

# Contribution to the syntaxonomy of plant communities with insular endemic species of genus *Brassica* (southern Croatia)

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**Key words:** coastal plant communities, distribution, eastern Adriatic, NE Mediterranean, small islands, vegetation diversity.

**Ključne besede:** obalne rastlinske združbe, razširjenost, vzhodni Jadran, SV Sredozemlje, majhni otoki, raznolikost vegetacije.

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## Abstract

Communities with constant presence of two insular endemic species of genus *Brassica* (*B. cazzae* Ginzb. et Teyber, *B. mollis* Vis.) were studied on the small south-eastern Adriatic islands and islets (South Croatia), following the Braun-Blanquet approach. From a total of 51 phytosociological relevés, mostly collected in the period from 2020 and 2022, eight associations and three subassociations belonging to seven alliances and six classes were identified. *Brassica cazzae* and *B. mollis* occur in a variety of habitat types (i) in bare or very shallow soils on which halophilous and halotolerant communities of the *Limonion anfracti-cancellati* and *Anthyllidion barbae-jovis* mostly thrive, (ii) on rocky crevices and cliffs with rupicolous chasmophytic vegetation of the *Centaureo cuspidatae-Portenschlagiellion ramosissimae*, (iii) within woody vegetation of the *Pistacio lentisci-Pinion halepensis*, maquis of the *Oleo-Ceratonion siliquae* and garrigues of the *Cisto cretici-Ericion manipuliflorae*, and (iv) grasslands of the *Chrysopogono grylli-Koelerion splendidis*. Two associations (*Plantagino holostei-Limonietum cazzae*, *Brassicum mollis-Anthyllidetum barbae-jovis*) and one subassociation (*Centaureetum ragusinae limonietosum cazzae*) are described for the first time.

## Izvešček

Preučevali smo združbe s stalno prisotnostjo dveh otoških endemičnih vrst iz rodu *Brassica* (*B. cazzae* Ginzb. et Teyber, *B. mollis* Vis.) na majhnih otokih in otočkih v jugovzhodnem Jadranu z Braun-Blanquetovo metodo. V obdobju med 2020 in 2022 smo naredili 51 fitocenoloških popisov in jih uvrstili v osem asociacij in tri subasociacije, ki pripadajo sedmim zvezam in šestim razredom. *Brassica cazzae* in *B. mollis* se pojavljata v različnih habitatnih tipih (i) na golih ali zelo plitvih tleh, kjer pogosto uspevajo slanoljubne in slanotolerantne združbe zvez *Limonion anfracti-cancellati* in *Anthyllidion barbae-jovis*, (ii) v skalnih razpokah in na klifih s hazmofitsko vegetacijo sten zveze *Centaureo cuspidatae-Portenschlagiellion ramosissimae*, (iii) v gozdni vegetaciji zveze *Pistacio lentisci-Pinion halepensis*, v makiji zveze *Oleo-Ceratonion siliquae*, v garigi zveze *Cisto cretici-Ericion manipuliflorae* in (iv) na travščih zveze *Chrysopogono grylli-Koelerion splendidis*. Dve asociaciji (*Plantagino holostei-Limonietum cazzae*, *Brassicum mollis-Anthyllidetum barbae-jovis*) in ena subasociacija (*Centaureetum ragusinae limonietosum cazzae*) so opisane prvič.

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## Introduction

The genus *Brassica* L. includes about 40 taxa, distributed mainly in the Mediterranean region, southwestern Europe and north-western Africa. Alongside the indigenous taxa, the genus includes the cultivated varieties, and oil-seeds as well as their products of great importance in the global economy.

According to Nikolić et al. (2015), and Nikolić (2022) twenty-four *Brassica* taxa occur in Croatia, three of which are insular endemics: (i) *Brassica botteri* Vis. (endemic to the Palagruža Archipelago), (ii) *B. cazzae* Ginzb. et Teyber (endemic of the Middle Adriatic islands Vis, Kamik, Svetac and Sušac), and (iii) *B. mollis* Vis. (endemic of the southern Adriatic islands and islets of the Dubrovnik Region). This recent taxonomic point of view is adopted in the present study, although some authors consider the above-mentioned endemic species as wild taxa closely related to *Brassica oleracea* L., and mostly ascribed to *B. incana* Ten. (e.g., Raimondo et al., 1991; Heywood & Zohary, 1995, Euro+Med, 2006+, etc.).

The salt-sprayed vegetation of the low rocky coasts of the eastern Adriatic islands has been widely explored and a lot of data have been published to date (e.g., Trinajstić, 1975, 1980, 1995; Pavletić, 1983, 1992; Terzi et al., 2020, etc.). Additionally, plant communities colonizing the vertical coastal cliffs of these islands have been adequately studied (e.g., Rac & Lovrić, 2002; Lovrić & Rac, 2003). However, no detailed phytosociological data on the vegetation of insular endemics of genus *Brassica* is so far available. This knowledge, which until now is lacking, is essential to habitat description, assessing and monitoring of their quality, searching for new localities

of endangered plant communities, re-establishment of them, and the evaluation of management effects of protected habitats/species.

The aim of the present study is the phytosociological description, syntaxonomic assignment and assessment of the ecological relevance of plant communities characterized by the constant presence of the endemics *B. mollis* and *B. cazzae* on the eastern Adriatic islands and islets.

## Material and methods

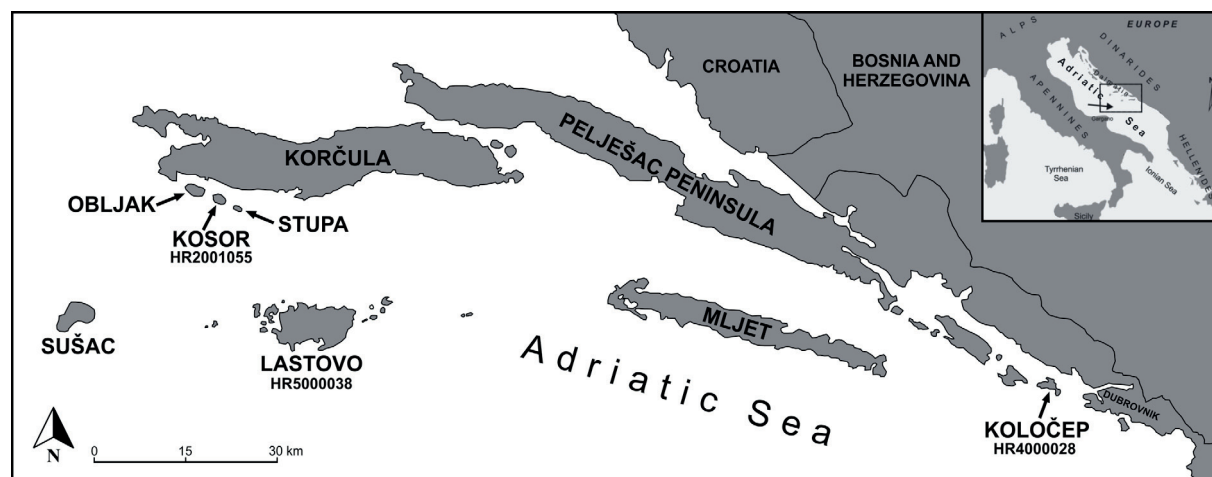
### Study area

The study area includes some small islands of the eastern Adriatic coast (southern Croatia): (i) the island of Koločep (2.44 km<sup>2</sup>) near the city of Dubrovnik; (ii) three small islets (Kosor 0.05 km<sup>2</sup>, Obljak 0.03 km<sup>2</sup> and Stupa 0.02 km<sup>2</sup>) adjacent to the southern coast of the island of Korčula (Korčula Archipelago); and (iii) the island of Sušac (4.02 km<sup>2</sup>) (Figure 1, Table 1).

**Table 1:** Geographic and geological features of the islands and islets studied in the southern Croatia.

**Tabela 1:** Geografske in geološke značilnosti otokov in otočkov na južnem Hrvaškem.

Island / Islet	Geology period	Surface area (km <sup>2</sup> )	Coastline length (km)	Altitude (m a.s.l.)
Sušac	Jurassic	4.02	16.8	239
Koločep	Upper Cretaceous	2.44	12.8	125
Kosor	Upper Cretaceous	0.05	1.244	13
Obljak	Upper Cretaceous	0.03	0.645	43
Stupa	Upper Cretaceous	0.02	0.944	8



**Figure 1:** Map of the studied islands and islets with endemic *Brassica* taxa in the southern Croatia. Site codes of the NATURA 2000 European Ecological Network in Croatia are also indicated.

**Slika 1:** Zemljevid preučevanih otokov in otočkov z endemičnimi vrstami rodu *Brassica* na južnem Hrvaškem. Prikazane so tudi oznake območij omrežja NATURA 2000.

In general, these islands show a predominant W–E or WSW–ENE direction. On the small islets the coastline is mainly low and rocky. The bigger islands (Koločep and Sušac) also consist of coastal steep cliffs mostly oriented in a SW–SE direction which on Koločep and Sušac rise up to 60 or 90 (–110) m a.s.l. (Magaš et al., 2001; Rac & Lovrić, 2002).

Palaeogeographically, the central Adriatic area is considered to represent a Jurassic to Palaeogene Adriatic basin enclosed between the Apulia carbonate platform to the southwest (Italy), and the Adriatic (Dalmatian) carbonate platform to the northeast (Croatia) (see Vlahović et al., 2005). The investigated islands are mostly composed of Mesozoic carbonate rocks that are intensely fractured and karstified (Jagačić, 1970; Vlahović et al., 2005) (Table 1). Lithosol, Terra Rossa, anthropogenic and the brown soils on limestone and dolomites (calco-cambisol) are the most commonly encountered soil types in the study area (e.g., Martinović, 1986; Bogнар, 1996; Ljubenkov, 2012).

The island flora of Koločep and Sušac includes 446 and 189 plant taxa (species and subspecies), respectively, and is on average rich compared to other Adriatic islands of similar size (Hećimović & Hećimović, 1987; Nikolić et al., 2008; Nikolić, 2022). Mediterranean floral elements, mostly circum-Mediterranean plant taxa, and therophytes predominate on the islands. Complete floristic lists for the small islets of the Korčula Archipelago are not yet available. The area in question is also among the richest sites of endemic flora of the central Adriatic (Nikolić et al., 2008, 2015). On Koločep, 12 taxa are considered endemic, most of which belong to the group of Illyrian-Adriatic endemics, while there are no true island endemics. In contrast, there are two stenoendemic plant species on Sušac, namely *Brassica cazzae* and *Limonium cazzae* Bogdanović et Brullo (for details see Nikolić et al., 2008).

The climate of the study area is Mediterranean with mild, humid, and rainy winters and dry/hot summers (*Csa* subtype of Mediterranean climate, *sensu* Gajić Čapka & Zaninović, 2008). The area of study which encompasses the most remote eastern Adriatic islands is semi-arid, representing the hottest part of the Croatian coast i.e. is included in the xeromediterranean zone (Milković, 1996; Rac & Lovrić, 2002; Lovrić & Rac, 2003). Sušac has a mean annual air temperature of 16.3 °C, the lowest precipitation values (300 – 600 mm yr<sup>-1</sup>) on the eastern Adriatic and more than 2880 of sunshine hours per year (Perčec Tadić & Gajić Čapka, 2010; Bonacci & Ljubenkov, 2020). For comparison, the island of Korčula has an average annual air temperature of 16.8 °C, precipitation ranges between 1000 – 1250 mm yr<sup>-1</sup> and 2400 hours

of sunshine a year (Krklec et al., 2011). The average annual temperature in Dubrovnik (the nearest station to Koločep) is 16.3 °C while the average annual rainfall is 1064 mm yr<sup>-1</sup> (Meteorological and Hydrological Service of Croatia, [https://klima.hr/k1/k1\\_2/dubrovnik.pdf](https://klima.hr/k1/k1_2/dubrovnik.pdf)).

The islands and islets included in this study are part of the Important Plant Areas (IPAs) in Croatia (Alegro et al., 2010) and are part of the NATURA 2000 European Ecological Network (Anonymous, 2019; Figure 1).

Phytogeographically, the majority of islets belong to the thermo-Mediterranean vegetation belt of the *Oleo-Ceratonion siliquae* Br.-Bl. ex Guinochet & Drouineau 1944 with orographically conditioned exclaves (e.g., Koločep) of the meso-Mediterranean *Fraxino orni-Quercion ilicis* Biondi et al. ex Biondi, Casavecchia et Gigante 2013 (Pavletić, 1983).

## Data collection and analysis

Field data were collected from fifty-one vegetation sample plots (relevés) most of which (forty-seven relevés) were conducted from July 2020 to September 2022, while the rest (four relevés) in March 2014. Vegetation was studied in accordance with the principles of the Braun-Blanquet approach (Braun-Blanquet, 1964), adopting the International Code of Phytosociological Nomenclature (Theurillat et al., 2021). The plot sizes were 20–50(–100) m<sup>2</sup> (mode 20 m<sup>2</sup>) for the *Crithmo-Staticetalia*, 25 m<sup>2</sup> for the *Asplenietea trichomanis*, and 20–100 m<sup>2</sup> (mode 100 m<sup>2</sup>) for woody vegetation of the *Pinetalia halepensis* and small-tree vegetation of the *Pistacio lentisci-Rhammetalia alaterni* (cf. Westhoff & van der Maarel, 1980). The average plot size of the relevés of the garrigue and grassland vegetation was 51 and 25 m<sup>2</sup>, respectively. These were largely in concordance with previously recommended plot sizes for particular vegetation types (e.g., Chytrý & Otýpková, 2003).

Vegetation was classified using numerical methods and compared with traditional syntaxonomy. The matrices consist of 119 taxa × 51 samples (relevés). The taxon scores originally recorded according to the Braun-Blanquet scale, were replaced by the 1–9 ordinal values (Westhoff & van der Maarel, 1980) before the numerical analyses. An agglomerative, hierarchical clustering algorithm based on Bray-Curtis similarity and Ward's method for determination of group linkages was used (McCune & Mefford, 2006). Differences between groups obtained in the classification were tested by analysis of similarities (ANOSIM). For these purposes the PC-ORD ver. 5 and PRIMERv7 software packages (McCune & Mefford, 2006; Clarke & Gorley, 2015) were used.

The delimitation of vegetation units (Tables 2–4) was carried out utilizing species groups derived from the

Braun-Blanquet technique. The results were interpreted from a syntaxonomic standpoint and the relevant syntaxonomic scheme is presented below. Geographical coordinates of relevés are given below each phytosociological table (Tables 2–4).

The nomenclature of high-rank vegetation units also follows the syntaxonomical system (the EuroVegChecklist) proposed by Mucina et al. (2016), and followed by Škvorc et al. (2017) except for the vegetation units of the *Asplenieta trichomanis* class whose classification is according to Terzi et al. (2017, 2020). The taxonomy and nomenclature of taxa follow Nikolić (2022) with the only exception being the genus *Limonium* for which the revision of Bogdanović & Brullo (2015) is adopted.

EUNIS habitat types were determined according to Chytrý et al. (2020, version 2021-06-01), and using the Database of the European Flora and Vegetation (www.floraveg.eu). In addition, classification of the vegetation units (alliances) distinguished into habitat types of Annex I of the Habitats Directive 92/43/EEC was made according to the List of NATURA 2000 habitats declared by the Croatian Government (Anonymous, 2019).

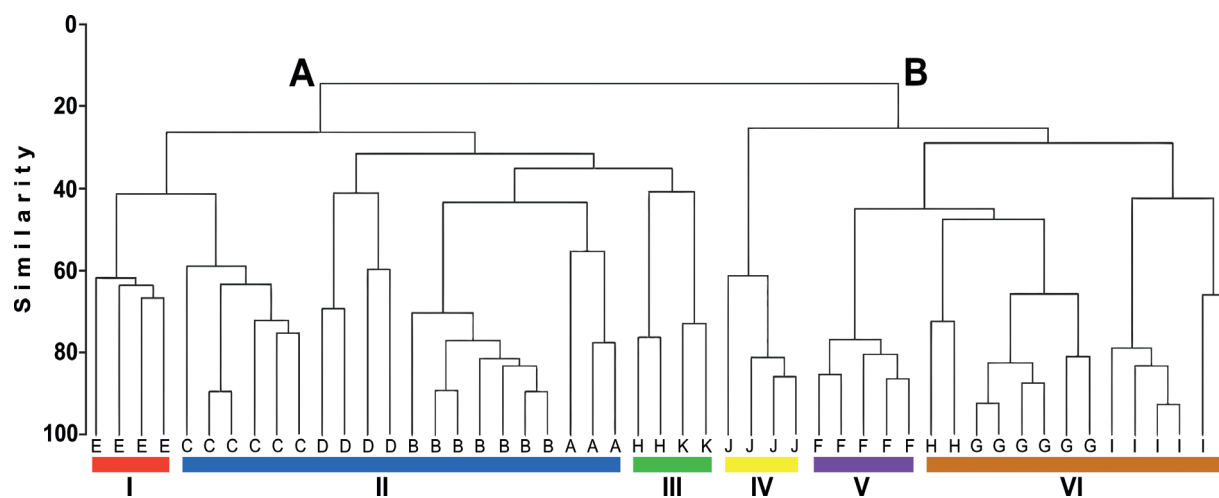
## Results

From the total of 51 relevés (rels.), 16 were carried out on Koločep island (halophilous bare or very shallow soils 7 rels., Aleppo pine forest 5 rels., garrigue vegetation 4

rels.), 17 in the Korčula Archipelago islets (halophilous bare or very shallow soils 7 rels., maquis vegetation 8 rels., grasslands 2 rels.), and 18 on Sušac (halophilous bare or very shallow soils 6 rels., rocky crevices and cliffs 4 rels., maquis 8 rels.).

The dendrogram obtained from the hierarchical clustering analysis of the data matrix, makes possible to distinguish two main clusters (A, B) of associations (Figure 2). The first cluster (A) mainly includes rupicolous chasmophytic association (I), and halophilous and halotolerant associations (II), while the second cluster (B) includes associations from the garrigues (IV), woody (V) and maquis vegetation (VI). The group III represents a few relevés collected from the grasslands and maquis located alongside the low rocky sea coast.

Data processing resulted in the distinction of eleven vegetation types (eight associations and three subassociations) belonging to seven alliances and six classes, which are presented in phytosociological tables (Tables 2–4) and discussed below. Among them the associations *Plantagino holostei-Limonietum cazzae* and *Brassico mollis-Anthyllidetum barbae-jovis*, and subassociation *Centaureetum ragusinae limonietosum cazzae*, are described for the first time (Tables 2, 3; Appendix 1). The complete syntaxonomic scheme is presented below [the islands or islets on which each association was found are mentioned in square brackets]:



**Figure 2:** Hierarchical cluster analysis dendrogram based on Bray-Curtis similarity distance and Ward's minimum variance method of the data matrix of 119 taxa × 51 relevés. **I** – *Asplenieta trichomanis* (E, *Centaureetum ragusinae limonietosum cazzae*); **II** – *Crithmo-Staticetea* (C, *Plantagino holostei-Limonietum cazzae*; D, *Brassico mollis-Anthyllidetum barbae-jovis*; B, *Plantagino-Limonietum cancellatae*; A, *Limonietum anfracti lavateretosum arboreae*); **III** – *Festuco-Brometea* (K, *Narcisso tazettae-Asphodeletum microcarpi*) and H, *Myrto communis-Pistacietum lentisci*; **IV** – *Ononido-Rosmarinetea* (J, *Erico manipuliflorae-Calicotometum infestae*); **V** – *Pinetea halepensis* (F, *Pistacio lentisci-Pinetum halepensis*); **VI** – *Quercetea ilicis* (H, *Myrto communis-Pistacietum lentisci*; G, *Pistacio lentisci-Juniperetum turbinatae*; I, *Oleo-Euphorbietum dendroidis coronilletosum emeraldoidis*).

**Slika 2:** Dendrogram hierarhične klasterke analize na osnovi razdalje podobnosti po Bray-Curtisu in Wardove metode minimalne variance in podatkovne matrike 119 taksonov × 51 popisov.



## Syntaxonomic scheme

### **Crithmo-Staticetea Br.-Bl. in Br.-Bl. et al. 1952**

*Crithmo-Staticetalia* Molinier 1934

*Limonion anfracti-cancellati* (Horvatić 1934) Mucina in Mucina et al. 2106

*Plantagino-Limonietum cancellatae* Horvatić (1934) 1939 [Obljak, Kosor, Stupa]

*Plantagino holostei-Limonietum cazzae* ass. nov. hoc loco [Sušac]

*Limonietum anfracti* Ilijanić et S. Hećimović 1982  
*lavateretosum arboreae* Ilijanić et S. Hećimović 1982 [Koločep]

*Helichrysetalia italici* Biondi et Géhu in Géhu et Biondi 1994

*Anthyllidion barbae-jovis* S. Brullo et De Marco 1989

*Brassico mollis-Anthyllidetum barbae-jovis* ass. nov. hoc loco [Koločep]

### **Pinetea halepensis Bonari et Chytrý in Bonari et al. 2021**

*Pinetalia halepensis* Biondi, Blasi, Galdenzi, Pesaresi et Vagge in Biondi et al. 2014

*Pistacio lentisci-Pinion halepensis* Biondi, Blasi, Galdenzi, Pesaresi et Vagge in Biondi et al. 2014

*Pistacio lentisci-Pinetum halepensis* De Marco, Veri et Caneva 1984 [Koločep]

### **Quercetea ilicis Br.-Bl. ex A. Bolós et O. de Bolós in A. Bolós y Vayreda 1950**

*Pistacio lentisci-Rhamnetalia alaterni* Rivas-Mart. 1975

*Oleo-Ceratonion siliquae* Br.-Bl. ex Guinochet et Drouineau 1944

*Oleo-Euphorbietum dendroidis* Trinajstić 1973

*coronilletosum emeroideis* Trinajstić 1973 [Obljak, Kosor, Sušac]

*Pistacio lentisci-Juniperetum turbinatae* Trinajstić 1987

ex Asensi, Díez-Garretas et Quézel 2007 [Kosor, Sušac]

*Myrto communis-Pistacietum lentisci* (Molinier 1954)

Rivas-Mart. 1975 [Stupa, Sušac]

### **Ononido-Rosmarinetea Br.-Bl. in A. Bolós y Vayreda 1950**

*Cisto-Micromerietalia julianae* Oberd. 1954

*Cisto cretici-Ericion manipuli-florae* Horvatić 1958

*Erico manipuli-florae-Calicotometum infestae* Horvatić 1958 [Koločep]

### **Festuco-Brometea Br.-Bl. & Tx. ex Klika & Hadač 1944**

*Scorzoneretalia villosae* Kovačević 1959

*Chrysopogono grylli-Koelerion splendidis* Horvatić 1973

*Narcisso tazettae-Asphodeletum microcarpi* Šegulja 1969 [Obljak]

### **Asplenietea trichomanis (Br.-Bl. in Meier et Br.-Bl. 1934)**

Oberd. 1977

*Centaureo dalmaticae-Campanuletalia pyramidalis* Trinajstić ex Terzi et Di Pietro 2016

*Centaureo cuspidatae-Portenschlagiellion ramosissimae*

Trinajstić ex Terzi et Di Pietro 2016

*Centaureetum ragusinae* Horvat ex Terzi, Jasprica et Caković 2017

*limonietosum cazzae* subass. nov. hoc loco [Sušac]

Seven alliances were assigned to seven of the EUNIS habitat types: (1) *Limonion anfracti-cancellati* [EUNIS2020 habitat code: N32, habitat type name: Mediterranean and Black Sea rocky sea cliff and shore]; (2) *Anthyllidion barbae-jovis* [S71, Western Mediterranean spiny heath]; (3) *Pistacio lentisci-Pinion halepensis* [T3A, Mediterranean lowland to submontane *Pinus* forest]; (4) *Oleo-Ceratonion siliquae* [S51, Mediterranean maquis and arborescent matorral]; (5) *Cisto cretici-Ericion manipuli-florae* [S63, Eastern garrigue]; (6) *Chrysopogono grylli-Koelerion splendidis* [R19, Dry steppic submediterranean pasture of the Amphi-Adriatic region]; (7) *Centaureo cuspidatae-Portenschlagiellion ramosissimae* [U38, Mediterranean base-rich inland cliff].

The above-mentioned alliances are also related to five habitat types of Annex I (Habitats Directive 92/43/EEC): (1) vegetated sea cliffs of the Mediterranean coasts with endemic *Limonium* spp. [habitat code 1240]; (2) Mediterranean pine forests with endemic Mesogean pines [9540]; (3) *Olea* and *Ceratonia* forests [9320]; (4) eastern sub-Mediterranean dry grasslands (*Scorzoneretalia villosae*) [62A0]; and (5) calcareous rocky slopes with chasmophytic vegetation [8210].

## Discussion

Insular endemics *Brassica cazzae* and *B. mollis* occur in a variety of habitat types (Tables 2–4, Figures 2–4). These species grow (i) in bare or very shallow soils on which halophilous (*Crithmo-Staticetalia*) and halotolerant communities (*Helichrysetalia italici*) mostly thrive (Table 2, rels. 1–16 and 17–20); (ii) on rocky crevices and cliffs with rupicolous chasmophytic vegetation of the *Centaureo cuspidatae-Portenschlagiellion ramosissimae* (Table 3); (iii) within woody vegetation of the *Pistacio lentisci-Pinion halepensis* and maquis of the *Oleo-Ceratonion siliquae*, and garrigues of the *Cisto cretici-Ericion manipuli-florae* (Table 4, rels. 1–21 and 22–25); and (iv) grasslands of the *Chrysopogono grylli-Koelerion splendidis* (Table 4, rels. 26–27).

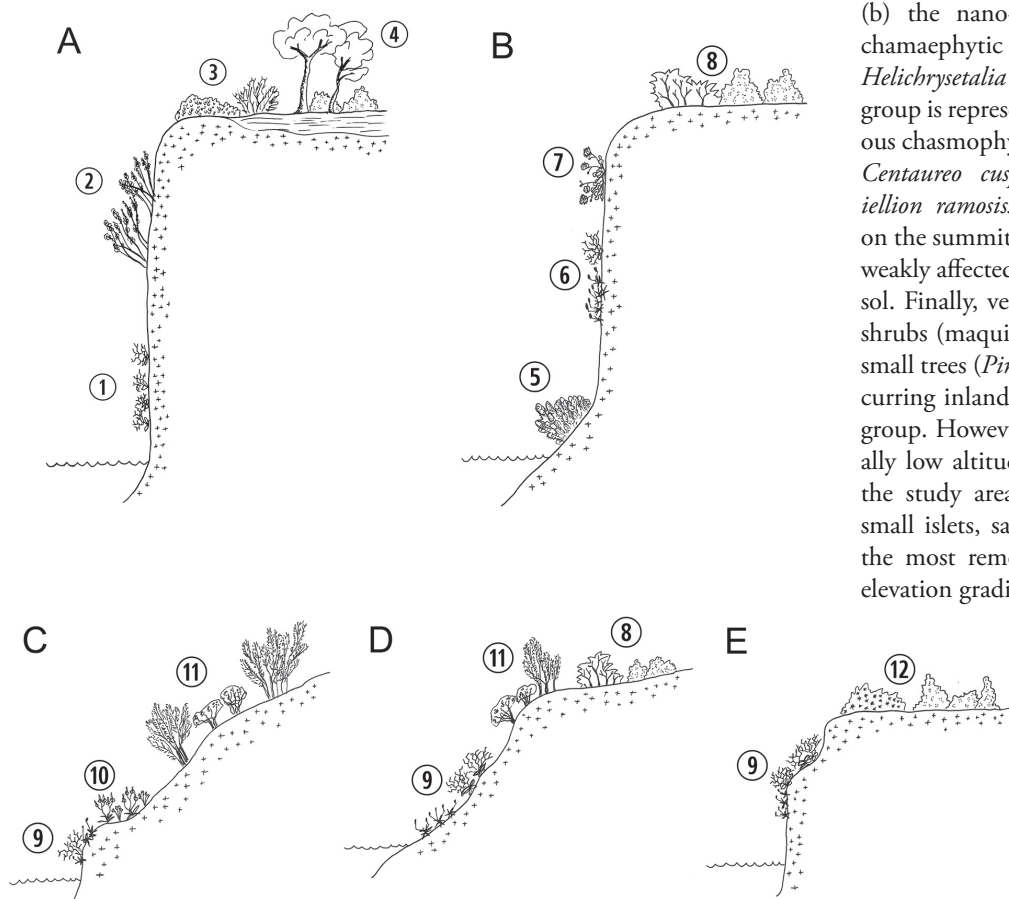
*Brassica cazzae* on the island of Sušac was found among vegetation of the association *Plantagino holostei-Limonietum cazzae* and subassociation *Centaureetum ragusinae limonietosum cazzae*, described here for the first time (see Tables 2, 3; see Appendix 1 for the holotypes description). It was also found within maquis of the *Pistacio lentisci-Juniperetum turbinatae* association (*Oleo-Ceratonion siliquae*) at the cliff top. The presence of the *Artemisia arborescens-Coronilla valentina* community of the *Artemisio arborescens-Capparidion spinosae* alliance (*Cymbalario-Parietarietea diffusae*) was observed on the lowest part of the cliff (Figure 3B). The occurrence of this community,

not studied here, is restricted to the most thermophilous habitats of eastern Adriatic i.e. in South Croatia and Montenegro (Jasprica et al., 2021).

*Brassica mollis* mostly occurs on low rocky coasts except on Koločep Island where it colonizes vertical sea-cliffs (Figure 3). It is more abundant within the stands of the association *Plantagino-Limonietum cancellatae* occurring on the small islets of the Korčula Archipelago in comparison to stands of *Limonietum anfracti lavateretosum arboreae* or *Brassico mollis-Anthyllidetum barbae-jovis* encountered on Koločep (Table 2). According to Terzi et al. (2020), this species (attributed to *B. incana*) was found

on the island of Vis within the association *Pimpinello lithophyllae-Centaureetum issaeae* of the central Adriatic endemic alliance *Capparo orientalis-Aurinion leucadeae* (*Helichrysetalia italici*).

From sea level to the most elevated localities of the study area, the pattern of vegetation distribution follows the environmental gradient and is represented by three main vegetation groups. The first group encompasses the halophilous and halotolerant vegetation of salt-sprayed areas near the sea. It includes (a) the halo-rupicolous chasmophytic communities, represented by different vicariant associations of the “*Crithmo-Limonietum* s.l.”, and (b) the nano-phanerophytic and chamaephytic vegetation of the *Helichrysetalia italici*. The second group is represented by the rupicolous chasmophytic vegetation of the *Centaureo cuspidatae-Portenschlagiellion ramosissimae* which thrives on the summits of high cliffs and is weakly affected by the marine aerosol. Finally, vegetation stands with shrubs (maquis and garrigues) and small trees (*Pinetalia halepensis*) occurring inland comprises the third group. However, due to the generally low altitudes that characterize the study area and especially the small islets, salt spray affects even the most remote locations of the elevation gradient.



**Figure 3:** Schemes of the distribution of the plant communities along the altitudinal gradient of the vertical sea-cliffs on the islands of Koločep (A) and Sušac (B), and over the islets of Obljak (C, max. 43 m a.s.l.), Kosor (D, max. 13 m a.s.l.), and Stupa (E, max. 8 m a.s.l.).

Abbreviations – 1. *Limonietum anfracti lavateretosum arboreae*, 2. *Brassico mollis-Anthyllidetum barbae-jovis*, 3. *Erico manipuliiflorae-Calicotometum infestae*, 4. *Pistacio lentisci-Pinetum halepensis*, 5. *Artemisia arborescens-Coronilla valentina* community, 6. *Plantago holostei-Limonietum cazzae*, 7. *Centaureetum ragusinae limonietosum cazzae*, 8. *Pistacio lentisci-Juniperetum turbinatae*, 9. *Plantagino-Limonietum cancellatae*, 10. *Narcisso tazettae-Asphodeletum microcarpi*, 11. *Oleo-Euphorbietum dendroidis coronilletosum emeroidis*, 12. *Myrto communis-Pistacietum lentisci* (Drawn by V. Stamenković).

**Slika 3:** Shema razširjenosti rastlinskih združb vzdolž višinskega gradienta na vertikalnih morskim klifih na otokih Koločep (A) in Sušac (B) in na otočjih Obljak (C, maks. 43 m nmv), Kosor (D, maks. 13 m nmv) in Stupa (E, maks. 8 m nmv).

Okrajšave – 1. *Limonietum anfracti lavateretosum arboreae*, 2. *Brassico mollis-Anthyllidetum barbae-jovis*, 3. *Erico manipuliiflorae-Calicotometum infestae*, 4. *Pistacio lentisci-Pinetum halepensis*, 5. *Združba Artemisia arborescens-Coronilla valentina*, 6. *Plantago holostei-Limonietum cazzae*, 7. *Centaureetum ragusinae limonietosum cazzae*, 8. *Pistacio lentisci-Juniperetum turbinatae*, 9. *Plantagino-Limonietum cancellatae*, 10. *Narcisso tazettae-Asphodeletum microcarpi*, 11. *Oleo-Euphorbietum dendroidis coronilletosum emeroidis*, 12. *Myrto communis-Pistacietum lentisci* (Slika V. Stamenković).

Our data did not confirm the presence of *B. mollis* within the chasmophytic vegetation of the *Sesleria robustae-Putorietum calabricae* association (*Centaureo cuspidatae-Portenschlagiellion ramosissimae*) in Koločep, as has been previously reported by Horvatić (1971). The *Sesleria robustae-Putorietum calabricae* does not include halophilous species (Terzi & Jasprica, 2020).

The vegetation distribution across the vertical cliff height gradient described above (see also Figure 3) is largely consistent with a general scheme of typical chain succession of microhabitats on Mediterranean cliffs, to which correspond various vegetation typologies described by Biondi (2007, p. 6). According to this scheme (op. cit.), the vegetation types are arranged on the vertical profile from bottom to top of the cliffs as follows: 1) halo-rupicolous chasmophytic vegetation of *Crithmo-Staticetalia*; 2) halotolerant chamaephytic garrigue vegetation of *Helichrysetalia italici* (*Euphorbion pithyusae*); 3) therophytic vegetation of *Malcolmietaalia ramosissimae*; 4) the halotolerant nano-phanerophytic and chamaephytic vegetation of *Anthyllidion barbae-jovis*; 5) the bushy and small-tree vegetation of *Quercetea ilicis*; and 6) the rupicolous chasmophytic vegetation of *Asplenieta trichomanis*. However, the halotolerant chamaephytic garrigue vegetation of the ledges of the cliffs with early soil is not found in our case. In addition, Škvorc et al. (2017) suggested that subaerohaline dwarf scrub of *Crucianellion rupestris* probably occurs on salt-sprayed cliffs in Croatia, but due to the lack of relevant vegetation data, its occurrence is still unconfirmed.

In this study we describe two new associations (*Plantagino holostei-Limonietum cazzae* and *Brassico mollis-Anthyllidetum barbae-jovis*) within the *Crithmo-Staticetalia* and *Helichrysetalia italici*, respectively. The *Limonium* vegetation of the island of Sušac was originally classified in the *Plantagino-Limonietum cancellati* but without this assignment being substantiated by quotation of relevant clusters (e.g., Rac & Lovrić, 2002). However, Bogdanović and Brullo (2015) report that *Limonium cancellatum* (Bernh. ex Bertol.) Kuntze is restricted to the North Adriatic calcareous rocky coasts, whereas in the vertical cliffs of Sušac island it is replaced by *Limonium cazzae*. For this reason, the new endemic association *Plantagino holostei-Limonietum cazzae* is defined, differentiated by the presence / dominance of *Limonium cazzae* and *Plantago holosteam* (Table 2, Appendix 1). In addition, for the same reason, the new halophilous subassociation *Centaureetum ragusinae limonietosum cazzae* is here proposed, and distinguished by the steno-endemic *Limonium cazzae* (Table 3, Appendix 1). The halophytic aspect of the *Centaureetum ragusinae* association is characterized by the presence of some ingressive taxa from the *Crithmo-Staticetalia* class

(*Crithmum maritimum*, *Lotus cytisoides*, *Limonium* spp.). According to Terzi and Jasprica (2020), stands of other two subassociations (*C.r. typicum*, *C.r. limonietosum cancellati*) are also under direct influence of sea-born salt spray over altitudinal gradient of vertical cliffs.

The case of *Anthyllis barba-jovis* L. is interesting. This species is endemic to the central Mediterranean and common in the central and southern Adriatic islands (see Nikolić, 2022). However, few data are available on the vegetation of *Anthyllidion barbae-jovis* in the eastern Adriatic. This alliance was documented by six relevés of *A. barba-jovis* dominated stands on the coastal cliffs of Vis Island (Terzi et al., 2020). Biondi et al. (1997) reported that *A. barba-jovis* also occurs in other habitats (e.g., in different syntaxa of *Quercetea ilicis*), but this was not observed in our study. In our case, this habitat type is more associated with the rocky sea cliffs and coasts of the Mediterranean and Black Seas (N32) than with the western Mediterranean thorny heath (S71) (cf. Chytrý et al., 2020). However, the *Anthyllidion barbae-jovis* alliance is defined as only one part of this habitat type, occurring in Corsica, Sardinia, Pantelleria and the Gulf of Taranto.

*Anthyllis barba-jovis* appears not to tolerate competition and thrives far from its optimum conditions only in localities where other shrubs are lacking (Fanelli et al., 2004). In addition, it is worth noting that vegetation structure of rocky shores is not only influenced by species salt tolerance, but also, by the chemical composition of the marine aerosol at a regional or local scale (Fanelli et al., 2004; Tedeschi & Piazzola, 2010). In case of smallest islets, halophilous and halotolerant vegetation largely overlap i.e. the strong dominance of species such as *Limonium* spp. or *Helichrysum italicum*, even *Crithmum maritimum* may be masked due to the continuous influence of the sea (waves, salt spray and strong wind) over altitudinal gradient.

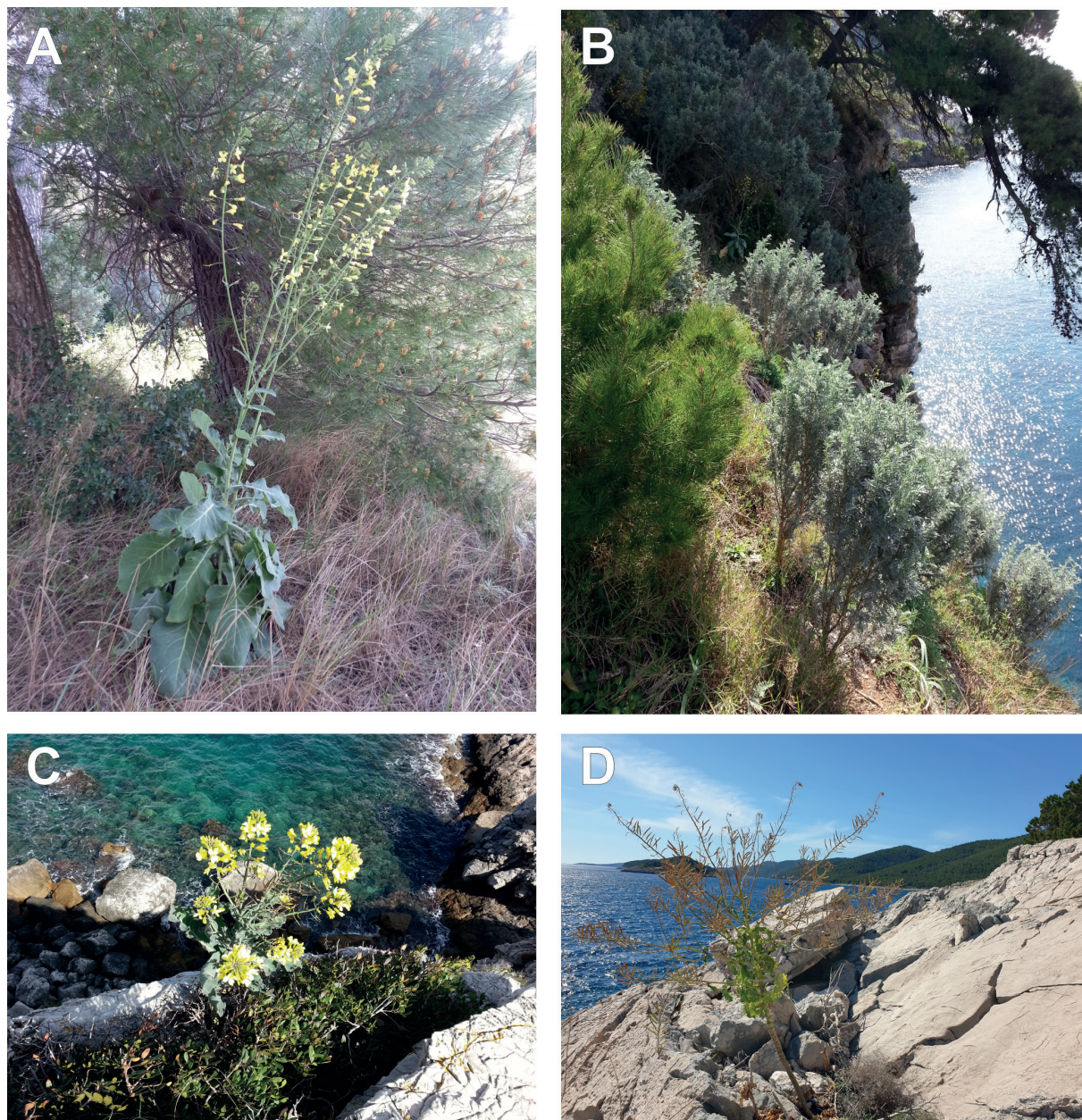
Here, we consider the stands with *Anthyllis barba-jovis* and *Brassica mollis* as a new association the *Brassico mollis-Anthyllidetum barbae-jovis*, which is differentiated from the *Anthyllis barba-jovis* community known from the island of Vis (Terzi et al., 2020) due to the presence of *B. mollis*. However, the study of *A. barba-jovis* vegetation of eastern Adriatic requires further improvement and collecting phytosociological data from other additional areas of Croatian territory (e.g., Franjić et al., 2003). This would make possible comparison of the communities on a large-scale i.e. from Central Mediterranean and/or Italian territory (see also Terzi et al., 2020).

Unfortunately, studies of the vegetation with *B. botteri* – species distributed in the most remote Croatian islets of the Palagruža Archipelago – planned as a research cruise within the project for early summer 2020 were cancelled



due to the COVID-19 pandemic. Data on its phytosociology still remains unknown. Lovrić & Rac (2003), with their general discussion of the vegetation synecology in Palagruža, mention that *B. botteri* have marked as “one of six insular endemics of central Adriatic found within the aerosaline vegetation”.

This work provides new insight on the coastal and sub-coastal vegetation of the islands and islets and its rarity. The association of these species with specific NATURA 2000 habitat types demonstrates the value of protecting and conserving both species and habitats. Both halophilous and halotolerant communities are threatened by tour-



**Figure 4:** *Brassica mollis* Vis. occurs within the distinct vegetation typologies: A – Aleppo Pine forest of the *Pistacio lentisci-Pinion halepensis*, B – halotolerant vegetation of the *Anthyllidion barbae-jovis*, C – xerothermic vegetation of the *Oleo-Ceratonion siliquae*, D – halophilous vegetation on the low rocky coast of the *Limonion anfracti-cancellati*. A-C – the island of Koločep, D – the islet of Kosor, Korčula Archipelago (Photo by N. Jasprica).

**Slika 4:** *Brassica mollis* Vis. se pojavlja v različnih vegetacijskih tipih: A – gozd alepskega bora zveze *Pistacio lentisci-Pinion halepensis*, B – vegetaciji, tolerantni na morsko sol zveze *Anthyllidion barbae-jovis*, C – kserotermni vegetaciji zveze *Oleo-Ceratonion siliquae*, D – halofilni vegetaciji na nižje ležećih skalnatih obalah zveze *Limonion anfracti-cancellati*. A-C – otok Koločep, D – otoček Kosor, arhipelag Korčula (foto N. Jasprica).



ism which is an emerging industry in the area. However, the rarity of these communities and taxa (some of them statutorily strictly protected by Croatian laws) suggests the need for a combined in-situ and ex-situ conservation strategy, with collecting, multiplying and conserving ex-situ of the more threatened taxa. Additionally, coastal cliffs and small islets form important nesting sites to pelagic and coastal seabirds, especially where these are inaccessible to predators and undisturbed by human or animals (e.g. no grazing).

Unfortunately, from a phytosociological point of view, the lack of studies on remote south-eastern Adriatic islands is still evident and effort has to be made to acquire knowledge of the syntaxonomy and ecology of the islands' local communities. We believe that the most significant result of this paper lies in the information on the small islands' vegetation in this part of the NE Mediterranean. Nevertheless, given the relatively small area studied, the results should be read and analysed in the context of the anthropogenic influences that are occurring as a generalized phenomenon throughout the Mediterranean basin.

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## Disclosure statement

No potential conflict of interest was reported by the author(s).

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## Appendix 1

### Holotypes of the new plant communities

***Plantagino holostei-Limonietum cazzae*** ass. nov. hoc loco [Sušac Island, holotypus Table 2, relevé no. 11, altitude 40 m a.s.l., aspect S-SE, slope 80°, plot size 25 m<sup>2</sup>, vegetation cover 25%, 2.9.2022.]: *Plantago holosteum* Scop. (1), *Limonium cazzae* Bogdanović et Brullo (2), *Crithmum maritimum* L. (1), *Lotus cytisoides* L. (1), *Silene vulgaris* (Moench) Garcke subsp. *angustifolia* Hayek (+), *Daucus carota* L. subsp. *hispanica* (Gouan) Thell. (+), *Capparis orientalis* Veill. (+), *Aurinia leucadea* (Guss.) K. Koch (+), *Helichrysum italicum* (Roth) G. Don (1), *Allium commutatum* Guss. (+), *Brassica cazzae* Ginz. et Teyber (1), *Inula verbascifolia* (Willd.) Hausskn. (+), *Parietaria judaica* L. (+), *Reichardia picroides* (L.) Roth (+), *Dactylis glomerata* L. subsp. *hispanica* (Roth) Nyman (+), *Desmazeria marina* (L.) Druce (+), *Valantia muralis* L. (+), *Melilotus italica* (L.) Lam. (+).

***Brassico mollis-Anthyllidetum barbae-jovis*** ass. nov. hoc loco [Koločep Island, holotypus Table 2, relevé no. 17, altitude 20 m a.s.l., aspect S, slope 90°, plot size 30 m<sup>2</sup>, vegetation cover 40%, 10.3.2014.]: *Limonium dictyophorum* (Tausch) Degen (1), *Anthyllis barba-jovis* L. (3), *Crithmum maritimum* L. (+), *Lotus cytisoides* L. (+), *Silene vulgaris* (Moench) Garcke subsp. *angustifolia* Hayek (+), *Capparis orientalis* Veill. (+), *Matthiola incana* (L.) R. Br. (+), *Elymus pycnanthus* (Godr.) Melderis (+), *Allium ampeloprasum* L. (1), *Brassica mollis* Vis. (1), *Smilax aspera* L. (+), *Asparagus acutifolius* L. (+), *Ephedra fragilis* Desf. subsp. *campylopoda* (C.A. Mayer) Asch. et Graeb. (+), *Rubus ulmifolius* Schott (+), *Juniperus phoenicea* L. (+), *Lonicera implexa* Aiton (+), *Phillyrea media* L. (+), *Umbilicus horizontalis* (Guss.) DC. (+), *Brachypodium retusum* (Pers.) P. Beauv. (1), *Pallenis spinosa* (L.) Cass. (r), *Euphorbia characias* L. subsp. *wulfenii* (Hoppe ex Koch) A. M. Sm. (r), *Bromus madritensis* L. (+), *Brachypodium distachyon* (L.) P. Beauv. (+), *Crupina crupinastrum* (Moris) Vis. (+), *Sonchus asper* (L.) Hill subsp. *glaucescens* (Jord.) Ball (1), *Carduus pycnocephalus* L. (r).

***Centaureetum ragusinae limonietosum cazzae*** subass. nov. hoc loco [Sušac Island, holotypus Table 3, relevé no. 1, altitude 60 m a.s.l., aspect SE, slope 85°, plot size 25 m<sup>2</sup>, vegetation cover 40%, 2.9.2022.]: *Centaurea ragusina* L. subsp. *ragusina* (3), *Limonium cazzae* Bogdanović et Brullo (+), *Inula verbascifolia* (Willd.) Hausskn. (1), *Allium ampeloprasum* L. (+), *Capparis orientalis* Veill. (+), *Aurinia leucadea* (Guss.) K. Koch (+), *Teucrium flavum* L. (r), *Sonchus asper* (L.) Hill subsp. *glaucescens* (Jord.)

Ball (r), *Helichrysum italicum* (Roth) G. Don (2), *Lotus cytisoides* L. (2), *Silene vulgaris* (Moench) Garcke subsp. *angustifolia* Hayek (1), *Crithmum maritimum* L. (1), *Ficus carica* L. (+), *Senecio bicolor* (Willd.) Tod. (+), *Brassica cazzae* Ginz. et Teyber (r), *Pistacia lentiscus* L. (+), *Asparagus acutifolius* L. (r), *Juniperus phoenicea* L. (+), *Brachypodium retusum* (Pers.) P. Beauv. (1), *Reichardia picroides* (L.) Roth (+), *Dactylis glomerata* L. subsp. *hispanica* (Roth) Nyman (+).

## Appendix 2

### Syntaxa quoted in the text and tables (in alphabetical order), but not in scheme

- Artemisia arborescens-Coronilla valentina* community  
*Artemisietea vulgaris* Lohmeyer et al. in Tx. ex von Rochow 1951  
*Artemisio arborescentis-Capparidion spinosae* Biondi, Blasi et Galdenzi in Biondi et al. 2014  
*Cakiletea maritimae* Tx. et Preising in Tx. ex Oberd. 1952  
*Capparo orientalis-Aurinion leucadeae* Lovrić ex Terzi, Bogdanović, D'Amico et Jasprica 2020  
*Chenopodietea* Br.-Bl. in Br.-Bl. et al. 1952  
*Crucianellion rupestris* S. Brullo et Furnari 1990  
*Cymbalaria-Parietarietea diffusae* Oberd. 1969  
*Dittrichietea viscosae* Trinajstić, B.Foucault et Jasprica 2019  
*Euphorbion pithyusae* Biondi et Gehu in Gehu et Biondi 1994  
*Lygeo sparti-Stipetea tenacissimae* Rivas-Mart. 1978 nom. conserv. propos. (*Thero-Brachypodietea* Br.-Bl. in Br.-Bl. et al. 1947)  
*Malcolmietalia ramosissimae* Rivas Goday 1958  
*Papaveretea rhoeadis* S. Brullo et al. 2001 nom. conserv. propos.  
*Pimpinello lithophyllae-Centaureetum issaeae* Terzi, Bogdanović, D'Amico et Jasprica 2020  
*Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959  
*Saginetea maritimae* Westhoff et al. 1962  
*Salicornietea fruticosae* Br.-Bl. et Tx. ex A. Bolòs y Vayreda et O. de Bolòs in A. Bolòs y Vayreda 1950  
*Seslerio robustae-Putorietum calabrica* Horvatić ex Birač 1973



**Table 2:** Phytosociological relevés of the halophilous and halotolerant plant communities with endemic *Brassica* taxa in southern Croatian islands and islets. Abbreviations: Kol – Koločep, Suš – Sušac, Stu – Stupa, Kos – Kosor, Ob – Obljak.

**Tabela 2:** Fitocenološki popisi slanoljubnih in slanotolerantnih rastlinskih združb z endemičnimi vrstami rodu *Brassica* na otokih in otočkih na južnem Hrvaškem. Okrajšave: Kol – Koločep, Suš – Sušac, Stu – Stupa, Kos – Kosor, Ob – Obljak.

Relevé number	1	2	3	4	5	6	7	8	9	10	11*	12	13	14	15	16	17*	18	19	20
Localities	Kol	Kol	Kol	Stu	Stu	Kos	Kos	Kos	Ob	Ob	Suš	Suš	Suš	Suš	Suš	Suš	Kol	Kol	Kol	Kol
Altitude (m a.s.l.)	10	5	5	2	2	2	3	3	2	2	40	40	50	50	25	25	20	30	30	25
Aspect	S	S	SW	S	N	S	S	S	NW	SW	S-SE	S-SE	S-SE	S-SE	NW	NW	S	S	E	E
Slope (°)	90	80	90	5	5	5	10	10	20	20	80	90	90	90	90	90	90	90	90	90
Plot size (mq)	25	25	25	20	20	20	20	20	20	20	25	20	20	20	25	25	30	25	30	25
Vegetation cover (%)	25	25	20	20	20	20	20	20	25	20	25	30	20	25	20	20	40	40	25	30
	<i>Limonium anfracti-lavateretosum arboreae</i>			<i>Plantagno-Staticetum cancellatae</i>							<i>Plantagno holostei-Limonietum cazzae</i>						<i>Brassica mollis-Anthyllidetum barbae-jovis</i>			

**Char. Ass.**

<i>Limonium dictyophorum</i> (Tausch) Degen	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+	+	
<i>Lavatera arborea</i> L.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	r	.	+	.	.	
<i>Limonium cancellatum</i> (Bernh. ex Bertol.) Kuntze	.	.	.	1	1	1	2	2	2	1	.	.	.	.	.	.	.	.	.	.	
<i>Plantago holosteum</i> Scop.	+	.	.	+	.	.	+	.	.	+	1	2	.	2	+	r	.	.	.	.	
<i>Limonium cazzae</i> Bogdanović et Brullo	.	.	.	.	.	.	.	.	.	.	2	3	2	3	1	2	.	.	.	.	
<i>Anthyllis barba-jovis</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	3	2	1	
<b><i>Limonium anfracti-cancellati</i></b>																					
<i>Crithmum maritimum</i> L.	2	2	2	2	1	+	+	+	1	+	1	1	2	2	2	2	+	.	+	+	
<i>Lotus cytisoides</i> L.	1	1	1	2	2	+	+	+	2	+	1	1	1	1	1	1	+	.	.	.	
<i>Silene vulgaris</i> (Moench) Garcke subsp. <i>angustifolia</i> Hayek	2	1	+	.	.	+	.	+	2	+	+	.	.	.	1	1	+	+	+	+	
<i>Silene sedoides</i> Poir.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	+	.	.	.	.	
<i>Daucus carota</i> L. subsp. <i>hispanicus</i> (Gouan) Thell.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	1	1	.	.	.	.	
<b><i>Capparo orientalis-Aurinion leucadeae</i></b>																					
<i>Capparis orientalis</i> Veill.	+	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	+	+	.	.	
<i>Aurinia leucadea</i> (Guss.) K. Koch	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	
<b><i>Anthyllidion barbae-jovis</i></b>																					
<i>Matthiola incana</i> (L.) R. Br.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	
<b><i>Crithmo-Staticetea</i></b>																					
<i>Helichrysum italicum</i> (Roth) G. Don	+	1	1	+	+	1	1	1	1	1	1	+	.	.	2	1	.	1	2	.	
<i>Allium commutatum</i> Guss.	.	.	.	+	+	+	+	+	+	+	+	.	.	.	.	.	.	2	2	1	
<i>Elymus pycnanthus</i> (Godr.) Melderis	1	1	+	1	1	.	1	1	.	1	.	.	.	.	.	.	.	+	+	.	
<i>Allium ampeloprasum</i> L.	.	.	.	+	.	.	+	+	+	.	.	.	.	.	.	.	1	.	.	.	
<i>Brassica mollis</i> Vis.	1	1	+	2	2	2	2	2	3	2	.	.	.	.	.	.	1	1	1	1	
<i>Brassica cazzae</i> Ginzl. et Teyber	.	.	.	.	.	.	.	.	.	.	1	1	1	.	+	+	.	.	.	.	
<b><i>Quercetea ilicis</i></b>																					
<i>Coronilla valentina</i> L.	+	+	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	+	.	.	
<i>Smilax aspera</i> L.	+	+	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.	
<i>Asparagus acutifolius</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	
<i>Ephedra fragilis</i> Desf. subsp. <i>campylopoda</i> (C. A. Mayer) Asch. et Graeb.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	
<i>Rubus ulmifolius</i> Schott	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	
<i>Juniperus phoenicea</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	
<i>Lonicera implexa</i> Aiton	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	
<i>Euphorbia dendroides</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	
<i>Phillyrea media</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	
<i>Pistacia lentiscus</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	
<i>Olea europaea</i> L.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	
<i>Teucrium flavum</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	

Relevé number	1	2	3	4	5	6	7	8	9	10	11*	12	13	14	15	16	17*	18	19	20	
<b>Ononido-Rosmarinetea</b>																					
<i>Rosmarinus officinalis</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Erica manipuliflora</i> Salisb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
<b>Asplenietea trichomanis</b>																					
<i>Inula verbascifolia</i> (Willd.) Hausskn.	.	2	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+
<i>Parietaria judaica</i> L.	+	+	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Sedum ochroleucum</i> Chaix	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.
<i>Hyoscyamus albus</i> L.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Phagnalon rupestre</i> (L.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.
<i>Umbilicus horizontalis</i> (Guss.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<b>Lygeo sparti-Stipetea tenacissimae</b>																					
<i>Reichardia picroides</i> (L.) Roth	1	1	+	.	.	.	.	.	.	.	+	+	+	+	+	1	.	.	1	1	
<i>Brachypodium retusum</i> (Pers.) P. Beauv.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	1	+	2
<i>Bromus erectus</i> Huds.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pallenis spinosa</i> (L.) Cass.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	1	.	.
<i>Euphorbia characias</i> L. subsp. <i>wulfenii</i> (Hoppe ex Koch) A. M. Sm.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	.	.
<i>Dactylis glomerata</i> L. subsp. <i>hispanica</i> (Roth) Nyman	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	1	.
<i>Bromus madritensis</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.
<i>Brachypodium distachyon</i> (L.) P. Beauv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+
<i>Crupina crupinastrum</i> (Moris) Vis.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Orobancha minor</i> Sm.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<b>Dittrichietea viscosae</b>																					
<i>Dittrichia viscosa</i> (L.) Greuter	+	+	.	+	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
<b>Cakiletea maritimae</b>																					
<i>Atriplex prostrata</i> DC.	.	.	.	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<b>Saginetea maritimae</b>																					
<i>Desmazeria marina</i> (L.) Druce	+	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.	.	.	.	.
<i>Parapholis incurva</i> (L.) C. E. Hubb.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<b>Artemisietea vulgaris</b>																					
<i>Sonchus asper</i> (L.) Hill subsp. <i>glaucescens</i> (Jord.) Ball	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	+
<b>Salicornietea fruticosae</b>																					
<i>Arthrocnemum macrostachyum</i> (Moris) C. Koch	.	.	3	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<b>Festuco-Brometea</b>																					
<i>Valantia muralis</i> L.	1	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<b>Papaveretea rhoeadis</b>																					
<i>Carduus pycnocephalus</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.
<i>Melilotus italica</i> (L.) Lam.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.

\*Holotypus

**Geographical coordinates of relevés.** Koločep: Rels.: 1, 17 (10.3.2014.) 42.668876 N, 18.014574 E; Rels.: 2, 18 (10.3.2014.) 42.668147 N, 18.015144 E; Rel.: 3 (1.10.2021.) 42.668123 N, 18.015459 E; Rel.: 19 (7.7.2020.) 42.662381 N, 18.019255 E; Rel.: 20 (1.10.2021.) 42.669339 N, 18.014273 E; Sušac: Rels: 11-14 (2.9.2022.) 42.750716 N, 16.490454 E; Rel.: 15 (6.7.2022.) 42.752225 N, 16.491088 E; Rel.: 16 (6.7.2022.) 42.751368 N, 16.492643 E; Stupa: Rels.: 4, 5 (7.7.2020.) 42.894411 N, 16.786779 E; Kosor: Rel.: 6 (15.7.2022.) 42.901277 N, 16.762046 E; Rels: 7, 8 (15.7.2020.) 42.900151 E, 16.763470 E; Obljak: Rel: 9 (6.7.2022.) 42.904517 E, 16.749472 E; rel. 10 (6.7.2022.) 42.903721 N, 16.749435 E.

**Table 3:** *Centaureetum ragusinae limonietosum cazzae* on the island of Sušac (Suš).

**Tabela 3:** *Centaureetum ragusinae limonietosum cazzae* na otoku Sušac (Suš).

Relevé number	1*	2	3	4
Localities	Suš	Suš	Suš	Suš
Altitude (m a.s.l.)	60	60	70	27
Aspect	SE	SE	E	NW
Slope (°)	85	90	90	90
Plot size (mq)	25	25	25	25
Vegetation cover (%)	40	40	45	60
<b>Char. Ass.</b>				
<i>Centaurea ragusina</i> L. subsp. <i>ragusina</i>	3	3	3	3
<i>Phagnalon graecum</i> Boiss. et Heldr.	.	r	+	.
<b>Diff. subassociations</b>				
<i>Limonium cazzae</i> Bogdanović et Brullo	+	+	+	+
<b>Asplenietea trichomanis</b>				
<i>Inula verbascifolia</i> (Willd.) Hausskn.	1	1	1	1
<i>Allium ampeloprasum</i> L.	+	.	.	+
<i>Capparis orientalis</i> Veill.	+	.	.	.
<i>Aurinia leucadea</i> (Guss.) K. Koch	+	.	.	.
<i>Teucrium flavum</i> L.	r	.	.	.
<i>Sonchus asper</i> (L.) Hill subsp. <i>glaucescens</i> (Jord.) Ball	r	.	.	.
<i>Phagnalon rupestre</i> (L.) DC.	.	.	+	.
<i>Umbilicus horizontalis</i> (Guss.) DC.	.	+	.	.
<b>Crithmo-Staticetea</b>				
<i>Helichrysum italicum</i> (Roth) G. Don	2	1	1	1
<i>Lotus cytisoides</i> L.	2	+	1	2
<i>Silene vulgaris</i> (Moench) Garcke subsp. <i>angustifolia</i> Hayek	1	+	+	2
<i>Crithmum maritimum</i> L.	1	2	.	+
<i>Ficus carica</i> L.	+	+	.	.
<i>Allium commutatum</i> Guss.	.	.	+	1
<i>Silene sedoides</i> Poir.	.	+	.	.
<i>Daucus carota</i> L. subsp. <i>hispanicus</i> (Gouan) Thell.	.	.	2	.
<i>Senecio bicolor</i> (Willd.) Tod.	+	.	.	.
<i>Brassica cazzae</i> Ginzb. et Teyber	r	+	+	+
<b>Anthyllidion barbae-jovis</b>				
<i>Matthiola incana</i> (L.) R. Br.	.	r	.	.
<b>Quercetea ilicis</b>				
<i>Pistacia lentiscus</i> L.	+	+	r	+
<i>Asparagus acutifolius</i> L.	r	1	+	+
<i>Juniperus phoenicea</i> L.	+	.	1	.
<i>Smilax aspera</i> L.	.	.	r	.
<b>Lygeo sparti-Stipetea tenacissimae</b>				
<i>Brachypodium retusum</i> (Pers.) P. Beauv.	1	1	1	1
<i>Reichardia picroides</i> (L.) Roth	+	1	1	.
<i>Dactylis glomerata</i> L. subsp. <i>hispanica</i> (Roth) Nyman	+	.	+	.
<i>Valantia muralis</i> L.	.	.	r	.
<i>Centaurium erythraea</i> Rafn	.	.	+	.
<i>Hyparrhenia hirta</i> (L.) Stapf	.	.	.	+
<b>Ononido-Rosmarinetea</b>				
<i>Rosmarinus officinalis</i> L.	.	.	.	1
<b>Festuco-Brometea</b>				
<i>Petrorhagia saxifraga</i> (L.) Link	.	.	+	+
<i>Aethionema saxatile</i> (L.) R. Br. subsp. <i>scopulorum</i> (Ronniger) I. A. Anderson, A. Carlström, Franzén, Karlenet H. Nybom	.	r	.	.
<i>Desmazeria rigida</i> (L.) Tutin	.	.	.	+

\*Holotypus

**Geographical coordinates of relevés.** Sušac: Rels.: 1–3 (2.9.2022.) 42.750716 N, 16.490454 E, Rel. 4 (6.7.2022.) 42.752135 N, 16.489985 E.



**Table 4:** Phytosociological relevés of woody and small-tree vegetation, garrigue and grassland plant communities with endemic *Brassicata* taxa in southern Croatian islands and islets. Abbreviations: Kol – Koločep, Suš – Sušac, Stu – Stupa, Kos – Kosor, Ob – Oblijak.

**Tabela 4:** Fitocenološki popisi raslinjskih združb lesnate in nizke gozdne vegetacije, gariže in travniš z endemičnimi vrstami rodu *Brassicata* na otocima i otočicima na južnom Hrvatskem. Okrajšave: Kol – Koločep, Suš – Sušac, Stu – Stupa, Kos – Kosor, Ob – Oblijak.

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27			
Localities	Kol	Kol	Kol	Kol	Kol	Kos	Kos	Suš	Suš	Suš	Suš	Stu	Suš	Suš	Suš	Ob	Ob	Kos	Kos	Suš	Suš	Kol	Kol	Kol	Kol	Ob	Ob			
Altitude (m a.s.l.)	22	23	26	31	41	10	10	23	26	25	18	4	5	10	10	8	8	8	8	50	50	22	23	27	38	4	5			
Aspect	.	.	.	E	E	S	S	.	.	.	SE	S	S	SW	SW	NW	SW	S	S	SE	SE	.	.	E	E	NW	SW			
Slope (°)	.	.	.	5	5	5	10	.	.	.	5	10	10	5	5	5	5	10	10	90	90	.	.	5	10	2	2			
Plot size (mq)	100	100	100	100	100	100	100	100	100	100	100	20	20	50	50	50	50	20	20	50	20	30	25	100	50	25	25			
Vegetation cover (%)	100	100	100	90	90	80	80	90	90	100	90	90	90	80	90	80	80	80	80	70	70	70	90	90	90	60	70			
	<b>Pistacio lentisci-Pinetum halepensis</b>					<b>Pistacio lentisci-Juniperetum turbinatae</b>					<b>Myrto communis-Pistacietum lentisci</b>					<b>Oleo-Euphorbietum dendroidis coronilietosum emeroideis</b>					<b>Erico manipuliflorae-Calicotometum infestae</b>					<b>Narcisso-Asphodelietum deletum</b>				

**Char. Ass.**

<i>Pinus halepensis</i> Mill.	5	4	4	4	4	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pistacia lentiscus</i> L.	2	3	3	3	4	1	1	2	2	2	1	4	4	3	4	2	2	2	2	.	.	1	1	+	.	.	.	.
<i>Juniperus phoenicea</i> L.	1	+	+	1	1	3	3	4	4	3	4	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Myrta communis</i> L.	+	1	1	2	2	1	2	1	1	+	+	2	2	2	1	2	1	1	1	.	.	.	.	.	.	.	.	.
<i>Euphorbia dendroides</i> L.	r	.	.	.	.	r	.	r	.	.	.	.	.	.	.	3	2	3	3	3	3	.	.	.	.	r	.	.
<i>Olea europaea</i> L.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	4	4	3	3	2	2	.	1	1	.	+	.	
<i>Erica manipuliflora</i> Salisb.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Calicotome villosa</i> (Poiret) Link (incl. <i>C. infesta</i> (C. Presl) Guss.)	1	+	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Narcissus tazetta</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	1	1	1	.	.	.	.	.	.	.	3	3
<i>Asphodelus aestivus</i> Brot.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	3
<i>Quercetea ilicis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Prasium majus</i> L.	1	+	1	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Asparagus acutifolius</i> L.	1	1	1	+	2	+	+	1	1	+	+	+	+	1	+	+	+	1	1	+	.	.	.	.	.	.	.	.
<i>Coronilla valentina</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lonicera implexa</i> Aiton	+	+	+	+	1	+	+	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Phillyrea latifolia</i> L.	+	1	1	1	1	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Smilax aspera</i> L.	2	1	.	+	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Juniperus oxycedrus</i> L. subsp. <i>macrocarpa</i> (Sm.) Ball	+	1	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ephedra fragilis</i> Desf. subsp. <i>campylopada</i> (C. A. Meyer) Asch. et Graeb.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Laurus nobilis</i> L.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cerantonia siliqua</i> L.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
<i>Rhannus alaternus</i> L.	+	+	1	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Rubia perigrina</i> L.	+	+	+	+	1	+	+	+	+	.	.	.	.	.	.	+	+	1	.	.	.	.	.	.	.	.	.	
<i>Juniperus oxycedrus</i> L. subsp. <i>oxycedrus</i>	1	2	1	1	2	+	+	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Arbutus unedo</i> L.	1	2	2	2	2	.	.	.	.	.	.	.	.	.	.	.	+	1	1	.	.	.	.	.	.	.	.	
<i>Quercus ilex</i> L.	1	1	.	+	+	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	.	.	.	.	
<i>Clematis flammula</i> L.	1	1	1	1	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Rosa sempervirens</i> L.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Tenacium flavum</i> L.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Spartium junceum</i> L.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Pistacia terebinthus</i> L.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	1	+	+	.	.	.	.	.	.	.	.	.	
<i>Viburnum tinus</i> L.	2	1	2	2	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Rubus ulmifolius</i> Schott	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Erica arborea</i> L.	+	+	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Carex halleriana</i> Asso	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Ruscus aculeatus</i> L.	+	+	.	+	1	.	.	.	.	.	.	.	.	.	.	+	+	1	.	.	.	.	.	.	.	.	.	
<i>Colutea arborescens</i> L.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Arisarum vulgare</i> O. Tang. Tozz.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	2	1	+	.	.	.	.	.	.	.	
<i>Oxyris alba</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Cyclamen repandum</i> Sibth. et Sm.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<b>Quercetea pubescentis</b>																												
<i>Coronilla emerus</i> L. subsp. <i>emeroides</i> Boiss. et Spruner	1	2	1	+	+	+	+	.	.	.	.	.	.	.	.	1	1	1	1	+	+	1	1	+	+	.	.	
<i>Calamintha nepetoides</i> Jord.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tamus communis</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<b>Ononido-Rosmarinetea</b>																												
<i>Rosmarinus officinalis</i> L.	+	1	1	2	2	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	
<i>Dorycnium hirsutum</i> (L.) Ser.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cistus incanus</i> L.	1	1	1	1	1	+	1	1	1	1	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Cistus salvifolius</i> L.	.	.	.	.	.	1	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Micromeria juliana</i> (L.) Benth. ex Rechb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<b>Festuco-Brometea</b>																												
<i>Helicobryum italicum</i> (Roth) G. Don	+	+	+	+	1	+	+	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	.	
<i>Koeleria splendens</i> C. Presl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	3
<i>Bituminaria bituminosa</i> (L.) C.H. Stirt.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Stipa</i> sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<b>Lygeo sparti-Stripetea tenuicissimae</b>																												
<i>Brachypodium retusum</i> (Pers.) P. Beauv.	3	2	3	4	3	1	2	1	1	1	2	1	1	1	+	+	1	1	2	2	+	.	.	.	.	.	.	

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
<i>Bromus erectus</i> Huds.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Reichardia picroides</i> (L.) Roth	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Allium subhirsutum</i> L.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hyparrhenia hirta</i> (L.) Stapf	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Dactylis glomerata</i> L. subsp. <i>hispanica</i> (Roth) Nyman	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Teucrium polium</i> L. subsp. <i>capitatum</i> (L.) Arcang.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carlina corymbosa</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ferula communis</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Opopanax chironium</i> (L.) W. D. J. Koch	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Piptatherum miliaceum</i> (L.) Coss.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Avena sterilis</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Euphorbia characias</i> L. subsp. <i>wulfenii</i> (Hoppe ex W. D. J. Koch) Radcl.-Sm.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<b>Critbmo-Staticetea</b>																											
<i>Lotus cytisoides</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Daucus carota</i> L. subsp. <i>hispanicus</i> (Couan) Thell.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Silene vulgaris</i> (Moench) Gareke subsp. <i>angustifolia</i> Hayek	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Inula crithmoides</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cribthum maritimum</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Allium commutatum</i> Guss.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Helichrysum italicum</i> (Roth) G. Don	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Elymus pycnanthus</i> (Godr.) Melderis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Anhyllis barba-jovis</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Limonium cancellatum</i> (Bernh. ex Bertol.) Kuntze	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Capparis orientalis</i> Veill.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Vincetoxicum hirundinaria</i> Medik. subsp. <i>adriaticum</i> (Beck) Markgr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Brassica mollis</i> Vis.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Brassica cazzae</i> Ginzb. et Teyber	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<b>Chenopodietea</b>																											
<i>Lavatera arborea</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Papaveretea rhoeadis</i>																											
<i>Gynodon dactylon</i> (L.) Pers.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sonchus tenerrimus</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Melilotus italica</i> (L.) Lam.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.



Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
<i>Geranium purpureum</i> Vill.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	+	.	.	.	+	.	.	.	.	+	
<b><i>Cakiletea maritimae</i></b>																												
<i>Atriplex prostrata</i> DC.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	1	.	.	.	.	.	+	
<i>Asplenitea trichomanis</i>																												
<i>Parietaria judaica</i> L.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	
<i>Inula verbascifolia</i> (Willd.) Hausskn.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	+	
<i>Frangula rupestris</i> (Scop.) Schur	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Hyoscyamus albus</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<i>Asplenium ceterach</i> L.	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
<b><i>Dittrichitea viscosae</i></b>																												
<i>Dittrichia viscosa</i> (L.) Greuter	.	.	.	.	+	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	

**Geographical coordinates of relevés.** Koločep: Rels. 1, 22 (7.7.2020.) 42.668876 N, 18.014574 E; Rels. 2, 23 (7.7.2020.) 42.668281 N, 18.015391 E; Rel.: 3 (7.7.2020.) 42.668123 N, 18.015459 E; Rel. 4,5 (7.7. 2020.) 42.662532 N, 18.019047 E; Rel.: 24, 25 (7.7. 2020.) 42.663083 N, 18.019030 E; Kosor: Rels.: 6, 18 (27.5.2021.) 42.901277 N, 16.762046 E; Rels: 7, 19 (27.5.2021.) 42.900151 E, 16.763470 E; Sušac: Rel.: 8 (2.9.2022.) 42.752102 N, 16.489940 E; Rel.: 9 (2.9.2022.) 42.751939 N, 16.489735 E; Rel.: 10 (2.9.2022.) 42.752225 N, 16.491088 E; Rel.: 11 (2.9.2022.) 42.751368 N, 16.492643 E; Rels: 14, 15 (6.7.2022.) 42.749806 N, 16.493901 E; Rels. 20, 21 (6.7.2022.) 42.750744 N, 16.490554 E; Stupa: Rels.: 12, 13 (2.9.2022.) 42.894411 N, 16.786779 E; Obljak: Rels.: 16, 26 (6.7.2022.) 42.904517 E, 16.749472 E; Rels.: 17, 27 (6.7.2022.) 42.903721 N, 16.749435 E.