

***Allio carinatae-Sedetum albae* Hasanbeg. 2024. comb. nova, new association in Miljacka canyon**

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ABSTRACT: A new association in the Miljacka canyon, *Allio carinatae-Sedetum albae* Hasanbeg. 2024. comb. nova, is described in this paper. The Braun-Blanquet method is phytocoenological approach used with the following parameters: life form, indicator value, phytocoenological affiliation, and floristic element. The research was conducted from 2022 to 2024. To determine the altitude, a GPS device "MagelaneXplorist" was used, and the slope of terrain was measured with the clinometer "Recta DP 6 Global". The most characteristic plant of this community is *Sedum album* L. Other significant species include: *Allium carinatum* L., *Silene vulgaris* (Mch) Gar., *Melica ciliata* L., *Chondrilla juncea* L., *Stipa calamagrostis* (L.) Wahlenb, and others. A total of 55 species have been recorded. In terms of indicator value, representatives of primary vegetation prevail. The most numerous phytocoenological order is *Amphoricarpetalia*. Hemicryptophyte are most numerous life form, the most individual floral element is smed, and the group is sub-Mediterranean. The total number of groups of floral elements is 13, and the number of individual floral elements is 44. In the association, the endemic species of Dinaridi-*Erysimum lineariifolium* Tausch was recorded, which should be further studied floristically. The aim of the work is to contribute to a better understanding of this canyon.

Keywords: canyon, Miljacka, association, rocks, Bentbaša

INTRODUCTION

For many endangered, rare and endemic species, canyons are natural refuges. Therefore, they are very interesting for various botanical studies. Apart from the Drina (Lakušić & Redžić, 1989) and Una canyon (Lakušić & Redžić, 1991) these natural refuges are largely unexplored. The Miljacka canyon can be said to be fairly well researched from a botanical perspective. On the other hand, phytocoenologically, this canyon is not sufficiently studied, and there are only a few studies available (Redžić, 1991; 1997 a, b), Hasanbegović (2018, 2020 a, b; 2022, a, b; and 2024). This canyon, in terms of geological age, belongs to the Mesozoic period and regarding tectonics, it is in the transitional zone (Čičić, 1984). The soil is lithosol and partially calcomelanosol. The aim of this paper is to contribute to a better understanding of this canyon.

MATERIAL AND METHODS OF RESEARCH

During the phytocoenological research of the Miljacka canyon, which lasted from 2022 to 2024, a large number of field studies were conducted across all vegetation aspects and a new association was identified in this area. A survey was carried out according to the Braun-Blanquet method (Braun-Blanquet, 1932). The size of each survey plot is 100m². All other parameters were also included: abundance and coverage, phytocoenological affiliation, life form, floristic element and indicator values. To determine the altitude, a GPS

device "MagelaneXplorist 500" was used, and the slope of terrain was measured with a clinometer "Recta DP 6 Global". The study area is located in the immediate vicinity of Dariva and within the "Bentbaša" protected area (Map 1).

Nomenclature

The following general literature was used in this study for the identification of plants: Aichele & Schwegler (1998), Beck-Mannagetta (1903-1923; 1927), Beck-Mannagetta et al. (1950; 1967; 1974; 1983), Čanak et al. (1978), Domac (1984), Horvatić (1954), Josifović et al. (1970-77), Kojić (1981), Kvakan (1952), Šarić (1991), Šilić (1990, 2002, 2005) and Šoštarić-Pisačić & Kovačević (1968). Specialised keys consulted for following genus: for *Acinos* and *Micromeria* Šilić (1979) and for *Allium* Radić (1989). Floral elements and life forms were taken from Raunkiaer (1937), Lakušić & Redžić (1989; 1991), Oberdorfer (2001) and Redžić (1988). Phytocoenological affiliation was taken from: Horvat et al. (1974), Lakušić (1989), Lakušić & Redžić (1989, 1991), Oberdorfer (1979) and Redžić (1988). Indicator values were taken from: Lakušić & Redžić (1989; 1991), Pavlović-Muratspahić (1995) and Redžić (1988).

Map 1. Position of researched asociacion of the "Bentbaša" protected area (Map taken from Đug et al. 2008)

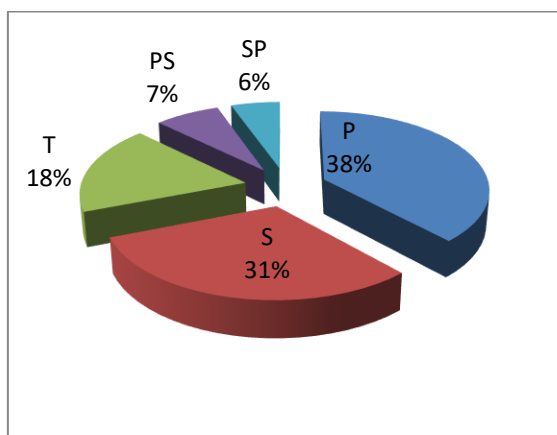


RESULTS AND DISCUSSION

The association *Allio carinatae-Sedetum albae* Hasanbeg. 2024. comb. nova develops on the rocks the Mijacka Canyon near Dariva. It is surrounded by a forest association of the order *Quercetalia pubescentis* and is partially sunlit. In total, 55 species have been recorded. The most characteristic plant of this association is *Sedum album* L., which covers large areas. Other significant species are: *Allium carinatum* L., *Silene vulgaris* (Mch) Gar., *Melica ciliata* L., *Chondrilla juncea* L., *Stipa calamagrostis* (L.) Wahlenb., and others. As the association borders the forest ecosystem, the number of species in this association is also large: *Fraxinus ornus*, *Syringa vulgaris*, *Smymium perfoliatum*, *Inula conyza*, *Arabis turrita* and others. Very interesting is also the reduced abundance of some widely distributed species in this canyon, such as: *Micromeria thymifolia*, *Ceterach officinarum*, and *Erysimum linearifolium*, as well as the complete absence of equally common species in this canyon: *Thymus jankae*, *Sesleria ujhelyii*, *Minuartia bosniaca*, *Asplenium trichomanes*, *Sedum ochroleucum*, *Leontodon crispus* and others. Among the indicator values, representatives of the primary vegetation prevail, although members of the secondary vegetation also have

high values (Graph 1). The most numerous phytocoenological order is *Amphoricarpetalia* and representatives of the following orders are also numerous: *Chenopodietalia*, *Scorzonero-Chrysopogonetalia*, *Quercetalia pubescentis* and *Brometalia erecti* (Graph 2). Hemicryptophytes are the most numerous life form (Table 3), and the most numerous individual floristic element is smed, while the most common group is sub-Mediterranean. The total number of floristic element groups is 13, and the number of individual floristic elements is 44. It should be emphasized that an endemic species of the Dinarides, *Erysimum linariifolium* Tausch, has been recorded in the association (Šoljan, 2023) which currently has no official status, and additional research is needed to assign this species an appropriate status. Additionally, a species listed in the "List of Plant Species (Pteridophyta and Spermatophyta) for the Red Book of Bosnia and Herzegovina" (Šilić, 1996) has been recorded: *Micromeria thymifolia* (Scop.) Fritsch with status of a rare species (R).

Graph 1. Ratio of indicator values in *Allio carinatae-Sedetum albae* Hasanbeg. 2024. comb. nova. association



Graph 2. Phytocoenological affiliation in the *Allio carinatae-Sedetum albae* Hasanbeg. 2024. comb. nova. association

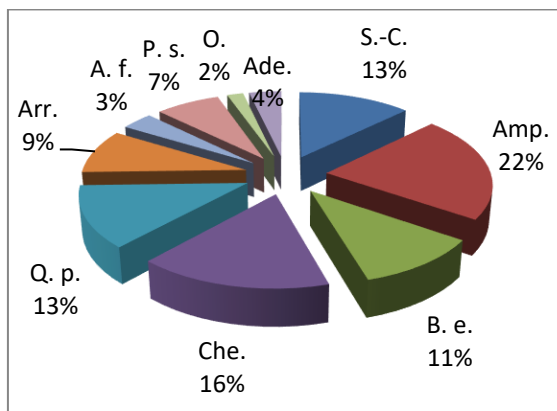


Figure 1. Part of the researched association ©Anis Hasanbegović



Table 1. Floral elements of the *Allio carinatae-Sedetum albae* Hasanbeg. 2024. comb. nova. association

Floral elements	Number of species	Σ	Σ %
balc	2	3	5.45
s. o. balc	1		
s. o. eur	1	1	1.81
alp-pralp-smed	1	1	1.81
wpralp	1		
w(pralp)	1	3	5.45
pralp-smed	1		
smed	6		
(pralp)smed-subatl	1		
(med)smed-subatl	1		
osmed	2		
osmed-gemässkont	2		
smed-subatl	1		
smed-subatl(circ)	1	20	36.36
smed-euras	1		
smed(-euras)	1		
smed-eurassubozean	1		
o(smed)	1		
(o)smed	1		
submed(-subatl)	1		
omed-kont	1		
med(-kont)	1		
med	1	5	9.09
med-smed-kont	1		
med-smed(-subatl)	1		
subatl-smed	2	2	3.63
euras(kont)(-smed)	1		
euras(subozean)	1		
euras(subozean)-smed	1		

Floral elements	Number of species	Σ	$\Sigma \%$
euras-smed	1	7	12.72
euras-smed,circ	1		
euras-med	1		
(no-)euras-smed	1		
no-euras-med	1	3	5.45
no-euras-smed	1		
no-euras(subocean)	1		
eurassubocean	1	4	7.27
eurassubocean-smed	2		
(no-)eurassubocean(-smed)	1		
s. o. kont	1	2	3.63
europkont	1		
gemässkont-osmed	2	2	3.63
s. w. asien	1	2	3.63
china	1		
Total number of floral elements groups: 13			
Total number of individual groups of floral elements: 44			
Total:	55	55	100

Table 2. Life forms of the *Allio carinatae-Sedetum albae* Hasanbeg. 2024. comb. nova. association

Life forms	Total number	Σ	%	$\Sigma \%$
H	22		40	
H(Ch)	3		5.45	
H(T)	2		3.63	
H(G)	1		1.81	
		28		50.90
T	7		12.72	
T(Ch)	2		3.63	
		9		16.36
Ch	7		12.72	
Ch(P)	1		1.81	
		8		14.54
P	8		14.54	
		8		14.54
G	2		3.63	
		2		3.63
Total:	55	55	100	100

Table 3. Phytocoenological composition of the researched association *Allio carinatae-Sedetum albae* Hasanbeg. 2024. comb. nova

F i a n d v i a c l a u t e o s r s	I n d v i a c l a u t e o s r s	Associations	<i>Allio carinatae-Sedetum albae</i> Hasanbeg. 2024 comb. nova											
		Locality	Kanyon Miljacke, Darive-north side											
		Altitude (m)	543	545	550	554	555	544	545	543	550	551	550	555
		Exposition	E-SE	E-SE	E-SE	E-SE	E-SE	E	E	E	E	S-SE	S-SE	N-NE
		Slope (°)	80	70-80	50-60	50	40-50	80	80-90	90	80-90	90	80-90	90
		Geological base	Limestone and dolomitized limestone											
		Type of soil	Lithosol and calcomelanosol											
		Image size (m ²)	100 m ²											
		General cover (%)	20	40-50	30-40	50	50-60	40	40-50	40	40-50	40-50	30	20
		Date	Maj 11, 2024.											
		Ordinal image number	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
		Floristic composition												
S.-C.	S	<i>Sedum album</i> L.	2.2	2.2	+2	2.2	+2	+2	1.1	2.2	1.1	2.2	1.1	
B. e.	S	<i>Silene vulgaris</i> (Mch) Garcke	1.1	1.1	+2	1.1	1.1	1.1	+2	+2	+2	1.1	+2	
Amp.	P	<i>Melica ciliata</i> L.	1.1	1.1	-	+2	-	-	+2	1.1	+2	+2	-	
Amp.	P	<i>Stipa calamagrostis</i> (L.) Wahlenb.	1.1	1.1	+2	+2	-	-	-	-	+2	+2	1.1	
Amp.	P	<i>Allium carinatum</i> L.	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	
Q. p.	P	<i>Coronilla emerus</i> L. ssp. <i>emeroides</i> (Boiss. et Spr.) Hayek	+2	-	+2	+2	1.1	-	+2	+2	-	+2	+1	
Amp.	P	<i>Chondrilla juncea</i> L.	+2	-	+2	-	-	+2	+2	-	-	+1	+1	
P. s.	PS	<i>Clematis vitalba</i> L.	+2	+2	-	-	+1	-	+1	+2	-	+2	-	
Amp.	P	<i>Galium corrudaefolium</i> Tausch	+2	+2	+2	+2	+2	-	-	-	-	-	-	
Q. p.	P	<i>Syringa vulgaris</i> L.	+2	+2	-	+2	-	-	-	-	+1	-	-	
Amp.	P	<i>Asplenium ruta muraria</i> L.	+2	+2	-	-	-	-	1.1	-	-	+2	-	
Ade.	SP	<i>Arabis glabra</i> (L.) Bernh.	+2	+2	-	-	+1	-	+2	-	-	-	-	
Che.	T	<i>Geranium dissectum</i> Jusl.	+2	+2	-	-	+1	-	-	-	-	-	-	
Ade.	SP	<i>Myrrhis odorata</i> (L.) Scop.	+2	-	-	+1	+1	-	-	-	-	-	-	
Arr.	S	<i>Vicia sepium</i> L.	+2	+2	-	-	+1	-	-	-	-	-	-	
Q. p.	P	<i>Smyrniium perforatum</i> L.	+2	+1	-	-	-	-	-	-	-	-	-	

B. e.	SP	<i>Hypericum perforatum</i> L.	+2	-	-	-	-	-	-	-	+1	+1	-
A. f.	P	<i>Arabis hirsuta</i> (L.) Scop.	+2	-	-	-	+2	-	-	-	-	-	-
Arr.	S	<i>Poa trivialis</i> L.	+2	-	-	-	-	-	-	-	-	-	-
Che.	T	<i>Stellaria media</i> L.	+2	-	-	-	-	-	-	-	-	-	-
P. s.	PS	<i>Rosa canina</i> L.	+1	+1	+1	+1	+1	-	-	-	-	-	-
Q. p.	P	<i>Fraxinus ornus</i> L.	+1	-	-	-	-	+1	-	+1	-	-	-
Q. p.	P	<i>Hedera helix</i> L.	+1	-	-	-	-	-	-	-	-	-	-
S.-C.	S	<i>Tunica saxifraga</i> (L.) Scop.	-	1.1	1.1	-	-	1.1	1.1	2.2	-	-	-
B. e.	S	<i>Bromus erectus</i> Huds.	-	1.1	+2	-	-	-	-	-	-	-	-
S.-C.	S	<i>Sedum acre</i> L.	-	+2	+2	-	+2	+2	-	+2	-	1.1	-
S.-C.	S	<i>Centaurea rhenana</i> Borb.	-	+2	-	-	-	+1	+1	+2	+2	-	-
Che.	T	<i>Ailanthus glandulosa</i> Desf.	-	+2	-	-	+1	+1	-	-	-	-	-
B. e.	S	<i>Medicago lupulina</i> L.	-	+2	-	-	-	-	+1	-	-	+2	-
Arr.	S	<i>Poa vivipara</i> L.	-	+2	+2	-	-	-	-	-	-	-	-
O.	T	<i>Verbascum phlomoides</i> L.	-	+2	-	-	-	-	-	-	-	-	-
Arr.	S	<i>Vicia tetrasperma</i> (L.) Schreb.	-	+1	-	-	-	-	-	-	-	-	-
Che.	T	<i>Veronica persica</i> Poir.	-	+1	-	-	-	-	-	-	-	-	-
Che.	T	<i>Bromus sterilis</i> L.	-	-	+2	+2	-	-	-	-	-	-	-
Q. p.	P	<i>Arabis turrita</i> L.	-	-	+2	-	-	-	-	-	-	-	+2
P. s.	PS	<i>Ligustrum vulgare</i> L.	-	-	-	+2	+2	-	-	-	-	-	-
Amp.	P	<i>Sedum sexangulare</i> L.	-	-	-	-	+2	+2	-	1.1	-	-	-
Che.	T	<i>Ballota nigra</i> L.	-	-	-	-	+2	-	-	-	-	-	-
Q. p.	P	<i>Inula conyza</i> DC.	-	-	-	-	+1	-	-	-	-	-	+2
Che.	T	<i>Chelidonium majus</i> L.	-	-	-	-	+1	-	-	-	-	-	-
Amp.	P	<i>Sedum dasyphyllum</i> L.	-	-	-	-	-	+2	+2	-	+2	+2	+2
S.-C.	S	<i>Acinos arvensis</i> (Lam.) Dandy	-	-	-	-	-	+1	-	-	-	-	-
P. s.	PS	<i>Crataegus monogyna</i> Jacq.	-	-	-	-	-	+1	-	-	-	-	-
S.-C.	S	<i>Galium purpureum</i> L.	-	-	-	-	-	-	+2	1.1	-	+2	-

A. f.	P	<i>Scrophularia canina</i> L.	-	-	-	-	-	-	-	1.1	+2	-	-
S.-C.	S	<i>Acinos hungaricus</i> Simonkai	-	-	-	-	-	-	-	+2	+2	+2	-
B. e.	S	<i>Sanguisorba muricata</i> (Spach.) Focke	-	-	-	-	-	-	-	+2	-	-	+1
B. e.	S	<i>Potentilla recta</i> L.	-	-	-	-	-	-	-	+1	-	+2	-
Che.	T	<i>Papaver rhoeas</i> L.	-	-	-	-	-	-	-	+1	-	-	-
Amp.	P	<i>Erysimum linearifolium</i> Tausch	-	-	-	-	-	-	-	-	+2	1.1	-
Amp.	P	<i>Ceterach officinarum</i> DC.	-	-	-	-	-	-	-	-	+2	-	-
Arr.	S	<i>Lolium perenne</i> L.	-	-	-	-	-	-	-	-	-	-	-
Che.	T	<i>Calystegia sepium</i> L.	-	-	-	-	-	-	-	-	-	-	+1
Amp.	P	<i>Sedum maximum</i> (L.) Hoffm.	-	-	-	-	-	-	-	-	-	-	-
Amp.	P	<i>Micromeria thymifolia</i> (Scop.) Fritsch	-	-	-	-	-	-	-	-	-	-	-

CONCLUSIONS

The *Allio carinatae-Sedetum albae* Hasanbeg. 2024. comb. nova association develops on the rocks Miljacka Canyon near Dariva. The most characteristic plant of this association is *Sedum album* L. Other significant species include *Allium carinatum* L., *Silene vulgaris* (Mch) Gar., *Melica ciliata* L., *Chondrilla juncea* L., *Stipa calamagrostis* (L.) Wahlenb., and others. A total of 55 species were recorded. Primary species are dominant in the studied association. The largest number of species in studied association belong to the phytocoenological order *Amphoricarpetalia*. Hemicryptophyte represent the most numerous life forms. The most significant floral element is smed and the most significant group is sub-Mediterranean. Total number of groups of floral elements is 13, and the total number of individual elements is 44. In the association, the endemic species from Dinaridi-*Erysimum linariifolium* Tausch was recorded, which currently has no status, so further research is needed to assign an appropriate status to this species.

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ABBREVIATIONS

Abbreviations of phytocenological affiliations:

Amp.-*Amphoricarpetalia*, Q. p.-*Quercetalia pubescentis*, Arr.-*Arrhenatheretalia*, B. e.-*Brometalia erectii*, P. s.-*Prunetalia spinosae*, S.-C.-*Scorzonero-Chrysopogonetalia*, Che.-*Chenopodietalia*, A. f.-*Arabidetalia flavescens*, Ade-*Adenostyletalia*, O-*Onopordetalia*.

Abbreviations of life forms:

P-*phanerophyta*, H-*hemicryptophyta*, Ch-*chamaephyta*, G-*geophyta*, T-*therophyta*

Abbreviations of indicator values:

P-primary, PS-primary-secondary, S-secondary, SP-secondary-primary, T-tertiary

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