

ECOLOGICAL AND AGRONOMICAL VALUE OF *BOTHRIOCHLOA ISCHAEMUM* GRASSLANDS

PĂCURAR F.* , ROTAR I.* , VIDICAN Roxana* , PLEȘA Anca* , VAIDA Ioana*** ,
MĂLINAȘ Anamaria* , STOIAN V.*

*Faculty of Agriculture, Department of Plant Crops. University of Agricultural Sciences and
Veterinary Medicine Cluj-Napoca, Manăștur street, 3-5, 400372, Romania

**Corresponding author e-mail: ioanavaida@yahoo.com

Abstract

The purpose of this research is to assess the state of the biodiversity and pastoral value for *Bothriochloa ischaemum* grasslands from the hill area. Also, there has been analyzed the floristic composition and a series of ecological indexes, respectively humidity, soil reaction, temperature and nitrogen. Other aspects taken in account were the agronomical and anthropogenic specters. The analyzed grasslands are placed in the perimeter of the localities: Gilău, Aiton, Jucu and Mociu, all from Cluj County.

Keywords: biodiversity, Cluj County, *Bothriochloa ischaemum*, hill area.

INTRODUCTION

Grasslands worldwide continue to be destroyed by expansions of agricultural fields, overgrazing, development, and urban sprawl (Hoekstra *et al.* 2005). The invasive yellow bluestem (*Bothriochloa ischaemum* [L.] Keng) threatens native biodiversity, and its control is of interest to land managers involved in restoration of invaded grasslands (Robertson *et al.*, 2013). Old World Bluestems (OWB; *Bothriochloa* spp.) are one group of non-native, perennial, warm-season grasses that have begun to raise concerns in the central and southern Great Plains (Smith and Knapp 1999; Grace *et al.* 2002; Reed *et al.* 2005; Harmony and Hickman 2004, cited by Schmidt *et al.*, 2008). These grasses were introduced from Europe

and Asia in the 1920s (Celarier and Harlen 1955), because of their purported superiority to native grasses (Coyné and Bradford 1985a). For instance, a comparison of growth of OWB versus native grasses showed that OWB produced more biomass than the native grasses and OWB seedlings were established more easily (Coyné and Bradford 1985b).

In Romania, *Bothriochloa ischaemum* grassland is part of the *Bothriochloa ischaemum* series, specific to the nemoral floor, suburban forests of the hornbeam and oak mixture. This is usually met on the layer steppe degraded, ribs rocky soils compacted in the upper part, poor in humus (Țucra *et al.*, 1987).

MATERIAL AND METHOD

Study site

In this study, we examined how estimated changed on a *Festuca rupicola - Bothriochloa ischaemum*. Grasslands with varying survey intensity and a 4 different area from The Transylvanian Plain, Romania. The experiment was performed in 2015 in Gilău, Aiton, Jucu and Mociu commune, Cluj County. The area shows a typical plain until hillside climate, the landscape is undulating, with altitudes between 250 and 750 m above sea level. It is characterized by a high variation of land use and topoclimatic conditions in the area and fine-grained mosaic of different land uses, including substantial amounts of semi natural vegetation with 7.2°C average temperature (Păcurar and Rotar, 2014). The vegetation observations were made on 22 plots.

Data analysis

The floristic composition was interpreted using an improved Braun-Blanquet scale with subdivisions (Păcurar and Rotar, 2014). Sward fodder value was calculated based on species quality score on a scale from 1 (poor) to 9 (excellent), after Dierschke and Briemle (2002), as modified by Păcurar and Rotar (2014). Sward fodder value was performed on a scale from 1 (poor sward, quality dominated by toxic species) to 9

(excellent) after Păcurar and Rotar (2014). Data regarding the share of economic groups (*Poaceae*, *Cyperaceae-Juncaceae*, *Fabaceae* and other botanical families- AFB), species number were processed by analysis of variance. Plant resistance against interference mechanical, such as mowing, grazing and crushed materialized by value indicator (from 1-9) after Dierschke and Briemle (2002), and the names of appropriate species depending on the category disturbance were taken after Păcurar and Rotar (2014). Based on data from spectrum it can be calculate the average indicator of a phytocenosis. This may be unweighted or weighted. Assigning a phytocenosis feed is achieved at the expense calculated weighted average indicator value.

Using descriptive statistics (Cristea *et al.* 2004) analyzes were performed which are divided into two categories: central tendency parameters and indicators of scattering data. In the central tendency parameters included those processes provide a representative value (central) measured for the data stream.

There are three estimators that can be used for this purpose: the mean, median and module (<http://statisticasociala.tripod.com/p/arametri.htm>).

RESULTS AND DISCUSSION

In this descriptive plot has been identified the *Bothriochloa ischaemum* grassland type, which is part of *Bothriochloa ischaemum* series, feature areas habitats meso-xerophile, thermophilic, with inclined slopes exposed to the south and southwest (Țucra et al., 1987). In our case, the type *Bothriochloa ischaemum* was described in nemoral area, at altitudes between 350 and 550, generally starting on exhibitions south until the west (90° - 180°), land with an average slope of around 39.39° (table 1). There have been studied 8 grassland plots in the Transylvanian Plain.

Bothriochloa ischaemum type is mostly used by grazing. In this type, woody vegetation cover has an average of 17.75% (table 1), the amplitude data is high (max = 45% and minimum = 1%), and the most common cover being 3% (Module = 3%). The stubs are present in only one case with 21% cover. The rocks and stones presence in most cases is lacking entirely. Fallow molehills have a presence, generally about 2.50% (table 1). Overall, the herbaceous vegetation coverage is averaging 71% and data distribution is one relatively normal. The floristic nucleus of this type of grassland is given for edifying species and frequent species. Thus, edifying species (K = V), for *Bothriochloa ischaemum* grassland

type are: *Festuca rupicola* (6.60%) and *Euphorbia cyparissias* (1.00%; table 1). The frequent (common) species (K = IV) are six: *Stipa capillata* (5.30%), *Medicago lupulina* (2.90%), *Achillea millefolium* (2.10%), *Agrimonia eupatoria* (1.17%), *Fragaria vesca* (5.17%) and *Salvia pratensis* (0.83%, table 1). Potential indicator species (K=III) for this studied type of grassland are: *Cardus acanthoides* (0.50%), *Cyrorium intybus* (0.50%), *Eryngium campestre* (2.00%) and *Plantago media* (0.50%).

In this phytocoenosis are 19 accompanying species (K = II), and 33 random species (K = I). The Phytodiveristy of this grassland type is given by a 65 species (table 1).

Poaceae family makes its presence felt in the sward with an average participation of 52.6% (Table 1), the data having high amplitude (minimum = 23% and maximum = 71.5%; Annex 1). From *Poaceae* family, besides of the dominant specie (*Bothriochloa ischaemum*) with a big mean abundance (39.50%) is present *Elymus elongatus* followed by *Festuca rupicola* (6.06% coverage), then the species *Stipa capillata* 5.30% (table 1).

Regarding the participation of *Cyperaceae* and *Juncaceae* families in this type of grassland, we find that they are lacking.

Fabaceae family participates in the floristic composition, an average of only 5.5%, registering a maximum of 23% (Annex 1). Data collected on *Fabaceae* participation are symmetric (obliquity = 0.46) and a distribution curvedflat (kurt = 1.30, Annex 1). From *Fabaceae* species the *Onobrichis vicifolia* has good participation (5.00%), followed by species *Medicago lupulina* (2.90%) and *Astragalus monspessulanus* (2.00%), other species are with lower covered. Plants from other botanical families (OBF) are present in *Bothriochloa ischaemum* phytocoenosis type on average by 30%, reaching a minimum of 13% and a maximum of 52% (Annex 1). Data obtained on the participation of plants from other botanical families are symmetrical, positive (obliquity

= 0.46) and platycurtic arching = - 1.80, Annex 1). Some species in this group have a significant mean abundance such as: *Equisetum arvense* (8.00%), *Thymus pulegioides* with 8.00% coverage, *Fragaria vesca* (5.17%), *Filipendula hexapetala* with 5.00%, *Potentilla erecta* with 5.00%, *Thymus vulgaris* with 5.00%, *Daucus carota* with 3.75%, *Centaurea bifurcata* with 2.50%, *Centaurea phrygia* with 2.50%, *Veronica chamaedrys* 2.50%, *Achillea millefolium* with 2.10%, and *Eryngium campestre* with 2.00% (Table 1). Some species have a lower participation on average of 2%, as species: *Galium verum*, *Agrimonia eupatoria*, *Hieracium pilosella* and *Euphorbia cyparissias*. Many species have a low participation on average 0.5-1%.

Table 1

Floristic composition of the type of grassland *Bothriochloa ischaemum* and specific requirement on ecological, agronomic and anthropogenic (B - BioForm, T - temperature, U - humidity, R - soil reaction, N - nutrition, C - tolerance of mowing, P - tolerance of grazing, S - tolerance of crushed, VF - fodder value, H - hemerobie, UR - urbanophile, SO - sozological category, □ - Average, Adm - mean abundance – dominance, K - Constancy)

Ecological indexes	Agronomical indexes	Anthropogenic indexes	Stand conditions	\bar{x}
			Altitude (m)	-
			Slope (°)	39.39
			Exposition	S-V
			Land use	pasture
			Grassland type	<i>Bothriochloa ischaemum</i>
			General cover (%)	71
			Wooden vegetation cover (%)	17.75
			Stubs (%)	2.6

										Rocks (%)		0			
										Stones (%)		0			
										Fallow molehills (%)		2.5			
										Fresh molehills (%)		0			
										Landslides (%)		36			
										Erosion (%)		10.2			
										Swamps (%)		0			
B	T	U	R	N	C	P	S	SO	VF	H	UR	SPECIES		ADm	K
-	-	-	-	-	-	-	-	-	-	-	-	<i>Agropyron intermedium</i>	2.50	I	
H												<i>Agrostis stolonifera</i>	2.50	I	
S	x	6	x	5	9	9	9	n	7	2-5	3	<i>Arenatherum elatius</i>	0.50	I	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Brachipodium pinnatum</i>	1.50	II	
GRs	5	4	7	4	3	6	6	n	5	2-3	2	<i>Bromus erectus</i>	5.00	I	
HT	5	3	8	3	5	4	4	n	6	2-3	2	<i>Botriochloa ischaemum</i>	39.50	V	
H	7	3	X	3	-	-	-	n	3	3-4	2	<i>Dactylis glomerata</i>	2.50	I	
HT	x	5	x	6	8	4	6	n	9	3-4	3	<i>Elymus elongatus</i>	8.00	I	
HT	x	5	x	8	7	5	7	n	6	3-6	3	<i>Festuca rupicola</i>	6.06	V	
H	7	3	8	2	7	7	7	n	4	2-3	2	<i>Festuca valesiaca</i>	1.17	II	
H	7	2	8	2	7	7	7	n	4	2-3	1	<i>Phleum phleoides</i>	2.50	I	
H	5	2	8	2	-	-	-	n	6	2-3	1	<i>Stipa capillata</i>	5.30	IV	
H	7	2	8	2	2	3	3	n	3	2-4	1	POACEAE	52.6		
-	-	-	-	-	-	-	-	-	-	-	-	CYPERACEAE-JUNCACEAE	0.00		
-	-	-	-	-	-	-	-	-	-	-	-	<i>Astragalus onobrychis</i>	1.50	II	
H	7	3	9	2	5	5	4	n	5	1-2	1	<i>Astragalus monspessulanus</i>	2.00	II	
H	7	2	7	2	4	7	4	n	4	1-2	1	<i>Briza media</i>	0.50	I	
HT	x	x	x	3	4	4	4	n	5	2-3	2	<i>Dorychnium herbaceum</i>	1.00	II	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Lotus corniculatus</i>	1.63	II	
HT	x	4	7	4	6	4	4	n	7	2-4	3	<i>Medicago falcata</i>	1.50	II	
H	6	3	9	3	5	2	2	n	7	2-4	2	<i>Onobrychis vicifolia</i>	5.00	I	
HT	7	3	8	x	6	2	2	n	8	3-4	1	<i>Medicago lupulina</i>	2.90	IV	
H												<i>Trifolium medium</i>	0.50	I	
S	5	4	8	x	7	4	6	n	8	3-5	3	<i>Trifolium repens</i>	0.50	II	
-	-	-	-	-	-	-	-	-	-	-	-	FABACEAE	5.5		
ChRs	x	x	x	6	8	8	8	n	8	3-5	3	<i>Achillea millefolium</i>	2.10	IV	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Adonis vernalis</i>	0.50	I	
ChRs	x	4	x	5	7	4	5	n	6	2-4	3	<i>Agrimonia eupatoria</i>	1.17	IV	
HT	6	3	7	1	5	8	8	n	1	2-3	1	<i>Artemisia austriaca</i>	0.50	I	
HRs	6	4	8	4	3	4	3	n	3	2-3	2	<i>Asperula cynanchia</i>	0.50	I	
H	7	3	8	4	2	6	1	n	2	4-6	3	<i>Cardus acanthoides</i>	0.50	III	
H	7	3	8	3	3	3	3	n	6	2-3	1	<i>Carlina acaulis</i>	0.50	II	
TT	5	3	X	8	3	7	3	n	2	3-5	3	<i>Campanula serpilifolia</i>	0.50	I	
H	X	4	X	2	3	8	7	n	3	2-3	1				
-	-	-	-	-	-	-	-	-	-	-	-				

-	-	-	-	-	-	-	-	-	-	-	-	<i>Centaurea bifurcata</i>	2.50	I	
HRs	6	4	6	6	4	2	2	n	4	2-4	1	<i>Centaurea nigrescens</i>	0.50	I	
HRs	4	5	5	3	5	2	2	n	4	2-3	1	<i>Centaurea phrygia</i>	2.50	I	
HRs	6	4	8	5	4	5	5	n	5	3-5	3	<i>Cycorium intybus</i>	0.50	III	
HRs	5	5	6	5	6	2	2	n	4	3-4	3	<i>Crepis biennis</i>	0.50	II	
HRs	4	5	5	5	5	3	3	n	4	3	1	<i>Crepis mollis</i>	0.50	I	
GRs	5	6	7	x	5	9	3	n	1	2-3	1	<i>Colchium autumnale</i>	0.50	I	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Chondrilla juncea</i>	0.50	I	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Dipsacum fullonum</i>	0.50	I	
HRs	6	4	x	4	6	3	4	n	5	3-5	3	<i>Daucus carota</i>	3.75	II	
GRs	x	6	x	x	5	7	6	n	1	3-6	3	<i>Equisetum arvense</i>	8.00	I	
H	7	3	8	4	2	4	3	n	2	2-4	2	<i>Eryngium campestre</i>	2.00	III	
H	X	4	8	X	4	8	7	n	1	2-4	2	<i>Euphorbia cyparissias</i>	1.00	V	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Filipendula hexapetala</i>	5.00	II	
H	X	5	X	6	3	4	4	n	4	2-3	2	<i>Fragaria vesca</i>	5.17	IV	
HT	5	4	7	3	5	4	4	n	5	2-3	2	<i>Galium verum</i>	1.50	II	
H															
S	x	4	x	2	4	7	7	n	4	2-4	2	<i>Hieracium pilosella</i>	1.17	II	
HRs	6	6	x	5	4	3	3	n	4	2-3	1	<i>Inula britannica</i>	0.50	II	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Linum austriacum</i>	0.50	I	
HRs	x	4	8	4	5	4	2	n	4	2-5	2	<i>Picris hieracioides</i>	0.50	I	
HR	x	x	x	x	7	6	6	n	6	2-4	3	<i>Plantago lanceolata</i>	0.50	II	
HR	x	4	8	3	4	8	8	n	5	2-4	2	<i>Plantago media</i>	0.50	III	
HT	x	x	x	2	3	4	5	n	5	2-3	1	<i>Potentilla erecta</i>	5.00	I	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Potentilla incana</i>	0.50	I	
H															
S	x	x	4	x	9	8	8	n	4	3-4	2	<i>Prunella vulgaris</i>	0.50	I	
HRs	6	4	8	4	5	3	3	n	4	2-3	2	<i>Salvia pratensis</i>	0.83	IV	
H	6	3	7	3	-	-	-	n	4	3-4	1	<i>Salvia nemorosa</i>	0.50	II	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Scabiosa argentea</i>	0.50	II	
HRs	5	4	8	2	5	3	4	n	4	2-3	1	<i>Scabiosa columbaria</i>	0.50	I	
HRs	5	4	7	6	6	9	4	n	1	2-3	2	<i>Senecio jacobaea</i>	0.50	II	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Stachis germanica</i>	0.50	I	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Spergula arvensis</i>	0.50	I	
-	-	-	-	-	-	-	-	-	-	-	-	<i>Thymus vulgaris</i>	5.00	I	
ChL															
T	x	4	5	6	4	4	4	n	3	2-3	2	<i>Thymus pulegioides</i>	8.00	I	
ChRs	x	4	x	6	7	6	6	n	4	2-4	2	<i>Veronica chamaedrys</i>	2.50	I	
-	-	-	-	-	-	-	-	-	-	-	-	OBF	30		
													Number of species	65	

From an environmental (ecological spectrum) phytocoenosis is of a meso-xerofil ($U_p = 3.7$), neutrophil ($R_p = 7.3$) and have a character oligomezotrophic ($N_p = 3.8$; table 2).

From agronomical point of view (agronomic spectrum), the phytocoenosis is medium tolerant of mowing ($C_p = 5.1$), is moderate grazing tolerant ($P_p = 4.8$) and moderate crushed tolerant ($S_p = 4.8$, table 2).

Thus, the pastoral value of *Bothriochloa ischaemum* type is 4.2 (VFP = 4.2, table 2). The presence of wood vegetation (17.75%) causes a reduction in pastoral value by 10%. Therefore the grassland falling within Class III, category of pasture is degraded and supports 0.21 to 0.40 LU/ha.

From agronomical point of view, in studied phytocoenosis, 5 species have toxic value with a total coverage of 10.5% (*Adonis vernalis*,

Colchium autumnale, *Equisetum arvense*, *Euphorbia cyparissias* and *Senecio jacobaea*; table 2) and 3 species are harmful of animal products: *Artemisia austriaca* (0.50%), *Cardus acanthoides* (0.50%) and *Eryngium campestre* (2.00%, Table 1). Phytocoenosis is composed of 5 species damaging the grassland vegetation: *Bothriochloa ischaemum* (39.50%), *Stipa capillata* (5.30%), *Agrimonia eupatoria* (1.17%), *Carlina acaulis* (0.50%) and *Thymus pulegioides* (8.00%, table 1).

Phytocoenosis shows high coverage with poor forage species (ballast) with a share of 25.4%. The species of medium fodder have a participation of 33.4%, the best feed species are in number of 6 and have a cumulative 14% coverage and the species of excellent fodder are represented by *Dactylis glomerata*, with a small coverage of 2.50% (table 2).

Table 2
Ecological and agronomical spectrum of *Bothriochloa ischaemum* grassland type

Eclg. indexes	Ecological spectrum										VIMnp
	1	2	3	4	5	6	7	8	9	x	VIMp
Unp	0	4	12	19	6	4	0	0	0	5	3.9
Up	0	11.0	63.1	31.5	19.2	11.5	0	0	0	7	3.7
Rnp	0	0	0	1	3	2	8	17	2	17	7.3
Rp	0	0	0	0.5	11	1	8.6	35.9	3	83	7.3
Nnp	1	10	9	8	6	7	0	2	0	7	3.9
Np	0.5	25.7	52	11.9	6.6	19.7	0	8.5	0	18	3.8
Agron. indexes	Agronomic spectrum										VIMnp
	1	2	3	4	5	6	7	8	9	x	VIMp
Cnp	0	3	7	9	12	5	7	2	2	0	5.0

Cp	0	7.8	14.3	14.7	23.3	11.4	23.2	3	3	0	5.1
Pnp	0	5	7	13	3	4	6	6	3	0	5.1
Pp	0	10	11.9	38.0	10	5	18.9	3.5	3.5	0	4.8
Snp	1	6	9	11	3	6	6	4	1	0	4.6
Sp	0.5	10.5	11.8	30.0	7.6	17.9	17.9	2	2.5	0	4.8
FVnp	5	3	5	16	8	6	3	3	1	0	4.4
FVp	10.5	3	54.5	25.4	14.8	18.6	5.6	8.4	2.5	0	4.2
Legend											
U	humidity	C	mowing	VF	fodder value						
R	soil reaction	P	grazing	np	unweighted (depending on the number of species)						
N	nutrition	S	crushed	p	weighted (depending on species coverage)						

CONCLUSION

Bothriochloa ischaemum appears on downhill, dry land with a neutral reaction and poor trophicity.

Maintenance work is hardly and seldom implemented, the proof being the presence of molehills and woody vegetation.

Agronomic value of the pasture of *Bothriochloa ischaemum* is degraded, being predominant by

species damaging the grassland vegetation.

Grasslands are used in a free-extensive system, plants being trampled 3-7 times in grazing period.

We recommend a management pastoral developing plan which should contain adequate maintenance and a system of sustainable use.

REFERENCES

1. Celarier R., Harlan J. (1955) Studies on old world bluestems. Okla Agric Exp Stn Bull T-58.
2. Coyne P., Bradford J. (1985a) Some growth characteristics of four Old World bluestems. J Range Manage 38:27-33.
3. Coyne P., Bradford J. (1985b) Morphology and growth in seedlings of several C4, perennial grasses. J Range Manage 38:504-512.
4. Cristea V., D Gafta, F. Pedrotti (2004) Fitosociologie. Publisher Presa Universitară Clujeană (Chapter IV).
5. Grace J., Smith M., Grace S., Collins S.L., Stohlgren T.J. (2002) Interactions between fire and invasive plants in temperate grasslands of North America. In: Galley K, Wilson T (eds) Proceedings of the invasive species workshop: the role of fire in the control and spread of invasive species. Fire conference 2000: the First National

- Congress on Fire Ecology, Prevention, and Management. Miscellaneous Publication No. 11, Tall Timbers Research Station, Tallahassee.
6. Harmoney K., Hickman K. (2004) Comparative morphology of caucasian old world bluestem (*Bothriochloa bladhii*) and native grasses. *Agron J* 96:1540–1544.
 7. Herbei M. (2011) Elemente metodologice aplicate in cercetarea pajistilor. Editura Mirton Timisoara.
 8. Hoekstra J., Boucher T., Ricketts T., Roberts C. (2005) Confronting a biome crisis: global disparities of habitat loss and protection. *Ecol Lett* 8:23–29.
 9. Păcurar F., Rotar I. (2014) Metode de studiu și interpretare a vegetației pajıştilor. Ed. Risoprint, Cluj-Napoca, ISBN 978-973-53-1452-1.
 10. Pușcaru-Soroceanu Evdochia, Pușcaru D., Buia A., Burduja C., Csuros Ș., Grâneau A., Niedermayer K., Popescu P., Răvăruț M., Resmeriță I., Samiolă Z., Vasii V., Velea C. (1963) Pășunile și fânețele din R.P.R. – Studiu geobotanic și agroproductiv, Editura Academiei R.P.R.
 11. Reed H., Seastedt T., Blair J. (2005) Ecological consequences of C4 grass invasion of a C4 grassland: a dilemma for management. *Ecol Appl* 15:1560–1569.
 12. Robertson S., Karen R., Hickman K. Harmoney R., David M. Leslie Jr. (2013) Combining Glyphosate With Burning or Mowing Improves Control of Yellow Bluestem (*Bothriochloa ischaemum*). *Rangeland Ecology & Management* May 2013, 66(3):376-381 <https://doi.org/10.2111/REM-D-11-00198.1>
 13. Schmidt C. D., Hickman K.R., Channell R., Harmoney K., Stark W. (2008) Competitive abilities of native grasses and non-native (*Bothriochloa* spp.). *Plant Ecology*, July 2008, 197(1):69–80.
 14. Smith M., Knapp A. (1999) Exotic plant species in a C4-dominated grassland: invisibility, disturbance, and community structure. *Oecol* 120:605–612.
 15. Țucra I., Kovacs A.J., Roșu C., Ciubotaru C., Chifu T., Marcela Neacșu, Bărbulescu C., Cardașol V., Popovici D., Simtea N., Motcă G., Dragu I., Spirescu M. (1987) Principalele tipuri de pajışti din R.S. România, Centrul de Material Didactic și Propagandă Agricolă, București.
 16. (<http://statisticasociala.tripod.com/parametri.htm>).

Statistic processing of data regarding stand conditions, species composition of *Botriochloa ischaemum* type and the species' frequency constancy in releves

Species	□	Median	Stdev	VC	Mode	Skew	Kurt	Min	Max	Count
<i>Agropyron intermedium</i>	2.50	2.50	0.00	0.00	0.00	0.00	0.00	3	3	1
<i>Agrostis stolonifera</i>	2.50	2.50	0.00	0.00	0.00	0.00	0.00	3	3	1
<i>Arenatherum elatius</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Brachipodium pinnatum</i>	1.50	1.50	1.41	0.94	0.00	0.00	0.00	1	3	2
<i>Bromus erectus</i>	5.00	5.00	0.00	0.00	0.00	0.00	0.00	5	5	1
<i>Botriochloa ischaemum</i>	39.50	37.50	14.55	0.37	37.50	-0.72	0.27	13	54	8
<i>Dactylis glomerata</i>	2.50	2.50	0.00	0.00	0.00	0.00	0.00	3	3	1
<i>Elymus elongatus</i>	8.00	8.00	0.00	0.00	0.00	0.00	0.00	8	8	1
<i>Festuca rupicola</i>	6.06	5.00	3.33	0.55	5.00	0.96	0.86	3	13	8
<i>Festuca valesiaca</i>	1.17	0.50	1.15	0.99	0.50	1.73	0.00	1	3	3
<i>Phleum phleoides</i>	2.50	2.50	0.00	0.00	0.00	0.00	0.00	3	3	1
<i>Stipa capillata</i>	5.30	5.00	3.07	0.58	8.00	-1.02	0.92	1	8	5
POACEAE	52.63	52.5	15.45	0.29	0.00	-0.83	0.85	23	71.5	8
CYPERACEAE E- JUNCACEAE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Astragalus onobrychis</i>	1.50	1.50	1.41	0.94	0.00	0.00	0.00	1	3	2
<i>Astragalus monspessulanus</i>	2.00	0.50	2.60	1.30	0.50	1.73	0.00	1	5	3
<i>Briza media</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Dorychnium herbaceum</i>	1.00	0.50	1.00	1.00	0.50	2.00	4.00	1	3	4
<i>Lotus corniculatus</i>	1.63	0.50	2.25	1.38	0.50	2.00	4.00	1	5	4
<i>Medicago falcata</i>	1.50	1.50	1.41	0.94	0.00	0.00	0.00	1	3	2
<i>Onobrychis vicifolia</i>	5.00	5.00	0.00	0.00	0.00	0.00	0.00	5	5	1
<i>Medicago lupulina</i>	2.90	0.50	5.37	1.85	0.50	2.24	5.00	1	13	5

<i>Trifolium medium</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Trifolium repens</i>	0.50	0.50	0.00	0.00	0.50	0.00	0.00	1	1	2
FABACEAE	5.5	2	7.41	1.35	2	2.15	4.79	0	23	7
<i>Achillea millefolium</i>	2.10	2.50	0.89	0.43	2.50	-2.24	5.00	1	3	5
<i>Adonis vernalis</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Agrimonia eupatoria</i>	1.17	0.50	1.03	0.89	0.50	0.97	-	1	3	6
<i>Artemisia austriaca</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Asperula cynanchia</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Cardus acanthoides</i>	0.50	0.50	0.00	0.00	0.50	0.00	0.00	1	1	4
<i>Carlina acaulis</i>	0.50	0.50	0.00	0.00	0.50	0.00	0.00	1	1	2
<i>Campanula serpilifolia</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Centaurea bifurcata</i>	2.50	2.50	0.00	0.00	0.00	0.00	0.00	3	3	1
<i>Centaurea nigrescens</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Centaurea phrygia</i>	2.50	2.50	0.00	0.00	2.50	0.00	0.00	3	3	2
<i>Cycorium intybus</i>	0.50	0.50	0.00	0.00	0.50	0.00	0.00	1	1	5
<i>Crepis biennis</i>	0.50	0.50	0.00	0.00	0.50	0.00	0.00	1	1	2
<i>Crepis mollis</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Colchium autumnale</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Chondrilla juncea</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Dipsacum fullonum</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Daucus carota</i>	3.75	3.75	1.77	0.47	0.00	0.00	0.00	3	5	2
<i>Equisetum arvense</i>	8.00	8.00	0.00	0.00	0.00	0.00	0.00	8	8	1
<i>Eryngium campestre</i>	2.00	2.50	1.00	0.50	2.50	-2.00	4.00	1	3	4
<i>Euphorbia cyparissias</i>	1.00	0.50	0.93	0.93	0.50	1.44	0.00	1	3	8
<i>Filipendula hexapetala</i>	5.00	5.00	0.00	0.00	5.00	0.00	0.00	5	5	2
<i>Fragaria vesca</i>	5.17	3.75	4.42	0.86	2.50	0.96	0.21	1	13	6
<i>Galium verum</i>	1.50	1.50	1.41	0.94	0.00	0.00	0.00	1	3	2
<i>Hieracium pilosella</i>	1.17	0.50	1.15	0.99	0.50	1.73	0.00	1	3	3
<i>Inula britannica</i>	0.50	0.50	0.00	0.00	0.50	0.00	0.00	1	1	2

<i>Linum austriacum</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Picris hieracioides</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Plantago lanceolata</i>	0.50	0.50	0.00	0.00	0.50	0.00	0.00	1	1	3
<i>Plantago media</i>	0.50	0.50	0.00	0.00	0.50	0.00	0.00	1	1	4
<i>Potentilla erecta</i>	5.00	5.00	0.00	0.00	0.00	0.00	0.00	5	5	1
<i>Potentilla incana</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Prunella vulgaris</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Salvia pratensis</i>	0.83	0.50	0.82	0.98	0.50	2.45	6.00	1	3	6
<i>Salvia nemorosa</i>	0.50	0.50	0.00	0.00	0.50	0.00	0.00	1	1	3
<i>Scabiosa argentea</i>	0.50	0.50	0.00	0.00	0.50	0.00	0.00	1	1	2
<i>Scabiosa columbaria</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Senecio jacobaea</i>	0.50	0.50	0.00	0.00	0.50	0.00	0.00	1	1	2
<i>Stachis germanica</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Spergula arvensis</i>	0.50	0.50	0.00	0.00	0.00	0.00	0.00	1	1	1
<i>Thymus vulgaris</i>	5.00	5.00	0.00	0.00	0.00	0.00	0.00	5	5	1
<i>Thymus pulegioides</i>	8.00	8.00	0.00	0.00	0.00	0.00	0.00	8	8	1
<i>Veronica chamaedrys</i>	2.50	2.50	0.00	0.00	0.00	0.00	0.00	3	3	1
OBF	30	25	16.32	0.54	0	0.46	-	13	52	8

Legend: \bar{X} – Average; St.dev. – Standard deviation; VC – variability coefficient; OBF – other botanical families