Fig. 2. Numerical classification of relevés 1 - 34.

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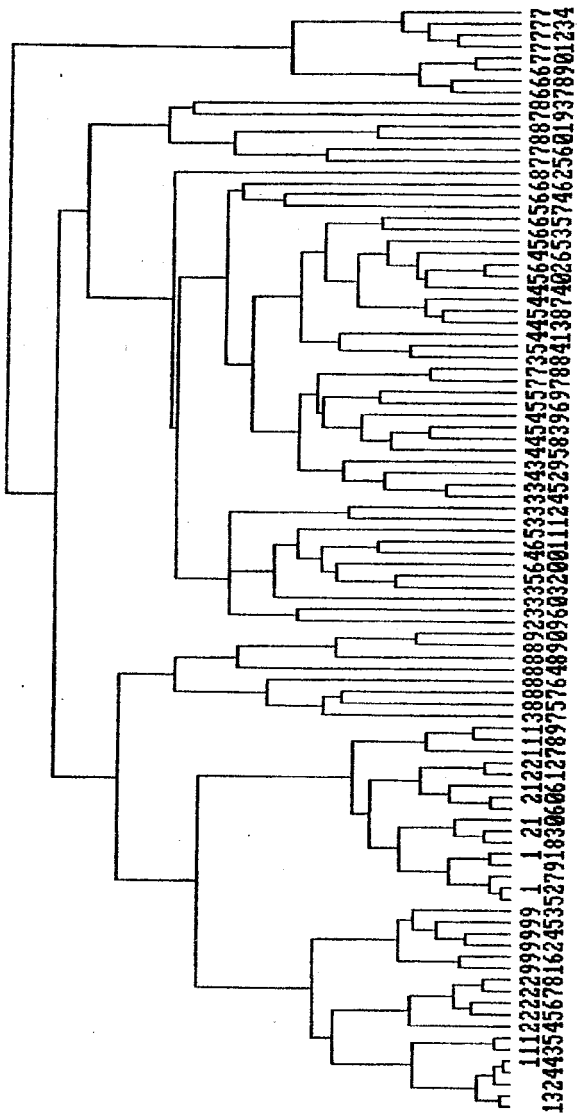


Fig. 3. Numerical classification of relevés 1-96.

1 - 28 *Cynodonto - Plantagineum* Gams 1927 (MOCHNACKÝ 1991)

29-33 *Conyzo canadensis - Cynodontetum dacyloni* Eliáš 1978 (JEHLÍK 1989)

34-66 *Conyzo - Cynodontetum dacyloni* (Felföldy 1942) Eliáš

67-74 *Erophilo - Arabidopsietum* Kropáč in Krippelová 1981 - ephemeric association (MOCHNACKÝ 1991)

75-90 *Plantagini - Cynodontetum* Gams 1927 (KRIPPELOVÁ 1974)

91-96 *Cynodonto - Plantagineum* Gams 1927 (MOCHNACKÝ 1991)

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Accepted 1 November 1991