Fitosociologia vol. 42 (1): 97-107, 2005

Comparison of short-lived ruderal vegetation of the inland and coastal regions in the southern part of the Balkan peninsula

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Abstract

The work presents two ruderal, therophytic communities in the southern part of the Balkan peninsula that develop early in the spring. The community occurring in the southern part of the Republic of Macedonia and being under the influence of the Submediterranean climate was classified into the association *Trigonello monspliecae-Anthemidetum austriacae* Carni et Matevski ass. nova (alliance *Sisymbrion officinalis*). However, the community that was sampled on the coast of the Aegean sea was classified into the *Geranio brutii-Anthemidetum chiae* Carni et Matevski ass. nova (*Hordeion leporini*). Since the alliances *Sisymbrion officinalis* and *Hordeion leporini* are geographical vicariants, the composition of the communities does not differ with regard to the life history traits, namely the species are mostly classified into ruderal species that survive the summer drought and heat in the form of seeds. However, they differ in the geoelement structure since there are several species that are defined as Paleotemperate, Eurasiatic, Pontic and Cosmopolitic geoelements in the Submediterranean community, particularly because of colder winters. In the Mediterranean community sampled in the coastal parts, there are more elements of the Mediterranean flora element. It was established that the main difference between both communities is in the fact that in the inland community the species from the family *Fabaceae* prevail whereas in the coastal community they are the species from the family *Poaceae*.

Keywords: Balkan peninsula, communities, Europe, floristics, geoelements, life forms, life history traits, phytosociology, ruderal vegetation, *Stellarieteae mediae*, therophytes, vegetation.

Auszug

Die Arbeit stellt zwei sich früh im Frühling entwickelnde ruderale therophytische Gesellschaften im südlichen Teil der Balkan-Halbinsel vor. Die Gesellschaft, die im südlichen Teil der Republik Mazedonien, wo ein submediterranisches Klima herrscht, vorkommt, wurde in die Assoziation *Trigonello monspliacae-Anthemidetum austriacae* Carni et Matevski ass. nova (alliance *Sisymbrion officinalis*) klassifiziert. Die Gesellschaft, derer Aufnahmen an der Küste des Aegeischen Meeres gemacht wurde, wurde als *Geranio brutti-Anthemidetum chiae* Carni et Matevski ass. nova (*Hordeion leporini*) eingestuft. Da die Allianzen *Sisymbrion* und *Hordeion* geographische Vikarianten sind, differenziert sich die Zusammensetzung der Gesellscahften nicht im Hinblick auf die Lebensmerkmale. Die Spezies sind nämlich meistens als ruderale Spezies eingestuft, die die Sommertrockenheit und Hitze in Form von Samen überstehen. Sie unterscheiden sich jedoch in der Struktur der Geoelemente, weil es gibt mehrere Spezies, die als paleotemperate, eurasiatische, pontische und kosmopolitische Geoelemente in der submediterranische Gesellschaft, vor allem infolge kälterer Winter, definiert wurden. In der mediterranischen Gesellschaft, derer Aufnahmen an den Küstenteilen gemacht wurden, gibt es mehr Elemente des mediterranischen Flora-Elementes. Es wurde festgestellt, dass der Hauptunterschied zwischen den beiden Gesellschaften in der Tatsache liegt, dass in der innenländischen Gemeinschaft die Spezies der Familie *Fabaccae* überwiegen während in der Küstengesellschaft die einjährige Spezies der Familie *Poaceae*.

Schlüsselwörter: die Balkan-Halbinsel, Gesellscahft, Europe, Floristik, Geoelemente, Lebensformen, Lebensmerkmale, Phytosoziologie, ruderale Vegetation, *Stellarieteae mediae*, Therophyten, Vegetation.

Introduction

Within the framework of the vegetation research in the southern part of the Balkan peninsula, short-lived ruderal vegetation that develops in abandoned fields, olive groves and similar habitats was sampled in 2001 and 2003. In the areas that are under the influence of the Mediterranean climate, multi-coloured vegetation carpets, rich in species, develop in spring. Later on in the dry and hot summer, this vegetation disappears. During this unfavourable period, it survives as seeds protected against the summer drought and heat. In the regions influenced by the Mediterranean climate, weed and ruderal species represent a greater share of species in the landscape than this is the case in temperate regions.

Methods and material

The vegetation was sampled and elaborated according to the standard Braun-Blanquet method (Braun-Blanquet, 1964; Westhoff & van der Maarel, 1973). The spectra were defined according to Poldini (1991), Pignatti (1982) and Klotz *et al*. (2002).

The therophytic communities occurring in the southern part of the Balkan peninsula were sampled. Two regions were selected, one under the influence of the Submediterranean climate and the other one in the coastal area of the Aegean sea where the Mediterranean climate dominates (Fig. 1).

The first region, under the influence of the Submediterranean climate, was chosen in the area between Demir Kapija and Gevgelija in the Republic of Macedonia. There the Submediterranean climate prevails and it is characteristic of this climate that the minimum winter average temperature falls below zero. In the summer, there is a dry period which is not so pronounced as in the area under the Mediterranean climate (Fig. 2) The transitional character of this region can be illustrated with an average annual temperature being in Athens 17.7 °C, in Volos 16.9 °C, in Gevgelija 14.2 °C and in Skopje - which is located north of Demir

Kapija, which prevents the deeper influence of the warm Mediterranean climate on the continent - it is 12.0 °C. (Walther & Lieth, 1960; Filipovski *et al*., 1996) The potential vegetation there is platane tree forest (*Juglando-Platanetum*) developing on alluvial soils along the Vardar river (Rizovski & Džekov, 1986).

The other region was selected in the zone of the Mediterranean scleophyllous forests. The region is dominated by the Mediterranean climate, i.e. mild winters with the average minimum temperature not falling below 0°C. Summers are hot with a more pronounced dry period (Fig. 2). There is less precipitation, only around 400 mm. The potential vegetation is forest dominated by evergreen oak classified within the *Quercetea ilicis* (Biondi *et al*., 2003). Often there can be found various degradation stages, dominated by scrub classified into the alliances *Oleo-Ceratonion* and *Ceratonio-Rhamnion* (Raus & Bergmeier, 2003), respectively.

Both communities develop in the early spring; they were sampled in the period between April 10 and 20. The communities were sampled in the abandoned fields, in olive groves and other ruderal sites. The communities in the Submediterranean area are dominated by *Anthemis austriaca*, and in the Mediteranean area by *Anthemis chia*.

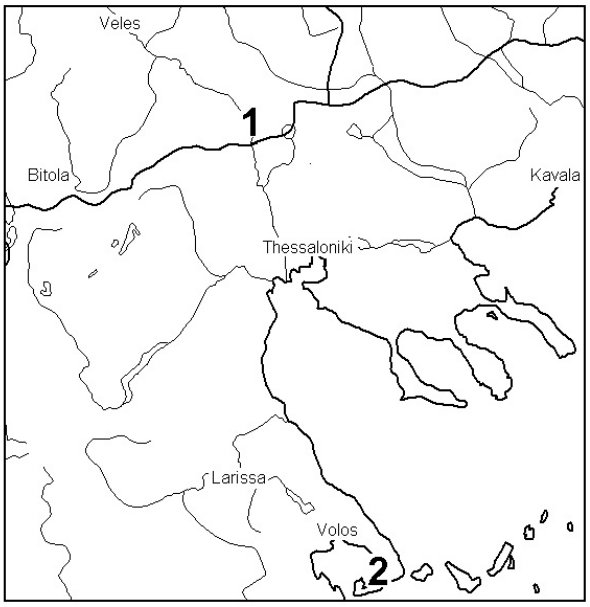

Fig. 1 - Geographical position of the area under research: 1- inland, 2 - coastal

Results

Description of communities

TRIGONELLO MONSPELIACAE-ANTHEMIDETUM AUSTRIACAE Čarni et Matevski ass. nova
(Tab. 1, *holotypus* Tab. 1/1 *holotypus hoc loco*)
The communities were sampled south of Demir Kapija, in abandoned fields and fields temporarily not cultivated, respectively. The rich therophytic communities were intensively mown or pastured during the sampling. Certain areas were then ploughed and cultivated in the subsequent months. The Bulgarian authors have come to similar conclusions whilst they were studying the area of SW Bulgaria with a modified

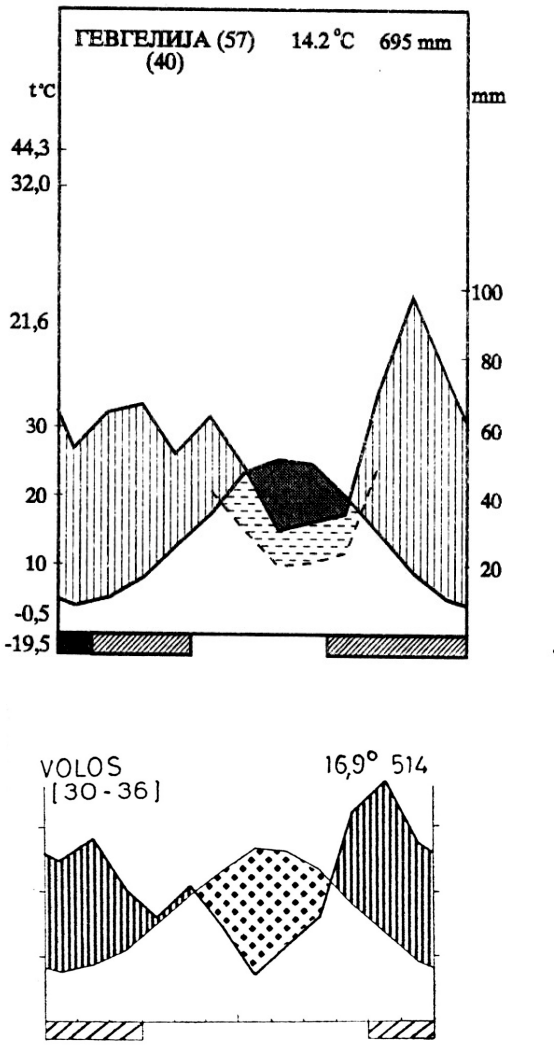

Fig. 2 - Climatic diagrams: upper inland (Gevgelija), lower coastal (Volos)

Mediterranean climate in the surroundings of the town of Petrič (Stojanov & Ahtarov, 1951).

The dominant species in these communities is *Anthemis austriaca* which can be classified into the Pontic phytogeographic element (Pignatti, 1982). It does not occur in the parts of the Balkan peninsula that are under the influence of the Mediterranean climate (Hayek, 1931). The species built also some other cereal weed communities in the continental parts of Europe such as *Consolido-Anthemidetum austriacae* or *Anthemido austriacae-Camelinetum microcarpae* and some others (cf. Kropáč & Mochnacký1990; Mochnacký, 2000). These communities differ significantly, floristically and ecologically, from the community under consideration although certain species from cereal weed communities like *Agrostema githago* or *Scandix pecten-veneris* - but with a reduced constancy - can also be found in the community researched.

In addition to the dominant species *Anthemis austriaca*, there appear several species that indicate the classification of the association into the alliance of the tall herb ruderal communities of spring annuals of temperate Europe with mild winters, *Sisymbrion*, and the order of ruderal communities of arable crops, gardens and waste places, *Sisymbrietalia* (Rodwell *et al*., 2002), such as *Hordeum murinum* subsp. *leporinum*, *Sisymbrium orientale*, *Cardaria draba*, to mention only some of them. The majority of species like *Papaver rhoes*, *Capsella bursa-pastoris*, *Stellaria media* and many others are characteristic of the class of weed and ruderal communities *Stellarietea mediae*.

If we take a look at the life forms, it can be noticed that the majority of species are therophytes (76 %), further there are hemicriptophytes 20% and geophytes 4% (Fig. 3). Among geoelements the Mediterranean species (44%) predominate, they are followed by Paleotemperate (16%), Cosmopolitic (13%) and Euroasian species (12%) (Fig. 4). Among the families, the majority of species originate from the family *Fabaceaea* (23%), *Asteracaea* (20%) and *Brasicaceae* (16%) (Fig. 5).

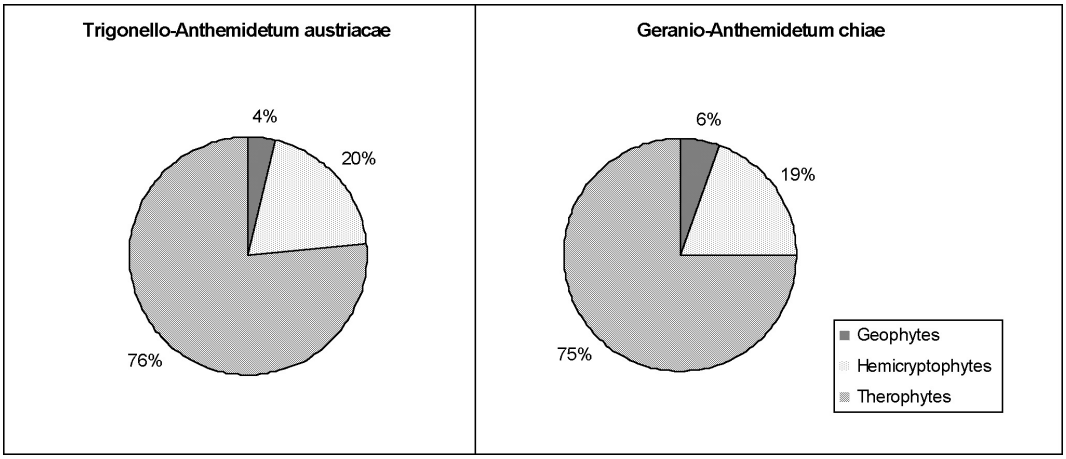

Fig. 3 - Life history spectra: left inland community, right coastal community

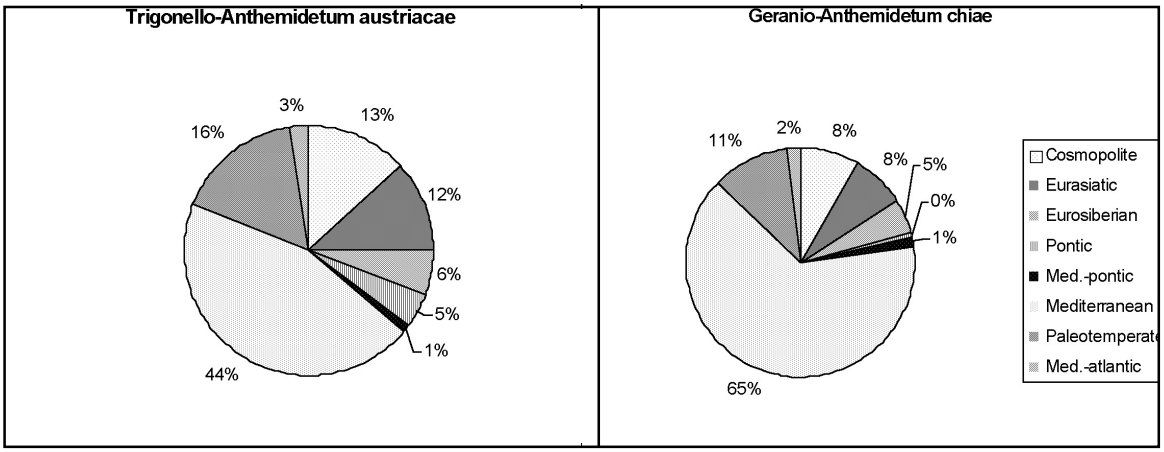

Fig. 4 - Geoelement structure: left inland, right coastal community

Tab. 1 - *Trigonello monspeliacae-Anthemidetum austriacae* Čarni & Matevski ass. nova

	Relevé number	1	2	3	4	5	6	7	8	
	Surface (in m²)	50	50	50	20	20	20	70	80	
	Altitude (in m)	88	83	64	60	94	60	77	85	
	Aspect	-	SW	-	-	-	-	-	-	
	Inclination (in°)	0	5	0	0	0	0	0	0	
	Coverage (%)	100	100	100	100	100	100	100	100	
	Number of species	49	52	47	50	43	41	36	37	
	Character species									Presence
	Anthemis austriaca Jacq.	4	4	4	4	4	4	3	5	8
SY	SISYMBRION, SISYMBRIETALIA									
	Hordeum murinum L. ssp. leporinum (Link) Arcang.	+	1	+	+	+	+	+	.	7
	Sisymbrium orientale L. var. orientale	1	+	+	1	1	1	3	.	7
	Cardaria draba (L.) Desf.	1	+	.	+	+	+	.	+	6
	Malva neglecta Wallr.	+	.	+	+	+	+	.	.	5
	Lactuca serriola L.	+	.	.	+	+	+	.	.	4
	Sisymbrium officinale (L.) Scop.	+	+	.	.	.	.	+	.	3
SM	STELLARITEA MEDIAE									
	Papaver rhoeas L. ssp. rhoeas.	2	1	1	1	+	1	1	3	8
	Capsella bursa-pastoris (L.) Med.	+	+	+	+	1	+	+	+	8
	Geranium molle L.	3	1	+	1	2	+	1	+	8
	Stellaria media (L.) Vill.	+	+	+	.	+	+	2	+	7
	Euphorbia helioscopia L.	1	+	.	+	1	+	+	1	7
	Senecio vulgaris L.	+	+	+	.	+	.	1	+	6
	Lathyrus cicera L.	+	+	+	+	+	+	.	.	6
	Viola kitaibelliana R.S.	.	+	+	+	+	1	.	+	6
	Camelina rumelica Vel.	+	1	+	1	.	.	.	1	5
	Bunias erucago L.	+	+	+	+	.	.	+	.	5
	Sonchus oleraceus (L.) Gou.	+	+	+	.	+	.	+	.	5
	Fumaria officinalis L.	+	+	+	.	+	.	2	.	5
	Veronica persica Poirr.	+	+	+	.	+	.	1	.	5
	Vicia panonica Crantz ssp. striata (Bieb.) Nym.	1	.	.	+	+	+	.	+	5
	Carduus pycnocephalus L.	.	.	1	+	+	+	+	.	5
	Lamium amplexicaule L.	+	+	+	.	.	+	.	.	4
	Vicia sativa L. ssp. nigra (L.)Ehrh.	+	.	+	+	.	.	.	+	4
	Vicia melanops Sibth. & Sm.	.	2	+	+	.	+	.	.	4
	Arabidopsis thaliana (L.) Heynh.	.	+	+	.	+	.	.	+	4
	Hypecoum procumbens L.	.	.	3	.	3	.	3	+	4
	Cerastium glomeratum Th.	.	.	.	+	+	+	.	+	4
	Scandix pecten-veneris L.	+	+	+	.	.	.	.	.	3
	Buglossoides arvensis (L.) I.M. Johns	+	+	+	.	.	.	.	.	3
	Tordylium apulum L.	+	+	.	1	.	.	.	.	3
	Rumex pulcher L.	+	.	.	+	.	1	.	.	3
	Agrostemma githago L.	.	+	.	.	.	.	1	+	3
	Convolvulus arvensis L.	.	.	.	+	.	+	.	+	3
	Erodium cicutarium (L.) L'Her	.	.	.	+	.	+	.	+	3
	Cardamine hirsuta L.	+	+	.	.	.	.	.	.	2
	Vicia narbonensis L var. narbonensis	1	.	.	.	.	.	.	+	2
	Vicia villosa Roth ssp. varia (Host.) Corb.	.	3	2	.	.	.	.	.	2
	Veronica arvensis L.	.	+	.	.	+	.	.	.	2
	Vicia bithynica (L) L.	.	+	.	.	.	.	.	+	2
	Geranium pusillum L.	.	.	+	.	+	.	.	.	2
	Cerastium semidecandrum L.	.	.	.	+	.	.	.	+	2
	Sherardia arvensis L.	.	.	.	+	.	1	.	.	2
	Lamium purpureum L.	.	.	.	.	.	+	+	.	2
	Other species									
	Crepis sancta (L) Bal.	1	+	+	1	+	1	+	.	7
	Trigonella monspeliaca L.	+	+	+	+	.	+	+	.	6

Valerianella turgida (Stev.) Betcke.	+	+	.	+	+	+	.	2	6
Anchusa officinalis L.	.	+	+	+	+	+	+	.	6
Arenaria leptoclados (Reich.) Guss. var. viscidula Will.	.	2	+	2	+	2	.	+	6
Filago pyramidata L.	.	+	+	1	+	1	+	.	6
Trifolium arvense L.	.	+	+	+	+	+	+	.	6
Trifolium subterraneum L.	.	+	+	+	+	+	.	.	5
Medicago minima (L.) Grufb.	.	+	+	+	1	.	.	+	5
Chondrilla juncea L.	.	.	+	.	+	+	+	+	5
Trifolium repens L.	.	.	+	+	+	.	+	+	5
Galium aparine L.	+	+	.	.	+	.	.	+	4
Herniaria hirsuta L.	.	+	+	+	.	.	+	.	4
Myosotis ramossisima Roch.	.	1	+	.	+	.	+	.	4
Taraxacum officinale Web.	+	.	+	.	.	.	+	.	3
Myosotis stricta Link. ex Roem. et Schultes	.	+	+	.	.	.	+	.	3
Trifolium pratense L.	.	+	.	+	.	+	.	.	3
Cichorium intybus L.	.	.	+	.	+	.	.	+	3
Trifolium nigrescens Viv.	.	.	+	.	.	.	+	+	3
Eryngium campestre L.	.	.	.	+	.	+	.	+	3
Senecio vernalis WK	+	+	.	.	.	.	.	.	2
Ornithogallum umbellatum L.	+	.	.	+	.	.	.	.	2
Plantago lanceolata L.	+	.	.	+	.	.	.	.	2
Valerianella coronata (L) DC	+	.	.	.	.	+	.	.	2
Bisserula pelecinus L.	.	+	.	.	.	.	+	.	2
Ranunculus marginatus D'Urv.	.	+	.	.	.	.	.	+	2
Berteroa orbiculata DC	.	.	+	.	+	.	.	.	2
Cnicus benedictus L.	.	.	+	.	.	.	+	.	2
Koeleria phleoides (Vill.) Pers.	.	.	.	.	+	+	.	.	2
Linaria arvensis (L) Desf.	.	.	.	.	.	+	+	.	2
Avena barbata Brott.	.	.	.	.	.	+	.	+	2

GERANIO BRUTII-ANTHEMIDETUM CHIAE Čarni & Matevski ass. nova

(Tab. 2, *holotypus* Tab. 2/2 *holotypus hoc loco*)

The community was sampled south of Volos, in olive groves and similar habitats, with a more or less ruderal character. During the sampling period, these communities rich in species were pastured, later these communities were partially ploughed and they dissapear due to the summer heat and drought.

The dominant species in these sites is *Anthemis chia* growing in the northeastern Mediterranean area. It can be found on uncultivated and ruderal sites (Pignatti,1982). In the Balkan peninsula, it can be found in the coastal parts ranging from Dalmatia to Greece (Hayek, 1931).

In addition to the dominant species, numerous species such as *Hirschfeldia incana*, *Avena barbata*, *Bunias erucago* can be found in relevés that indicate the classification of the community into the alliance of the Mediterranean ruderal communities rich in winter annual grasses *Hordeion leporini* (Mucina, 1991; Rodwell *et al*., 2002). There are many species such as *Euphorbia helioscopia*, *Sherardia arvensis* and *Cerastium glomeratum* that indicate the classification of the association into the class *Stellarietea mediae*.

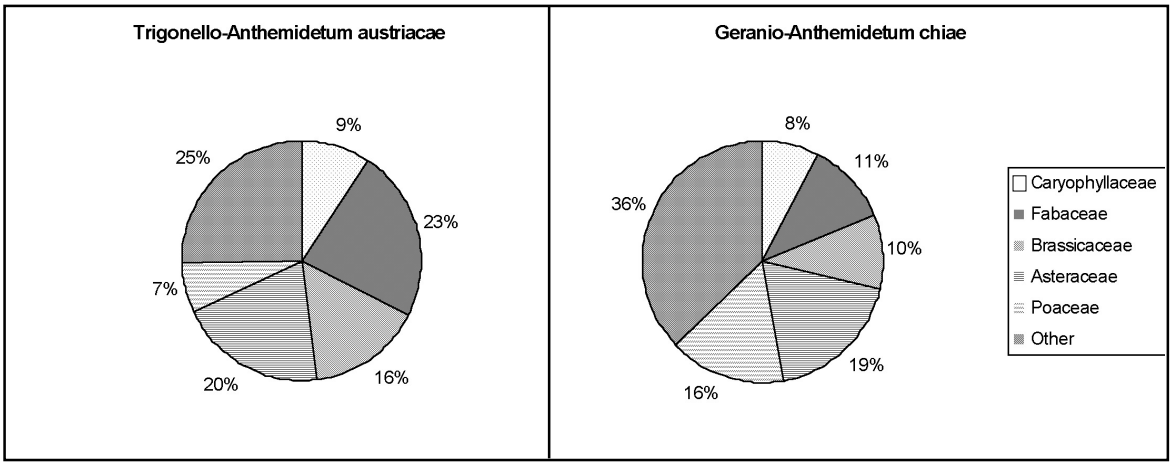

Fig. 5 - Presence of families: left inland, right coastal community

Tab. 2 - *Geranio brutii-Anthemidetum chiae* Čarni & Matevski ass. nova

	Relevé number	1	2	3	4	5	6	7	8	
	Surface (in m^2)	50	50	50	100	50	50	50	50	
	Altitude (in m)	5	5	5	27	10	15	20	16	
	Aspect	S	S	S	W	W	W	W	W	
	Inclination (in °)	2	2	1	2	2	2	10	2	
	Coverage (%)	100	100	100	100	100	100	100	100	
	Number of species	83	62	78	48	58	62	57	60	Presence
	Character species									
	Anthemis chia L.	4	4	4	4	5	5	4	4	8
HL	HORDEION, SISYMBRIETALIA									
	Hirschfeldia incana (L.) Lagr.-Fossat	+	+	+	+	+	+	+	+	8
	Avena barbata Pott. Ex Link	+	+	+	.	+	+	+	+	7
	Bunias erucago L.	1	1	1	1	+	+	.	+	7
	Dasypirum villosum (L.) P. Candarrgy	+	.	+	+	+	+	+	.	7
	Hordeum murinum L. ssp. leporinum (Link) Archangeli	+	+	+	+	.	.	+	.	5
	Trifolium nigrescens Viv.	1	.	+	.	.	+	+	.	4
	Bromus madritensis L.	.	2	.	+	+	+	.	.	4
	Crepis setosa Haller fil.	+	+	.	.	.	+	.	.	3
	Desmazeria rigida (L.) Tutin	+	.	+	.	.	.	.	+	3
	Lolium rigidum Gaudin ssp.lepturoides (Boiss.) Sennen & Mauricio	+	+	.	.	.	.	.	.	2
	Aegilops triuncialis L.	+	.	+	.	.	.	.	.	2
	Echium plantagineum L.	.	+	.	2	.	.	.	.	2
	Cynoglossum creticum Miller.	.	+	.	.	+	.	.	.	2
	Carthamus lanatus L.	.	+	.	.	.	+	.	.	2
	Geranium rotundifolium L	+	.	.	.	.	.	.	.	1
	Rumex pulcher L.	.	+	.	.	.	.	.	.	1
SM	STELLARIETEA MEDIAE									
	Euphorbia helioscopia L.	2	2	1	1	1	1	+	+	8
	Sherardia arvensis L.	+	1	+	+	+	+	+	+	8
	Cerastium glomeratum Theill.	1	1	1	+	2	1	+	1	8
	Euphorbia peplus L.	+	+	+	+	+	+	+	+	8
	Sisymbrium officinale (L.)Scop.	+	+	+	+	1	+	+	+	8
	Tordylium apululum L.	+	+	+	+	+	+	+	+	8
	Calendula arvensis L.	+	2	1	+	+	+	.	3	7
	Cardamine hirsuta L.	+	+	+	+	+	+	+	.	7
	Stellaria cupaniana (Jord. & Fourr.) Beguin.	1	1	+	1	1	1	.	+	7
	Veronica persica Poiret	+	.	+	+	.	+	+	+	6
	Senecio vulgaris L.	+	.	+	.	+	+	+	+	6
	Veronica arvensis L.	1	+	+	.	+	+	+	.	6
	Erodium malacoides (L.) L Her.	+	1	+	+	+	.	.	.	5
	Arabidopsis thaliana (L.) Heynh.	+	.	+	.	+	+	+	.	5
	Leontodon tuberosus L.	+	+	.	.	.	+	+	+	5
	Medicago arabica (L.) Hudson.	+	+	.	+	.	.	+	+	5
	Mercurialis annua L.	+	+	+	.	.	.	+	.	4
	Capsella bursa-pastoris (L.) Medicus	+	.	.	+	+	.	.	+	4
	Anagalis arvensis L.	.	+	+	+	.	.	.	1	4
	Vicia sativa L.ssp. cordata (Wulfen ex Hoppe) Ashersen & Graebner	.	.	+	+	.	.	+	+	4
	Silene cretica L.	+	+	.	.	.	+	.	.	3
	Crepis neglecta L.	+	.	1	.	.	.	.	+	3
	Erysimum crassistilum C. Presl.	+	.	+	.	.	.	.	+	3
	Pimpinella peregrina L.	+	.	+	.	.	+	.	.	3
	Aphanes arvensis L.	+	.	.	.	.	.	+	+	3
	Veronica cymbalaria Bodard	.	+	+	.	+	.	.	.	3
	Raphanus raphanistrum L. ssp. raphanistrum	.	1	.	1	+	.	.	.	3
	Torylis nodosa (L.) Gaert.	.	.	+	.	+	.	+	.	3
	Lamium purpureum L.	.	.	.	+	+	+	.	.	3
	Malva pusilla Sm.	.	.	.	.	+	+	.	+	3

Stellaria media (L.) Vill.	+	.	.	.	+	.	.	.	2
Papaver rhoeas L.	.	.	.	+	+	.	.	.	2
Sonchus oleraceus (L.) Gon.	.	.	.	+	.	.	+	.	2
Other species									
Geranium brutium Gaspar.	1	3	1	2	+	1	1	+	8
Hypochoeris achyrophorus L.	+	+	1	.	2	2	1	1	7
Calamintha nepeta (L.) Savi ssp. nepeta	+	+	+	+	.	+	+	+	7
Myosotis ramossisima Rodal.	+	+	+	+	+	+	+	.	7
Nonea obtusifolia (Willd.) DC	+	+	1	1	.	+	+	+	7
Daucus carota L.	+	+	.	+	+	+	+	.	6
Galium murale (L.) Lam.	+	+	+	.	+	.	+	+	6
Hymenocarpos circinatus (L.) Savi	+	.	+	.	+	+	+	+	6
Trifolium subterranum L.	.	1	+	+	2	2	.	2	6
Medicago minima (L.) Bartal.	+	+	+	.	.	+	+	.	5
Muscari neglectum Guss. Ex Ten.	+	.	+	.	1	1	.	+	5
Taraxacum officinale Weber	+	.	+	+	+	+	.	.	5
Thelygonum cynocrambe L.	+	.	+	+	+	.	2	.	5
Valerianella turgida (Steven) Betcke	+	.	+	.	+	+	+	.	5
Verbascum sinuatum L.	+	.	+	.	+	+	+	.	5
Anemone pavonina Lam. var. pavonina	+	.	+	.	+	2	+	.	5
Bellis annua L.	+	.	.	+	.	+	+	+	5
Carduus australis L. fil.	+	+	+	+	.	+	.	.	5
Dactylis glomerata L.	.	1	+	+	.	+	+	.	5
Anemone pavonina Lam. var. purpureoviolacea (Boiss.) Hay.	+	1	.	+	.	.	+	.	4
Arenaria leptoclados (Reich) Gun. var. leptoclados	+	.	+	.	+	.	.	+	4
Crepis foetida L. ssp. commutata (Sprengel) Barbcock	+	+	+	.	.	.	.	+	4
Cynosurus echinatus L.	+	.	+	.	+	+	.	.	4
Onobrychis sp.	+	.	+	.	.	+	.	+	4
Bupleurum sp.	.	+	+	+	.	+	.	.	4
Chondrilla juncea L.	.	+	+	+	.	.	.	+	4
Plantago lanceolata L.	.	1	.	.	+	1	.	+	4
Avena fatua L.	.	.	.	+	+	.	+	+	4
Cardaria draba (L.) Desv.	+	+	+	.	.	.	.	.	3
Petrorhagia dubia (Rati) G. Lopez et Romo	+	+	+	.	.	.	.	.	3
Centaurium tenuiflorum (Hoffm. & Link.) Fritsch.	+	+	.	.	.	.	+	.	3
Lamium bifidum Cyr. ssp. biFidum	+	.	+	.	.	+	.	.	3
Lophochloa cristata (L.) Hyl.	+	.	+	.	.	+	.	.	3
Sedum rubens L.	+	.	+	.	.	.	+	.	3
Erodium cicutarium (L.) L Her.	+	.	+	.	.	.	.	+	3
Minuartia hybrida (Vill.) Schisch	+	.	+	.	.	.	.	+	3
Ranunculus muricatus L. f.graecus (Griseb.) Held & Sart.	+	.	.	+	.	+	.	.	3
Corynephorus divaricatus (Pourr.) Br.	+	.	.	.	+	.	.	+	3
Allium sp.	+	.	.	.	.	+	.	+	3
Trifolium repens L.	.	1.2	.	.	+	+	.	.	3
Plantago media L.	.	+	.	.	.	+	.	+	3
Lotus collinus (Boiss.) Heldr.	.	+	.	.	.	.	+	+	3
Galium tricornutum Dandy	.	.	+	+	.	+	.	.	3
Micromeria nervosa (Dest.) Benth.	.	.	+	.	.	+	+	.	3
Ranunculus bulbosus L. ssp. bulbosus	.	.	.	.	+	1	+	.	3
Eryngium campestre L.	.	.	.	.	+	+	.	+	3
Parentucelia latifolia (L.) Caruel.	.	.	.	.	+	+	.	+	3
Stachys sp.	.	.	.	.	.	+	+	+	3
Hypericum perforatum L. var. microphyllum DC	.	.	.	.	.	+	+	+	3

Within the spectrum of life forms it can be stated that there are 75% species of therophytes, 19% of hemicriptophytes and 4% of geophytes (Fig. 3). In the geoelement structure, the species with the Mediterranean distribution pattern (64%) dominate. They are followed by Paleotemperates (11%), cosmopolitic (8%) and Euroasian (8%) species (Fig. 4). Among the families, the species from the families *Asteraceae* (19%) and *Poaceaea* (Fig. 5) dominate.

Syntaxonomical scheme

Stellarietae mediae Tüxen, Lohmeyer et Preising ex von Rochow 1951
- *Sisymbietalia* J. Tüxen in Lohmeyer *et al.* 1962 em. Rivas-Martínez, Báscones, T.E. Díaz, Fernández-González & Loidi 1991
  - *Sisymbrion officinalis* Tüxen, Lohmeyer & Preising in Tüxen 1950
    - *Trigonello monspeliacae-Anthemidetum austiacae* Čarni et Matevski ass. nova
  - *Hordeion leporini* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 corr. O Bolòs 1962
    - *Geranio brutii-Anthemidetum chiae* Čarni et Matevski ass. nova

Classification

The two communities are classified into the *Stellarietea mediae*. Both communities are included in the order *Sisymbrietalia* that is further divided into two alliances: *Sisymbrion* appearing in the temperate part of Europe, and *Hordeion* appearing in more thermic parts of Europe (Fanelli, 2002; Rivas-Martínez *et al*., 2001, 2002).

Sometimes these alliances are classified into into separate orders, namely the continental alliance *Sisymbrion* into the order *Sisymbrietalia* and the alliance *Hordeion leporini* with the Mediterranean distribution pattern into the order *Brometalia rubenti-tectorum* (Mucina, 1991; Rodwell *et al.*, 2002).

These two alliances are often considered as vicariants. Mucina (1991) found that there was a clear geographical difference between the distribution area of the *Sisymbrion officinalis* and *Hordeion leporini*, the therophytic ruderal communities growing in temperate Europe and in the Mediterranean area. The distribution area of the *Sisymbrion officinalis* is characterized by a subhumid (cold to temperate) climate. The *Hordeion leporini* is found under milder climatic conditions. In the Emberger climate diagram (Daget, 1977) prepared by Mucina (1991), there is no association of the *Hordeion* in the areas where the mean temperature of the coldest month is below zero, as in the part of Balkans where *Trigonello-Anthemidetum austriacea* was sampled. Gevgelija was taken as a climatic station with a mean minimum temperature of the coldest month of -0.5°C and Emberger pluviometric coefficient of 74. The climate can be classified into the category subhumid and cold, and there the alliance *Sisymbrion* is distributed according to the shema proposed by Mucina (1991). Further to the south, in the coastal part the climate is considered as subarid and cool regions, and that is the distribution area of the alliance *Hordeion leporini*.

Discussion

In the Mediterranean area, weed and ruderal vegetation is richer in species than in the temperate parts of Europe. In the Mediterranean area, mesic habitats are not very common and, therefore, a lot of rare species appear in such communities. These species appear also frequently in dry grassland and in overexploited forests. In the tables, the maximum number of species is over 80 in a relevé, whereas on average about 70. That is far more than in the continental parts of Europe where in such communities sometimes up to 40 species per sample plot can be found.

With regard to the floristic inventory and climate, it can be stated that the influence of the Mediterranean climate can obviously be felt in the southern part of the Republic of Macedonia. In this way it can be noted that the communities that are characteristic of the Mediterranean area occur early in the spring. The fact is that dry and hot summers accelerate the growth of the communities that are characteristic of the Mediterranean. Moreover, it is necessary to establish that the influence of the continental climate is still sufficiently strongly felt in this area, particularly due to the cold winters. Consequently, the vegetation characteristic of the Mediterranean area cannot develop to a great extent.

As far as the life forms are concerned, differences between the Submediterranean and Mediterranean communities can hardly be recognised since their establishment and management are similar. Mostly they consist of plant species that can be classified into ruderal species with regard to their ecological strategy. Plants develop fast, produce a large quantity of persistent seeds and then die (Grime, 1977; Klotz & Kühn, 2002).

The chrological spectrum shows the geographical position of each community. In the coastal community dominated by *Anthemis chia*, species with a Mediterranean distribution pattern prevail. In the more continental community dominated by *Anthemis austriaca*, the Eurasiatic, Paleotemperate and Pontic elements are also well pronounced. This is in correlation with the already discussed classification of communities.

The main difference between the spectrums of families reveals that in the community from the Mediterranean region more species from the family *Poaceae* appear. One of the reasons is that many species of this family have the C4 assimilation syndrome that gives advantage to the species growing in high temperature and low humidity conditions. In this community, there are 22 species of the family *Poaceaea*, whereas in the Submediterranean community there are only 5 grasses.

In the Submediterranean communities, there are more species of the family *Fabaceae*. In these communities, there are 27 species of *Fabaceaea*, whilst in the Mediterranean one there are only 16 species from this

family.The species of the family *Fabaceae* are found in dry habitats poor in nitrogen and they are appear abundantly in the steppic zones of Eurasia (Ehrendorfer, 1978).

Acknowledgements

We would like to express our thanks to Mr. Tode Donevski for the help in the field work and Ms Barbara Šuštar for the help given in preparation of the manuscript. We would like to thank also Prof. Dr. Edoardo Biondi (Ancona) for his comments on the previous version of the manuscript. The research was financed by the Ministry of Higher Education, Science and Technology of the Republic of Slovenia and the Ministry of Education and Science of the Republic of Macedonia.

Appendix

Tab. 1

Less common species: 1. *Allysum desertorum* Stapf. +, *Calepina irregularis* (Asso.)Thell. +, *Daucus carota* L. +, *Draba muralis* L. +, *Geranium rotundifolium* L. +, *Glechoma hirsuta* Waldst. et Kit. +, *Medicago arabica* (L.) Huds. +, *Medicago rigidula* (L.) All. +, *Muscari comosum* (L.) Miller +, *Ononis spinosa* L. +, *Ranunculus ficaria* L. +, *Vicia hybrida* L.; 2. *Alcea pallida* (Willd.) WK +, *Myosotis incrassata* Guss. +, *Picnomon acarna* Cass. +, *Secale cereale* L. +, *Trifolium scabrum* L. +, *Veronica hederifolia* L. +, 3. *Legousia speculum veneris* (L.) Chaix. +, *Raphanus raphanistrum* L. ssp. *landra* (Moretti ex DC) Bonnier et Layens +, *Vicia hirsuta* (L.) SF Gray; 4. *Allysum strigosum* Banks & Silan +, *Anchusa arvensis* (L.) MB +, *Aphanes arvensis* L. +, *Astragalus hamosus* L. +, *Erodium ciconium* (L.) L'Her. +, *Fumaria kralikii* Jordan +, *Moenchia mantica* (L) Bartl. ssp. *mantica* +, *Poa bulbosa* L. +, *Sedum rubens* L. +, *Trifolium incarnatum* L. ssp. *molinierii* (Balbis ex Hornem.) Syne.; 5. *Chamomilla recutita* (L.) Rauschert +, *Descurainia sophiae* (L.) Webb ex Prantl +, *Sisymbrium altissimum* L. +, *Trifolium purpureum* Loisel +, 6. *Geranium dissectum* Jusl. +, *Helianthemum salicifolium* (L.) Mill. +, *Lathyrus aphaca* L.; 7. *Delphinium balcanicum* Pawl. +, *Equisetum arvense* L. +, *Stenactis annua* (L.) Nees. +, 8. *Nonea lutea* (Deser) DC +, *Parentucellia latifolia* (L.) Car. +, Silene conica L. ssp. conica +, *Trifolium micranthum* Viv. +, *Trigonella corniculata* L..

Localities

1. Demir Kapija, 17.4.2001, 41º23'22'', 22º19'37''; Udovo, 18.4.2001, 41º21'45'', 22º25'33''; 3. Udovo, 18.4.2001, 41º20'23'', 22º26'65''; 4. Smokvica, 16.4.2001, 41º13'52'', 22º29'55''; 5. Paljurci, 18.4.2001, 41º12'20'', 22º36'52''; 6. Smokvica, 16.4.2001, 41º13'52'', 22º29'55''; 7. Udovo, 17.4.2001, 41º20'24'', 22º26'55'', 8. Demir Kapija, 17.4.2001, 41º23'55'', 22º18'36''.

Tab. 2

Less common species: 1. *Cynodon dactylon* (L.) Pers. +, *Euphorbia prostrata* Aiton +, *Galium parisiense* L. +, *Nigella damascena* L. +, *Ophrys* sp. +, *Poa infirma* Kunth. +, *Silene graeca* Boiss et Spun. +, *Acanthus spinosus* L. +, *Apera spica-venti* (L.) Beauv. +, *Arenaria leptoclados* (Reich) Gun. var. *viscidula* +, *Campanula scutellata* Griseb. +, *Gastridium ventricosum* (Gouan.) Scinz. & Thell. +, *Reichardia picroides* (L.) Roth +, *Trifolium angustifolium* L.+, *Trifolium arvense* L. +; 2. *Cynodon dactylon* (L.) Pers. + +, *Kickxia commutata* (Bernh ex Reichenb.) Fritsch. +, *Lagurus ovatus* L. +, *Ornithopus compressus* L. +, *Rhagadiolus stellatus* (L.) Gaert.+, *Scorzonera hispanica* L. +, *Trifolium scabrum* L. +, *Briza minor* L. +, *Erodium ciconium*(L.) L Her. +, *Linum bienne* Miller +, *Muscari comossum* (L.) Miller +; 3. *Trifolium scabrum* L. +, *Galium parisiense* L. +, *Silene graeca* Boiss et Spun. +, *Brachypodium distachyon* (L.) Beauv. +, *Ornithogalum* sp. +, *Scrophularia peregrina* L. +, *Ajuga orientalis* L. +, *Alyssum strigosum* Banns & Solandu +, *Anchusa officinalis* L. +, *Coronilla cretica* L. +, *Lagoecia cuminoides* L. +, *Lathyrus cicera* L. +, *Melica ciliata* L. ssp. *taurica* (C. Koch) Tzvelev +, *Micromeria cremnophila* Boiss. et Held. +, *Securigera securidaca* (L.) Deg. & Dorfl. +, *Bromus fasciculatus* C. Presl 1; 4. *Kickxia commutata* (Bernh ex Reichenb.) Fritsch. +, *Rhagadiolus stellatus* (L.) Gaert. *Poa infirma* Kunth. +, *Hypochoeris maculata* L. +, *Silene gallica* L. +, *Urtica piluliflera* L.; 5. *Scrophularia peregrina* L. +, *Lagurus ovatus* L. +, *Filago vulgaris* Lam. +, *Plantago lagopus* L. +, *Serapias vomeracea* (Burm.) Briq. +, *Buglossoides arvensis* (L.) M. John. +, *Carduus nutans* L. +, *Phleum subulatum* (Savi) Asch. & Graeb.; 6. *Scrophularia peregrina* L. +, *Lagurus ovatus* L. +, *Filago vulgaris* Lam. +, *Plantago lagopus* L. +, *Serapias vomeracea* (Burm.) Briq. +, *Buglossoides arvensis* (L.) M. John. +, *Carduus nutans* L. +, *Phleum subulatum* (Savi) Asch. & Graeb. *Ornithogalum* sp. 1, 7. *Brachypodium distachyon* (L.) Beauv. +, *Bromus fasciculatus* C. Presl +, *Scorzonera hispanica* L. +, *Euphorbia prostrata* Aiton +, *Nigella damascena* L. +, *Vicia lathyroides* L. +, *Erophila verna* (L.) Chevall. +, *Piptatherum virescens* (Trin.) Boiss. +, *Ranunculus ficaria* L. ssp. *calthifolius* (Reich.) Arcang. +, *Silene behen* L.; 8. *Vicia lathyroides* L. +, *Filago vulgaris* Lam. +, *Plantago lagopus* L. +, *Serapias vomeracea* (Burm.) Briq. +, *Ornithopus compressus* L. +, *Asterolinum linum-stellatum* (L.) Duby. +, *Evax contracta* Boiss. +, *Linum*

corymbulosum Reichenb. +, *Pallenis spinosa* (L.) Cass. +, *Plantago bellardii* L. +, *Poa bulbosa* L. +, *Sanguisorba minor* Scop. +.

Localities

1. Kato Gatzea, 13.4.2003, long. 39º18,610', lat. 23º06,104'; 2. Platania, 12.4.2003, 39º08,365', 23º16,509'; 3. Kato Gatzea, 13.4.2003, 39º18,579', 23º06,121'; 4. Planatnia, 12.4.2003, 39º08,795', 23º16,509'; 5. Kala Nera, 14.4.2003, 39º18,525', 23º07,214'; 6. Kala Nera, 14.4.2003, 39º18,544', 23º07,193'; 7. Kala Nera, 14.4.2003, 39º18,523', 23º07,278'; 8. Kala Nera, 14.4.2003, 39º18,523', 23º07,278'.

The syntaxa used in the text

Anthemido austriacae-Camelinetum microcarpae Holzner 1973; *Brometalia rubenti-tectorum* (Rivas Goday et Rivas-Martínez 1963) Rivas-Martínez et Izco 1977; *Ceratonio-Rhamnion* Barbero et Quenzel 1979; *Consolido-Anthemidetum austriacae* Kropač *et Mochnacký 1990; Geranio brutii-Anthemidetum chiae* Čarni et Matevski ass. nova; *Hordeion leporini* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 corr. O Bolòs 1952 *Juglando-Platanetum orientalis* Em et Džekov 1961; *Oleo-Ceratonion siliquae* Br.-Bl. ex Guinochet et Drouineau 1944 em. Rivas-Martínez 1975; *Sisymbrietalia* J. Tx. 1966; *Quercetea ilicis* Br.-Bl. ex A. & O. Bolòs 1950, *Sisymbietalia* J. Tüxen in Lohmeyer *et al*. 1962 em. Rivas-Martínez, Báscones, T.E. Díaz, Fernández-González & Loidi 1991, *Sisymbrion officinalis* Tüxen, Lohmeyert et Preising in Tüxen 1950; *Stellarietea mediae* Tüxen, Lohmeyer et Preising ex von Rochow 1951*; Trigonello monspliecae-Anthemidetum austriacae* Čarni et Matevski ass.nova.

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