Poo bulbosae-Achilleetum pseudopectinatae: a new plant association

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Abstract. A new grassland association defined by the presence of the Balkan endemic *Achillea pseudopectinata* is described from South Bulgaria. The association is characterized ecologically and floristically. The analysis of floristic elements shows that the Submediterranean species are the most numerous. The analysis of life forms demonstrates that therophytes and hemicryptophytes prevail in these communities. The association is of a zooanthropogenic origin and belongs to the *Trifolion cherleri* alliance. The *Festuco-Brometea* species are also strongly present.

Key words: Balkan endemic, dry grasslands, *Trifolion cherleri*

Introduction

Dry grasslands are of interest to European researchers owing to their great species richness and high conservation value because of the presence of rare and endemic species. They are suitable as model systems for biodiversity analyses. Along with this, they are considerably influenced across Europe by a number of factors, namely destruction, afforestation, abandonment of traditional uses, and invasion of neophytes (cf. European Dry Grasslands Group – http://edgg.org/). Rather detailed information on dry grasslands in the Western Mediterranean and North and Central Europe is available, whereas information about Southeast Europe is scarce. In Bulgaria, dry grasslands referred to various syntaxa have been studied phytocoenologically by Tzonev (2002), Meshinev & al. (2005), Apostolova & Meshinev (2006), Tzonev & al. (2006), Sopotlieva & Apostolova (2007) and Pedashenko & al. (2009).

During the studies of grasslands diversity in the Straldzha-Aytos geobotanical region (Sopotlieva 2008) dry grassland communities harbouring the Balkan endemic *Achillea pseudopectinata* accompanied by *Poa bulbosa* and *Thymus striatus* have been found. On the Besapar Hills, *Achillea pseudopectinata* falls into the associations described by the dominance approach: *Psilurus aristatus* + *Brachypodium distachyon* (Stanev 1977), *Andropogon ischaemum-Brachypodium distachyon* and *Andropogon ischaemum-Thymus striatus* (Stanev 1980). In all three associations, similarly to the description from the Straldzha-Aytos region, *Achillea pseudopectinata* occurs jointly with *Poa bulbosa* and *Thymus striatus*. This vegetation is described as a new association *Poo bulbosae-Achilleetum pseudopectinatae*.

Materials and methods

The study region is situated, between 42–43° N and 26–27°E, in Southeast Bulgaria. It is assigned to the Straldzha-Aytos phytogeographic region (Bondev 2002). The region is characterized by mild climate with mean annual temperatures of 12.2 °C for Aytos

and Yambol, 12.4 °C for Sliven; mean annual precipitation of 490.6 mm for Aytos, 567 mm for Sliven, and 535.9 mm for Yambol (unpublished data provided by Bulgarian National Institute of Meteorology and Hydrology, Bulgarian Academy of Sciences).

A total of 349 relevés have been collected in the Straldzha-Aytos geobotanical region, following the Braun-Blanquet approach (Braun-Blanquet 1965; Westhoff & van der Maarel 1980). The plots were set in places of visually assessed homogeneity of the topographic conditions and plant cover, each with an area of 16 m^2 (Chytrý & Otýpková 2003). The abundance and cover of each species have been assessed according to the nine-point combined scale of Braun-Blanquet, with subdivisions 2m, 2a and 2b proposed by Barkman & al. (1964) (Westhoff & van der Maarel 1980). The total cover of vegetation was recorded in percentage.

The relevés were analysed by numerical methods (TWINSPAN, Cluster Analysis), and seven of them formed a separate group that could be interpreted on the association level. An additional relevé was recorded in the summer of 2008 in Mt Mala Aytoska. Five other relevés from the Besapar Hills (Stanev 1977, 1980) were also used, selected by the presence of *Achillea pseudopectinata* in the plots. Quantitative estimates of the species cover of these five relevés have been adapted to the new Braun-Blanquet scale based on Meshinev & Apostolova (2002).

The taxonomy and nomenclature of the species follows Kozhuharov (1992) for vascular plants and Natcheva & Ganeva (2005) for mosses. Contrary to the common use of *Achillea depressa* in Kozhuharov (1992) and different literature sources, in this paper the name *Achillea pseudopectinata* is accepted by reason of priority (Saukel & al. 2003). The floristic elements are given according to Assyov & al. (2002) for vascular plants and according to Ganeva & Düll (1999) for mosses. The life forms have been assessed on the basis of data about the biological type of the species, according to Kozhuharov (1992). The diagnostic values of species were evaluated according Mucina (1997) and different available literature sources from the West Mediterranean (Rivas-Martínez & al. 2001; Rivas-Martínez & al. 2002; Pérez Prieto & Font 2005), Central Europe (e.g. Korneck 1993; Valachovič 1995; Chytrý & Tichý 2003; Chytrý 2007; Jarolímek & Šibík 2008), the Balkans (e.g. Micevski 1970, 1977, 1978; Micevski & Matevski 1984) and the neighbouring countries (e.g. Sanda & al. 1997, 1999). Phytosociological nomenclature is according to the International Code of Phytosociological Nomenclature (Weber & al. 2000).

A soil sample was collected for chemical analysis in the plot of relevé No 6, in order to study the chemical characteristics of the soil. The sample was air-dried. Pre-treatment of the sample for the chemical analysis has followed ISO 11464:1994 (E). Electrical conductivity (EC) and pH were measured in water solution with 1:5 soil/water ratio and pH-meter Jenway3310 (ISO 10390:1994 (E)). $CaCO_3$ concentration was measured in 1:10 water solution with Photometer PC 22, the results are presented in mg/l. Humus was determined according to the modified Turin method (Kononova 1966). All analyses were performed at the Analytical Laboratory, Department of Phytocoenology and Ecology, Institute of Botany, Bulgarian Academy of Sciences.

Results and discussion

An outline of the association

The association *Poo bulbosae-Achilleetum pseudopectinatae* is described on the basis of 13 relevés (Table 1). **Relevé 8 is designated here as a nomenclatural type (Holotype)**.

Communities of this association have been identified in South Bulgaria (Fig. 1) and can be referred to the thermophilous vegetation. Their horizontal structure is of semi-open to closed type, with total cover between 50 % and 90 % (Fig. 2). *Achillea pseudopectinata* or *Dichanthium ischaemum* are the main dominant species (with scores 3–4), and occasionally *Psilurus incurvus* and *Scleranthus perennis* also have high abundance. The average number of species per relevé is 34, and the general species diversity of the association is 143 plant species.

Therophytes (Th) (67 species, 46.9 %) and hemicryptophytes (H)(63 species, 44 %) claim approximately equal shares. Chamaephytes (Ch) and cryptophytes (K) are lesser in number, represented by seven species (4.9 %) and six species (4.2 %), respectively.

Geographical distribution of the studied vegetation determines the presence of a great number of Submediterranean species (30 species, 21 %). Generally, a marked Mediterranean influence has been

registered: the Submediterranean, Mediterranean, Euro-Mediterranean, and Mediterranean-Asian species amounted to 40.6 %. Eurasian species accounted for 11.2 % (16 species). The endemic elements are represented by seven Balkan, three Balkan-Anatolian and one Balkan-Dacian species, and they together make up 7.7 % of the association's composition.

The communities of the association in the Straldzha-Aytos district are distributed on slanted slopes, mainly with sunny exposition (facing west or south), at altitudes between 66 m and 334 m. On the Besapar Hills, they occupy ridges or south-facing slopes (slope 15–25°) (Stanev 1977, 1980). The base rock is exclusively silicate. The communities develop on shallow or medium deep, dry, eroded soils, with fine skeleton material and trampled surface.

The stands are used as pasture, but the intensity of grazing is low or moderate. The soil sample analyses have shown moderately acidic soil (pH 5.91), low humus content (1.45 %), total nitrogen content of 0.11 %, and highly enriched humus with nitrogen (C/N 7.65). The amount of $CaCO_3$ was 31 $mg.l^{-1}$, and conductivity 30 $\mu S.cm^{-1}$.

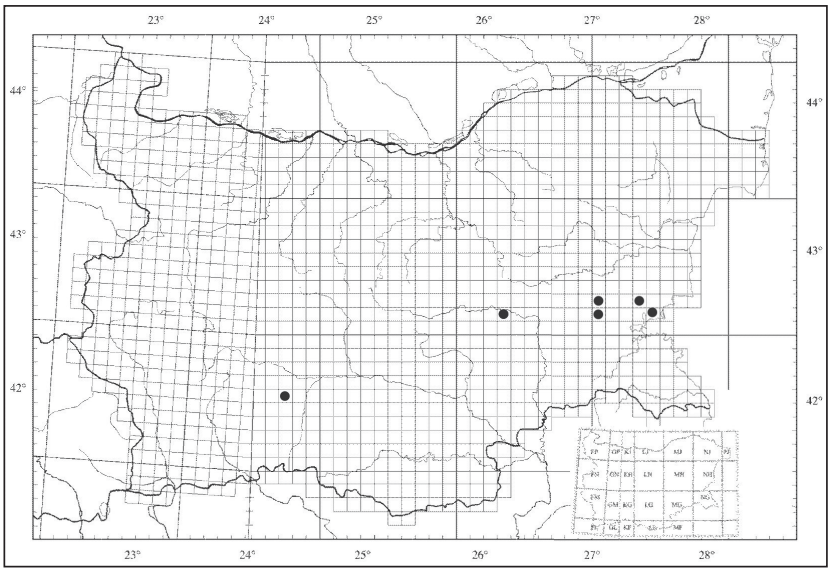

Fig. 1. Map of localities of the association *Poo bulbosae-Achilleetum pseudopectinatae* (with 10 × 10 km UTM grid).

Fig. 2. The association *Poo bulbosae-Achilleetum pseudopectinatae* in the locality near Laka village, Burgas district.

Assignment of the association to a higher syntaxonomical level

In the Table 1 not only therophytes and hemicryptophytes but also different phytosociological contingencies show more or less equivalent presence. According to the above-mentioned literature, the *Trifolion cherleri* alliance is represented by 12 species, the *Helianthemetalia guttati* order by 3 species and the class *Helianthemetea guttati* by 4 species. Thirteen species are referred to the order *Astragalo-Potentilletalia* and 20 to the class *Festuco-Brometea*. The alliance *Thero-Airion* and/or class *Koelerio-Corynephoretea* are represented by 28 species (separated or marked by asterisk in the Table).

The communities of *Poo bulbosae-Achilleetum pseudopectinatae* include a great number of therophyte species, and of species with a short vegetation period, e.g. *Poa bulbosa* that have diagnostic value for *Helianthemetea guttati*, *Koelerio-Corynephoretea* and *Poetea bulbosae*. Along with this, these stands show high presence of species of the class *Festuco-Brometea*.

Such species as *Trifolium arvense*, *Scleranthus perennis*, *Medicago minima*, *Arenaria leptoclados*, *Trifolium campestre*, *Logfia minina*, *Vulpia myuros,* etc.,

belong to the class *Koelerio-Corynephoretea* sensu lato, according to the researchers of Central Europe (Mucina 1997; Chytrý & Tichý 2003; Chytrý 2007; Jarolímek & Šibík 2008) and to the class *Helianthemetea guttati,* according to the phytosociologists from the West Mediterranean (Galán de Mera & al. 2000; Rivas-Martínez & al. 2002; Pérez Prieto & Font 2005). May be this is due to their wide acceptance as diagnostic for the *Thero-Airion* alliance, however different syntaxonomical schemes place the *Thero-Airion* into the *Koelerio-Corynephoretea* in Central Europe or into the *Helianthemetea guttati* in the West Mediterranean. On the other hand, *Trifolium arvense*, *Logfia minina* and *Vulpia myuros* have diagnostic value for the *Trifolion cherleri* alliance (Micevski 1970, 1977, 1978; Micevski & Matevski 1984).

Table 1. Table of the association *Poo bulbosae-Achilleetum pseudopectinatae* Sopotlieva, assoc. nov.

Life forms	Floristic elelements	Number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	Constancy
		altitude (m)	237	377	334	180	240	204	123	66	NA	NA	NA	NA	NA	
		exposition	S	W	W	NE	S	S	W	W	.	.	S	S	S	
		cover (%)	55	80	75	80	90	75	85	70	70	80	75	65	65	
		number of species	20	21	30	23	34	23	21	47	40	34	53	51	49	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		Characteristic for association														
Ch	bal	*Achillea pseudopectinata*	2a	3	3	2a	3	4	2a	2a	1	+	+	+	+	**V**
H	eur-as	*Poa bulbosa*	2b	2b	2a	2b	2a	2b	2b	3	1	+	1	1	+	**V**
Ch	submed	*Thymus striatus*	+	2a	1	1	3	+	3	+	+	+	+	2b	2b	**V**
		***Trifolion cherleri* Micevski 1970**														
Th	eur-sib	*Trifolium arvense**	+	+	+	2b	.	+	+	+	+	+	.	+	+	**V**
H	eur	*Erysimum diffusum**	.	.	.	.	+	.	.	+	+	+	+	+	+	**III**
Th	pont-med	*Petrorhagia prolifera*	.	.	+	+	+	+	+	+	.	.	.	.	.	**III**
H	eur-submed	*Rumex acetosella*	.	.	.	.	.	.	.	.	1	1	.	+	+	**II**
Th	med-as	*Vulpia ciliata**	.	.	.	.	.	.	.	.	+	+	.	+	+	**II**
Th	med	*Galium divaricatum**	.	.	.	.	.	.	.	.	1	+	.	+	+	**II**
Th	eur-as	*Taeniatherum caput-medusae*	.	.	.	+	+	.	.	+	.	.	.	.	.	**II**
Th	submed	*Silene subconica*	.	+	.	.	+	+	.	.	.	.	.	.	.	**II**
H	med	*Trifolium cherleri**	.	+	.	.	.	+	.	.	.	.	.	.	.	**I**
Th	eur-sib	*Logfia minima**	.	.	+	.	.	.	.	+	.	.	.	.	.	**I**
Th	med	*Aira elegantissima**	.	.	.	.	.	.	.	.	+	+	.	.	.	**I**
Th	subboreal	*Vulpia myurus**	.	.	.	.	.	+	.	.	.	.	.	.	.	**I**
		***Helianthemetalia guttati* Braun-Blanq. in Braun-Blanq., Molin. et Wagner 1940**														
Th	submed	*Helianthemum salicifolium*	.	.	.	.	1	.	+	.	.	.	+	+	+	**III**
Th	boreal	*Filago lutescens**	.	.	.	+	.	.	.	.	+	+	.	+	+	**II**
Th	submed	*Psilurus incurvus*	.	.	.	.	.	.	.	2m	2b	3	.	+	+	**II**
		***Helianthemetea guttati* (Braun-Blanq. in Braun.-Blanq., Roussine et Négre 1952) Rivas Goday et Rivas Mart. 1963 em. Rivas Mart. 1978**														
Th	eur-as	*Medicago minima**	.	.	.	.	1	.	.	2a	+	+	+	+	+	**III**
Th	eur-as	*Arenaria serpyllifolia* group*	.	+	.	.	+	.	.	+	+	+	.	+	+	**III**
Th	med-as	*Trifolium scabrum**	.	+	.	1	2m	.	.	1	.	.	.	.	.	**II**
Th	eur-med	*Trifolium campestre**	.	.	+	.	.	.	.	+	+	.	.	.	.	**II**

Table 1. Continuation.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	
		Astragalo-Potentilletallia **Micevski 1970**														
H	eur-as	*Astragalus onobrychis*	1	+	.	+	+	.	+	2a	+	+	+	+	+	**V**
H	eur-med	*Scleranthus perennis**	+	1	3	2a	.	.	1	.	+	+	.	+	+	**IV**
Th	submed	*Xeranthemum annuum*	.	.	.	r	.	+	.	.	+	+	+	+	+	**III**
Th	eur-med	*Medicago rigidula*	+	.	+	+	+	+	.	1	.	.	+	.	.	**III**
H	submed	*Euphorbia myrsinites*	+	.	.	r	1	.	.	.	.	.	+	+	+	**III**
Th	submed	*Bromus squarrosus*	.	.	.	.	+	.	+	.	+	+	+	.	.	**III**
Th	eur-as	*Aegilops triuncialis*	.	.	+	.	.	.	.	+	+	.	+	.	+	**III**
H	bal	*Hypericum rumeliacum*	.	.	.	.	.	.	+	.	+	+	+	+	+	**III**
Th	submed	*Anthemis ruthenica*	+	+	+	.	1	.	.	+	.	.	.	.	.	**II**
Th	pont-Cas	*Galium tenuissimum*	.	+	+	.	+	.	.	+	.	.	.	.	.	**II**
H	submed	*Potentilla laciniosa*	.	.	.	.	.	.	.	.	.	.	.	+	+	**I**
H	submed	*Dasypyrum villosum*	.	.	.	.	+	.	.	.	.	.	.	.	.	**I**
H	pont-med	*Petrorhagia illyrica*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
		Festucion valesiacae **Klika 1931,** ***Festuco-Brometea*** **Braun-Blanq. et Tüxen ex Soó 1947**														
H	smed-as	*Dichanthium ischaemum*	.	.	.	.	+	2b	+	+	1	+	3	3	3	**IV**
H	pont-med	*Teucrium polium*	+	.	.	.	+	+	+	.	+	+	1	1	1	**IV**
H	pont-med	*Eryngium campestre*	+	+	.	.	.	+	.	+	+	+	+	+	+	**IV**
H	pont	*Festuca valesiaca*	+	.	+	2a	+	.	.	2a	+	.	.	+	+	**IV**
Th	submed	*Sideritis montana*	.	.	.	.	.	.	+	.	+	.	+	+	+	**II**
H	eur-sib	*Chondrilla juncea*	.	.	+	.	.	r	.	.	+	.	.	.	+	**II**
H	bal	*Achillea clypeolata*	.	.	+	2a	.	.	.	+	.	.	.	.	.	**II**
H	pont	*Convolvulus cantabrica*	.	.	.	.	+	+	.	.	.	.	+	.	.	**II**
H	pont	*Asperula cynanchica*	.	.	.	.	.	.	.	.	.	.	+	+	+	**II**
H	pont	*Inula oculus-christi*	.	.	.	.	.	.	.	.	.	.	+	+	+	**II**
H	subboreal	*Sanguisorba minor*	.	.	.	.	.	.	.	.	+	+	.	+	.	**II**
H	pont-sib	*Linaria genistifolia*	.	.	.	.	.	r	+	.	.	.	.	.	.	**I**
H	pont-med	*Stipa capillata*	.	.	.	.	.	.	2a	+	.	.	.	.	.	**I**
H	pont-med	*Chrysopogon gryllus*	.	.	.	.	.	.	.	.	.	.	.	1	1	**I**
Ch	submed	*Ononis pusilla*	.	.	.	.	.	.	.	.	.	.	.	+	1	**I**
Th	eur-med	*Alyssum desertorum*	.	.	.	.	.	.	.	.	.	.	.	+	+	**I**
H	submed	*Achillea setacea*	.	+	.	.	.	.	.	.	.	.	.	.	.	**I**
H	submed	*Centaurea rhenana*	.	.	.	.	.	+	.	.	.	.	.	.	.	**I**
Th	eur-med	*Alyssum hirsutum*	.	.	.	.	.	.	.	2a	.	.	.	.	.	**I**
Ch	submed	*Thymus longicaulis*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
		Thero-Airion **Tüxen ex Oberd. 1957,** ***Koelerio-Corynephoretea*** **Klika in Klika et Novák 1941**														
H	pont-med	*Centaurea diffusa*	.	.	r	r	+	.	.	.	+	+	+	+	+	**IV**
H	cosm; temp	*Ceratodon purpureus*	1	1	+	+	.	.	1	.	.	.	.	.	.	**II**
Th	eur-as	*Holosteum umbellatum*	.	.	.	.	.	.	.	.	+	+	.	+	+	**II**
H	cosm; temp	*Syntrichia ruralis*	.	.	+	+	.	.	.	+	.	.	.	.	.	**II**
Th	pont	*Acinos arvensis*	.	.	.	.	.	.	.	.	.	.	+	+	.	**I**
Th	eur-as	*Herniaria glabra*	.	.	+	.	.	.	.	+	.	.	.	.	.	**I**
Th	eur-sib	*Veronica arvensis*	.	.	+	.	.	.	.	+	.	.	.	.	.	**I**
Th	subboreal	*Erodium cicutarium*	.	.	.	.	+	.	.	1	.	.	.	.	.	**I**

Table 1. Continuation.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	
Th	boreal	*Bromus tectorum*	.	.	.	.	+	.	.	+	.	.	.	.	.	**I**
H	subboreal	*Brachythecium albicans*	.	.	.	+	.	.	.	.	.	.	.	.	.	**I**
H	eur-med	*Sedum acre*	+	.	.	.	.	.	.	.	.	.	.	.	.	**I**
Th	eur-med	*Logfia arvensis*	.	.	.	.	+	.	.	.	.	.	.	.	.	**I**
Th	submed	*Bombycilaena erecta*	.	.	.	.	.	.	.	.	.	.	.	+	.	**I**
Th	subboreal	*Apera spica-venti*	.	.	+	.	.	.	.	.	.	.	.	.	.	**I**
		***Thero-Brachypodietea* Braun-Blanq. ex A. Bolòs et Vayr. 1950**														
Th	med-as	*Trachynia distachya*	.	.	.	.	.	.	.	.	1	2a	2b	+	.	**II**
		Other species														
H	cosm	*Plantago lanceolata*	.	+	.	+	.	.	.	+	+	+	+	.	.	**III**
Th	eur-as	*Crepis setosa*	+	.	+	.	+	+	.	+	.	.	.	.	.	**III**
H	eur-med	*Carduus nutans*	.	.	.	.	.	.	.	.	+	+	+	+	+	**II**
Th	med-as	*Althaea hirsuta*	.	.		.	.	.	.	.	+	+	+	+	+	**II**
H	subboreal	*Potentilla neglecta*	+	+	+	.	1	.	.	.	.	.	.	.	.	**II**
Th	subboreal	*Tragus racemosus*	.	.	.	.	+	.	+	1	.	.	+	.	.	**II**
H	eur-med	*Minuartia caespitosa*	1	.	.	.	+	.	+	1	.	.	.	.	.	**II**
Th	submed	*Nigella arvensis*	.	.	.	.	.	.	.	+	+	.	+	+	.	**II**
Th	pont	*Thymelaea passerina*	.	.	.	.	.	.	.	.	+	+	+	+	.	**II**
Th	pont-med	*Valerianella pumila*	.	.	.	.	.	.	.	.	+	+	.	+	+	**II**
H	cosm	*Cynodon dactylon*	.	+	.	.	.	.	.	.	+	+	.	.	+	**II**
H	bal	*Koeleria simonkaii*	2a	2a	.	.	.	.	+	.	.	.	.	.	.	**II**
Th	bal	*Centaurea caliacrae*	+	.	.	.	+	.	+	.	.	.	.	.	.	**II**
Th	submed	*Trigonella monspeliaca*	r	.	.	.	.	.	.	+	.	.	+	.	.	**II**
H	pont-med	*Ajuga chamaepitys*	.	.	.	.	.	.	.	.	+	+	.	+	.	**II**
H	bal-anat	*Onobrychis lasiostachya*	.	.	.	.	.	.	.	.	.	.	+	+	+	**II**
Th	med	*Sherardia arvensis*	.	.	.	.	.	.	.	.	+	+	+	.	.	**II**
H	bal-anat	*Scabiosa argentea*	.	.	.	.	.	.	.	.	.	.	+	+	+	**II**
Th	submed	*Euphorbia taurinensis*	.	.	.	.	.	.	.	.	.	.	+	+	+	**II**
Th	med	*Neatostema apulum*	.	.	.	.	.	.	.	.	.	.	+	+	+	**II**
Th	med	*Trifolium retusum*	.	+	+	.	.	.	.	.	.	.	.	.	.	**I**
Th	cosm	*Polygonum aviculare*	.	.	.	+	+	.	.	.	.	.	.	.	.	**I**
Th	eur-as	*Herniaria hirsuta*	.	.	.	.	+	+	.	.	.	.	.	.	.	**I**
K	eur-Nam	*Allium vineale*	.	.	+	r	.	.	.	.	.	.	.	.	.	**I**
H	pont	*Goniolimon collinum*	.	.	.	.	.	+	.	r	.	.	.	.	.	**I**
K	pont	*Allium flavum*	.	.	.	.	.	.	.	+	.	.	+	.	.	**I**
Th	eur-med	*Cerastium brachypetalum*	.	.	.	.	.	.	.	.	+	+	.	.	.	**I**
Ch	submed	*Dianthus gracilis*	.	.	.	.	.	.	.	.	.	.	+	+	.	**I**
H	pont	*Centaurea salonitana*	.	.	.	.	.	.	.	.	.	.	+	+	.	**I**
H	pont	*Dianthus pallens*	.	.	.	.	.	.	.	.	.	.	+	.	+	**I**
H	bal	*Astragalus spruneri*	.	.	.	.	.	.	.	.	.	.	.	+	+	**I**
Th	submed	*Carthamus lanatus*	.	.	.	.	.	.	.	.	.	.	.	+	+	**I**
Th	eur-med	*Crepis foetida* subsp. *comutata*	.	.	.	.	.	.	.	.	.	.	+	.	+	**I**
H	eur-as	*Potentilla inclinata*	.	.	.	.	.	+	.	.	.	.	.	.	.	**I**
H	pont	*Koeleria nitidula*	.	.	2a	.	.	.	.	.	.	.	.	.	.	**I**
Th	submed	*Trifolium pallidum*	.	.	+	.	.	.	.	.	.	.	.	.	.	**I**

Table 1. Continuation.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	
H	eur	*Carduus acanthoides*	.	.	+	.	.	.	.	.	.	.	.	.	.	**I**
H	bal-dac	*Verbascum banaticum*	.	.	1	.	.	.	.	.	.	.	.	.	.	**I**
Th	eur-as	*Tribulus terrestris*	.	.	+	.	.	.	.	.	.	.	.	.	.	**I**
Th	boreal	*Setaria viridis*	.	.	.	+	.	.	.	.	.	.	.	.	.	**I**
H	eur-as	*Phleum phleoides*	.	2a	.	.	.	.	.	.	.	.	.	.	.	**I**
Th	bal-anat	*Trifolium affine*	.	.	.	.	.	1	.	.	.	.	.	.	.	**I**
H	eur-submed	*Cleistogenes serotina*	.	.	.	.	.	+	.	.	.	.	.	.	.	**I**
H	pont-sib	*Dianthus roseoluteus*	.	.	.	.	+	.	.	.	.	.	.	.	.	**I**
K	pont-submed	*Allium moschatum*	.	.	.	.	.	.	1	.	.	.	.	.	.	**I**
H	med	*Sedum caespitosum*	.	.	.	.	.	.	.	1	.	.	.	.	.	**I**
K	pont-submed	*Ornithogalum umbellatum*	.	.	.	.	.	.	.	+	.	.	.	.	.	**I**
Th	adv	*Portulaca oleracea*	.	.	.	.	.	.	.	+	.	.	.	.	.	**I**
Th	cosm	*Capsella bursa-pastoris*	.	.	.	.	.	.	.	+	.	.	.	.	.	**I**
Th	eur-as	*Filago vulgaris*	.	.	.	.	.	.	.	+	.	.	.	.	.	**I**
Th	submed	*Velezia rigida*	.	.	.	.	.	.	.	+	.	.	.	.	.	**I**
H	med	*Potentilla pedata*	.	.	.	.	.	.	.	+	.	.	.	.	.	**I**
H		*Carduus candicans*	.	.	.	.	.	.	.	+	.	.	.	.	.	**I**
Th	eur-sib	*Polycnemum arvense*	.	.	.	.	.	.	.	+	.	.	.	.	.	**I**
H	eur-as	*Lolium perenne*	.	.	.	.	.	.	.	+	.	.	.	.	.	**I**
Th	med	*Echinaria capitata*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
H	pont	*Cleistogenes bulgarica*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
Th	submed	*Hippocrepis ciliata*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
H	submed	*Galium glaucum*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
H	pont-med	*Potentilla astracanica*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
Ch	bal	*Thymus longidentatus*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
H	pont	*Taraxacum serotinum*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
Th	submed	*Valerianella carinata*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
H	eur-med	*Echinops sphaerocephalus*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
Ch	submed	*Alyssum stribrnyi*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
K	eur-OT	*Allium rotundum*	.	.	.	.	.	.	.	.	.	.	+	.	.	**I**
H	submed	*Onobrychis alba*	.	.	.	.	.	.	.	.	.	.	.	+	.	**I**
H	eur-med	*Taraxacum sp.*	.	.	.	.	.	.	.	.	.	.	.	+	.	**I**
Th	submed	*Crupina vulgaris*	.	.	.	.	.	.	.	.	.	.	.	.	+	**I**
K	med	*Colchicum biebersteinii*	.	.	.	.	.	.	.	.	.	.	.	.	+	**I**
Th	submed	*Spergula pentandra*	.	.	.	.	.	.	.	.	.	.	.	.	+	**I**
H	eur-sib	*Salvia nutans*	.	.	.	.	.	.	.	.	.	.	.	.	+	**I**

Localities: 1. Malak Topchii Hill, between Karnobat and Detelina, Burgas distr., 42.60678°N, 27.00423°E, 11.07.2005; **2.** Shumnatoto Kale loc., between villages Dragovo and Chukarka, Burgas distr., 42.64509°N, 27.09980°E, 13.07.2005; **3.** E of Dragovo village, Burgas distr., 42.69102°N, 27.44451°E, 21.07.2005; **4.** Between villages Sadievo and Dryankovets, Burgas distr., 42.67654°N, 27.32114°E, 22.07.2005; **5.** Malak Topchii Hill, between Karnobat and Detelina, Burgas distr., 42.60638°N, 27.00507°E, 11.07.2005; **6.** N of Konyovo village, Sliven distr., 42.55244°N, 26.16498°E, 19.07.2004; **7.** N of Vratitsa village, Burgas distr., 42.59851°N, 27.17150°E, 11.07.2005; **8.** E of Laka village, Burgas distr., 42.37127°N, 27.31388°E, 17.06.2008; **9.** Kuru Cheshma loc., Kapitan Dimitrievo village, Pazardzhik distr., Stanev 1977, table 2, column 5; **10.** Garvanitsa loc., Kapitan Dimitrievo village, Pazardzhik distr., Stanev 1977, table 2, column 6; **11.** Kutela loc., Besapar Hills, Pazardzhik distr., Stanev 1980, table 1, column 11; **12.** Merite loc., Besapar Hills, Pazardzhik distr., Stanev 1980, table 2, column 6; **13.** Mileviya Gaber loc., Besapar Hills, Pazardzhik distr., Stanev 1980, table 2, column 7;

* species with diagnostic value to *Thero-Airion* and/or *Koelerio-Corynephoretea*

The association is characterized by the diagnostic combination of *Achillea pseudopectinata, Poa bulbosa* and *Thymus striatus*. *Achillea pseudopectinata* is distributed on the Balkan Peninsula (including southeastern Romania, Nedelcheva 1997). On the basis of its morphological and phytochemical characteristics this species is well differentiated from the other species of the genus (Nedelcheva 1997). *Achillea pseudopectinata,* along with *A. ochroleuca* recently found in Bulgaria (Nedelcheva & Tzonev 2006), represent the *A. ochroleuca* group in the country (Saukel & al. 2003). There are contradictory data on the distribution of *Achillea pseudopectinata* in Bulgaria. Assyov & al. (2002) mentioned it for the lowland regions of South Bulgaria, up to 1000 m. According to Nedelcheva (1997), it occurs in rocky, open and sunny stony spots, less frequently also in grassy and shrubby places in forests, in the plains and mountains, mainly on limestone, scattered across the country. The latter statement is reported to be supported by the herbarium vouchers from the major Bulgarian herbaria (SO, SOM, SOA) and her personal collections. However, my observations correspond to opinion of Stanev (1977, 1980), who characterized the species as an "obligate calcifuge".

Poa bulbosa is distributed in Europe, West and Central Asia, Siberia, North Africa, and the Canary Islands (Kitanov & Penev 1963). Its communities are related to the ephemeral vegetation, and their formation is by overgrazing and trampling by cattle (Ganchev & al. 1964; Galán de Mera & al. 2000). Syntaxonomically, the communities with its participation are referred to different classes. In the Balkans, Micevski (1977, 1978) listed *Poa bulbosa* as a *Festuco-Brometea* species. According to Mucina (1997), the species has diagnostic value for the classes *Koelerio-Corynephoretea* Klika in Klika et Novák 1941 and *Thero-Brachypodietea* Braun-Blanq. ex A. Bolòs et Vayr. 1950. In the Mediterranean, its communities have been referred to the class *Poetea bulbosae* Rivas Goday et Rivas Mart. in Rivas Mart.1978 (Rivas-Martínez & al. 2001). Some contemporary studies on European scale include the class *Poetea bulbosae* into *Thero-Brachypodietea* (along with the class *Helianthemetea guttati*, Mucina 1997). Rodwell & al. (2002) maintain a similar opinion and refer it as an order to the class *Helianthemetea guttati*. However, these views are rejected by the authors from the Western Mediterranean, who differentiate *Poetea bulbosae* as a pastureland class, with perennial grasses subjected to anthropozoogenic impact, while *Helianthemetea guttati* is regarded as a pastureland class formed generally by annual species, with preference for poorly developed lithosols, with low content of nutrients (Galán de Mera & al. 2000).

Thymus striatus is a species widely distributed in Bulgaria, growing in dry, sunny, stony and grassy spots (Kozhuharov 1992). In the Straldzha-Aytos region it occurs in all identified associations of xerophilous grasslands, both of the class *Festuco-Brometea*, and of the classes *Helianthemetea guttati* and *Koelerio-Corynephoretea* (Sopotlieva 2008). Stanev (1977, 1980) described it as a "typical calcifuge", but in literature (e.g. Velchev 1962) its own communities or communities with its participation have been described from calcareous sites. Mucina (1997) listed it as diagnostic for the class *Festuco-Brometea*.

The features of the *Poo bulbosae-Achilleetum pseudopectinatae* association described above suggest that it has affiliations to different classes/alliances of European graslands. The phytogeographic position of Bulgaria and some parts of the Southeast Balkans predetermines the presence of Central European as well as Mediterranean floristic elements, and consequently of corresponding vegetation types (cf. Bohn & al. 2003). Thus some homogenous plant communities, especially dry grasslands distributed in this region of Southeast Europe, have transitional character among different European classes.

In the author's opinion, *Poo bulbosae-Achilleetum pseudopectinatae* should be related to the alliance *Trifolion cherleri*. This alliance includes silicicolous swards of Submediterranean distribution, rich in therophytes (Rodwell & al. 2002). *Trifolion cherleri* alliance is distributed in Macedonia and North Greece (Rodwell & al. 2002) and was recently recorded in Bulgaria where it is represented by one association (Sopotlieva & Apostolova 2007). Affiliation of *Trifolion cherleri* to higher syntaxa is still questionable. When it was described, it was assigned to the order *Astragalo-Potentilletalia* Micevski 1970, without any decision about its affiliation to a class (Micevski 1970). In later publications (e.g. Micevski 1977, 1978; Micevski & Matevski 1984), the alliance and the order were assigned to the *Festuco-Brometea* class. Thus, despite the high frequency of therophytes, the hemicryptophytes have also significant presence in the communities of this alliance, and oc-

casionally are the dominant. On the other hand, the communities with chamaephytes as diagnostic and/or dominant species (for example *Cistus incanus* in ass. *Diantho-Cistetum incani* Micevski et Matevski 1984) are also classified into this alliance.

According to the current syntaxonomical classification of European vegetation (Rodwell & al. 2002), *Trifolion cherleri* belongs to the *Helianthemetalia guttati* order and *Helianthemetea guttati* class. However, Rivas-Martínez & al. (2002) describe the class *Helianthemetea guttati* as "Pioneer spring and early summer ephemeral plant communities dominated by non- nitrophilous annual short herbs and grasses, thermo to lower oromediterranean xeric and pluviseasonal, also wide spread in thermo to supratemperate in Mediterranean Region, but found only in dry or initial soils inside the Eurosiberian Region, mostly in submediterranean or steppic territories". Thus, despite the significant presence of therophytes in the communities of *Trifolion cherleri,* their assignement to the *Helianthemetea guttati* is still controversial.

The solution of this phytosociological problem concerning the syntaxonomical position of *Trifolion cherleri* is still open. A correct decision would need an analysis of a large data set across the region of its distribution in the Balkans and a comparison with the European data.

Therefore the syntaxonomical scheme proposed here could be regarded only as a hypothesis. The association *Poo bulbosae-Achilleetum pseudopectinatae* matches better *Trifolion cherleri*. For affiliation of the alliance to higher syntaxa, the latest overall classification scheme for European vegetation (Rodwell & al. 2002) is accepted.

Class ***Helianthemetea guttati*** (Braun-Blanq. in Braun.-Blanq., Roussine et Nègre 1952) Rivas Goday et Rivas Mart. 1963 em. Rivas Mart. 1978

Order *Helianthemetalia guttati* Braun-Blanq. in Braun-Blanq., Molin. et Wagner 1940

Alliance *Trifolion cherleri* Micevski 1970

Assoc. *Poo bulbosae-Achilleetum pseudopectinatae* Sopotlieva, **assoc. nov.**

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