



## **Flora and phytogeographical significance of the islands Chrisi, Koufonisi and nearby islets (S Aegean, Greece)**

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## Flora and phytogeographical significance of the islands Chrisi, Koufonisi and nearby islets (S Aegean, Greece)

### Abstract

Bergmeier, E., Kypriotakis, Z., Jahn, R., Böhling, N., Dimopoulos, P., Raus, Th. & Tzanoudakis, D.: Flora and phytogeographical significance of the islands Chrisi, Koufonisi and nearby islets (S Aegean, Greece). – Willdenowia 31: 329-356. 2001. – ISSN 0511-9618.

An annotated floristic catalogue is provided for the islands Chrisi (Gaidouronisi), Koufonisi and the nearby islets Mikronisi, Strongili, Makrouli and Trachilos, all off SE Kriti. Critical use is made of literature data, and hitherto unpublished records, mostly from 1997 through 2000, add substantially to the first full vascular plant inventory of the islands. The total numbers of vascular plant taxa currently known from each island are as follows (accepted taxon records from literature, if extant, in brackets): Chrisi 275 (162), Mikronisi 71 (21), Koufonisi 273 (71), Strongili 110, Makrouli 115, Trachilos 96. Most noteworthy are *Suaeda palaestina* and *Ononis vaginalis* (currently with their single localities in Europe); *Allium brachyspathum*, *Astragalus boeoticus*, *A. peregrinus*, *Galium recurvum*, *Hippocrepis unisiliquosa*, *Lagurus ovatus* subsp. *nanus*, *Ononis diffusa*, *Orobanche grisebachii*, *Schoenoplectus litoralis* (new records or confirmations for the Cretan area as a whole, or for the territory of Kriti proper including offshore islands); and *Chlamydomphora tridentata*, *Frankenia corymbosa* and *Hymenolobus procumbens* (new regional records for the E part of Kriti and its offshore islands). The N African, pronouncedly thermophilous phytogeographical element is fairly well represented in the investigated area, thence Koufonisi in particular must be considered the driest and hottest SE European island. The principal habitats encountered in each of the islands are outlined and the present conditions for nature conservation discussed.

### Introduction

The islands off the SE coast of Kriti, Chrisi (Gaidouronisi) and Koufonisi, are known to harbour several plant species of S Mediterranean, N African and W Irano-Turanian distribution, which are otherwise rare or missing in Kriti or in the whole of Greece and the Aegean. The geographical position at the far southern end of the Aegean may be the reason why the islands received early attention by botanical travellers. Only Chrisi, however, an easily accessible island opposite the town of Ierapetra (Fig. 1), was visited already in the first half of the 19th century (by Heldreich; Raulin 1869) while, until recently, the only known botanical facts regarding Koufonisi were communicated by Gandoger (Cousturier & Gandoger 1916) and Rechner (1943b).

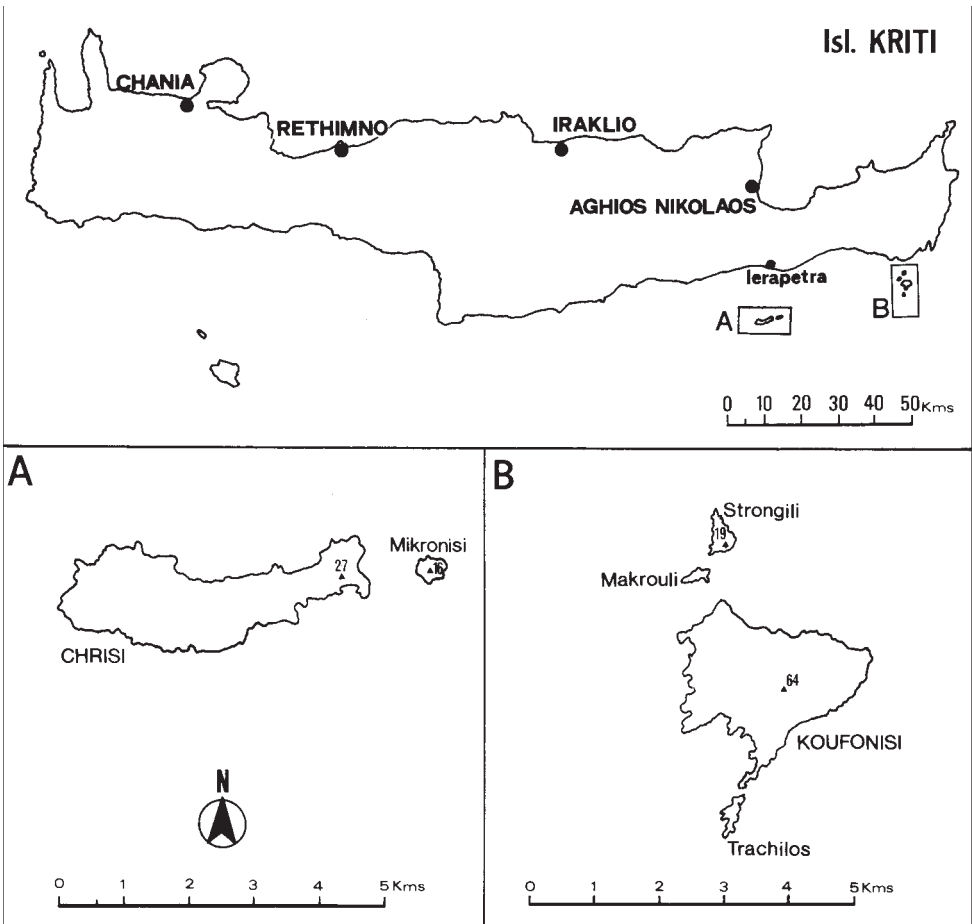


Fig. 1. Position of the investigated islands.

Rechinger (1943b, 1951) provided also a plant list of Mikronisi, an islet nearby Chrisi. For the other islets treated here, viz. Strongili, Makrouli and Trachilos, all situated close to Koufonisi, this contribution provides the first floristic account.

The aims of the present paper are (1) to bring together unpublished floristic records, independently made by the authors, during short visits in the last 10 years, which add substantially to what is known from literature; (2) to compile and to make critical use of literature information; (3) to provide, by means of our joint contributions, from different seasons, a full floristic inventory, i.e., an estimated 90 % or more of the total vascular plant species composition of the islands; (4) to predict climatic gradients in the Cretan area on the basis of varying joint occurrences of the most thermophilous species.

### Study area

Easternmost and SE Kriti are among the driest and hottest areas of Greece and Europe. Direct meteorological information is lacking for the islands Chrisi (situated leeward of Mts Dikti and Thriptis) and Koufonisi. Ierapetra, the coastal town 14 km to the north (Fig. 1) receives a little

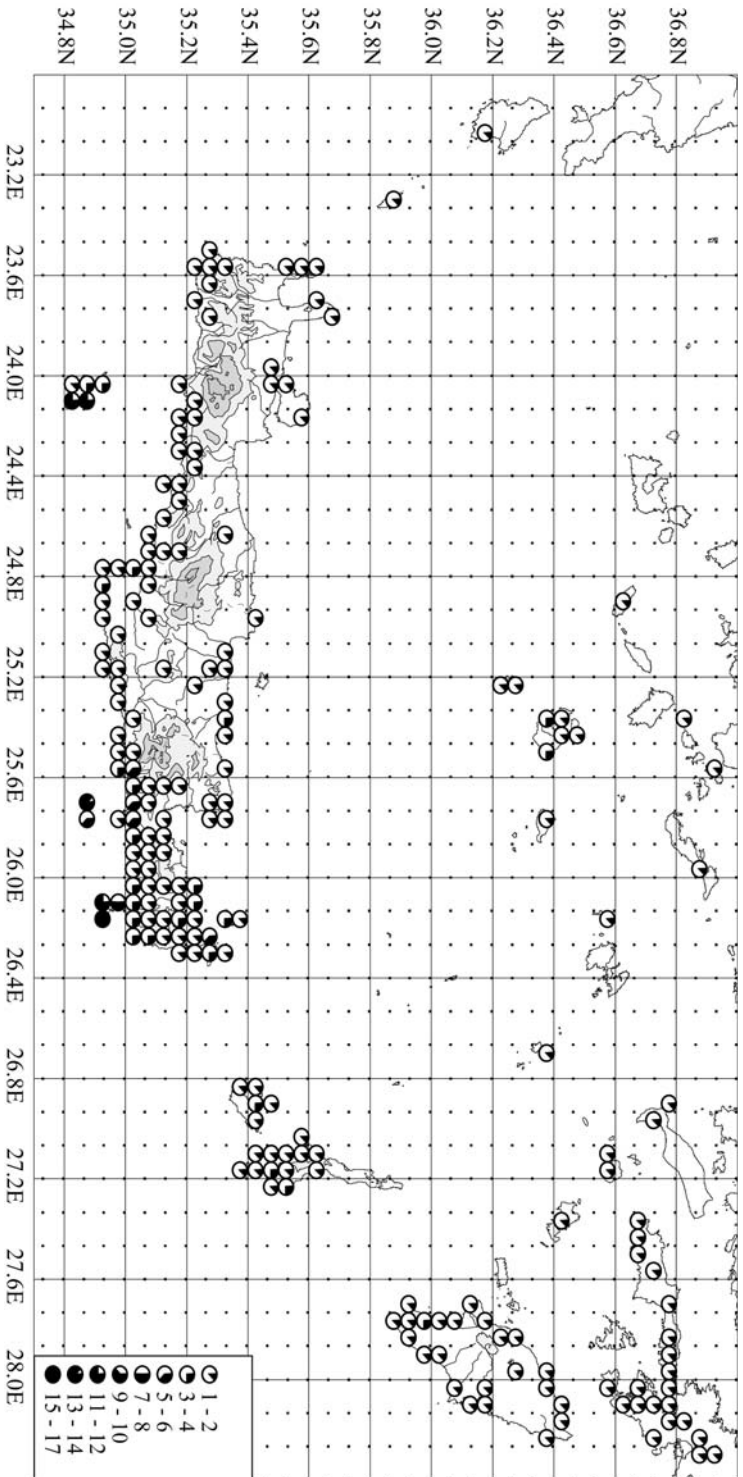


Fig. 2. The relative representation of selected taxa of chiefly N African/S Mediterranean/W Irano-Turanian distribution in the S Aegean (\*: taxa occurring in the study area: *Azoon hispanicum*, *Allium longum*, *Aristida caerulea*, *Artemisia herba-alba*, *Asragalus epiglottis*, *A. peregrinus*, *Atriplex mollis*, *Callitriche pulchra*, *Carrichera annua*, *Chlamydomorpha tridentata*, *Cistanche phelypaea*, *Erodium crassifolium*, *E. neuradifolium*, *Fagonia cretica*, *Frankenia corymbosa*, *Gynandris monophylla*, *Helianthemum stipulatum*, *Hippocrepis cyclocarpa*, *Limnistrum monopedalum*, *Lycium schweinfurthii*, *Lycium spartium*, *Marricaria aurea*, *Ononis vaginalis*, *Periploca angustifolia*, *Plantago amplexicaulis*, *P. squarrosa*, *Reseda odorata*, *Stilene succulentia*, *Suaeda palaestina*, *Zygophyllum album*). The categories designate the number of taxa per grid square. The square size is 4' x 3' (c. 6 x 5.5 km).

Tab. 1. Geographical and ecological parameters of the islands off SE Crete.

	Chrisi	Mikronisi	Koufonisi	Strongili	Makrouli	Trachilos
Size [ha]	462	12	392	12	6	11
Max. altitude[m]	27	16	64	19	7	43
Geology	flysch mixed with limestone, alluvium	flysch mixed with lime- stone	marly and hard limestones, alluvium	marly limestone	marly limestone	marly limestone
Present popu- lation	few, sea- sonal, day tourism	–	–	–	–	–
Former cultiva- tion	+	–	+	–	–	–
Former grazing	+	–	+	+	+	?
Present grazing	–	–	–	(+)	(+)	–

more than 400 mm of annual precipitation: Pennas (1977) gives an average of 545 mm for the period 1938-75 while figures of 458 mm and 432 mm (communicated by Brullo & Guarino 2000 and Rackham & Moody 1996, respectively) include, though not explicitly, more recent, and drier, periods. Even less precipitation can be taken for granted further E, along the SE edge of Kriti. Rackham & Moody (1996: 35) estimate less than 300 mm, a value which is plausible particularly for Koufonisi, 5 km off the coast of Kriti, and its nearby islets.

Relevant geographical and ecological parameters for each island are given in Table 1. All islands are actually uninhabited but abandoned fields can be found on Chrisi and Koufonisi (scattered on the former, to a greater extent on the latter island), suggesting an economical basis for an unknown population number in the past. On Koufonisi, remnants of an ancient theatre evidence more than a mere rural civilization in antiquity. The island of Chrisi, the name of which evolved in the recent past from “Donkey’s Island” (Gaidouronisi) to “Golden [beach]” (Chrisi), became recently inhabited again seasonally, due to an increasing beach tourism made possible by a regular boat traffic from Ierapetra during summer. Grazing by sheep and goats has been ceased although practiced for centuries on some of the islands but, owing to the absence of sweet water, only seasonally in springtime. The islands Makrouli and Strongili are said to be still grazed by sheep sometimes; Trachilos and Mikronisi perhaps never were. We found rabbit faeces on Strongili, Makrouli and Trachilos. On Mikronisi exists a sea-gull colony (*Larus cachinnans*), which causes eutrophication.

## Methods

All literature and unpublished sources available were used for the present floristic catalogue, either directly or through Rechinger’s (1943a) Flora Aegaea (Table 2). Literature data have largely been taken from a database on the flora of the S Aegean islands established and attended by one of us (R. Jahn). This database and the programme DMAP were employed for the preparation of Fig. 2. For the catalogue, we followed a critical approach: all literature reports from the study area have been used and the taxon names nomenclaturally updated, but records were considered reliable only if supported by voucher specimens preferably revised by later scholars, or by various independent observations. An attempt was made to exclude dubious records, misidentified or mislabelled specimens. Only the original data of botanists who actually visited the islands were taken into consideration. The works of Turland & al. (1993) and Jahn & Schönfelder (1995), which were compiling as far as concerns the islands off SE Kriti, were used for comparison only. Our own extensive unpublished records, both field observations and herbarium specimens, were treated accordingly (Table 2). Annotations were made on numerous taxa.

Table 2. Data sources (in chronological sequence), and history of floristic exploration of Chresi and the Koufonisia. – Abbreviation = Reference abbreviations of collectors' names as used in the catalogue; Islands: Chr-Chresi, Kou-Koufonisia, Mak-Makrouli, Mik-Mikronisi, Str-Strongili, Tra-Trachilos; v.sp. = voucher specimens; obs. = field observations. Herbarium abbreviations are according to Holmgren & al. (1990); for private herbaria: Be = E. Bergmeier, Freiburg; Bö = N. Böhling, Kirchheim; Ch = L. Chilton, Hunstanton; Gr = W. Greuter, Berlin; Ja = R. Jahn, Radebeul; Kalh = H. Kalheber, Runkel; Ky = Z. Kyriotakis, Iraklio; Ma = A. Mayer, Roma; Zi = M. Zimmermann, Ulm.

Source	Evaluated reference	Abbreviation	Island(s) visited	Date	Records			Herbarium (in brackets: partial dupl.set)
					v.sp.	obs.	unspecified: total number	
F. W. Sieber	Förther & Podlech 1991		Chr	6/7.1817	1		1	M
Th. von Heldreich		He	Chr	2-5.5.1846			42	G-Bois
P. Cousturier	Rechinger 1943a	Co	Chr	4.1914			23	LY
P. Cousturier, M. Gandoger		Ga	Kou	1914, 1916			89	
K.H. Rechinger, Stubbe	Rechinger 1943b, 1951	Re	Chr, Mik	19.5.1942	44 22	10 -	54 22	W
			Kou	20-22.5.1942	18		18	
J. Zaffran	Zaffran 1990	Za	Chr	25-26.5.1966	25		25	Marseille
W. Greuter	Greuter, in litt.	Gr	Chr	28.10.1966	7	32	39	G, Gr, (B, E, K, M, ATH, UPA, LD, W)
A. Strid, C. Baden	Strid, in litt.	St Ba	Kou	12.4.1981	77	1	78	C, LD, (Gr, Kalh)
L. Chilton	Turland, in litt.	Ch	Chr	13.6.1989			30	Ch
A. Mayer	Mayer 1995	Ma	Chr	29-30.5.1991; 19.6.1991			7	Ma
Z. Kyriotakis	publ. here	Ky	Chr, Mik	23-27.3.1994; 21-22.4.1997; 2.5.1999	119 49	90 3	209 52	Ky, (UPA)
			Kou, Str, Mak, Tra	16.9.1989; 9-10.6.1990; 27.4-5.5.1997; 25.6.1999	210 16 2 1 30	11 65 69  50	221 81 9 0 80	
R. Jahn	publ. here	Ja	Chr	14.5.1995	17	103	120	Ja, (B, UPA, REG)
			Kou	13.5.1995	38	109	147	
M. Zimmermann	publ. here	Zi	Chr	5.4.1996	6		6	Zi
S. Brullo, G. Guarino	Brullo & Guarino 2000	Br Gu	Chr	25.8.1996			151	CAT
N. Böhling	publ. here	Bö	Chr	16.5.1998	21	33	54	Bö, (B)
Th. Raus	publ. here	Ra	Kou, Str, Mak, Tra	27.10.1999	10 9 16  5	17  28 4 11	27 37 20  16	B, Bö
N. Böhling		Bö			9 11 1 6	16 24 18  -	25 35 19  6	
E. Bergmeier, P. Dimopoulos	publ. here	Be Di	Chr, Mik	23-24.4.1999	79 6	135 40	214 46	Be
			Str, Mak, Tra	21.3.2000	4 16 1	71 74 44	75 90 45	
			Kou	25.4.1999; 25-26.3.2000	52	167	219	

In the catalogue, collectors' and/or observers' references are abbreviated as given in Table 2; bold-type letters refer to records supported by voucher specimens, normal-type letters to records explicitly or presumably based on field observations only, italics denote doubtful records. The references per island for each taxon are given in chronological order. Taxon names preceded by a question mark represent unreliable records. Abbreviated island names, underlined in the catalogue, are as follows: Chr = Chrisi, Kou = Koufonisi, Mak = Makrouli, Mik = Mikronisi, Str = Strongili, Tra = Trachilos. The floristic catalogue includes a synopsis indicating the status per island (in the sequence Chr, Mik, Kou, Str, Mak, Tra): ■ = recorded as new or presence confirmed; ◻ = literature record accepted, not seen by us; ◻ = taxonomic status questionable; ⊗ = literature record not accepted by us; □ = not found. The catalogue serves as a basis for a quantitative survey of taxon numbers on the islands (Table 4).

## Floristic catalogue

### *Pteridophyta*

#### *Sinopteridaceae*

*Cheilanthes acrostica* (Balbis) Tod. – **Ky**-BeDi

Chr	Mik	Kou	Str	Mak	Tra
■	□		□	□	□

### *Gymnospermae*

#### *Cupressaceae*

*Juniperus macrocarpa* Sm. – He-Co-**Re-Za-Gr-Ch-Ky**-Ja-BrGu-Bö-BeDi

■	□		□	□	□	□
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*J. phoenicea* L. – Chr: Co-**Re-Gr-Ch-Ky**-Ja-BrGu-Bö-BeDi; Kou: *Ga*

■	□		⊗	□	□	□
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Gandoger's unconfirmed record from Koufonisi might refer to another locality. The plants on Chrisi have been assigned to *J. turbinata* Guss. by Brullo & Guarino (2000) but, at least in the E Mediterranean, the latter taxon is doubtfully distinct from *J. phoenicea*.

### *Pinaceae*

*Pinus halepensis* subsp. *brutia* (Ten.) Holmboe – He-Re-Gr-Ch-BrGu

◻	□		□	□	□	□
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Heldreich (in Raulin 1869: 555) mentioned "2 trees" of pine on Chrisi, and W. Greuter (pers. comm.) observed pine, in 1966, in the S part of the central dune portion. The most recent records are by Brullo & Guarino (2000) and Paragamian (2000: 17, including a photograph captured "the island's few pines").

### *Dicotyledones*

#### *Aizoaceae*

*Carpobrotus edulis* (L.) N. E. Br. var. *rubescens* Druce – Ja-BeDi

■	□		□	□	□	□
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Once planted near a house at the NW coast of Chrisi, now locally naturalized.

*Mesembryanthemum nodiflorum* L. – Chr: **Re-Ky**-Ja-BrGu-**BeDi**; Mik: **Re-Ky**; Kou: Ga-**StBa-Ky**-Ja-BeDi; Str: **BeDi**; Mak: Ky; Tra: Ky

■	■		■	■	■	■
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#### *Anacardiaceae*

*Pistacia lentiscus* L. – Chr: He-Re-Gr-Ch-**Ky**-Ja-BrGu-Bö-BeDi; Kou: Ga-**Ky**-Ja-BeDi; Str: Ky-**Ra**-Bö-BeDi; Mak: Ky-**Ra**-Bö-BeDi

■	□		■	■	■	□
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#### *Asclepiadaceae*

*Periploca angustifolia* Labill. – **Re-Gr-Ch-Ky**-Ja-BrGu-**Bö-BeDi**

■	□		□	□	□	□
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**Boraginaceae**

- ?*Alkanna sieberi* DC. – Chr: Co; Kou: Ga ☒ □ | ☒ □ □ □  
Both of Gandoger's island records may be based on misidentification, or the locality might have been confused.
- A. tinctoria* (L.) Tausch – **BeDi** ■ □ | □ □ □ □  
*Anchusa aegyptiaca* (L.) DC. – Kou: **Ky-BeDi**; Str: Ky □ □ | ■ ■ □ □  
*Buglossoides arvensis* (L.) I. M. Johnston – Chr: **Ky**; Kou: **Ky-BeDi** ■ □ | ■ □ □ □  
*Echium angustifolium* Mill. – Chr: He-Gr-**Ky**-Ja-BrGu-BeDi; Mik: **Re-BeDi**; Kou: **StBa-Ky-Ja-Bö-BeDi**; Str: Ky-Ra-Bö-BeDi; Mak: **Ky-Bö-BeDi**; Tra: Ky-BeDi ■ ■ | ■ ■ ■ ■  
*E. arenarium* Guss. – Chr: He-**Re-Ky**-BrGu-**Bö-BeDi**; Kou: **Ky-Ja-BeDi**; Str: Ky; Mak: Ky; Tra: Ky ■ □ | ■ ■ ■ ■  
*Heliotropium hirsutissimum* Rochel – BrGu ▣ □ | □ □ □ □  
*Neatostema apulum* (L.) I. M. Johnston – Chr: Ja-BrGu-BeDi; Kou: Ga-BeDi ■ □ | ■ □ □ □

**Cactaceae**

- Opuntia ficus-indica* (L.) Mill. – BrGu – Planted. ▣ □ | □ □ □ □

**Campanulaceae**

- Campanula erinus* L. – Chr: Ky-Ja-BrGu-BeDi; Kou: **Ky**; Str: Bö ■ □ | ■ ■ □ □

**Capparaceae**

- Capparis spinosa* subsp. *rupestris* (Sm.) Nyman – Kou: **Ky-Ra-BeDi**; Str: Ky-**Ra**; Mak: Ky-**Ra-BeDi**; Tra: **Ra-BeDi** □ □ | ■ ■ ■ ■

**Caryophyllaceae**

- Arenaria leptoclados* (Reichenb.) Guss. – Chr: He (“*A. serpyllifolia*”) – **Re-Za-Ky-BrGu-BeDi**; Kou: **Ky-Ja-BeDi**; Str: Ky-BeDi; Mak: **Ky-BeDi**; Tra: Ky ■ □ | ■ ■ ■ ■  
?*Dianthus fruticosus* L. – Ga □ □ | ☒ □ □ □  
Gandoger's record is almost certainly erroneous; Runemark (1980) did not see any voucher specimens, and there is no later record.
- Herniaria hirsuta* L. – **Ky** ■ □ | □ □ □ □  
*Minuartia hybrida* (Vill.) Schischk. subsp. *hybrida* – BeDi ■ □ | □ □ □ □  
*Paronychia macrosepala* Boiss. – Chr: He-Co-Za-Gr-Ky-Ja-BrGu-Bö-BeDi; Mik: Re-Ky-BeDi; Kou: Ga-StBa-Ky-Ja-BeDi; Str: Ky-Ra-Bö-BeDi; Mak: Ky-Bö-BeDi; Tra: Ky ■ ■ | ■ ■ ■ ■  
Specimens have been recognized as var. *insularum* by Chaudhri (1968).  
*Petrorhagia dubia* (Raf.) G. López & Romo – **Ky-BeDi** ■ □ | □ □ □ □  
*Polycarpon tetraphyllum* (L.) L. – Chr: **Ky-BeDi**; Mik: **Ky-BeDi**; Kou: Ga (var. *alsinifolium*)-**Ky-Ja-BeDi**; Mak: BeDi ■ ■ | ■ □ ■ □  
*Sagina maritima* G. Don – Chr: BrGu-**BeDi**; Kou: **Ja-BeDi**; Str: BeDi ■ □ | ■ ■ □ □  
*Silene ammophila* Boiss. & Heldr. subsp. *ammophila* – Chr: He-**Re-BrGu-BeDi**; Kou: Ga ■ □ | ☒ □ □ □  
The record from Koufonisi is questionable and was not considered by Greuter (1997a).  
*S. apetala* Willd. – Chr: **Ky-Ja-BrGu-BeDi**; Mik: **Ky-BeDi**; Kou: **Ky-Ja-BeDi**; Str: Ky-BeDi; Mak: **Ky-BeDi**; Tra: Ky-BeDi ■ ■ | ■ ■ ■ ■  
*S. behen* L. – Ja □ □ | ■ □ □ □  
*S. gallica* L. – BeDi ■ □ | □ □ □ □  
*S. nocturna* L. – Chr: **Ky-BrGu**; Kou: **Ky-Ja-BeDi** ■ □ | ■ □ □ □  
*S. sclerocarpa* Dufour – Chr: **Ky-BeDi**; Kou: **Ky-Ja-BeDi** ■ □ | ■ □ □ □  
*S. sedoides* Poir. subsp. *sedoides* – Chr: He-**Re-Za-Ky-Ja-BrGu-Bö-BeDi**; Mik: **Ky-BeDi**; Kou: Ga-**StBa-Ky-Ja-Bö-BeDi**; Str: Ky-Ra-Bö; Mak: **Ky**; Tra: Ky ■ ■ | ■ ■ ■ ■



- S. succulenta* Forssk. subsp. *succulenta* – Chr: He-Co-**Re**-Gr-Ch-Ma-Ky-Ja-BrGu-**Bö**-BeDi;  
Kou: Ga ■ □ | ☒ □ □ □  
 Gandoger's record from Koufonisi is questionable and was not confirmed since. The post-1930 indication by Turland & al. (1993) is probably erroneous.
- Spergularia bocconeii* (Scheele) Asch. & Graebn. – **Re**-Ja-BrGu ■ □ | □ □ □ □
- S. diandra* (Guss.) Boiss. – Chr: **Re**-Ky-**BeDi**; Kou: **StBa**-Ky-**Ja**-BeDi; Tra: **Ky** ■ □ | ■ □ □ ■
- S. salina* J. Presl & C. Presl – Ky-BrGu-**BeDi** ■ □ | □ □ □ □
- Velezia rigida* L. – BeDi ■ □ | □ □ □ □

### Chenopodiaceae

- Arthrocnemum macrostachyum* (Morici.) K. Koch – Chr: **Re**-Za-Gr-Ky-**Ja**-BrGu-**Bö**-**BeDi**; Kou: **Ky**-**Ja**-**BeDi**; Str: Ky-Ra-**Bö**-**BeDi**; Mak: **Ky**-Ra-**BeDi**; Tra: Ky-Ra-BeDi ■ □ | ■ ■ ■ ■
- Atriplex halimus* L. – Chr: Ky-Ja-BrGu; Mik: **Re**-BeDi; Kou: **Re**-**StBa**-Ky-**Ja**-Ra-**Bö**-**BeDi**; Str: **Ky**-Ra-**Bö**-**BeDi**; Mak: Ky-Ra-**Bö**-**BeDi**; Tra: Ky-Ra-BeDi ■ ■ | ■ ■ ■ ■
- Beta vulgaris* subsp. *maritima* (L.) Arcang. – **BeDi** ■ □ | □ □ □ □
- Chenopodium murale* L. – Chr: **Ky**-BeDi; Str: Ky; Tra: BeDi ■ □ | □ ■ □ ■
- Salsola aegaea* Rech. f. – Kou: **StBa**-Ky-**Ja**-**BeDi**; Str: Ky-**Bö**-Ra-BeDi; Mak: Ky-Ra-**Bö**-**BeDi**; Tra: Ky-**Bö**-Ra □ □ | ■ ■ ■ ■
- Plants on Koufonisi reach 1.6 m in height, not only 30 cm or 60 cm as given in literature (Aellen 1964, 1993; Freitag 2001; Tan 1997).
- S. kali* L. subsp. *kali* – Chr: **Za**-Gr-Ch-Ma-Ja-BrGu-**Bö**-**BeDi**; Kou: **Re**-Ky ■ □ | ■ □ □ □
- ?*Sarcocornia fruticosa* (L.) A. J. Scott – Chr: *Re*-BrGu; Kou: Ga ☒ □ | ☒ □ □ □
- Recorded as *Salicornia fruticosa* L. by Rechinger and Gandoger but frequently misidentified, in our area most likely for *Arthrocnemum macrostachyum*.
- S. perennis* (Mill.) A. J. Scott – Chr: Ch; Mak: **BeDi** ■ □ | □ □ ■ □
- The identification, based on habitual characters, is preliminary since the collection from Makrouli does not include ripe material.
- Suaeda palaestina* Eig & Zohary – **Ky**-**Ja**-**Bö**-Ra-**BeDi** □ □ | ■ □ □ □
- The occurrence on Koufonisi was recently published as new to Kriti and Greece by Kit Tan & al. in Greuter & Raus (1998: 165).
- S. vera* Forssk. – Chr: He ("*S. maritima*")-**BeDi**; Tra: **Bö**-Ra-**BeDi** ■ □ | □ □ □ ■

### Cistaceae

- Cistus parviflorus* Lam. – Chr: He; Kou: **Ky** ■ □ | ■ □ □ □
- Fumana thymifolia* (L.) Webb  
 – Chr: **Re**-Ky-**Ja**-BrGu-**Bö**-**BeDi**; Kou: **Re**-**StBa**-Ky-**Ja**-Ra-BeDi ■ □ | ■ □ □ □
- Helianthemum salicifolium* (L.) Mill.  
 – Chr: **Re**-Ky-**Ja**-BrGu-**Bö**-**BeDi**; Kou: **Ky**-**Ja**-BeDi ■ □ | ■ □ □ □
- H. stipulatum* (Forssk.) C. Chr. – Chr: **Za**-Ky-**Ja**-BrGu-**Bö**-**BeDi**; Kou: Ga-**Re**-**StBa**-Ky-**Ja**-Ra-**Bö**-**BeDi** ■ □ | ■ □ □ □
- Tuberaria lipopetala* (Murb.) Greuter & Burdet – Ky-BrGu ■ □ | □ □ □ □

### Compositae

- Aetheorhiza bulbosa* subsp. *microcephala* Rech. f. – Chr: Ky-BrGu-BeDi; Kou: BeDi; Str: BeDi; Mak: BeDi; Tra: Ky-BeDi ■ □ | ■ ■ ■ ■
- ?*Anthemis ammanthus* Greuter – Ga □ □ | ☒ □ □ □
- This and the record of the dubious "*Ammanthus tomentellus* Gand." should be regarded as erroneous.
- A. rigida* Heldr. subsp. *rigida* – Chr: **Re**-Gr-Ky-**Ja**-BrGu-**BeDi**; Mik: **Re**-Ky-BeDi; Kou: Ga-**Ky**-**Ja**-BeDi; Str: Ky-Ra-BeDi; Mak: Ky-BeDi; Tra: Ky ■ ■ | ■ ■ ■ ■

- Asteriscus aquaticus* (L.) Less.  
– Chr: Gr-Ky-Ja-BrGu-BeDi; Kou: **StBa**-Ky-Ja-BeDi ■ □ | ■ □ □ □  
For nomenclature see Greuter (1997b).
- Atrectylis cancellata* L. – Chr: Re-Ky-Ja-BrGu-**Bö**-BeDi; Kou: Ga-**StBa-Ky**-Ja-BeDi; Str: Ky-Bö-BeDi; Mak: Ky-BeDi ■ □ | ■ ■ ■ □
- Bellium minutum* (L.) L. – Chr: **Ky**-Ja; Mik: **Ky**; Kou: Ky-BeDi; Str: Ky-BeDi; Mak: Ky-BeDi; Tra: Ky ■ ■ | ■ ■ ■ ■
- Calendula arvensis* L. – Kou: **Ky-BeDi**; Str: BeDi; Mak: **Ky-BeDi** □ □ | ■ ■ ■ □
- ?*Carduus bicolor* Vis. – Chr: Co; Kou: G ☒ □ | ☒ □ □ □
- The plants seen by Gandoger might have been *C. pycnocephalus* (see next).
- C. pycnocephalus* L. – Chr: He-Ky-BrGu-BeDi; Kou: **StBa-Ky**-Ja-Ra-BeDi ■ □ | ■ □ □ □
- Carlina barnebiana* B. L. Burt & P. H. Davis – Ja □ □ | ■ □ □ □
- The species was found exclusively near the NW corner of Koufonisi, together with *C. sitiensis* (see next), but differing in the striking compact habit.
- C. sitiensis* Rech. F.  
– Kou: **Ky**-Ja-BeDi; Str: Ky-**Bö**; Mak: Ky-Bö-BeDi; Tra: BeDi □ □ | ■ ■ ■ ■  
Vouchers from Makrouli and Strongili (*Bö*10437, 10440) determined by E. Vitek; field observations of BeDi and Ky refer to the genus.
- C. lanata* L. – Chr: Gr-Ky-Ja-BrGu; Kou: **Ky**-Ja-**Ra**; Str: Ra; Tra: Ky ■ □ | ■ ■ □ ■
- Carthamus lanatus* subsp. *baeticus* (Boiss. & Reut.) Nyman  
– Chr: BeDi; Kou: Ja-Bö-BeDi ■ □ | ■ □ □ □  
For some observations the identification is considered provisional, owing to plants in pre-flowering stage.
- C. leucocaulos* Sm. – **Ky**-Ja-Ra-BeDi □ □ | ■ □ □ □
- ?*C. boissieri* Halácsy – Chr: BrGu; Kou: Ga ☒ □ | ☒ □ □ □  
Confusion with other *Carthamus* species cannot be excluded.
- Centaurea aegialophila* Wagenitz – Chr: Co-**Ky**-BeDi; Kou: Ga ■ □ | ☒ □ □ □  
A very rare species on Chrisi, and on Koufonisi apparently missing now, if ever there.
- Chlamydomphora tridentata* (Delile) Less. – Chr: **Ky-BeDi**; Mik: Ky; Kou: BeDi; Str: **Ky-BeDi**; Mak: **Ky-BeDi**; Tra: **Ky-BeDi** ■ ■ | ■ ■ ■ ■  
The species was known to occur in the Cretan area only on the islands of Gavdos (Bergmeier & al. 1997) and Gavdopoula (unpubl.); new record for the E part of Kriti + islands.
- Chrysanthemum coronarium* L. – BeDi ■ □ | □ □ □ □
- Cichorium endivia* subsp. *divaricatum* (Schousb.) P. D. Sell  
– BrGu (*C. pumilum* Jacq.) ■ □ | □ □ □ □  
The nomenclature is according to Wagenitz & Bedarff (1989).
- C. spinosum* L. – Chr: He-Gr-Ky-BrGu-BeDi; Kou: **Re-Ky**-Ja-BeDi; Mak: Ky ■ □ | ■ □ ■ □
- Crepis cretica* Boiss. – Chr: He-Co-Re-Ky-Ja-BrGu-**BeDi**; Kou: Ga-**StBa-Ky**-Ja-BeDi; Str: Ky-Bö; Mak: Ky-BeDi ■ □ | ■ ■ ■ □
- C. foetida* L. – **Re-BeDi** □ ■ | □ □ □ □
- C. multiflora* Sm. – Chr: **Ky**-BeDi; Kou: **Ky**; Str: BeDi; Mak: BeDi ■ □ | ■ ■ ■ □
- C. tybakiensis* Vierh. – **BeDi** ■ □ | □ □ □ □
- C. vesicaria* L. – **Ky** □ □ | ■ □ □ □
- Cynara cornigera* Lindl. – Chr: Ky-BrGu-BeDi; Mik: **Re-BeDi**; Kou: Ga-**Ky**-Ja-Bö-BeDi; Str: BeDi; Mak: Ky-Ra-Bö-BeDi; Tra: Ky-Ra-BeDi ■ ■ | ■ ■ ■ ■
- Dittrichia viscosa* (L.) Greuter – Ch ■ □ | □ □ □ □
- Filago aegaea* Wagenitz subsp. *aegaea* – Chr: **Za**-Ky-**Ja**-BrGu-**BeDi**; Mik: **Ky**-BeDi; Kou: **Ky**-Ja-BeDi; Str: **Ky**-BeDi; Mak: **Ky-BeDi**; Tra: **Ky** ■ ■ | ■ ■ ■ ■
- F. cretensis* subsp. *cycladum* Wagenitz – Str: BeDi; Mak: **BeDi** □ □ | □ ■ ■ □
- F. pygmaea* L. – Ja ■ □ | □ □ □ □
- Geropogon hybridus* (L.) C. H. Schultz – **Ky** □ □ | ■ □ □ □
- Hedynois rhagadioloides* subsp. *tubaeformis* Ten. (incl. subsp. *cretica* (L.) Hayek) – Chr:

He-Co-Ky-BrGu (*H. coronopifolia* Ten., *H. cretica* [L.] Dum. Cours.); Kou: Ga-**StBa-Ky**-BeDi;  
Str: Ky-Bö; Mak: Ky; Tra: **Ky**   |

Indications for Makrouli, Strongili and Trachilos refer to *H. rhagadioloides* (L.) F. W. Schmidt s.l.

*H. rhagadioloides* subsp. *monspeliensis* (Murb.) Hayek – Chr: **Re**-Ja-BrGu (*H. rhagadioloides*)-  
 BeDi; Kou: Ja   |

*Helichrysum conglobatum* (Viv.) Steud.

– Chr: Gr-**Ky-BeDi**; Kou: **StBa-Ky**-Ja-**BeDi**; Str: BeDi   |

?*Hyoseris lucida* L. – *BrGu*   |

The record of this species which, in the Cretan area, is otherwise restricted to the west, cannot be accepted without voucher specimen.

*H. scabra* L. – Chr: BrGu-BeDi; Mik: **Ky**; Str: Ky; Tra: **Ky**   |

*Hypochaeris achyrophorus* L. – Chr: Ky-Ja-BrGu-BeDi; Mik: **Ky**; Kou: **Ky-BeDi**; Str: Ky-  
 BeDi; Mak: Ky-BeDi; Tra: Ky   |

*H. glabra* L. – **Ky**   |

*Leontodon tuberosus* L. – Chr: Ky-BrGu; Kou: **StBa-Ky**-Ja-BeDi; Tra: Ky   |

*Pallenis spinosa* (L.) Cass. – Chr: He; Kou: **StBa**-Ja-**BeDi**   |

For nomenclature see Greuter (1997b).

*Phagnalon graecum* Boiss. & Heldr. – Chr: **Re**-Ch-Ky-Ja-BrGu-**Bö**-BeDi; Mik: BeDi; Kou: **StBa**-  
**Ky**-Ja-Ra-Bö-BeDi; Str: Ky-BeDi; Mak: Ky-**Ra**-Bö-BeDi; Tra: Ky-BeDi   |

*Picnomon acarna* (L.) Cass. – Ky-Ja-BeDi   |

?*Reichardia intermedia* (Sch. Bip.) Cout. – *Ga*   |

Gandoger's record cannot be trusted owing to possible misidentification or locality confusion.

*R. orientalis* (L.) Hochr. – Chr: **Re**-Ky-Ja-BrGu-**BeDi**; Mik: Ky; Kou: Ga-**Re**-**StBa-Ky**-**Ja**-  
**BeDi**; Str: Ky-BeDi; Mak: Ky-**BeDi**; Tra: Ky-BeDi   |

*R. picroides* (L.) Roth – Chr: Ky-BrGu (var. *maritima* Fiori); Mik: **Re**-Ky-BeDi; Kou: **Re**-Ky-  
 Ja-BeDi; Tra: **Ky**   |

*Scolymus hispanicus* L. – Chr: Ja-BrGu-BeDi; Kou: **Re**   |

*Scorzonera cretica* Willd. – Chr: **Re**-Ky-Ja-BrGu-**BeDi**; Mik: **Re**-Ky-BeDi; Kou: Ga-**StBa-Ky**-  
 Ja-BeDi; Mak: Ky-**BeDi**; Tra: **Ky**   |

*Senecio leucanthemifolius* Poir. – Chr: BrGu-**BeDi**; Kou: **Ky-BeDi**; Str: BeDi; Mak: **BeDi**; Tra:  
 BeDi   |

Plants match, in quantitative characters, var. *leucanthemifolius* but ligulate florets are lacking.

*S. vulgaris* L.

– Chr: **Ky**-Ja-BeDi; Mik: **Ky**; Kou: **Ky**-Ja-**BeDi**; Mak: **Ky-BeDi**; Tra: **Ky**   |

*Sonchus oleraceus* L. – Chr: **Re**-Ky-Ja-BrGu-BeDi; Mik: **Re**-BeDi; Kou: **Ky**-Ja-BeDi; Str:  
 Ky-BeDi; Mak: Ky-**BeDi**; Tra: Ky-BeDi   |

Records of *S. tenerrimus* L. by Rechinger (1943b, 1951) are assigned here.

*Steptorhamphus tuberosus* (Jacq.) Grossh. – Chr: **Ky-BeDi**; Kou: **Ky**   |

*Taraxacum* sect. *Scariosa* Hand.-Mazz. emend. Dahlst.

– Chr: Gr-**Ky**; Kou: **Ky**   |

*Tragopogon sinuatus* Avé-Lall. – Chr: BeDi; Kou: **Ky**-Ja-BeDi   |

*Urospermum picroides* (L.) F. W. Schmidt – Chr: **Ky**-Ja-BeDi; Mik: **Ky**; Kou: **StBa-Ky**-  
 Ja-BeDi; Str: Ky; Mak: Ky-BeDi   |

### Convolvulaceae

*Convolvulus althaeoides* L. – Chr: BeDi; Kou: Ga-**StBa-Ky**-Ja-BeDi   |

?*C. oleifolius* Desr. – *Ga*   |

Not confirmed by us. Although occurrence not unlikely, Gandoger's record is not accepted here unless substantiated by recent herbarium material.

*Cressa cretica* L. – Chr: **Za-Gr-Ky-Bö-BeDi**; Mik: **Re**; Str: **Ra**   |

The record from Mikronisi is somewhat doubtful for ecological reasons and might perhaps be referable to the opposite coastal part of Chrisi.

*Cuscuta palaestina* Boiss. – Chr: **Ky**; Kou: **Ky-BeDi**; Mak: **BeDi**; Tra: **Ky**   |

The genus (without species identification) was also recorded from Chrisi by N. Böbling.

*C. planiflora* Ten. – **BeDi**   |

### Crassulaceae

*Sedum litoreum* Guss. – Chr: **Ky-BeDi**; Mik: **Ky**; Kou: **StBa-Ky-Ja-BeDi**; Str: **Ky-Ra-Bö-BeDi**; Mak: **Ky-BeDi**; Tra: **Ky**   |

*S. rubens* L. – Chr: **BeDi**; Kou: **Ja-BeDi**; Str: **BeDi**; Mak: **BeDi**; Tra: **BeDi**   |

*Tillaea alata* Viv. – Kou: **BeDi**; Str: **BeDi**; Mak: **BeDi**   |

*Umbilicus horizontalis* (Guss.) DC. – Chr: **Ky-BeDi**; Mik: **BeDi**; Kou: **Ky-BeDi**; Mak: **Ky-BeDi**; Tra: **BeDi**   |

### Cruciferae

?*Arabidopsis pumila* (Willd.) N. Busch – *Ga*   |

Gandoger's record (as "*Sisymbrium pumilum*") was already considered impossible by Rechinger (1943a: 207).

*Biscutella didyma* L. – Chr: **Ky-BeDi**; Kou: **Ky-BeDi**; Str: **BeDi**; Mak: **Ky-BeDi**; Tra: **Ky-BeDi**   |

*Brassica tournefortii* Gouan – Chr: **Ch-Ky-Ja-BrGu-BeDi**; Kou: **Ga-StBa-Ky-BeD**   |

*Cakile maritima* Scop. – Chr: **Re-Ch-Ma-Ky-Ja-BrGu-BeDi**; Kou: **Ky-Ja-BeDi**   |

*Carrichtera annua* (L.) DC. – **Ky-Ja-BrGu**   |

*Clypeola jonthlaspi* L. – Kou: **Ky-BeDi**; Mak: **BeDi**; Tra: **Ky**   |

?*Didesmus aegyptius* (L.) Desv. – *Ga*   |

Not seen by us in the area investigated. Although occurrence not unlikely, Gandoger's record is not accepted here unless substantiated by recent herbarium material.

?*Erophila praecox* (Steven) DC. – *BrGu*   |

The record is not accepted here since this species can never be reliably determined on material found in the end of August when Chrisi was visited by Brullo & Guarino (2000).

*Diploxix viminea* (L.) DC. – **Ky**   |

*Hirschfeldia incana* (L.) Lagr.-Foss. – **Ky-Ja-BeDi**   |

*Hornungia procumbens* (L.) Hayek – Chr: **Ky-BeDi**; Mik: **Ky**; Str: **Ky-BeDi**; Mak: **BeDi**; Tra: **Ky-BeDi**   |

The nomenclature is according to Appel & Al-Shehbaz (1997). This is a new record for the E part of Kriti and offshore islands.

*Malcolmia chia* (L.) DC. – Chr: **Ky-BeDi**; Mik: **Ky**; Kou: **Ga-Ky-BeDi**   |

*M. flexuosa* (Sm.) Sm. – Chr: **He-Re**; Kou: **Ky-Ja-BeDi**; Str: **Ky-BeDi**; Mak: **Ky-BeDi**; Tra: **BeDi**   |

*M. nana* (DC.) Boiss. – Chr: **Ky-BeDi**; Kou: **Ky-Ja-BeDi**   |

*Rapistrum rugosum* (L.) All. – **Ga-Re** (var. *orientale* [L.] Arcang.)-**StBa-Ky-BeDi**   |

### Cucurbitaceae

*Bryonia cretica* L. – **Ky-BeDi**   |

### Ericaceae

*Erica manipuliflora* Salisb. – Chr: **Re-Gr-Ch-Ky-Ja-BrGu-Bö-BeDi**; Kou: **Ga-StBa-Ky-Ja-Ra-BeDi**   |

**Euphorbiaceae**

- Andrachne telephioides* L. subsp. *telephioides* – **Ky**  |
- Euphorbia acanthothamnus* Boiss. – **Ky-BeDi**  |
- E. exigua* L. – **Chr: Ky-BeDi; Kou: BeDi**  |
- E. paralias* L. – **Chr: Ch-Ky-Ja-BrGu-Bö-BeDi; Kou: Ky-BeDi**  |
- E. peplis* L. – **Chr: Re-Za-Ch-Ma-BrGu; Kou: Ky**  |
- E. peplus* L. – **Chr: Ky-BeDi; Mik: Ky-BeDi; Kou: Ga-Ky-BeDi; Str: Ky-BeDi; Mak: Ky-BeDi; Tra: Ky**  |
- Mercurialis annua* L. – **Chr: He-Ky-Ja-BeDi; Mik: Ky-BeDi; Kou: StBa-Ky-Ja-BeDi; Str: Ky-BeDi; Mak: Ky-BeDi; Tra: Ky-BeDi**  |

**Frankeniaceae**

- Frankenia corymbosa* Desf. s.l. – **Kou: Ky; Tra: Ky-Bö-Ra**  |
- This is the second record for Kriti and Greece (see Böhling & al. in Greuter & Raus 1999: 55). The affinities of the local populations and the taxonomy of the variable species require further investigations.
- F. hirsuta* L. – **Chr: He-Gr-Ky-BrGu-Bö-BeDi; Mik: Re; Str: Ky; Mak: Ky**  |
- F. pulverulenta* L. – **Chr: He-Re-BrGu; Mik: Re-Ky; Kou: Ky**  |

**Gentianaceae**

- ?*Blackstonia acuminata* (Koch & Ziz) Domin subsp. *acuminata* – **BrGu**  |
- Almost certainly recorded in error for *B. perfoliata* (see next).
- B. perfoliata* (L.) Huds. – **Chr: Ky-BeDi; Kou: Ga**  |
- Gandoger's record from Koufonisi cannot be accepted unless confirmed.
- Centaureum pulchellum* (Sw.) Druce – **Chr: Co-Ky-BeDi; Kou: Ga-StBa-Ky-BeDi; Str: Ky; Mak: Ky; Tra: Ky**  |
- C. spicatum* (L.) Fritsch – **Bö**  |
- C. tenuiflorum* (Hoffmanns. & Link) Fritsch subsp. *tenuiflorum* – **Chr: Ja-BrGu-BeDi; Kou: Ja-BeDi**  |

**Geraniaceae**

- Erodium cicutarium* (L.) L'Hér. s.l. – **Chr: He-Re-Ky-BrGu-BeDi; Mik: Ky; Kou: Ky-BeDi; Str: Ky-BeDi; Mak: Ky-BeDi; Tra: Ky**  |
- E. crassifolium* L'Hér. – **Ky-Ja-BeDi**  |
- E. laciniatum* (Cav.) Willd. subsp. *laciniatum* – **Chr: Za-Ky-Ja-BrGu-BeDi; Kou: Ga-Ky-Ja-BeDi**  |
- E. malacoides* (L.) L'Hér. – **Chr: Ky-BeDi; Mik: Ky-BeDi; Kou: Ky-Ja-BeDi; Str: Ky-BeDi; Mak: Ky-BeDi; Tra: BeDi (cf.)**  |
- E. neuradifolium* Delile – **BeDi**  |
- Geranium molle* L. – **BeDi**  |
- G. purpureum* Vill. – **Ky-BeDi**  |
- G. rotundifolium* L. – **Chr: Ky-BeDi; Kou: Ky-BeDi; Mak: BeDi**  |

**Guttiferae**

- ?*Hypericum empetrifolium* Willd. – **He**  |
- Heldreich's record (Rechinger 1943a: 262) could not be confirmed and may originate somewhere else.

**Labiatae**

- Ajuga iva* (L.) Schreb. – **Chr: Ky-Ja-BeDi; Kou: Ky-Ja-BeDi**  |

*Coridothymus capitatus* (L.) Reichenb. f. – Chr: He-Re-Gr-Ch-Ky-Ja-BrGu-Bö-BeDi; Kou: StBa-Ky-Ja-Ra-BeDi; Str: Ra; Mak: Ky-Ra-Bö-BeDi; Tra: Ky-Ra   |

A frequent constituent of phrygana on most islands, but on Strongili only a single shrub on the very top of the islet.

*Prasium majus* L. – Chr: He-Ky-Ja-BrGu-Bö-BeDi; Mik: Ky; Kou: Ky-Ja-BeDi; Mak: Ky-BeDi; Tra: Ky   |

*Salvia verbenaca* L. – Chr: BeDi; Kou: StBa-Ky-Ja-BeDi   |

?*S. viridis* L. – *Ga*   |

Gandoger's record might be based on a misidentification or mislabelled specimen.

?*Satureja thymbra* L. – *Ga* (*f. albiflora*)   |

Gandoger's record was not confirmed and perhaps originated elsewhere.

*Sideritis curvidens* Stapf – Chr: He-Co-Ky-Ja-BeDi; Mik: Ky; Kou: Ga-Ky-Ja; Str: Ky-Bö-BeDi; Mak: Ky-BeDi; Tra: Ky   |

*Teucrium brevifolium* Schreb.

– Chr: Re-Gr-Ch-Ky-Ja-BrGu-Bö-BeDi; Kou: Ky-BeDi   |

*T. alpestre* Sm. – He (var. *majus* Boiss.)-Gr-Ky-Ja   |

*T. capitatum* L. – Chr: He (“*T. polium* L.”)-Re-Ky-BrGu-BeDi; Kou: Re-Ky-Ja-Ra-BeDi; Str: Ky-Bö-Ra-BeDi; Mak: Ky-Ra-Bö-BeDi; Tra: Ky-Ra   |

The taxonomic status of the *Teucrium* populations on the investigated islands remains to be clarified. Varietal rank (*T. polium* var. *dumulosum* Rech. f.) was given by Rechinger (1943), and recently species rank (*T. dumulosum* [Rech. f.] Brullo & Guarino) by Brullo & Guarino (2000). Another open question is whether or not the populations on Chrisi and on the Koufonisia islands belong to different taxa (Rechinger 1943b for Koufonisi: *T. polium* var. *intermedium* Čelak.).

## Leguminosae

*Anthyllis hermanniae* L. – Chr: He-Re-Gr-Ch-Ky-Ja-BrGu-BeDi; Kou: Re-StBa-Ky-Ja-Ra-BeDi   |

?*Astragalus echinatus* Murray – Chr: Co; Kou: Ga   |

Doubts remain whether the species seen by Cousturier & Gandoger (Rechinger 1943: 317, sub *A. pentaglottis* L.) is now extinct or had erroneously been assigned to the islands treated here.

*A. boeticus* L. – **Ky**   |

The species was recorded for the Cretan area more than 150 years ago by Heldreich near Chania (Rechinger 1943a: 317) but was not confirmed for the Cretan area after 1930 (Chilton & Turland 1997).

*A. hamosus* L. – Chr: Ky-BeDi; Mik: BeDi   |

*A. pelecinus* (L.) Barneby – **Ky-BeDi**   |

*A. peregrinus* Vahl – Chr: Ky-Zi-BeDi; Kou: Ga (var. *kouphoënsis* [Gand.] Hayek)-StBa-Ky-Ja-BeDi; Mak: Ky-BeDi (cf.)   |

This species was not recorded for Kriti + islands since 1930 (Chilton & Turland 1997).

*A. sinaicus* Boiss. – **Re-Ky-BeDi**   |

Collected by R. Jahn also along the coasts of S Central and SE Kriti.

*Bituminaria bituminosa* (L.) C. H. Stirt. – **Ky-BeDi**   |

*Ceratonia siliqua* L. – Ch-BrGu-BeDi   |

The species occurs very scattered in *Pistacia* scrub in the W part of Chrisi.

*Coronilla scorpioides* (L.) W. D. J. Koch – Chr: Ky-Ja-BrGu-BeDi; Kou: Ky   |

*Ebenus cretica* L. – Chr: Ky-BeDi; Kou: Ky   |

In both islands, only single plants occur very locally in the phrygana.

*Hedysarum spinosissimum* L. – Chr: Ky-BeDi; Kou: Ky-Ja-BeDi   |

*Hippocrepis ciliata* Willd. – Ky-Ja-BrGu-BeDi   |

*H. cyclocarpa* Murb. – Chr: BeDi; Kou: Ja-BeDi   |

Not confined to the southern islets but also present on Kriti (Akr. Mavros near Vai; R. Jahn, unpubl.) and on Dragonada (Dionysades; Bergmeier & Dimopoulos 2001).

*H. unisiliquosa* L. subsp. *unisiliquosa* – **Ky**   |

New to Kriti + islands; the species was known in the S Aegean only from a Pichler collection of 1880 originating from Karpathos (Lassen in Greuter & Raus 1987).

*Hymenocarpus circinnatus* (L.) Savi – **Chr: Ky-Ja-BeDi; Kou: Ky-Ja-BeDi**   |

?*Lathyrus clymenum* L. – **Ga**   |

Not seen by us in the area investigated. The former presence of this species on Koufonisi is not improbable considering the extent of arable fields in the past. The taxon was assigned to var. *articulatus* (L.) Arcang. by Gandoger.

*L. saxatilis* (Vent.) Vis. – **Ky-BeDi**   |

*Lotus cytisoides* L. – **Chr: BeDi; Mik: BeDi; Kou: Ga-Ky-BeDi; Str: BeDi; Mak: Ky-BeDi; Tra: Ky**   |

*L. edulis* L. – **Chr: Ky-Ja-BrGu-BeDi; Mik: BeDi; Kou: StBa-Ky-Ja-BeDi; Str: Ky; Mak: Ky; Tra: Ky**   |

*L. halophilus* Boiss. & Spruner – **Chr: Co-Re-Ky-Ja-BrGu-Bö-BeDi; Kou: Ga-StBa-Ky-Ja-BeDi; Str: Ky-Ra-BeDi; Mak: Ky-BeDi**   |

*L. peregrinus* L. – **Chr: Ky-Ja-BrGu-BeDi; Mik: Ky; Kou: Ky-BeDi**   |

*L. tetragonolobus* L. – **Ky-BeDi**   |

?*Medicago arabica* (L.) Huds. – **BrGu**   |

The fruits that, in the end of August, Brullo & Guarino (2000) reported as belonging to *M. arabica* could have been confused for another *Medicago* species.

*M. coronata* (L.) Bartal. – **Chr: Ky-Ja-BrGu-BeDi; Mik: Ky-BeDi; Kou: Ky-Ja-BeDi; Str: Ky-Bö-BeDi; Mak: Ky-Bö-BeDi; Tra: Ky-BeDi**   |

*M. disciformis* DC. – **Chr: Ky-BeDi; Kou: Ky-Ja-BeDi; Tra: Ky**   |

*M. littoralis* Loisel. – **Chr: Co-Ky-Ja-BrGu-BeDi; Mik: Ky-BeDi; Kou: Ga-StBa-Ky-Ja-BeDi; Mak: Ky-BeDi**   |

The species is variable on Koufonisi: collections include a form with unarmed fruits which grows associated with the typical form and was referred by Gandoger to var. *brevisetata* DC.

*M. marina* L. – **Chr: Ky-Ja-BrGu-Bö-BeDi; Kou: Ga-StBa-Ky-Ja-BeDi**   |

*M. minima* (L.) L. – **Chr: Ky-Ja-BeDi; Kou: Ky-Ja-Ra-BeDi; Tra: Ky-Ra**   |

*M. monspeliaca* (L.) Trautv. – **Chr: Gr-Ky; Mik: Ky; Kou: Ky-BeDi; Str: Ky-Ra-BeDi; Mak: Ky-BeDi**   |

*M. truncatula* (Retz.) Willd. – **Ja**   |

*Melilotus indicus* (L.) All. – **BeDi**   |

?*Onobrychis aequidentata* (Sm.) D'Urv. – **BrGu**   |

Record probably in error for *O. caput-galli* (see next).

*O. caput-galli* (L.) Lam. – **Chr: Ky-Ja-BeDi; Kou: StBa-Ky-Ja-BeDi**   |

*Ononis diffusa* Ten. – **Ky-Ja-BeDi**   |

The species was not recorded for the Cretan area since 1930 (Chilton & Turland 1997).

*O. hispanica* L. f. subsp. *hispanica*   |

– **He-Re-Za-Gr-Ch-Ma-Ky-BrGu-Bö-BeDi**

Also reported by Förther & Podlech (1991) based on a Sieber collection at M.

*O. ornithopodioides* L. – **Ky-Ja-BrGu-BeDi**   |

*O. reclinata* L. s.l. – **Chr: Re-Ky-Ja-Zi-BrGu-BeDi; Kou: Ga-StBa-Ky-Ja-BeDi; Str: Ky; Mak: Ky; Tra: Ky**   |

*O. sieberi* DC. – **StBa-Ky-Ja-BeDi**   |

*O. vaginalis* Vahl – **Ky**   |

This is a new record for the Cretan area, the whole of Greece, and Europe.

*Scorpiurus muricatus* L. – **Chr: Ky-BeDi; Kou: Re-StBa-Ja-BeDi; Str: Ky-BeDi; Mak: Ky-BeDi; Tra: Ky**   |

All plants seen by us belong to var. *subvillosus* (L.) Fiori.

- Trifolium campestre* Schreb. – Chr: Re-Ky-Ja-BrGu-BeDi; Kou: Ga-StBa-Ky-Ja-Ra-BeDi; Str: Bö; Mak: Ky ■ □ | ■ ■ ■ □
- T. infamia-ponertii* Greuter – Chr: Re-Ky-Ja-BrGu-BeDi; Kou: Ga-StBa-Ky-Ja-Ra-BeDi; Str: Ky; Mak: Ky ■ □ | ■ ■ ■ □
- T. scabrum* L. – Chr: Ky-Ja-BrGu-BeDi; Mik: Ky; Kou: Ga-StBa-Ky-Ja-BeDi; ; Str: Ky-Ra; Mak: Ky-BeDi ■ ■ | ■ ■ ■ □
- T. stellatum* L. – Chr: Ky-BeDi; Kou: StBa-Ky-BeDi; Str: Ky ■ □ | ■ ■ □ □
- ?*T. suffocatum* L. – BrGu ☒ □ | □ □ □ □
- The occurrence on Chrisi would not be unlikely but requires confirmation, owing to the late recording time (end of August; Brullo & Guarino 2000) which hardly permits a reliable determination.
- T. tomentosum* L. – BrGu-BeDi ■ □ | □ □ □ □
- T. uniflorum* L. – Chr: Gr-Ky-Ja-BrGu-BeDi; Mik: Ky-BeDi; Kou: StBa-BeDi ■ ■ | ■ □ □ □
- Tripodion tetraphyllum* (L.) Fourr. – Chr: Ky-Ja-BeDi; Kou: Ky-Ja-BeDi; Mak: BeDi ■ □ | ■ □ ■ □
- Vicia cretica* Boiss. & Heldr. – Ky ■ □ | □ □ □ □
- V. sativa* L. s.l. – Ky □ □ | ■ □ □ □

### Linaceae

- Linum strictum* L. – Chr: Ky-Ja-BrGu-BeDi; Kou: Ga-StBa-Ky-Ja-BeDi; Str: Ky-Bö; Mak: Ky; Tra: Ky ■ □ | ■ ■ ■ ■
- All plants seen by us belong to var. *spicatum* Pers.

### Lythraceae

- Lythrum hyssopifolia* L. – Ky-BeDi ■ □ | □ □ □ □

### Malvaceae

- Malva aegyptia* L. – Chr: Ky-Ja-Bö-BeDi; Mik: Ky-BeDi; Kou: Ga-Ky-Ja-BeDi ■ ■ | ■ □ □ □
- ?*M. cretica* Cav. – Chr: BrGu; Kou: Ga ☒ □ | ☒ □ □ □
- The Chrisi record probably in error for *M. aegyptia*; Gandoger's Koufonisi record not confirmed by us.
- M. parviflora* L. – Chr: Ky-BrGu; Mik: Ky; Kou: Ky; Str: BeDi; Mak: BeDi; Tra: Ky-BeDi ■ ■ | ■ ■ ■ ■

### Oleaceae

- Olea europaea* L. – Chr: BrGu; Kou: Ky-Bö-BeDi ■ □ | ■ □ □ □
- Olive is rare on Koufonisi and is represented by both var. *europaea* (Bö 10470) and var. *sylvestris* (Mill.) Lehr; the record from Chrisi is said to belong to the latter taxon.

### Orobanchaceae

- Cistanche phelypaea* (L.) Cout. – Mik: Re-Ky-BeDi; Kou: Ga-Re-StBa-Ky-Ja-Ra-Bö-BeDi; Mak: Ky-BeDi □ ■ | ■ ■ ■ □
- Most or all individuals of this significant root parasite were found close to *Atriplex halimus* scrub. Rechingers records from Koufonisi and Mikronisi have been cited by Gilli (1966); an occurrence on Chrisi was communicated to Z. Kypriotakis but could not be confirmed.
- Orobanche grisebachii* Reut. – Ja □ □ | ■ □ □ □
- Determination confirmed by H. Uhlich. The species was not recorded from the area since 1930 (Chilton & Turland 1997) but occurs also on the main island of Kriti (R. Jahn, unpubl.).
- ?*O. lavandulacea* Reichenb. – Ga □ □ | ☒ □ □ □



This record by Gandoger (Rechinger 1943a: 488) is almost probably based on a misidentification.

- O. mutellii* F. W. Schultz – **Chr:** Ky-BeDi; **Kou:** Ga-StBa ■ □ | ■ □ □ □  
 Specimens from Chrisi (*Ky 8565*) and from Koufonisi (*Strid 17633*) were determined by H. Uhlich.
- O. cf. nana* (Reut.) Beck – **Ky** □ □ | ■ □ □ □  
 The specimen *Ky 8591* (det. H. Uhlich) is of poor quality, and the occurrence of this taxon in the area needs confirmation by appropriate herbarium material.
- O. pubescens* d'Urv. – **Mik:** Ky; **Kou:** Ga-Ky-BeDi □ ■ | ■ □ □ □  
 Specimens from Mikronisi and Koufonisi (*Ky 8545, 8590*) were determined by H. Uhlich.

### Oxalidaceae

- Oxalis pes-caprae* L. – **Chr:** Ky-BeDi; **Kou:** Ky-BeDi; **Mak:** BeDi; **Tra:** BeDi ■ □ | ■ □ ■ ■  
 The adventive species has become established and occurs scattered on most islands but on Makrouli it was only found in a single locality in the northern part.

### Papaveraceae

- Fumaria officinalis* L. subsp. *officinalis* – **Ky** □ ■ | □ □ □ □  
*F. sp.* – **Kou:** BeDi; **Tra:** Ky-BeDi □ □ | ■ □ □ ■  
 Plants found, probably different from *F. officinalis*, were not in an identifiable stage.
- Glaucium flavum* Crantz – He-Ky-BrGu-BeDi ■ □ | □ □ □ □  
*Hypecoum procumbens* L. subsp. *procumbens* – Ga-Ky-BeDi □ □ | ■ □ □ □  
*Papaver argemone* subsp. *nigrotinctum* (Fedde) Kadereit – **Ky-BeDi** ■ □ | □ □ □ □  
 The taxon was only recently recorded for the Cretan area by Sfikas (1986) and by Chilton (Chilton & Turland 1997: 69). The determination of the specimen *Be 99-C9a* was confirmed by J. W. Kadereit.
- P. purpureomarginatum* Kadereit – **Ky** □ □ | ■ □ □ □  
*P. rhoeas* L. – **StBa-Ky-BeDi** □ □ | ■ □ □ □

### Plantaginaceae

- Plantago afra* L. – **Chr:** Ky-Ja-BrGu-Bö; **Mik:** Ky-BeDi; **Kou:** Ky-Ja-BeDi; **Str:** Ky-Ra-Bö-BeDi; **Mak:** Ky-Bö-BeDi; **Tra:** Ky-BeDi ■ ■ | ■ ■ ■ ■  
*P. albicans* L. ■ □ | ■ □ □ □  
 – **Chr:** He-Co-Re-Za-Gr-Ky-Ja-Zi-BrGu-Bö-BeDi; **Kou:** Ga-StBa-Ky-Ja-BeDi ■ □ | ■ □ □ □  
*P. amplexicaulis* Cav. ■ □ | ■ ■ ■ ■  
 – **Chr:** Zi; **Kou:** StBa-Ky-Ja-Bö-BeDi; **Str:** Ky; **Mak:** Ky-BeDi; **Tra:** Ky ■ □ | ■ ■ ■ ■  
*P. bellardii* All. – **Chr:** Ky-Ja-BeDi; **Kou:** Ky-Ja-BeDi; **Str:** Ky-Ra-BeDi ■ □ | ■ ■ □ □  
 Plants seen may be assigned to subsp. *deflexa* (Pilger) Rech. f. ■ □ | ■ □ □ □  
*P. cretica* L. – **Chr:** Ky-BrGu-BeDi; **Kou:** Ga-BeDi ■ □ | ■ □ □ □  
*P. lagopus* L. – **StBa-Ky-Ja-BeDi** □ □ | ■ □ □ □  
*P. weldenii* Reichenb. – **Chr:** Gr-Ky-Ja-Zi-BrGu-BeDi; **Mik:** Re-Ky-BeDi; **Kou:** StBa-Ky-Ja-Bö-BeDi; **Str:** Ky-Ra-Bö-BeDi; **Mak:** Ky-Bö-BeDi; **Tra:** Ky-BeDi ■ ■ | ■ ■ ■ ■

### Plumbaginaceae

- Limoniastrum monopetalum* (L.) Boiss. – **Chr:** He-Re-Za-Gr-Ch-Ky-Ja-BrGu-Bö-BeDi; **Kou:** Ky; **Str:** Ky-Ra-Bö-BeDi; **Mak:** Ky-Ra-BeDi ■ □ | ■ ■ ■ □  
 On Koufonisi, there is but a single individual near Aj. Nikolaos; the species is more frequent on Strongili and Makrouli.
- ?*Limonium chrisianum* Brullo & Guarino – **BrGu** ■ □ | □ □ □ □  
 Vouchers of this recently described species (Brullo & Guarino 2000) are currently not available in CAT (Brullo, in litt.); thus, owing to the unreliability of several identifications of species from

Chrisi, by Brullo & Guarino, the taxonomic status of this species which seems to be close to, or conspecific with, *L. rigidum* A. Mayer, remains an open question (M. Erben, in litt.).

*L. echioides* (L.) Mill. – Chr: He-**Re**-Gr-Ch-Ky-**Ja**-BrGu-**Bö**-**BeDi**; Mik: **Re**-BeDi; Kou: **Ky**-**Ja**-**BeDi**; Str: **Ky**-**Bö**-BeDi   |

A voucher specimen from Strongili (*Bö 10434*) was confirmed by R. Artelari.

*L. graecum* (Poir.) Rech. f. agg. – Chr: Gr-Ky-Ja-Ma-BrGu-**Bö**-**BeDi**; Mik: **Re**-**Ky**-**BeDi**; Kou: **StBa**-**Ky**-**Ja**-**BeDi**; Str: **Ky**-**Ra**-**Bö**-BeDi; Mak: **Ky**-**Ra**-BeDi; Tra: Ky-**Bö**-**Ra**-BeDi   |

A voucher specimen from Strongili (*Bö 10432*) was determined by R. Artelari. Brullo & Guarino (2000) recorded *L. roridum* (Sm.) Brullo & Guarino from Chrisi; however, the identity of this species which is distinct from *L. graecum* remains to be clarified (M. Erben, in litt.).

*L. hyssopifolium* (Girard) Rech. f. – Chr: **Bö**; Kou: **Bö**   |

The identification of a specimen from Chrisi (*Bö 8384*) is provisional; another one from Koufonisi (*Bö 10454*) was determined by R. Artelari.

*L. virgatum* (Willd.) Fourr. – He (*Statice oleifolia* [Mill.] Sm.)-Gr-BrGu-**BeDi**   |

### Polygonaceae

*Emex spinosa* (L.) Campd. – Chr: **Ky**-BeDi; Kou: Ga-**Ky**-Ja-BeDi   |

*Polygonum maritimum* L. – Chr: **Re**-Ma-Ky-BrGu-BeDi; Kou: **Ky**   |

*Rumex bucephalophorus* subsp. *aegaeus* Rech. f. – Chr: Co-**Re**-Ky-BrGu-**BeDi**; Mik: **Re**-BeDi; Kou: Ga-**Re**-**StBa**-**Ky**-Ja-BeDi; Str: Ky-BeDi; Mak: Ky-BeDi; Tra: Ky-BeDi   |

*R. pulcher* L. s.l. – BeDi   |

### Primulaceae

*Anagallis arvensis* L.

– Chr: Ky-Ja-BrGu-BeDi; Kou: **StBa**-**Ky**-Ja-BeDi; Mak: BeDi   |

All plants seen by us belong to var. *caerulea* (L.) Gouan.

*Asterolinon linum-stellatum* (L.) Duby – Chr: **Ky**-Ja; Kou: BeDi   |

### Rafflesiaceae

?*Cytinus hypocistis* (L.) L. – *Ga*   |

Gandoger's record was not confirmed and may originate elsewhere.

### Ranunculaceae

*Adonis microcarpa* subsp. *cretica* (Huth) Vierh. – **Ky**-**BeDi**   |

We found red- and yellow-flowered plants.

*Clematis cirrhosa* L. – BeDi   |

*Nigella doerfleri* Vierh. – Chr: **Zi**-**BeDi**; Kou: **Ky**-**Ja**-**BeDi**   |

*N. fumariifolia* Kotschy – **Ja**   |

*Ranunculus asiaticus* L. – Chr: **Ky**; Kou: BeDi   |

All plants seen in flower belong to var. *albus* Hayek.

*R. paludosus* Poir. – Chr: BrGu; Kou: BeDi   |

### Resedaceae

*Reseda lutea* L. – Ga-**StBa**-**Ky**   |

### Rhamnaceae

*Rhamnus lycioides* subsp. *oleoides* (L.) Jahand. & Maire

– Kou: **Ky**-**Ra**-BeDi; Mak: Ky   |

**Rosaceae***Sanguisorba minor* Scop. – **StBa** □ □ |  □ □ □ □*Sarcopoterium spinosum* (L.) Spach – Chr: Ky-BrGu; Kou: **Ky-Ja-Ra-BeDi**; Mak: **Ky-Ra-BeDi** ■ □ | ■ □ ■ □ □**Rubiaceae***Galium aparine* L. – Chr: **Ky-BeDi**; Kou: **Ky-Ja-BeDi** ■ □ | ■ □ □ □*G. murale* (L.) All.– Chr: Ky-BrGu; Mik: **Ky**; Kou: **Ky-Ja-BeDi**; Str: BeDi; Mak: BeDi; Tra: **Ky** ■ ■ | ■ ■ ■ ■*G. recurvum* DC. – **Ky-BeDi** ■ □ | □ □ □ □

In the Cretan area, this species was only found on Chrisi (Bergmeier &amp; Dimopoulos in Greuter &amp; Raus 1999).

*G. setaceum* Lam. – **Za-Ky-Ja-BeDi** ■ □ | □ □ □ □*Sherardia arvensis* L. – BeDi □ □ | ■ □ □ □*Valantia hispida* L. – Chr: He-Gr-Ky-Ja-BrGu-**BeDi**; Mik: BeDi; Kou: Ga-**StBa-Ky-Ja-BeDi**; Str: **Ky-BeDi**; Mak: **Ky-BeDi**; Tra: **Ky-BeDi** ■ ■ | ■ ■ ■ ■*V. muralis* L. – Chr: Ky-Ja-BrGu-Bö-BeDi; Mik: **Ky-BeDi**; Kou: **Ky-Ja-BeDi**; Str: **Ky-Bö-BeDi**; Mak: **Ky**; Tra: **Ky** ■ ■ | ■ ■ ■ ■**Santalaceae***Thesium humile* Vahl – **Ky-Ja-BeDi** □ □ | ■ □ □ □**Scrophulariaceae***Cymbalaria microcalyx* (Boiss.) Wettst. – **Ky** ■ □ | □ □ □ □A single plant was found, which Z. Kypriotakis assigns to subsp. *microcalyx*; in the S Aegean area this subspecies is only known from W Kriti.*Linaria simplex* (Willd.) DC. – Chr: **Ky-BeDi**; Mak: **Ky** ■ □ | □ □ ■ □*Misopates orontium* (L.) Raf. – Chr: Co (*Antirrhinum nanum* Gand.)-Ky-Ja-BrGu-**BeDi**; Kou: Ga (*A. nanum*)-**Ky-BeDi**; Str: BeDi; Mak: **Ky-BeDi** ■ □ | ■ ■ ■ □*Parentucellia latifolia* (L.) Caruel – Chr: Ky-BrGu-BeDi; Kou: Ga-**Ky** ■ □ | ■ □ □ □**Solanaceae***Lycium schweinfurthii* Dammer – Chr: **Za-Gr-Ch-Ky-Ja-BrGu-Bö-BeDi**; Mik: **Ky-BeDi**; Kou: Ga-**StBa-Ky-Ja-Ra-Bö-BeDi**; Str: **Ky-Ra-BeDi**; Mak: **Ky-Ra-BeDi**; Tra: **Ky-Ra-BeDi** ■ ■ | ■ ■ ■ ■*Mandragora autumnalis* Bertol. – Chr: Ja-BrGu-BeDi; Mik: **Ky-BeDi**; Kou: **StBa-Ky-Ja-BeDi**; Str: **Ky-BeDi**; Mak: **Ky-BeDi**; Tra: BeDi ■ ■ | ■ ■ ■ ■**Tamaricaceae***Tamarix parviflora* DC. – **StBa-Ky-BeDi** □ □ | ■ □ □ □

There are several small native stands scattered on sand dunes.

*T. cf. smyrnensis* Bunge – Gr-BeDi ■ □ | □ □ □ □

Scattered trees were found in various coastal sites, not identified by us with certainty; most or all of them may originate from planting.

**Theligonaceae***Theligonum cynocrambe* L. – Mik: **Ky**; Str: BeDi; Mak: BeDi; Tra: BeDi □ ■ | □ ■ ■ ■**Umbelliferae***?Bupleurum gaudianum* Snogerup – *BrGu* ☒ □ | □ □ □ □

The record is almost probably based on a misidentification of *B. semicompositum* (see next); the figure in Brullo & Guarino (2000) depicts the latter species, certainly not *B. gaudianum*.

*B. semicompositum* L. – Chr: **Re-Ky-Ja-Bö-BeDi**; Kou: **Ky-Ja-BeDi**; Str: Ky-Ra-Bö; Mak: Ky; Tra: Ky

*Crithmum maritimum* L. – Chr: BrGu; Kou: BeDi; Tra: Ky

*Daucus guttatus* Sm. – Chr: BrGu; Kou: Ga; Str: Bö; Mak: Bö

*D. involucratus* Sm. – Chr: **Ky-Ja-BeDi**; Kou: **Ky-Ja-BeDi**; Str: Ky

*Eryngium campestre* L. – Ja

*E. maritimum* L. – **Ky-Ja**

*Lagoecia cuminoides* L. – Chr: **Ky-BeDi**; Kou: **Ky-BeDi**

*Orlaya daucoides* (L.) Greuter – BeDi

?*Pimpinella cretica* Poir. – Ga

The record of Gandoger/Cousturier (Rechinger 1943a: 407) remains unconfirmed and may be based on another species or locality.

*Pseudorlaya pumila* (L.) Grande  
– Chr: Co-**Re-Ky-Ja-BrGu-BeDi**; Kou: Ga-**StBa-Ky-Ja-BeDi**

*Scandix australis* L. – BeDi

*S. pecten-veneris* L. – Chr: Ky-BrGu-BeDi; Kou: **Ky**

*Tordylium apulum* L. – **Ky-BeDi**

*Torilis nodosa* (L.) Gaertn.

– Chr: **Ky-BeDi**; Kou: **Ky-Ja-Bö-BeDi**; Str: BeDi; Mak: Ky-BeDi

The specimen Ky 8558 represents a spiny homocarpic variant; however, we refrain from assigning it to *T. webbii* Jury due to the presence of basal leaf rosettes (Jury 1987).

### Urticaceae

*Parietaria cretica* L. – Chr: **Ky-Bö-BeDi**; Mik: **Ky-BeDi**; Kou: **Ky-BeDi**; Str: Ky-BeDi; Mak: Ky-BeDi; Tra: **Ky-BeDi**

### Valerianaceae

?*Centranthus calcitrapae* (L.) Duf. – Ga

The unconfirmed record may be based on another locality.

*Valerianella discoidea* (L.) Loisel. – Kou: Ga; Tra: **Ky**

On Koufonisi not confirmed but not unlikely.

*V. microcarpa* Loisel. – Chr: **Ky**; Kou: **Ky-BeDi**

### Zygophyllaceae

*Fagonia cretica* L. – **Ch-Ky-Ja-Bö-BeDi**

*Zygophyllum album* L. f. – Chr: **Re-Za-Gr-Ch-Ky-Ja-BrGu-Bö-BeDi**; Kou: Ga-**Re-StBa-Ky-Ra-BeDi**; Mak: Ky-**Ra-BeDi**

### Monocotyledones

#### Agavaceae

*Agave americana* L. – Ky-BrGu-BeDi

Naturalized on Chrisi on the NE beach, also in the NW; fruiting as well as juvenile plants were found.

#### Alliaceae

*Allium brachyspathum* Brullo & al. – **Bö**

This taxon was recently described as new from Karpathos (Brullo & al. 2001, see also Tzanoudakis 2001), and is given here for the first time for Kriti and offshore islands.

- A. rubrovittatum* Boiss. & Heldr. – Chr: Ky-Ja-BrGu-Bö-BeDi; ; Mik: **Re-Ky**; Kou: **Ky-Ja-BeDi**;  
Str: Ky-BeDi; Mak: **Ky-BeDi**; Tra: Ky-BeDi   |
- A. staticiforme* Sm. – Chr: **Ky**; Mik: **BeDi**; Tra: **K**   |
- Earlier records for the Cretan area were considered erroneous by Greuter & al. (1985: 46) but the species was given for the Nomos of Iraklio by Jahn & Schönfelder (1995) based on Tzanoudakis & Vosa (1988), and Tzanoudakis & al. (1991).
- A. sp.* – Kou: **Bö-Ra**; Tra: **Bö-Ra-BeDi**   |
- Specimens under cultivation in B, still undetermined.

### Amaryllidaceae

- Narcissus serotinus* L. – Ky   |
- Pancratium maritimum* L. – Chr: Ch-Ky-Ja-BrGu-Bö-BeDi; Kou: Ky-Ja-Ra-BeDi; Str: Ky; Mak:  
 Ky-Ra-BeDi   |

### Araceae

- Arisarum vulgare* Targ.- Tozz. – Chr: **Ky-Ja-BeDi**; Kou: **Ky-BeDi**; Str: BeDi; Mak: BeDi; Tra:  
 Ky   |

### Asparagaceae

- Asparagus aphyllus* subsp. *orientalis* (Baker) P. H. Davis  
 – Chr: **BrGu**; Kou: BeDi   |
- The dot for Chrisi in the map provided by Turland & al. (1993) is based on a printing error (N. Turland, pers. comm.); the Chrisi record from Brullo & Guarino (2000) is considered doubtful.
- A. horridus* L. – Chr: Ch-Ky-Ja-BrGu-Bö-**BeDi**; Mik: **Re-Ky-BeDi**; Kou: **StBa-Ky-Ja-Ra-Bö-BeDi**; Str: **Ky-Ra-Bö-BeDi**; Mak: **Ra-Bö-BeDi**; Tra: **Ky-Ra-BeDi**   |

### Asphodelaceae

- Asphodelus ramosus* L. – BeDi   |

### Colchicaceae

- Colchicum cousturieri* Greuter  
 – Chr: Co-**Re-Ky-Ja-BrGu-BeDi**; Mik: **Ky-BeDi**; Kou: Ga   |
- The species was given under the misapplied names “*C. variegatum*” and “*C. cupanii*” by Rechinger (1943a-b).

### Cyperaceae

- Cyperus capitatus* Vandelli – Ga-**Re-StBa-Ky-Ja-Bö-BeDi**   |
- Schoenoplectus litoralis* (Schrad.) Palla – **Ky-BeDi**   |
- The species was not recorded for Kriti after 1930 (Chilton & Turland 1997).

### Gramineae

- Aegilops biuncialis* Vis. – Chr: **Ky-BeDi**; Kou: **Ky-Ja-BeDi**   |
- Aeluropus lagopoides* (L.) Thwaites – **Gr-Ch-Ky-Ja-BrGu-Bö-BeDi**   |
- Bö 8386 was determined by H. Scholz.
- Arundo pliniana* Turra – Re (*A. plinii* Turra)-Ch (“*A. donax*”)-BeDi   |
- The tall grass occurs in moderately saline habitats in the E part of Chrisi; the identification is based on field observation and in need of confirmation.
- Aristida caerulescens* Desf. – **Ky**   |
- Avellinia michelii* (Savi) Parl. – Ky-BrGu   |

- Avena barbata* Link subsp. *barbata* – Chr: Co-Ky-Ja-BeDi; Kou: Ga-StBa-Ky-Ja-BeDi; Str: Ky-BeDi; Mak: Ky; Tra: Ky-BeDi   |
- A. sterilis* L. – Chr: Re-BrGu; Kou: Ky   |
- Material collected or seen in August is hardly suitable for a reliable identification of *A. ludoviciana* Durieu (as given by Brullo & Guarino 2000).
- Brachypodium distachyon* (L.) P. Beauv. – Chr: Re-Ky-Ja-BrGu-Bö-BeDi; Kou: StBa-Ky-Ja-Bö-BeDi; Mak: Ky-BeDi; Tra: BeDi   |
- Briza maxima* L. – Chr: BrGu-BeDi; Kou: Ky-Ja-BeDi   |
- Bromus fasciculatus* C. Presl – Chr: Ky-Ja-BrGu-BeDi; Mik: BeDi; Kou: StBa-Ky-Ja-BeDi; Str: Bö-BeDi; Mak: BeDi   |
- A specimen from Strongili (*Bö 10439*) was determined by H. Scholz.
- B. intermedius* Guss.  
– Chr: Ky-Ja-BeDi; Kou: StBa-Ky-Ja-Bö-BeDi; Str: Ky-Bö   |
- B. madritensis* subsp. *haussknechtii* (Boiss.) H. Scholz  
– Chr: Ky; Kou: Ja-BeDi; Mak: BeDi   |
- All field observations refer to *B. madritensis* L. s.l.
- B. rubens* L. – Chr: He-Ky-Ja-BrGu-Bö-BeDi; Mik: Ky-BeDi; Kou: Ky-Ja-BeDi; Str: Ky-Bö-Ra; Tra: Ky-BeDi   |
- A specimen from Chrisi (*Bö 8395*) was determined by H. Scholz.
- B. scoparius* L. – Chr: BrGu; Kou: Ja   |
- Annual brome grasses can hardly be reliably identified on material observed in August; therefore confusion with *B. intermedius* is possible as far as the record for Chrisi is concerned (Brullo & Guarino 2000).
- B. sterilis* L. – Chr: BeDi; Kou: Ky-BeDi; Mak: Ky   |
- Catapodium balearicum* (Willk.) H. Scholz – Chr: Ky-BrGu (“*C. marinum*”)-BeDi; Kou: Ky-Ja-BeDi; Tra: Ky   |
- The taxonomy and nomenclature is according to Scholz (2000).
- C. rigidum* (L.) C. E. Hubb. – Chr: Ky-Bö; Kou: Ky-Ja-BeDi; Mak: BeDi   |
- Cutandia maritima* (L.) Barbey – Chr: Ky-Ja-BeDi; Kou: Ky-Ja   |
- Cynodon dactylon* (L.) Pers.  
– Chr: Ky-Ja-BrGu-BeDi; Kou: Ky; Str: Ky-Ra-BeDi   |
- Dactylis glomerata* L. – Kou: Ky-BeDi; Str: Ky-Ra-BeDi; Mak: Ky-Bö   |
- Generally, subsp. *hispanica* (Roth) Nyman was recorded but subsp. *hackelii* (Asch. & Graebn.) Cif. & Giacom. was identified on Strongili by Th. Raus.
- Elytrigia bessarabica* (Savul. & Rayss) Dubovik – Bö   |
- A voucher specimen (*Bö 8385*) was determined by H. Scholz.
- E. juncea* (L.) Nevski – Chr: Ky-Ja-BeDi; Kou: Ky-Ja-BeDi   |
- ?*E. rechingeri* (Runemark) Holub – BrGu   |
- The identification by Brullo & Guarino (2000) is considered erroneous due to possible confusion with either *E. bessarabica* or *E. juncea*.
- Gastridium phleoides* (Nees & Meyen) C. E. Hubb.  
– Chr: BeDi; Kou: Ga (“*G. scabrum*”)-BeDi   |
- Hordeum leporinum* Link  
– Chr: Ky-BrGu-BeDi; Kou: StBa-Ky-BeDi; Str: Ky; Tra: Ky-BeDi   |
- H. marinum* Huds. – Ky   |
- Hyparrhenia hirta* (L.) Stapf – Chr: Ky-Bö-BeDi; Mik: Re-Ky-BeDi; Kou: StBa-Ky-Ja-BeDi; Str: Ky-Ra-Bö-BeDi; Mak: Ky-Ra-Bö-BeDi; Tra: Ky   |
- Lagurus ovatus* L. subsp. *ovatus* – Chr: He-Ky-BeDi; Kou: Ga-StBa-Ky-Bö-BeDi; Str: Ky-Ra-Bö; Tra: Ky   |
- Field observations included under the type subspecies, as well as *Strid 17588* from Koufonisi, refer to the species sensu lato.
- Lagurus ovatus* subsp. *nanus* (Guss.) Messeri – Chr: Ky-Ja; Kou: Ky-Ja   |

Voucher specimens (*Jahn s.n.*) have been confirmed by H. Scholz. The subspecies is new to Kriti and offshore islands; it was also found on the Cretan mainland (R. Jahn, unpubl.).

*Lolium rigidum* subsp. *lepturoides* (Boiss.) Sennen & Mauricio

– Ga (“*L. strictum*”)–BeDi   |

*Lygeum spartum* L.

– Kou: Ga-Re-StBa-Ky-Ja-Ra-Bö-BeDi; Str: Ky-Ra-BeDi; Mak: Ky-Ra   |

*Melica minuta* L. – Ky-BeDi   |

*Parapholis incurva* (L.) C. E. Hubb. – Chr: Ky-BrGu-BeDi; Kou: Ky-Ja-BeDi; Mak: Ky; Tra: Ky   |

*P. marginata* Runemark – BrGu-BeDi   |

*Phleum crypsoides* (d’Urv.) Franch. subsp. *crypsoides* – Chr: Ky-Ja-BrGu-BeDi; Kou: **Ky-Ja**-BeDi; Str: **Ky**-BeDi; Tra: BeDi   |

*Piptatherum miliaceum* (L.) Coss. subsp. *miliaceum* – Chr: Ky-Ja-BrGu-Bö-BeDi; Kou: **Ky-Ja**-Bö-BeDi   |

*Polypogon maritimus* Willd. s.l. – Ky-BrGu (*P. subspatheus* Req.)–BeDi   |

Scholz (1991: 139) underlines the specific status of *P. subspatheus* besides *P. maritimus* s.str.; whether or not both taxa occur sympatrically on Chrisi still remains to be verified by sufficient herbarium material.

*Psilurus incurvus* (Gouan) Schinz & Thell. – Chr: Ky-Ja-BrGu-BeDi; Kou: **Ky-Ja**-BeDi; Str: Ky-Ra-Bö; Mak: Ky; Tra: **Ky**   |

*Rostraria cristata* (L.) Tzvelev – Chr: He-Ky-BrGu-BeDi; Mik: **Re**-BeDi; Kou: **StBa-Ky**-Ja-BeDi; Str: **Bö**-BeDi-Ra; Mak: Bö-BeDi; Tra: BeDi   |

The voucher *Bö 10435* from Strongili was determined by H. Scholz.

?*R. hispida* (Savi) Doğan – BrGu   |

This is a dubious record (Brullo & Guarino 2000), possibly only representing a form of *R. cristata*.

*Stipa capensis* Thunb. – Chr: Ja-BrGu-Bö-BeDi; Mik: BeDi; Kou: **StBa-Ky**-Ja-BeDi; Str: Ky; Mak: Ky; Tra: Ky   |

The voucher *Bö 8389* from Chrisi was determined by H. Scholz.

*Triplachne nitens* (Guss.) Link – Chr: **Re-Za**-Ky-Ja-BrGu-BeDi; Kou: Ga-**Ky-Ja**-BeDi; Str: Ky-Ra; Mak: **Ky**   |

*Vulpia ciliata* Dumort. – Chr: BrGu; Kou: **Ky**-BeDi   |

*V. fasciculata* (Forssk.) Fritsch

– Chr: **Ky**-Ja-Bö-BeDi; Kou: Ga-**StBa-Ky**-Ja-BeDi   |

### Hyacinthaceae

*Bellevalia sitiaca* Tzanoud. & Kypriotakis – **Ja**   |

Due to the late season, the voucher is a somewhat poor fruiting specimen with large, shortly pedicelled capsules typical for this species.

*Charybdis maritima* (L.) Speta agg. – Chr: He-Gr-Ky-Ja-BrGu-Bö-BeDi; Kou: Ky-Ja-Ra-BeDi; Str: Ra-BeDi; Mak: Ky-Ra-BeDi; Tra: Ky-Ra   |

Generic nomenclature follows Speta (2001). According to Krenn & al. (2001: 104) and Pfosser & Speta (2001: 235), the hexaploid *Charybdis maritima* s. str. is restricted to the W Mediterranean, while the plants of the islands off SE Kriti, traditionally listed as *Urginea maritima* (L.) Baker [agg.] or *Drimia maritima* (L.) Stearn [agg.], may belong to the tetraploid *C. aphylla* (Forssk.) Speta, or to an as yet undescribed taxon (Pfosser & Speta 2001: 230); living material is required for identification.

?*Muscari comosum* (L.) Mill. – BrGu (*Leopoldia comosa* [L.] Parl.)   |

The late-season (August) record is not accepted here due to possible confusion with *M. spreitzenhoferi* (see below).

*M. cycladicum* P. H. Davis & D. C. Stuart – Ky-BeDi   |

Plants from Strongili differ from typical *M. spreitzenhoferi* (see next) in shorter pedicels (to 1 mm) of the fertile flowers, and the presence of numerous sterile flowers with long pedicels. *M. cycladicum* was included in *M. spreitzenhoferi* by Greuter & al. (1985: 47) and therefore omitted by Turland & al. (1993) and Jahn & Schönfelder (1995). It is tentatively separated here in order to remind field botanists to pay attention to the complex around *M. weissii* Freyn, which is still in need of a detailed taxonomic study.

*M. spreitzenhoferi* (Osterm.) Vierh. – Chr: He-Co-Ky-Ja-Bö-BeDi; Mik: Ky-BeDi; Kou: Ga-StBa-Ky-BeDi

A collection from Chrisi (Bö 8382, also under cultivation in B, as “*M. weissii* s.l.”) represents a form intermediate between *M. spreitzenhoferi* and *M. weissii*; both taxa are not always clearly distinguishable (see preceding note, and Davis & Stuart 1984: 251).

*Ornithogalum creticum* Zahar. – **Ky**            
*Prospero autumnale* (L.) Speta agg. – Chr: Ky-BrGu; Kou: Ky-Ra-BeDi; Str: Bö-Ra-BeDi; Mak: Ky-Ra-Bö-BeDi; Tra: Ky-Ra-Bö-BeDi

Generic nomenclature follows Speta (2000); the genus, traditionally listed as *Scilla autumnalis* L. [agg.], is represented on the Koufonisia by an as yet unidentified and probably undescribed taxon, which does not match any of the six new Cretan *Prospero* species described by Speta (2000).

### Iridaceae

*Gladiolus italicus* Mill. – BeDi            
*Gynandris monophylla* Klatt – Chr: Ky-BrGu-BeDi; Kou: Ky-Ja-BeDi            
*G. sisyrinchium* (L.) Parl. – **Ky-BeDi**            
*Romulea* sp. – **Ky**

### Juncaceae

*Juncus heldreichianus* Parl. – Chr: He-Za-Gr-Ch-Ky-Ja-BrGu-BeDi; Kou: Ga-Re; Str: Ky-Ra-BeDi            
 The records from Chrisi and Koufonisi, listed by Rechinger under “*J. acutus*” and “*J. maritimus*” (Rechinger 1943a, 1943b), belong here.  
 ?*J. bufonius* L. – **BrGu**            
 Brullo & Guarino (2000), depending on plants collected or seen in August, probably confused *J. bufonius* with *J. hybridus* (see next).  
*J. hybridus* Brot. – **Ky-BeDi**

### Liliaceae

*Gagea fibrosa* (Desf.) Schult. & Schult. f. – **BeDi**            
*G. graeca* (L.) A. Terracc. – BeDi

### Orchidaceae

*Anacamptis pyramidalis* (L.) Rich. – **Ky**            
*Barlia robertiana* (Loisel.) Greuter – **Ky**            
 ?*Ophrys apifera* Huds. – **Ga**            
 The record is not substantiated by herbarium material (Künkele 1979); it may be based on a different species or locality.  
*O. cretica* (Vierh.) E. Nelson agg. – **Ky, BeDi**            
*O. fusca* Link agg. – BeDi            
*O. tenthredinifera* Willd. – BeDi            
*Orchis collina* Banks & Sol. – **Ky-BeDi**            
*O. coriophora* subsp. *fragrans* (Pollini) Sudre – **Ky-Ja**



*O. papilionacea* L. – **Chr:** Ky; **Kou:** BeDi

■ □ | ■ □ □ □

*Serapias lingua* L. – BeDi

□ □ | ■ □ □ □

*S. orientalis* E. Nelson – **Chr:** BeDi; **Kou:** Ga (“*S. vomeracea*”)

■ □ | ■ □ □ □

The Gandoger record is assigned to this species following Künkele (1979).

### Potamogetonaceae

?*Zostera marina* L. – **Chr:** Co; **Kou:** Ga

☒ □ | ☒ □ □ □

Species identity as well as the exact offshore localities are uncertain.

### Floristic and habitat differences among the islands

Coniferous scrub and woodland (*Juniperus phoenicea*, *J. macrocarpa*) occurs only on Chrisi, while haloxerophilous scrub (*Atriplex halimus*, *Asparagus horridus*, *Salsola aegaea*, *Lycium schweinfurthii*) is more prominent on Koufonisi and its nearby islets (Table 3). In the E part of Chrisi one of the few salt marshes in the S Aegean exists, with the halophytes *Arthrocnemum macrostachyum* and *Aeluropus lagopoides* predominating. A single small stand of *Schoenoplectus litoralis*, to our knowledge the only one in Kriti and offshore islands, occurs not far from the NW shore. Extensive perennial grasslands dominated by *Lygeum spartum* and small areas of inland dunes with native *Tamarix* stands are unique features of Koufonisi. Steppe-like *Lygeum* grasslands are indicative vegetation for the driest regions in Europe. Grasslands dominated by annuals indicate formerly cultivated fields. They occur both on Chrisi and Koufonisi but not on the smaller islands. In such places, probably more than 25 years after agriculture has been abandoned, small populations of weeds are still thriving (*Convolvulus althaeoides*, *Gladiolus italicus*, *Papaver rhoeas*, *Rapistrum rugosum*).

### Phytogeography

The N African/S Mediterranean/W Irano-Turanian element is the phytogeographically most striking one in the flora of the islands. It is represented by the following taxa (numbers in brackets):

Chrisi (13): *Astragalus peregrinus*, *Carrichtera annua*, *Chlamydophora tridentata*, *Fagonia cretica*, *Gynandris monophylla*, *Helianthemum stipulatum*, *Hippocrepis cyclocarpa*, *Lycium schweinfurthii*, *Malva aegyptia*, *Periploca angustifolia*, *Plantago amplexicaulis*, *Silene succulenta*, *Zygophyllum album*;

Table 3. Principal habitat types of the islands off SE Crete.

	Chr	Mik	Kou	Str	Mak	Tra
coastal dunes	+	–	+	+	–	–
inland dunes	–	–	+	–	–	–
sea cliffs	–	–	+	–	–	+
coastal rock	+	+	+	+	+	+
saltmarsh	+	–	–	–	–	–
phrygana	+	+	+	+	+	+
coniferous scrub and woodland	+	–	–	–	–	–
<i>Pistacia</i> scrub	+	–	–	+	+	–
haloxerophilous scrub	–	+	+	+	+	+
abandoned fields	+	–	+	–	–	–
perennial grassland	–	–	+	+	–	–

Table 4. Taxon numbers (species and additional subspecies) of the islands off SE Crete.

	Literature records		Unpublished records		
	total	accepted	total	new island records	post-1990 records
Chrisi	184	163	277	114	259
Mikronisi	22	22	72	50	70
Koufonisi	98	71	273	202	268
Strongili	–	–	110	110	110
Makrouli	–	–	115	115	115
Trachilos	–	–	96	96	96

Mikronisi (4): *Chlamydomphora tridentata*, *Cistanche phelypaea*, *Lycium schweinfurthii*, *Malva aegyptia*;

Koufonisi (16): *Aristida caerulea*, *Astragalus peregrinus*, *Chlamydomphora tridentata*, *Cistanche phelypaea*, *Erodium crassifolium*, *E. neuradifolium*, *Gynandriris monophylla*, *Helianthemum stipulatum*, *Hippocrepis cyclocarpa*, *Lycium schweinfurthii*, *Lygeum spartum*, *Malva aegyptia*, *Ononis vaginalis*, *Plantago amplexicaulis*, *Suaeda palaestina*, *Zygophyllum album*;

Strongili (4): *Chlamydomphora tridentata*, *Lycium schweinfurthii*, *Lygeum spartum*, *Plantago amplexicaulis*;

Makrouli (6): *Chlamydomphora tridentata*, *Cistanche phelypaea*, *Lycium schweinfurthii*, *Lygeum spartum*, *Plantago amplexicaulis*, *Zygophyllum album*;

Trachilos (4): *Chlamydomphora tridentata*, *Frankenia corymbosa*, *Lycium schweinfurthii*, *Plantago amplexicaulis*.

For *Astragalus peregrinus*, *Chlamydomphora tridentata*, *Erodium crassifolium*, *Fagonia cretica*, *Frankenia corymbosa*, *Helianthemum stipulatum*, *Periploca angustifolia* and *Zygophyllum album* we estimate about half or more of the total known population in Greece to be restricted to the study area. *Limoniastrum monopetalum* (native occurrences only), *Suaeda palaestina* and *Ononis vaginalis* are, within Greece and the Aegean, and SE Europe as a whole, restricted to Koufonisi or the study area. Most of these taxa belong to the N African element. Fig. 2 shows that the respective taxa are best represented on the islands S of Kriti, much less along the S and NE coast of the main island, and only scattered elsewhere in the S Aegean. Koufonisi harbours more such species than any other place in Greece and the Aegean, Chrisi slightly less so. Haloxerophilous scrub and *Lygeum* grasslands, both being best developed on Koufonisi, are the principal habitat types for many of the species belonging to the N African element. The ecological conditions and the distribution of pronouncedly thermophilous species suggest a climatic (precipitation) gradient in Kriti towards the SE, and locally from Chrisi to Koufonisi, with the latter being the driest island and in fact closer to semi-desert conditions than any other place in SE Europe.

### Nature conservation

All islands treated here are integrated in the Natura 2000 network of sites of common interest for nature conservation in the European Union (Dafis & al. 1996, Boteva & al. 2001). For Chrisi, a LIFE project was initiated and performed in order to elaborate a conservation and management concept. The latter was apparently of little effect so far, since the most serious impacts continue to grow worse uncontrolled, viz. construction of provisional tourist facilities, illegal camping and pollution of the *Juniperus* woodland, and unrestricted beach tourism. The tiny population of *Silene ammophila* subsp. *ammophila*, endemic to E Crete and rightly included in the Red Data Book of Greece (Phitos in Phitos & al. 1996), is severely threatened by the increasing tourism.

For the island of Koufonisi, luckily an only occasional destination of individual boat trips so far, the situation is less alarming, but random extinctions caused by unintended disturbance,

careless and uncontrolled impact cannot be excluded in the absence of a sound conservation concept that is accepted by the local population. From a botanical point of view, we recommend a strict conservation status in order to safeguard the unique nature (including the archaeological heritage) of Koufonisi and nearby islets, with limited access made possible by individual boat trips only, while prohibiting the construction of tourist facilities of any kind.

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