

Taxonomic Composition of Pasture Flora on Ćićarija (Istria, Croatia)

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Summary

Autochthonous vascular pasture flora was researched at the localities of two family owned farms which breed sheep, situated on the Ćićarija mountain (Istria, Croatia). During research conducted in 2003 and 2004, a total of 314 plant taxa (279 species, 34 subspecies and 1 variety) were found. The taxa belonged to 173 genera and 45 families. The most dominant families are: *Asteraceae* with 49 species and 2 subspecies, and *Poaceae* with 34 species and 4 subspecies, followed by *Lamiaceae* with 26 species and 6 subspecies, and *Fabaceae* with 22 species and 6 subspecies. According to analysis of life forms, the most numerous are hemicryptophytes (53.82%) and therophytes (22.93%). Phytogeographical analysis has shown that the most pasture plants belong to the Mediterranean floral element (32.91%) and Euro-Asiatic floral element (29.17%).

Key words

vascular pasture flora; family farm; Ćićarija; Istria; Croatia

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Introduction

Pasture flora is an important factor upon which sheep production depends. Considering that the nutrition of sheep is one of the factors which critically influence the quantity and quality of milk and meat, it is necessary to study flora of pastures. Also, pastures are where we find many rare and endangered plant species, and therefore, management methods for pastures in agriculture are imperative for preserving plant diversity.

Despite multiple researches of flora in Croatia, recent reference data about pasture flora in Istria is relatively low (Šugar 1984, 1992, Kaligarić 1997, Čarni 1999, 2003, Pericin 2001, Starmühler 1998, 1999, 2000, 2001, 2002, 2003a, 2003b, 2005, Alegro 2003, Bernhardt & Britvec 2005). It is also important to note that systematic research of pasture flora on family farms in the Adriatic region has been insufficiently studied to date (Britvec et al. 2005, Vitasović Kosić & Britvec 2005).

Therefore, the aim of this study is to preserve the pasture plant diversity, based on researching the pasture flora on family-owned agricultural farms on Čičarija, on the north of Istria.

Area of investigation

The research localities are situated at the north and northeast of the Istrian Peninsula, on Čičarija. The vascular pasture flora was researched at the locality of two family owned sheep-raising farms: family farm near Slum (Zlatić family) - 45° 26' 23"N, 14° 00' 14"E and family farm near Boljunski Katun (Rogović family) - 45° 16' 44"N, 14° 08' 07"E (Figure 1). The researched family farms varied in altitude from 149-227 m above sea level (Boljunski Katun) to 453 – 589 m above sea level (Slum). The number of sheep, which are used for milk and cheese production, varies every year. There were about 100 sheep in Slum and about 220 sheep in Boljunski Katun.

The localities have a Cfb climate type - moderately warm and humid with warm summers, but the area of Boljunski Katun is on the boundary of a Cfa climate - moderately humid with hot summers (Filipčić 1992). The soil type is flat, gravelly brown soil; the bedrock consists of limestone. The researched rocky pastures in Slum are hilly and have a lot of swallow enclosed with dry stone walls. However, pastures in Boljunski Katun are hilly with 10-15% inclination. On the majority of the investigated area, the prevailing forest type is *Ostryo-Quercetum pubescentis*, a climazonal community of the epi-Mediterranean zone of the Mediterranean-montane vegetation belt (Čarni 2003).

Material and methods

Our research of the autochthonous vascular pasture flora in Istria included field work as well as the analysis

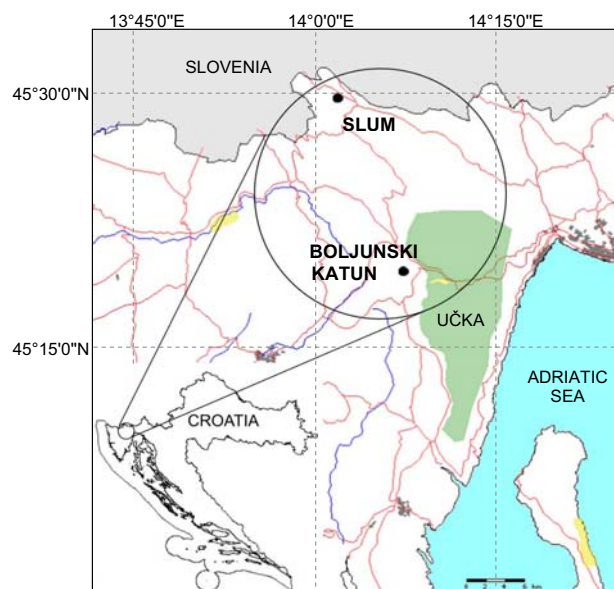


Figure 1. Area of investigation; the Istrian Peninsula with localities of the Slum and Boljunski Katun family farms

of herbarium specimens. Field research was carried out from April to October in 2003 and 2004. The taxa of families, genera, species and subspecies is presented in alphabetical order in the list of flora. The plants were determined using standard flora keys (Pignatti 2002, Tutin et al. 1968-1993). The nomenclature was adjusted according to Nikolić et al. (1994, 1997, 2000) and Tutin et al. (1968-1993). The analysis of life forms was made according to Pignatti (2002). The flora list uses abbreviations of the life forms that precede the names of taxa: Ch - Chamaephyta, G - Geophyta, H - Hemicryptophyta, H/G - transition form between Hemicryptophyta and Geophyta, P - Phanerophyta, T - Therophyta and T/H - transition form between Therophyta and Hemicryptophyta. The abbreviation for localities of the Slum (s) and Boljunski Katun (bk) family farms follow the names of the taxa.

The following abbreviations are used to designate the species, subspecies and varieties to a specific floral element (in the flora list after the names of taxa):

1. MEDITERRANEAN FLORAL ELEMENT
 - A. Circum-Mediterranean plants - CM
 - B. East Mediterranean plants - EAM
 - C. Illyrian-Mediterranean plants
 - a) Illyrian South European plants - ILSEU
 - b) Illyrian Adriatic plants:
 1. Illyrian Adriatic endemic plants - ILAE
 2. Illyrian Apennine plants - ILAP
 - D. Mediterranean Atlantic plants - MA
 - E. European Mediterranean plants - EUM
 - F. Mediterranean Pontic plants - MP
 - G. Steno-Mediterranean plants - SM

2. SOUTH EUROPEAN FLORAL ELEMENT
 - A. South European Mediterranean plants - SEUM
 - B. South European Pontic plants - SEUP
 - C. South European Atlantic plants - SEUA
3. EAST EUROPEAN-PONTIC FLORAL ELEMENT - EAEUPFE
4. EUROPEAN FLORAL ELEMENT - EUFE
5. CENTRAL EUROPEAN FLORAL ELEMENT - CEUFE
6. EURO-ASIATIC FLORAL ELEMENT - EUAFE
7. CIRCUM-HOLARCTIC SPREAD PLANTS - CIRCUMH
8. WIDESPREAD PLANTS - WP
9. ADVENTIVE AND CULTIVATED PLANTS - ADV

Threatened plants of pasture flora in Čićarija were analysed according to Nikolić & Topić (2005) and rare plants were analysed according to Pericin (2001).

Results

A total of 314 plant taxa (species, subspecies and variety) of autochthonous vascular pasture flora were found on Istrian Slum and Boljunski Katun family farms (Table 1). The results of the taxonomical and ecological analysis are presented in Table 1, 2 and Figure 2, 3.

The most dominant group is *Dicotyledones* (*Magnoliatae*) with 257 species, subspecies and varieties (81.85%), followed by *Monocotyledones* (*Liliatae*) with 57 species and subspecies (18.15%), according to the floristic list. Plants from *Pterydophyta* group were not found. The pasture flora that was explored included 45 families, 173 genera, 279 species, 34 subspecies and 1 variety (Table 1). The most dominant families are: *Asteraceae* with 49 species and 2 subspecies (16.24%) and *Poaceae* with 34 species and 4 subspecies (12.10%), followed by *Lamiaceae* with 26 species, 6 subspecies (10.19%) and *Fabaceae* with 22 species and 6 subspecies (8.92%). Other families are represented with a smaller number of taxa. Analysis of quantity of taxa by localities of two family farms showed that the flora of the Slum family farm had 54 species (17.20%) more than family farm in Boljunski Katun, but the number of plant families and genus was similar (Table 1 and 2).

According to the spectrum of life forms, the most numerous life forms are hemicryptophytes - 53.82% (62.39% - Slum, 44.51% - Boljunski Katun), followed by therophytes - 22.93% (13.30% - Slum, 31.71% Boljunski Katun). The pasture flora of researched farms varied in hemicryptophytes and therophytes about 20% (Figure 2, 3).

Phytogeographical analysis (Table 1) has shown that most plants of the total number of registered species belong to the Mediterranean floral element (33.49%

Table 1.
Floristic list of vascular pasture flora of the Slum and Boljunski Katun family farms

Life form	Taxa	Floral element	Locality of family farm
	<i>ANGIOSPERMAE</i>		
	<i>DICOTYLEDONES</i>		
	<i>AMARANTHACEAE</i>		
T	<i>Amaranthus albus</i> L.	ADV	bk
T	<i>Amaranthus retroflexus</i> L.	ADV	bk
	<i>APIACEAE</i>		
T	<i>Bupleurum baldense</i> Turra subsp. <i>baldense</i>	EUM	bk
T	<i>Bupleurum praealtum</i> L.	ILAE	s
H	<i>Carum carvi</i> L.	EUAFE	s, bk
H	<i>Daucus carota</i> L.	EUAFE	s, bk
H	<i>Eryngium amethystinum</i> L.	EAM	s, bk
H	<i>Ferulago campestris</i> (Besser) Grecescu	SEUP	bk
H	<i>Heracleum sphondylium</i> L.	EUAFE	s
H	<i>Laserpitium siler</i> L.	SEUM	s
H	<i>Pastinaca sativa</i> L.	EUAFE	s
H	<i>Peucedanum oreoselinum</i> (L.) Moench	EUAFE	s
H	<i>Pimpinella saxifraga</i> L.	EUAFE	bk
H	<i>Seseli tortuosum</i> L.	ILAP	bk
H	<i>Trinia glauca</i> (L.) Dumort.	SEUM	s
	<i>ARISTOLOCHIACEAE</i>		
G	<i>Aristolochia lutea</i> Desf.	EUM	s
	<i>ASTERACEAE</i>		
H	<i>Achillea millefolium</i> L.	EUAFE	s, bk
H	<i>Achillea virescens</i> (Fenzl) Heimerl	ILAE	s
T	<i>Ageratum houstonianum</i> Miller	WD	bk
T	<i>Anthemis arvensis</i> L.	CM	bk
T	<i>Anthemis cotula</i> L.	WD	s
H	<i>Arctium lappa</i> L.	EUAFE	bk
H	<i>Artemisia vulgaris</i> L.	WD	bk
H	<i>Balsamita major</i> Desf.	EUAFE	s
H	<i>Bellis perennis</i> L.	CEUFE	bk
T	<i>Bombycilaena erecta</i> (L.) Smoljan.	EUAFE	bk
H	<i>Buphthalmum salicifolium</i> L.	SEUM	s, bk
H	<i>Carduus acanthoides</i> L.	SEUP	s
H	<i>Carduus micropterus</i> (Borbás) Teyber	SM	bk
H	<i>Carduus nutans</i> L.	EUAFE	s
H	<i>Carlina acaulis</i> L.	CEUFE	s
H	<i>Carlina corymbosa</i> L.	SM	s
H	<i>Carlina vulgaris</i> L.	EUAFE	bk
T	<i>Carthamus lanatus</i> L.	CM	bk
H	<i>Centaurea jacea</i> L.	EUAFE	bk
H	<i>Centaurea rupestris</i> L.	ILAE	s
H	<i>Centaurea spinosociliata</i> Seenus subsp. <i>tommasinii</i> (A. Kerner) Dostál	ILAE	s
H	<i>Centaurea triumphetti</i> All.	EUFE	s
H	<i>Centaurea weldeniana</i> Rchb.	ILAE	s
T	<i>Chamomilla recutita</i> (L.) Rauschert	WD	bk
H	<i>Cichorium intybus</i> L.	WD	s, bk
G	<i>Cirsium arvense</i> (L.) Scop.	EUAFE	s, bk
G	<i>Cirsium vulgare</i> (Savi) Ten.	EUAFE	bk
T	<i>Conyza canadensis</i> (L.) Cronquist	ADV	s, bk

H	<i>Crepis biennis</i> L.	CEUFE	s	Ch	<i>Minuartia verna</i> (L.) Hiern subsp.	EUAFE	bk
T	<i>Crepis capillaris</i> (L.) Wallr.	CEUFE	bk		<i>collina</i> (Neilr.) Domin		
T	<i>Crepis neglecta</i> L.	EUM	s, bk	T	<i>Petrorhagia prolifera</i> (L.) P. W. Ball & Heywood	EUAFE	bk
H	<i>Crepis sancta</i> (L.) Babcock	EUM	s	H	<i>Silene dioica</i> (L.) Clairv.	EUAFE	s
T	<i>Erigeron annuus</i> (L.) Pers.	ADV	bk	H	<i>Silene vulgaris</i> (Moench) Garcke	SEUM	s, bk
T	<i>Filaginella uliginosa</i> (L.) Opiz	EUAFE	bk	T	<i>Stellaria media</i> (L.) Vill.	WD	bk
T	<i>Filago pyramidata</i> L.	EUM	bk		CHENOPODIACEAE		
T	<i>Filago vulgaris</i> Lam.	WD	bk	T	<i>Chenopodium album</i> L.	WD	bk
H	<i>Hieracium pilosella</i> L.	EUAFE	s	T	<i>Chenopodium rubrum</i> L.	CIRCUMH	bk
H	<i>Inula ensifolia</i> L.	SEUP	s		CISTACEAE		
H	<i>Inula hirta</i> L.	EUAFE	s	Ch	<i>Fumana ericoides</i> (Cav.) Gand.	SM	s
H	<i>Inula spiraeifolia</i> L.	EUM	s	Ch	<i>Fumana procumbens</i> (Dunal) Gren. & Godron	MP	s, bk
H	<i>Jurinea mollis</i> (L.) Reichenb.	SEUM	s	Ch	<i>Helianthemum nummularium</i> (L.) Miller	SEUM	s, bk
H	<i>Leontodon autumnalis</i> L.	EUAFE	s		<i>Helianthemum salicifolium</i> (L.) Miller	EUM	s, bk
H	<i>Leontodon crispus</i> Vill.	SM	s		CONVOLVULACEAE		
H	<i>Leucanthemum atratum</i> (Jacq.) DC. subsp. <i>platylepis</i> (Borbás) Heywood	ILAE	s	G	<i>Convolvulus arvensis</i> L.	EUAFE	s
T	<i>Logfia arvensis</i> (L.) Holub	SEUP	bk	H	<i>Convolvulus cantabrica</i> L.	EUM	bk
H	<i>Picris hieracioides</i> L.	EUAFE	s	T	<i>Cuscuta epithymum</i> (L.) L.	EUAFE	s
H	<i>Scorzonera austriaca</i> Willd.	EUAFE	s	T	<i>Cuscuta suaveolens</i> Ser.	WD	bk
H	<i>Scorzonera hispanica</i> L.	EUAFE	s		CRASSULACEAE		
H	<i>Scorzonera villosa</i> Scop.	ILAP	s	Ch	<i>Sedum acre</i> L.	EUFE	bk
Ch	<i>Senecio abrotanifolius</i> L.	ILAP	s	Ch	<i>Sedum sexangulare</i> L.	CEUFE	s
H	<i>Taraxacum officinale</i> Weber	CIRCUMH	s, bk		DIPSACACEAE		
	BORAGINACEAE			H	<i>Cephalaria leucantha</i> (L.) Roem. & Schult.	CM	bk
H	<i>Echium vulgare</i> L.	EUFE	s	H	<i>Dipsacus fullonum</i> L.	WD	s
T	<i>Myosotis arvensis</i> (L.) Hill	EUAFE	bk	H	<i>Knautia arvensis</i> (L.) Coulter	EUAFE	s, bk
H	<i>Myosotis sylvatica</i> Hoffm.	EUAFE	s	H	<i>Knautia illyrica</i> Beck	ILAE	s
H	<i>Onosma visianii</i> Clementi	EAM	bk	H	<i>Knautia purpurea</i> (Vill.) Borbás	ILAP	s
	BRASSICACEAE			H	<i>Scabiosa columbaria</i> L.	EUAFE	s
Ch	<i>Aethionema saxatile</i> (L.) R. Br.	SEUM	bk	H	<i>Succisa pratensis</i> Moench	EUAFE	s, bk
T	<i>Arabis hirsuta</i> (L.) Scop.	WD	s		ERICACEAE		
T	<i>Arabis turrata</i> L.	EUM	bk	Ch	<i>Calluna vulgaris</i> (L.) Hull	EUFE	s
T	<i>Capsella bursa-pastoris</i> (L.) Medicus	WD	bk		EUPHORBIACEAE		
H	<i>Cardamine hirsuta</i> L.	WD	s	H	<i>Euphorbia cyparissias</i> L.	CEUFE	s, bk
T	<i>Diploaxis muralis</i> (L.) DC.	WD	bk	H	<i>Euphorbia esula</i> L.	EUAFE	s
H	<i>Erysimum carniolicum</i> Dolliner	ILAE	bk	Ch	<i>Euphorbia nicaeensis</i> All.	CM	s, bk
T	<i>Lepidium campestre</i> (L.) R. Br.	EUAFE	bk		FABACEAE		
T	<i>Myagrum perfoliatum</i> L.	ADV	bk	H	<i>Anthyllis vulneraria</i> L.	EUM	s
T	<i>Sisymbrium officinale</i> (L.) Scop.	WD	bk	H	<i>Anthyllis vulneraria</i> L. subsp. <i>polyphylla</i> (DC.) Nyman	EUM	s
T	<i>Thlaspi arvense</i> L.	EUAFE	bk	H	<i>Anthyllis vulneraria</i> L. subsp. <i>praepropera</i> L. (A. Kerner) Bornm.	EUM	bk
H	<i>Thlaspi praecox</i> Wulfen	ILSEU	s, bk	Ch	<i>Astragalus glycyphyllos</i> L.	EUAFE	s
	CAMPANULACEAE			Ch	<i>Dorycnium pentaphyllum</i> Scop.	SEUP	s
H	<i>Campanula persicifolia</i> L.	EUAFE	s	Ch	<i>Dorycnium pentaphyllum</i> Scop. subsp. <i>germanicum</i> (Gremli) Gams	SEUP	s
T	<i>Legousia speculum-veneris</i> (L.) Chaix	SEUM	s, BK	Ch	<i>Dorycnium pentaphyllum</i> Scop. subsp. <i>herbaceum</i> (Vill.) Rouy	SEUP	s
	CARYOPHYLLACEAE			Ch	<i>Genista sylvestris</i> Scop.	ILAE	s
H/Ch	<i>Cerastium arvense</i> L. subsp. <i>strictum</i> (L.) Gaudin	ILAP	s	P	<i>Genista tinctoria</i> L.	EUAFE	s, bk
H	<i>Cerastium fontanum</i> Baumg. subsp. <i>vulgare</i> (Hartm.) Greuter & Burdet	CIRCUMH	s, bk	G	<i>Lathyrus tuberosus</i> L.	EUAFE	s, bk
T	<i>Cerastium glomeratum</i> Thuill.	WD	s, bk	H	<i>Lotus corniculatus</i> L.	EUAFE	s, bk
T	<i>Cerastium pumilum</i> Curtis subsp. <i>glutinosa</i> (Fr.) Jalas	MA	s	Ch	<i>Lotus cytisoides</i> L.	SM	s
H	<i>Cerastium sylvaticum</i> Waldst. & Kit.	CEUFE	s	T	<i>Lotus ornithopodioides</i> L.	SM	s
Ch	<i>Cerastium tomentosum</i> L.	ILAE	bk	T	<i>Lotus tenuis</i> Waldst. & Kit. ex Willd.	WD	s
H	<i>Dianthus carthusianorum</i> L.	ILAE	s, bk		<i>Medicago lupulina</i> L.	EUAFE	s
H	<i>Dianthus ferrugineus</i> Miller subsp. <i>liburnicus</i> (Bartl.) Tutin	ILAE	s, bk	T	<i>Medicago minima</i> (L.) Bartal.	EUAFE	bk
H	<i>Dianthus sylvestris</i> Wulfen in Jacq. subsp. <i>tergestinus</i> (Reichenb.) Hayek	ILAE	s	H	<i>Medicago sativa</i> L.	WD	s

H	<i>Medicago sativa</i> L. subsp. <i>falcata</i> (L.) Arcang.	EUAFE	s	LINACEAE	H	<i>Linum bienne</i> Miller	SEUA	s
H	<i>Trifolium alpestre</i> L.	EUAFE	s		T	<i>Linum catharticum</i> L.	EUM	s
T	<i>Trifolium aureum</i> Pollich	EUFE	s		T	<i>Linum tenuifolium</i> L.	SEUP	s
T	<i>Trifolium campestre</i> Schreber	EUAFE	s, bk	MALVACEAE				
T	<i>Trifolium dubium</i> Sibth.	EUAFE	bk	H	<i>Malva sylvestris</i> L.	EUAFE	bk	
H	<i>Trifolium montanum</i> L.	SEUP	s, bk	OROBANCHACEAE				
H	<i>Trifolium pratense</i> L.	EUAFE	s, bk	G	<i>Orobanche alba</i> Stephan ex Willd.	EUAFE	s	
Ch	<i>Trifolium repens</i> L.	WD	s, bk	PAPAVERACEAE				
T	<i>Trifolium striatum</i> L.	CM	s	T	<i>Papaver argemone</i> L.	EUM	bk	
H	<i>Vicia cracca</i> L.	CIRCUMH	bk	T	<i>Papaver dubium</i> L.	EUM	bk	
T	<i>Vicia sativa</i> L. subsp. <i>nigra</i> (L.) Ehrh.	EUAFE	s	T	<i>Papaver rhoeas</i> L.	WD	s, bk	
H	<i>Vicia tenuifolia</i> Roth	EUAFE	s	PLANTAGINACEAE				
	GERANIACEAE			H	<i>Plantago holosteum</i> Scop.	EAEUPFE	s	
T	<i>Geranium dissectum</i> L.	WD	s	H	<i>Plantago holosteum</i> Scop. subsp. <i>holosteum</i>	EAM	s	
T	<i>Geranium purpureum</i> Vill.	SEUP	bk	H	<i>Plantago lanceolata</i> L.	EUAFE	s, bk	
H	<i>Geranium robertianum</i> L.	WD	bk	H	<i>Plantago major</i> L.	WD	s, bk	
	GLOBULARIACEAE			H	<i>Plantago major</i> L. subsp. <i>intermedia</i> (DC.) Arcang.	WD	s	
Ch	<i>Globularia cordifolia</i> L.	ILAP	s, bk	H	<i>Plantago media</i> L.	EUAFE	s	
Ch	<i>Globularia meridionalis</i> (Podp.) O.Schwarz	ILAP	s		POLYGALACEAE			
H	<i>Globularia punctata</i> Lapeyr.	SEUP	s	H	<i>Polygala nicaeensis</i> Risso ex Koch	EUM	s	
	HYPERICACEAE			H	<i>Polygala nicaeensis</i> Risso ex W.D.J.Koch subsp. <i>mediterranea</i> Chodat var. <i>adriatica</i> Chodat	EUM	s	
H	<i>Hypericum perforatum</i> L.	EUAFE	s	H	<i>Polygala vulgaris</i> L.	EUAFE	s, bk	
	LAMIACEAE				POLYGONACEAE			
H	<i>Ajuga genevensis</i> L.	EUAFE	bk	T	<i>Polygonum aviculare</i> L.	WD	bk	
H	<i>Ajuga reptans</i> L.	EUAFE	bk	H	<i>Rumex acetosa</i> L.	CIRCUMH	bk	
H	<i>Calamintha nepeta</i> (L.) Savi	SEUP	s, bk	H	<i>Rumex crispus</i> L.	WD	s, bk	
H	<i>Calamintha sylvatica</i> Bromf.	EUAFE	bk		PORTULACACEAE			
H	<i>Calamintha sylvatica</i> Bromf. subsp. <i>ascendens</i> (Jordan) P. W. Ball	EUFE	bk	T	<i>Portulaca oleracea</i> L.	WD	bk	
H	<i>Clinopodium vulgare</i> L.	WD	bk		PRIMULACEAE			
T	<i>Glechoma hederacea</i> L.	WD	s	G	<i>Cyclamen hederifolium</i> Aiton	EUM	bk	
Ch	<i>Hyssopus officinalis</i> L.	EUM	s	G	<i>Cyclamen repandum</i> Sibth. & Sm.	EUM	s, bk	
T	<i>Lamium purpureum</i> L.	EUAFE	bk		RANUNCULACEAE			
H	<i>Marrubium incanum</i> Desr.	ILAP	s, bk	H	<i>Aconitum lycoctonum</i> L. subsp. <i>lycoctonum</i>	EUAFE	s	
H	<i>Marrubium vulgare</i> L.	WD	bk	G	<i>Helleborus purpurascens</i> Waldst. & Kit.	SEUP	s	
H	<i>Mentha arvensis</i> L.	WD	s	G	<i>Helleborus multifidus</i> Vis. subsp. <i>istriacus</i> (Schiffner) Merxm. & Podl.	ILAE	s, bk	
H	<i>Mentha pulegium</i> L.	CM	bk	G	<i>Helleborus viridis</i> L. subsp. <i>viridis</i>	SEUP	s	
H	<i>Prunella laciniata</i> (L.) L.	EUM	bk	H	<i>Ranunculus acris</i> L.	WD	s, bk	
Ch	<i>Salvia officinalis</i> L.	EUM	bk	T	<i>Ranunculus arvensis</i> L.	WD	bk	
Ch	<i>Salvia pratensis</i> L.	EUM	s	H	<i>Ranunculus bulbosus</i> L.	EUAFE	s	
H	<i>Salvia verticillata</i> L.	SEUM	s	G	<i>Ranunculus ficaria</i> L.	EUFE	bk	
Ch	<i>Satureja montana</i> L.	ILAE	s, bk	H	<i>Thalictrum minus</i> L.	EUAFE	s	
Ch	<i>Satureja montana</i> L. subsp. <i>illyrica</i> Nyman	ILAE	s, bk		RESEDACEAE			
Ch	<i>Satureja montana</i> L. subsp. <i>variegata</i> (Host) P. W. Ball	ILAE	s, bk	H	<i>Reseda lutea</i> L.	WD	bk	
H	<i>Stachys officinalis</i> (L.) Trevisan	EUFE	s		ROSACEAE			
H	<i>Stachys officinalis</i> (L.) Trevisan subsp. <i>serotina</i> (Host.) Murb	EUFE	s, bk	H	<i>Filipendula ulmaria</i> (L.) Maxim.	EUAFE	s	
H	<i>Stachys recta</i> L.	ILAP	s, bk	H	<i>Filipendula vulgaris</i> Moench	EUAFE	s, bk	
H	<i>Stachys recta</i> L. subsp. <i>subcrenata</i> (Vis.) Briq.	ILAP	s	H	<i>Fragaria vesca</i> L.	WD	s	
Ch	<i>Teucrium chamaedrys</i> L.	SEUP	s, bk	H	<i>Potentilla alba</i> L.	SEUP	s	
Ch	<i>Teucrium montanum</i> L.	SEUM	s	H	<i>Potentilla australis</i> Krašan	ILAE	s	
Ch	<i>Teucrium polium</i> L.	MP	bk	H	<i>Potentilla micrantha</i> Ramond ex DC.	EUM	s, bk	
Ch	<i>Teucrium polium</i> L. subsp. <i>capitatum</i> (L.) Arcang.	MP	bk	H	<i>Potentilla recta</i> L. sensu lato	MP	s	
H	<i>Thymus longicaulis</i> C. Presl	EUM	s, bk	H	<i>Potentilla reptans</i> L.	EUAFE	s, bk	
Ch	<i>Thymus pulegioides</i> L.	EUAFE	s	P	<i>Rosa canina</i> L.	EUAFE	bk	
Ch	<i>Thymus serpyllum</i> L.	EUFE	s, bk	P	<i>Rubus caesius</i> L.	EUAFE	bk	
Ch	<i>Thymus vulgaris</i> L.	MP	bk					

H	<i>Sanguisorba minor</i> Scop.	EUAFE	s, bk	H	<i>Anthoxanthum odoratum</i> L.	EUAFE	s
H	<i>Sanguisorba minor</i> subsp. <i>muricata</i>	EUAFE	s	H	<i>Arrhenatherum elatius</i> (L.) Beauv. ex J. & C. Presl	EUFE	s, bk
RUBIACEAE							
H	<i>Asperula cynanchica</i> L.	EUM	s, bk	H	<i>Brachypodium pinnatum</i> (L.) Beauv.	EUAFE	s
Ch	<i>Asperula purpurea</i> (L.) Ehrend.	ILAE	s	H	<i>Brachypodium pinnatum</i> (L.) P.Beauv. subsp. <i>rupestre</i> (Host) Schübl. & G. Martens	WD	s
H	<i>Galium corrudifolium</i> Vill.	MP	s	H	<i>Bromus erectus</i> Huds. subsp. <i>condensatus</i> (Hack.) Asch. & Graebn.	ILAP	s
H	<i>Galium lucidum</i> All.	EUM	s	H	<i>Bromus erectus</i> Hudson	WD	s, bk
H	<i>Galium mollugo</i> L.	EUM	s, bk	T	<i>Bromus hordeaceus</i> L.	WD	s
H	<i>Galium verum</i> L.	EUAFE	s	H	<i>Bromus inermis</i> Leysser	EUM	bk
RUTACEAE							
Ch	<i>Dictamnus albus</i> L.	EUAFE	s	T	<i>Bromus secalinus</i> L.	EUAFE	s
Ch	<i>Ruta graveolens</i> L.	EUM	s	T	<i>Bromus sterilis</i> L.	WD	s, bk
SCROPHULARIACEAE							
G	<i>Linaria vulgaris</i> Miller	EUAFE	bk	H	<i>Calamagrostis varia</i> (Schradler) Host	EUAFE	s
T	<i>Melampyrum fimbriatum</i> Vandas	ILAE	bk	H	<i>Chrysopogon gryllus</i> (L.) Trin.	MP	s, bk
T	<i>Melampyrum pratense</i> L.	EUAFE	bk	H	<i>Cynodon dactylon</i> (L.) Pers.	WD	bk
H	<i>Paederota lutea</i> Scop.	SEUP	s	H	<i>Dactylis glomerata</i> L.	EUAFE	s
H	<i>Verbascum blattaria</i> L.	EUAFE	s	H	<i>Danthonia alpina</i> Vest	EUM	s
H	<i>Verbascum chaixii</i> Vill.	EUAFE	bk	H	<i>Dichanthium ischaemum</i> (L.) Roberty	MP	s
T	<i>Veronica arvensis</i> L.	WD	s	G	<i>Elymus repens</i> (L.) Gould	CIRCUMH	s
Ch	<i>Veronica chamaedrys</i> L.	EUAFE	bk	H	<i>Festuca ovina</i> L.	CEUFE	s, bk
T	<i>Veronica persica</i> Poir.	WD	bk	H	<i>Festuca rupicola</i> Heuff.	CM	s
H	<i>Veronica spicata</i> L.	EUFE	s	H	<i>Koeleria macrantha</i> (Ledeb.) Schultes	EUAFE	s, bk
H	<i>Veronica spicata</i> L. subsp. <i>barrelieri</i> (Schott ex Roemer & Schultes) Murb.	EAM	s, bk	H	<i>Koeleria pyramidata</i> (Lam.) P.Beauv.	CEUFE	s
SOLANACEAE							
T	<i>Solanum nigrum</i> L.	WD	s	H	<i>Koeleria splendens</i> C. Presl	ILAP	s
VERBENACEAE							
H	<i>Verbena officinalis</i> L.	WD	s	T/H	<i>Lolium multiflorum</i> Lam.	EUM	s, bk
VIOLACEAE							
T	<i>Viola arvensis</i> Murray	WD	bk	H	<i>Lolium perenne</i> L.	CIRCUMH	bk
H	<i>Viola reichenbachiana</i> Jordan ex Boreau	EUAFE	s, bk	T	<i>Lophochloa cristata</i> (L.) Hyl.	EUAFE	s
MONOCOTYLEDONES							
AMARYLLIDACEAE							
G	<i>Narcissus poeticus</i> L. subsp. <i>radiiflorus</i> (Salisb.) Baker	CM	s	H	<i>Melica ciliata</i> L.	EUAFE	s
CYPERACEAE							
G	<i>Carex caryophyllea</i> Latourr.	EUAFE	s	G	<i>Melica uniflora</i> Retz.	EUFE	s, bk
H	<i>Carex divulsa</i> Stokes	SEUM	s	H	<i>Nardus stricta</i> L.	EUFE	s
H	<i>Carex humilis</i> Leysser	EUAFE	s	T	<i>Poa pratensis</i> L.	CIRCUMH	s
IRIDACEAE							
G	<i>Crocus biflorus</i> Miller	EUAFE	bk	H	<i>Poa trivialis</i> L.	EUAFE	bk
G	<i>Crocus neapolitanus</i> Ten.	ILAE	s	H	<i>Poa trivialis</i> L. subsp. <i>sylvicola</i> (Guss.) H.Lindb.	EUM	bk
LILIACEAE							
G	<i>Allium saxatile</i> M. Bieb.	CM	s	H	<i>Sesleria autumnalis</i> (Scop.) F.W.Schultz	ILAE	s
G	<i>Allium senescens</i> L. subsp. <i>montanum</i> (F.W.Schmidt) Holub	SEUP	s	H	<i>Sesleria tenuifolia</i> Schradler	ILAP	bk
G	<i>Allium sphaerocephalon</i> L.	EUAFE	s	T	<i>Setaria viridis</i> (L.) Beauv.	EUAFE	bk
G	<i>Anthericum ramosum</i> L.	CEUFE	s	H	<i>Stipa pennata</i> L. subsp. <i>ericaulis</i> (Borbás) Martinovsky & Skalicky	EUFE	s
G	<i>Asparagus acutifolius</i> L.	SEUM	s, bk	H	<i>Trisetum flavescens</i> (L.) P. Beauv.	EUAFE	s
G	<i>Asparagus officinalis</i> L.	CM	bk	<hr/>			
G	<i>Asparagus tenuifolius</i> Lam.	SEUP	bk	- Slum, 32.32% - Boljanski Katun), followed by Euro-Asiatic floral element (30.28% - Slum, 28.05% - Boljanski Katun).			
G	<i>Muscari botryoides</i> (L.) Miller	EUM	s	On the researched area we determined the presence of <i>Papaver argemone</i> L. - Critically Endangered plant of Croatian flora (CR), <i>Asparagus tenuifolius</i> Lam. and <i>Orchis morio</i> L. - Near Threatened plants (NT), and <i>Saturea montana</i> L. subsp. <i>illyrica</i> Nyman and <i>Poa trivialis</i> L. subsp. <i>sylvicola</i> (Guss.) H.Lindb. - Last Concern plants of Croatian flora (LC) (Nikolić & Topić 2005). Six taxa was in the rare plants category for Istria (<i>Cerastium</i>			
G	<i>Ornithogalum umbellatum</i> L.	SEUM	s				
P	<i>Ruscus aculeatus</i> L.	MP	bk				
G	<i>Scilla bifolia</i> L.	EUFE	bk				
ORCHIDACEAE							
G	<i>Gymnadenia conopsea</i> (L.) R.Br.	EUAFE	s				
G	<i>Orchis morio</i> L.	EUAFE	s, bk				
POACEAE							
T	<i>Aegilops neglecta</i> Req. ex Bertol.	CM	bk				
T	<i>Aira elegantissima</i> Schur	EUM	bk				

Table 2.
Analysis of quantity of taxa by localities of the Slum and Boljunski Katun family farms

Taxa / Locality	Family		Genus	Species	Subspecies	Variety	Σ
	Dicotyledones	Monocotyledones					
Slum	32	6	128	190	27	1	218
Boljunski Katun	31	4	120	152	12	–	164
Σ	39	6	173	279	34	1	314

arvense L. subsp. *strictum* (L.) Gaudin, *Erysimum carniolicum* Dolliner, *Leontodon autumnalis* L., *Onosma visianii* Clementi, *Scorzonera hispanica* L., *Senecio abrotanifolius* L.) and one taxa (*Hyssopus officinalis* L.) was rare plant currently (Pericin 2001).

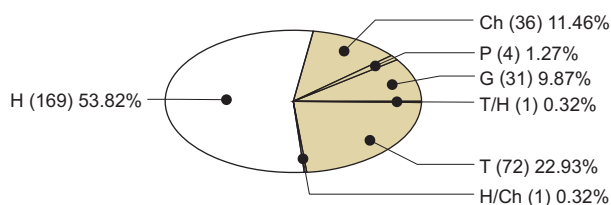


Figure 2.
Spectrum of life forms (number of taxa, percentage) of the pasture flora from the Slum and Boljunski Katun family farms. (Ch - Chamaephyta, G - Geophyta, H - Hemicryptophyta, P - Phanerophyta, T - Therophyta, T/H - transition form between Therophyta and Hemicryptophyta, H/Ch - transition form between Hemicryptophyta and Chamaephyta)

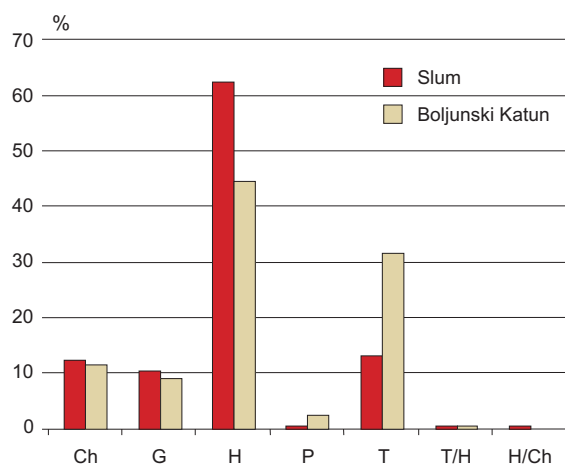


Figure 3.
Spectrum of life forms by localities of the Slum and Boljunski Katun family farms (Ch - Chamaephyta, G - Geophyta, H - Hemicryptophyta, P - Phanerophyta, T - Therophyta, T/H - transition form between Therophyta and Hemicryptophyta)

Discussion

In the pastures of the Slum and Boljunski Katun family farms in Istria, 314 autochthonous vascular plants (279 species, 34 subspecies and 1 variety) from 173 genera and 45 families were found. Most plants belong to the *Asteraceae* (16.24%), *Poaceae* (12.10%), *Lamiaceae* (10.19%) and *Fabaceae* (8.92%) families.

A taxonomic analysis has shown that the flora of the Slum farm comprises 128 genera, 190 species, 28 subspecies and 1 variety. According to Krebs (1989), the largest species richness is where the number of species is the largest. Since the pastures of the Slum farm have 17.20% more species than the pasture flora of the Boljunski Katun farm, we may conclude that the Slum farm pastures are habitats that contribute to the plant diversity in Istria and Croatia.

The domination of hemicryptophytes (53.82%) on both farms is typical for the pasture flora, and the high proportion of therophytes (22.93%) shows the great influence of Eumediterranean zone. The abundance of geophytes on both farms indicates a floristically rich spring aspect of the studied pastures. It is important to note that among the geophytes, there are many rare and protected plant species.

Phytogeographical analysis showed that the most plants on both farms belong to the Mediterranean floral element (32.91%), followed by Euro-Asiatic floral element (29.17%). Accordingly, the investigated pasture flora can be characterized as Mediterranean.

There are a relatively high percentage of endemic plants, especially in the pastures of the Slum farm, due to the Slum farm's location in the boundary zone of the mountainous belt of beech forests which are at an altitude of 600 m above sea level. Despite the fact that the Boljunski Katun farm lies at the very boundary of the Učka Nature Park that abounds in endemic species, fewer endemic plants were discovered on this farm when compared to the Slum farm pastures. We consider this to be the result of both the location of the Boljunski Katun pastures at lower altitudes and the larger number of cattle grazing on the pastures. The relatively larger grazing

load of the said pastures has led to the appearance of nitrophyllous (*Marrubium incanum* Desr., *Marrubium vulgare* L. and *Lamium purpureum* L.) and prickly species (*Carduus*, *Carlina*, *Cirsium* genera).

In the pastures of the Boljunski Katun farm a larger number of adventive plants was found than in the Slum farm. In our opinion, the pastures of the Slum family farm have a more natural floristic composition than Boljunski Katun pastures. On both farms we observed plants that are potentially poisonous as cattle fodder: *Euphorbia cyparissias* L. and *Euphorbia nicaeensis* All. (Forenbacher 1998).

Conclusion

Autochthonous vascular pasture flora was researched at the locality of two family owned farms which breed sheep, situated on the north and northeast of the Istrian Peninsula, the Mountain Čičarija (Croatia). On family farms Slum and Boljunski Katun, a total of 314 plant taxa (279 species, 34 subspecies and 1 variety) were found. The taxa belonged to 45 families and 173 genera. Most of them were *Compositae* (16.24%), followed by *Gramineae* (12.10%), *Labiatae* (10.19%) and *Leguminosae* (8.92%).

The analysis of biological spectrum of the pasture flora indicated a domination of hemicryptophytes (53.82%), which is characteristic for pasture flora, and the relatively high presence of terrophytes (22.93%) suggesting the great influence of the eumediterranean zone.

According to phytogeographical analysis, most plants belong to the Mediterranean floral element (32.91%), followed by Euro-Asiatic floral element (29.17%) which points to the Mediterranean character of pasture flora of the investigated area.

It should also be noted that pasture flora on the locality of family farm Slum has a major species richness.

On the researched family farms, we establish presence of one critically endangered plant of Croatian flora (*Papaver argemone* L.), two near threatened plants (*Asparagus tenuifolius* Lam. and *Orchis morio* L.), and two last concern plants of Croatian flora (*Satureja montana* L. subsp. *illyrica* Nyman and *Poa trivialis* L. subsp. *sylvicola* (Guss.) H.Lindb.). Six plants were in the rare plants category for Istria (*Cerastium arvense* L. subsp. *strictum* (L.) Gaudin, *Erysimum carniolicum* Dolliner, *Leontodon autumnalis* L., *Onosma visianii* Clementi, *Scorzonera hispanica* L., *Senecio abrotanifolius* L.) and one taxa (*Hyssopus officinalis* L.) was rare plant currently.

These data point out the high level of plant diversity and floristic importance of researched area. To complete studies about the pasture flora on the family agricultural

farms in Istria, further research is necessary. We expect that long term research will allow for the definition of protectionary measures and the preservation of pastures which will contribute not only to the full utilization of the pasture and advancing livestock production, but also to the preservation of plant diversity.

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