

Geobotanical survey of Cabo Verde Islands (West Africa)

Salvador RIVAS-MARTÍNEZ⁽¹⁾, Mario LOUSÃ⁽²⁾, Jose Carlos COSTA⁽²⁾ & Maria Cristina DUARTE⁽³⁾

(1) Phytosociological Research Center, 28400 Collado-Villalba, Madrid, Spain..

(2) Instituto Superior de Agronomia. Universidade Técnica de Lisboa. Centro de Botânica Aplicada à Agricultura. Tapada da Ajuda.1349-017 Lisboa. Portugal.

(3) Centre for Ecology, Evolution and Environmental Changes (cE3c), Faculdade de Ciências, Universidade de Lisboa, 1749-016 Lisboa, Portugal

Abstract:

The results of the study of the bioclimate, biogeography, flora and vegetation of Cabo Verde Islands, after seven years of field works in all inhabited isles are presented in this paper. Tropical hyperdesertic to pluviseasonal, upper infra- to low supratropical and upper ultrahyperarid to upper dry, and occasionally lower subhumid (short period years), are the bioclimates in these archipelago. Biogeographically they are situated in the Paleotropical Kingdom, Afrotropical Subkingdom, Tropical Saharan Region, and Cabo Verde Province. Eight new species are described: *Acacia caboverdeana*, *Asphodelus mariolousae*, *Frankenia pseudoericifolia*, *Hyparrhenia caboverdeana*, *Lotus chevalieri*, *Polycarpaea caboverdeana*, *Suaeda caboverdeana* and *Tetraena vicentina*, and also fifteen new combinations are proposed. In taxonomic phytosociology, five new classes: *Cocculo penduli-Sarcostemmetea daltonii*, *Heteropogonetea contorti*, *Tetraenetea simplicis*, *Frankenio pseudoericifoliae-Suaedetia caboverdeanae* and *Arthrocnemetea franzii*; nine new orders: *Euphorbio tuckeyanae-Sarcostemmetalia daltonii*, *Dichrostachyo platycarpae-Acacietaalia caboverdeanae*, *Melinio grandiflorae-Heteropogonetalia contorti*, *Aristido cardosoi-Tetraenetalia simplicis*, *Frankenio pseudoericifoliae-Suaedetia caboverdeanae*, *Arthrocnemetalia franzii*, *Sesuvietalia sesuvioideis*, *Kickxietalia elegantis* and *Euphorbietalia prostrato-hirtae*; fourteen new alliances: *Asparago squarrosi-Sarcostemmion daltonii*, *Globulario amygdalifoliae-Periplocion chevalieri*, *Fico gnaphalocarpae-Acacion caboverdeanae*, *Phoenicion atlanticae*, *Tamaricion senegalensis*, *Heteropogonion melanocarpo-contorti*, *Aristido cardosoi-Tetraenion simplicis*, *Polycarpaeo caboverdeanae-Tetraenion waterlotii*, *Arthrocnemion franzii*, *Sesuvion sesuvioideis*, *Adiantion trifidi*, *Kickxion elegantis*, *Adiantion incisophilippensis* and *Trianthemion portulacastri* and, finally, fifty two new associations: *Cocculo penduli-Sarcostemmetum daltonii*, *Campylantho spathulati-Sarcostemmetum daltonii*, *Frankenio caboverdeanae-Asparagetum squarrosi*, *Aeonio gogonei-Sarcostemmetum daltonii*, *Echio stenosisiphonis-Euphorbietum tuckeyanae*, *Suaedo caboverdeanae-Asparagetum squarrosii*, *Tetraeno waterlotii-Sarcostemmetum daltonii*, *Erysimo caboverdeanae-Periplocetum chevalieri*, *Echietum vulcanori*, *Actinopterido radiatae-Sarcostemmetum daltonii*, *Echio hypertropici-Euphorbietum tuckeyanae*, *Launaeo thalassicae-Euphorbietum tuckeyanae*, *Loto latifolii-Artemisietum gogonei*, *Melanoselino bischoffii-Globularietum amygdalifoliae*, *Asterisco smithii-Euphorbietum tuckeyanae*, *Dichrostachyo platycarpae-Acacietaum caboverdeanae*, *Cocculo penduli-Acacietaum caboverdeanae*, *Forsskaoleo procrigidifoliae-Acacietaum caboverdeanae*, *Cocculo penduli-Ficetum gnaphalocarpae*, *Forsskaoleo procrigidifoliae-Ficetum gnaphalocarpae*, *Dichrostachyo platycarpae-Ficetum sur*, *Euphorbio tuckeyanae-Ficetum sur*, *Sideroxyletum marginati*, *Dracaenatum caboverdeanae*, *Cocculo penduli-Phoenicetum atlanticae*, *Cocculo penduli-Tamaricetum senegalensis*, *Dichanthio foveolati-Heteropogonetum contorti*, *Heteropogonetum melanocarpi*, *Bothriochloa bladhii-Enneapogonetum desvauxii*, *Aristido cardosoi-Tetraenetum simplicis*, *Asphodelo mariolousae-Aristidetum cardosoi*, *Sehimatetum ischaemoidis*, *Polycarpaeo caboverdeanae-Tetraenetum waterlotii*, *Tetraenetum vicentinae*, *Sporobolo spicati-Cyperetum crassipedis*, *Loto brunneri-Pulicarietum diffusae*, *Arthrocnemetum franzii*, *Cressetum salinae*, *Sesuvietum sesuvioideis*, *Sesuvietum portulacastri*, *Blutaparonetum vermicularis*, *Adiantetum trifidi*, *Hypodematio crenati-Campanuletum bravensis*, *Kickxietum webbiana*, *Diplotaxio hirtae-Kickxietum elegantis*, *Umbilico schmidtii-Cheilantheum acrosticae*, *Campanuletum jacobaeae*, *Campanulo bravensis-Launaeum thalassicae*, *Adiantetum incisophilippensis*, *Trianthemetum portulacastri*, *Euphorbio hirtae-Boerhaviatum repentis* and *Oldenlandietum corymbosae* are proposed and described.

Resumen:

Se presentan los resultados del estudio del bioclima, biogeografía, flora y vegetación de las Islas de Cabo Verde. El bioclima varía del tropical hiperdesértico al tropical xérico, del infratropical superior al supratropical inferior y del ultrahiperárido superior al seco superior. Biogeográficamente las islas de Cabo Verde están en el Reino Paleotropical, Subreino Afrotropical, Región Tropical-Sahariana, Provincia Caboverdeana. Se proponen nueve nuevas especies: *Acacia*

cia caboverdeana, *Asphodelus mariolousae*, *Frankenia pseudoericifolia*, *Hyparrhenia caboverdeana*, *Lotus chevalieri*, *Polycarpaea caboverdeana*, *Suaeda caboverdeana* y *Tetraena vicentina*; así como quince nuevas combinaciones. Se describen cinco nuevas clases fitosociológicas: *Cocculo penduli-Sarcostemmetea daltonii*, *Heteropogonetea contorti*, *Tetraenetea simplicis*, *Frankenio pseudoericifoliae-Suaedetia caboverdeanae* y *Arthrocnemetea franzii*, nueve nuevos órdenes: *Euphorbio tuckeyanae-Sarcostemmetalia daltonii*, *Dichrostachyo platycarpae-Acacietaalia caboverdeanae*, *Melinio grandiflorae-Heteropogonetalia contorti*, *Aristido cardosoi-Tetraenetalia simplicis*, *Frankenio pseudoericifoliae-Suaedetalia caboverdeanae*, *Artrocnetometalia franzii*, *Sesuvietalia sesuviooidis*, *Kickxietalia elegantis* y *Euphorbietalia prostrato-hirtae*; también catorce nuevas alianzas: *Asparago squarrosi-Sarcostemmion daltonii*, *Globulario amygdalifoliae-Periplocion chevalieri*, *Fico gnaphalocarpace-Acacion caboverdeanae*, *Phoenicion atlanticae*, *Tamaricion senegalensis*, *Heteropogonion melanocarpo-contorti*, *Aristido cardosoi-Tetraenion simplicis*, *Polycarpaeo caboverdeanae-Tetraenion waterlotii*, *Arthrocnemion franzii*, *Sesuvion sesuviooidis*, *Adiantion trifidi*, *Kickxion elegantis*, *Adiantion incisophilippensis* y *Trianthemion portulacastri*, así como cincuenta y dos nuevas asociaciones: *Cocculo penduli-Sarcostemmetum daltonii*, *Campylantho spathulati-Sarcostemmetum daltonii*, *Frankenio caboverdeanae-Asparagetum squarrosi*, *Aeonio gogonei-Sarcostemmetum daltonii*, *Echio stenosisiphonis-Euphorbietum tuckeyanae*, *Suaedo caboverdeanae-Asparagetum squarrosii*, *Tetraeno waterlotii-Sarcostemmetum daltonii*, *Erysimo caboverdeanae-Periplocetum chevalieri*, *Echietum vulcanori*, *Actinopterido radiatae-Sarcostemmetum daltonii*, *Echio hypertropici-Euphorbietum tuckeyanae*, *Launaeo thalassicae-Euphorbietum tuckeyanae*, *Loto latifolii-Artemisietum gogonei*, *Melanoselino bischoffii-Globularietum amygdalifoliae*, *Asterisco smithii-Euphorbietum tuckeyanae*, *Dichrostachyo platycarpae-Acacietaum caboverdeanae*, *Cocculo penduli-Acacietaum caboverdeanae*, *Forsskaoleo procrigidifoliae-Acacietaum caboverdeanae*, *Cocculo penduli-Ficetum gnaphalocarpace*, *Forsskaoleo procrigidifoliae-Ficetum gnaphalocarpace*, *Dichrostachyo platycarpae-Ficetum sur*, *Euphorbio tuckeyanae-Ficetum sur*, *Sideroxyletum marginati*, *Dracaenetum caboverdeanae*, *Cocculo penduli-Phoenicetum atlanticae*, *Cocculo penduli-Tamaricetum senegalensis*, *Dichanthio foveolati-Heteropogonetum contorti*, *Heteropogonetum melanocarpi*, *Bothriochloa bladhii-Enneapogonetum desvauxii*, *Aristido cardosoi-Tetraenetum simplicis*, *Asphodelo mariolousae-Aristidetum cardosoi*, *Sehimatetum ischaemoidis*, *Polycarpaeo caboverdeanae-Tetraenetum waterlotii*, *Tetraenetum vicentinae*, *Sporobolo spicati-Cyperetum crassipedis*, *Loto brunneri-Pulicarietum diffusae*, *Arthrocnemetum franzii*, *Cressetum salinae*, *Sesuvietum sesuviooidis*, *Sesuvietum portulacastri*, *Blutaparonetum vermicularis*, *Adiantetum trifidi*, *Hypodematio crenati-Campanuletum bravensis*, *Kickxietum webbiana*, *Diplotaxio hirtae-Kickxietum elegantis*, *Umbilico schmidtii-Cheilantheum acrosticae*, *Campanuletum jacobaeae*, *Campanulo bravensis-Launaeum thalassicae*, *Adiantetum incisophilippensis*, *Trianthemetum portulacastri*, *Euphorbio hirtae-Boerhaviatum repentis* y *Oldenlandietum corymbosae*.

Keywords: Cabo Verde, Bioclimatology, Biogeography, Phytosociology, Vascular Flora.

Contents

Introduction

1. Bioclimatology

- 1a. Bioclimatical notions
- 1b. Bioclimatic classification system
 - 1ba. Parameters and bioclimatic indexes
 - 1bb. Synoptical table “Worldwide bioclimatic classification system” (table1, 30-08-2017)
 - 1bc. Keys for bioclimatic classification
 - 1bd. Thermotypes, ombrotypes and continentality
 - 1be. Vegetation formations of the arid and xeric types
 - 1bf. Bioclimatic variants
- 1c. Bioclimatic types, maps and data of Cabo Verde
 - 1ca. Thermotypes, ombrotypes of Cabo Verde Islands
 - 1cb. Bioclimatic data of Cabo Verde Islands
 - 1cc. Isobioclimatic maps and surface (%) of Cabo Verde Islands (authors: S. Rivas-Martínez, A. Penas, S. Rivas-Sáenz, M. Álvarez & S. del Río)

2. Biogeography

- 2a. Biogeographical notions
- 2b. Biogeographic typology of Cabo Verde and surrounding territories

3. Cabo Verde flora

- 3a. New taxa and combinatio nova
- 3b. List endemic plant and synonymous of Cabo Verde
- 3c. Cabo Verde endemic species: distribution and syntaxa

4. Vegetation synthesis

- 4a. World formation types
- 4b. Classification formation types and syntaxa
- 4c. Typological syntaxonomy
- 4d. Description of Cabo Verde syntaxa

5. Indexes

6. References

Introduction

The archipelago of Cabo Verde, 14°45'-17°10'N and 22°40'-25°20'W, is located in the Atlantic Ocean mostly in the high eutropical north latitudinal band (table 2), about 700 km from Mauritania and Senegal coasts. It has 4033 km² and includes nine major islands and several islets, going from the “Barlavento” to “Sotavento”: Santo Antão (779 km²), São Vicente (227 km²) (with Santa Luzia (35 km²), Branco and Raso Islets (10 km²)), São Nicolau (388 km²), Sal (261 km²), Boavista (620 km²), Maio (269 km²), Santiago (991 km²), Fogo (476 km²), and Brava (67 km²) (with Rombo Islets); the abbreviations used in this paper are respectively: A, V, N, SL, BO, M, SN, F, BR. The archipelago constitutes a particular biogeographic unit: Cabo Verde Province, included in the Saharian Tropical Region (Paleotropical Kingdom). Globally the Cabo Verde Islands has serotropical bioclimate, mostly infra-thermotropical arid and strong eu-hyperoceanic (Ic 4.0-6), with torrential rains and strong interannual variations. This severe bioclimate, the high population and hard erosion in agroforestral activities, increase every year the desertification and a correlate extension of the hyperdesertic landscape.

1. Bioclimatology

1a. Bioclimatical notions

Bioclimatology is a geobotanical science that studies the reciprocity between the climate data and the distribution of living plants and their communities on the Earth. This discipline, which might also be called Phytoclimatology, for the weight of the phytoindicators, began to be structured as result of connecting numeric climate values (mainly temperature and rainfall) with the distribution of plants areas, plant communities and other bioindicators, adding at a later stage information of biogeocenosis and knowledge from dynamic-catenal phytosociology (vegetation series, geoseries and geopermaseries) (Rivas-Martínez, 2005, Géhu, 2006).

For more than two decades, we have tried to improve the bioclimatic classification system of the Earth that covers the whole geobiosphere. The reasons for doing so are to have an easily quantifiable bioclimatic typology that shows the close relationship between the vegetational components and climate index values, and which, at the same time, considering the high predictive value of the bioclimatic units, could be used in other sciences and conservation programmes. The increasingly detailed knowledge of the distribution of plants and vegetation on Earth, as well as the modifications in the appearance and composition of the potential natural vegetation and its substitution stages caused by climatic, edaphic, geographic and anthropic factors, makes possible to recognize the bioclimatic and vegetational boundaries with greater precision and objectivity. Once the bounds of the vegetation series, geoseries, geopermaseries and bioindicators are known, located, and mapped, it is possible to calculate the numerical bioclimatic threshold values. These territories corresponding to the bioclimatic units (bioclimates, isobioclimates, variants, thermotypes and ombrotypes), have been progressively delimited and adjusted. The resulting biophysical models have demonstrated a high level of reciprocity in the relationship between climate and flora-vegetation, and allow to produce bioclimatic and biogeographical maps and data in any part of the world that could be increasingly accurate. One practical consequence is to have achieved a reciprocal predictive value, all over the Earth, only knowing the climate data or, reciprocally, the flora, formations and vegetation types.

The global bioclimatic classification we use are based on the axioms and reasoning principles of reciprocity, photoperiods, continentality, seasonality of the rains, mediterraneity, deserts, orobioclimates and orogeny. This classification (Rivas-Martínez, Rivas-Sáenz & Penas, 2011) recognizes five macrobioclimates, twenty-eight bioclimates, eight bioclimatic variants and about four hundred isobioclimates. The macrobioclimate is the supreme typological unit in the bioclimatic classification system. It is an eclectic biophysical model, delimited by specific climatic, floristic, formations and vegetational types, which covers a wide territorial range and which are related with the main types of climates, biomes, bioregions, ecosystems and biogeographical regions nowadays accepted on the Earth. There are five macrobioclimates: tropical, mediterranean, temperate, boreal and polar. Each of them, and each of their 28 respective sub-

ordinate units or bioclimates, are represented by a group of vegetation and formations types, bioindicators and plant communities. In the bioclimates, apart from their ombro-thermo-climatic variations or bioclimatic stages – thermotypes and ombrotypes – a certain number of units have been identified depending on the seasonal temperature and rainfall seasonally rhythms (table 1).

1b. Bioclimatic classification system

For the bioclimatic analysis and bioclimatic classification of Cabo Verde Island and surrounding territories we use the more recent criteria and models exposed in “Worldwide bioclimatic classification system” in Rivas-Martínez, Rivas-Sáenz & Penas with colls., (Glob. Geobot. 1: 1-634+ 4 maps. 2011) and also in Rivas-Martínez & Rivas-Sáenz (2009, website:

<http://www.globalbioclimatic.org>),

the climatic data of our data bank. As well as the updated approach proposed by Rivas-Martínez, Rivas-Sáenz, Penas & del Río (30-08-2017).

1ba. Parameters and bioclimatic indexes

T: Mean annual temperature in centigrades.

Tmin: Mean temperature of coldest month in °C.

Tmax: Mean temperature of warmest month in °C.

Tamax: Mean annual of monthly maxima. $\Sigma T_{i,max}/12$ in °C.

T_i : Mean monthly temperature in °C, where i: 1 = January, ..., 12 = December.

T_p : Positive annual temperature: Sum in tenths of °C of the mean monthly higher than 0°C. $\Sigma T_{i,1-12} > 0^\circ\text{C}$.

T_{ps} : Positive summer temperature: Sum in tenths of °C of the mean monthly summer higher than 0°C. $\Sigma T_{ps}, T_i > 0$.

T_{p_i} : Positive mean monthly temperature in tenths of degrees centigrade, where i: 1 = January, ..., 12 = December

$T_{p_i,max}$: Positive annual maxima monthly temperature. Sum in tenths of centigrades of the monthly maxima higher 0°C. $(\Sigma T_{p_i,max}, 1+...+12 > 0^\circ \times 10)$.

Ic: Simple continentality index or annual range temperature Thermic interval value (range) in °C between the mean of the warmest and coldest month of the year ($Ic = T_{max} - T_{min}$).

P: Mean annual precipitation in millimeters (litres per square meter).

P_p : Positive annual precipitation of the months with T_i higher than 0°C ($\Sigma P_{T_i > 0^\circ\text{C}}$) in mm.

P_{p_i} : Positive monthly precipitation in mm, where i: 1 = January, ..., 12 = December

P_{cm_1} : Precipitation of the warmest four months of the year in mm.

P_{cm_2} : Precipitation of the four months following the warmest of the year in mm.

P_{cm_3} : Precipitation of the four months before the warmest of the year in mm.

P_s : Precipitation of summer quarter in mm.

P_{ss} : Precipitation of the warmest consecutive six months of the year in mm.

P_{sw} : Precipitation of the coldest consecutive six months of the year in mm.

Macrobioclimates ⁽¹⁾	Bioclimates ⁽⁶⁾	Abbr.	Bioclimatic ranges				Thermoclimatic types			Abbr.	Ombroclimatic types (Io)		Abb.
			Ic	Io	Iod2		It (Ite)	TP ⁽²⁾					
Tropical Zone warm: equatorial, eutropical and subtropical (0° to 36° N & S). In subtropical (23° to 35° N & S) at < 200 m two values: T ≥ 25°, m ≥ 10°, Itc ≥ 580. If Pcm ₂ < Pcm ₁ ; Pcm ₁ y Pss > Psw, two values: T ≥ 21°, M ≥ 18°, It ≥ 470. Eurasia and Africa: 25° to 35° N > 2000 m is not tropical.	Tr. Pluvial Tr. Pluviseasonal Tr. Xeric Tr. Desertic Tr. Hyperdesertic	trpl trps trxe trde trhd	- - - - -	≥ 3.6 ≥ 3.6 1.0-3.6 0.2-1.0 < 0.2	> 2.5 ≤ 2.5 - - -	- - - - -	1. Infratropical 2. Thermotropical 3. Mesotropical 4. Supratropical 5. Orotropical 6. Cryorotropical 7. Gelid ⁽³⁾	670 - 890 490 - 670 320 - 490 160 - 320 < 160 - -	> 2860 > 2300 > 1700 > 1000 600-1000 1-600 0	itr ttr ntr str otr ctr gtr	1. Ultrahyperarid 2. Hyperarid 3. Arid 4. Semiarid 5. Dry 6. Subhumid 7. Humid 8. Hyperhumid 9. Ultrahyperhumid 10. Extreme hyperhumid	< 0.2 0.2-0.4 0.4-1.0 1.0-2.0 2.0-3.6 3.6-6.0 6.0-12.0 12.0-24.0 24.0-48.0 > 48.0	uha har ari sar dry shu hum hhu uhh ehh
Mediterranean Zone warm: subtropical and temperate eutemperate (23° to 52° N & S), with aridity P < 2T, at least two months in summer: Ios ₂ ≤ 2, Iosc ₄ ≤ 2. In subtropical (23° to 36° N & S) at least two values: T < 25°, m < 10°, Itc < 580.	Me. Pluviseasonal Oceanic Me. Pluviseasonal Continental Me. Xeric Oceanic Me. Xeric Continental Me. Desertic Oceanic Me. Desertic Continental Me. Hyperdesertic Oceanic Me. Hyperdesertic Continental	mepo mepc mexo mexc medo medc meho mehc	≤ 21 > 21 ≤ 21 > 21 ≤ 21 > 21 ≤ 21 > 21	> 2.0 > 2.0 1.0-2.0 1.0-2.0 0.2-1.0 0.2-1.0 < 0.2 < 0.2	- - - - - - - -	- - - - - - - -	1. Inframediterranean 2. Thermomediterranean 3. Mesomediterranean 4. Supramediterranean 5. Oromediterranean 6. Cryoromediterranean 7. Gelid ⁽³⁾	450 - 580 350 - 450 220 - 350 80 - 220 < 80 - -	> 2400 > 2100 > 1500 > 900 500-900 1-500 0	ime tme mme sme ome cme gme	1. Ultrahyperarid 2. Hyperarid 3. Arid 4. Semiarid 5. Dry 6. Subhumid 7. Humid 8. Hyperhumid 9. Ultrahyperhumid 10. Extreme hyperhumid	< 0.2 0.2-0.4 0.4-1.0 1.0-2.0 2.0-3.6 3.6-6.0 6.0-12.0 12.0-24.0 24.0-48.0 > 48.0	uha har ari sar dry shu hum hhu uhh ehh
Temperate Zone warm: subtropical and temperate (23° to 66° N & 23° to 54° S). From 23° to 35° N & S, at < 200 m, at least two values: T < 21°, M < 18°, Itc < 470. Ios ₂ > 2, Iosc ₄ > 2.	Te. Hyperoceanic Te. Oceanic Te. Continental Te. Xeric	teho teoc teco texe	≤ 11 11-21 > 21 ≥ 4	> 3.6 > 3.6 > 3.6 ≤ 3.6	- - - -	- - - -	1. Infratemperate 2. Thermotemperate 3. Mesotemperate 4. Supratemperate ⁽⁴⁾ 5. Orottemperate ⁽⁴⁾ 6. Cryorottemperate 7. Gelid ⁽³⁾	> 410 290 - 410 190 - 290 < 190 380-800 1-380 0	> 2350 > 2000 > 1400 > 800 - - 0	ite tte mte ste ote cte gte	4. Semiarid 5. Dry 6. Subhumid 7. Humid 8. Hyperhumid 9. Ultrahyperhumid 10. Extreme hyperhumid	< 2.0 2.0-3.6 3.6-6.0 6.0-12.0 12.0-24.0 24.0-48.0 > 48.0	sar sec shu hum hhu uhh ehh
Boreal Zones temperate and cold (42° to 72° N, 49° to 56° S). At < 200 m: Ic ≤ 11; T ≤ 6°, Tp = 380-720; Tps > 320; Ic = 11-21; T ≤ 5.3°, Tp = 380-720; Ic = 21-28; T ≤ 4.8°, Tp = 380-740; Ic = 28-45; T ≤ 4.3°, Tp = 380-800; Ic ≥ 45; T ≤ 0°, Tp = 380-800.	Bo. Hyperoceanic Bo. Oceanic Bo. Subcontinental Bo. Continental Bo. Hypercontinental Bo. Xeric	boho booc bosc boco bohc boxe	≤ 11 11-21 21-28 28-46 > 46 < 46	> 3.6 > 3.6 > 3.6 > 3.6 - ≤ 3.6	≤ 720 ≤ 720 ≤ 740 ≤ 800 ≤ 800 ≤ 800	< 6.0° ≤ 5.3° ≤ 4.8° ≤ 3.8° ≤ 0.0° ≤ 3.8°	1. Thermoboreal 2. Mesoboreal 3. Supraboreal 4. Oroboreal 5. Cryoroboreal 6. Gelid ⁽³⁾	> 680 580-680 480-580 380-480 1-380 0		tbo mbo sbo obo cbo gbo	4. Semiarid 5. Dry 6. Subhumid 7. Humid 8. Hyperhumid 9. Ultrahyperhumid 10. Extreme hyperhumid	< 2.0 2.0-3.6 3.6-6.0 6.0-12.0 12.0-24.0 24.0-48.0 > 48.0	sar sec shu hum hhu uhh ehh
Polar Zones temperate and cold (51° to 90° N & S). At < 100 m: Tp < 380.	Po. Hyperoceanic Po. Oceanic Po. Continental Po. Xeric Po. Pergelid	poho pococ poco poxe pope	≤ 11 11-21 > 21 ≥ 4 -	> 3.6 > 3.6 > 3.6 ≤ 3.6 -	> 0 > 0 > 0 > 0 -	- - - - -	1. Infrapolar ⁽⁶⁾ 2. Thermopolar 3. Mesopolar 4. Suprapolar ⁽³⁾ 5. Gelid ^(3,7)	380-600 280-380 100-280 1-100 0		ipo tpo mpo spo gpo	4. Semiarid 5. Dry 6. Subhumid 7. Humid 8. Hyperhumid 9. Ultrahyperhumid 10. Extreme hyperhumid	< 2.0 2.0-3.6 3.6-6.0 6.0-12.0 12.0-24.0 24.0-48.0 > 48.0	sar sec shu hum hhu uhh ehh

1bb. Synoptical table Worldwide bioclimatic classification system (S. Rivas-Martínez, S. Rivas-Sáenz, A. Penas & S. del Río. Updated 30-08-2017) (Table 1)

(1) North and south of equatorial and eutropical latitudinal belt (23°N & 23° S), if the locality is at 200 m altitude or higher, the thermal values at this altitude must be calculated increasing T in 0.6°, M in 0.5°, and It or Ite in 13 units, every 100 m higher than 200m. But if the locality is northern 48° N or southern 51° S, the increases are T in 0.4° and Tp in 12 units, every 100 m higher than 200 m. (2) If Ic ≥ 21 (continental) or Io or Ite < 120 the thermotype must be calculated through Tp values, and the theoretic values of Tp at 200 m increasing 55 units every 100 m exceeding that altitude. (3) In the pergelid bioclimate (polar), the upper suprapolar and the gelid thermotype we recognize the following ombrotypes (chionotypes): un-snowy (<50 mm), scanty-snowy (50-200 mm), low-snowy (200-400 mm), medium-snowy (400-600 mm), high-snowy (600-1000 mm), super-snowy (1000-2000 mm), ultra-snowy (>2000 mm). (4) The hemiboreal thermotype (hbo) is used inside the temperate macrobioclimate, north of 45°N and south 49°S, within the following values: Ic < 21, altitude < 400 m, tp 720-900; Ic 21-28, altitude < 600 m, tp 740-900; Ic > 28, alt. < 1000 m, tp 800-900. (5) Bioclimatic variants: steppic (stp), submediterranean (sbm), bixeric (bix), antitropical (ant), seropluvial (spl), polar semiboreal (posbo), semipolar subantarctic (sepoa) and tropical semimediterranean desertic (trdsm), polar euhyperoceanic (poeuhy), boreal subantarctic (bosuba) and temperate subantarctic (tesuba). (6) The infrapolar thermotype (Tp: 380-600) only correspond to semipolar antarctic bioclimatic variant in the coast [values: Alt<100 m, T<7.5°, Tp<600, Tps<280, Tmax<10°, Ic<8, Io>10]; the polar semiboreal bioclimatic variant correspond to semicontinental to hyperoceanic hyperhumid northern oroboreal treeless arctic tundra territories [values: Tp 380-480, Ic<28, Tmax ≤ 11°, Tps ≤ 320]. (7) In the polar pergelid bioclimate on identify three gelid thermotypes in the Antarctic Region and only two in the Circumarctic Region: hypogelid (T -10° to -25°, Tp 0, Tpmax < 30, Tpmamax < 500, Twmax < -7°); hypergelid (T -25° to -45°, Tp 0, Tpmax 0, Tpmamax 300, Twmax -7° to -22°); ultragelid (T < -45°, Tpmax 0, Tpmamax 0, Twmax < -22°) (only in Antarctica). If necessary, on utilize the ombrotype. (10) Extreme hyperhumid value, Io>48.0 (ehh) 10a. Lower horizon Io 48.0-96.0; 10b. Upper horizon >96.0. Last global approach published: Global Geobotany 1: 1-638 (2011): DOI: 10.5616/gg110001.

Thermic zones	Latitudinal zones	Latitudinal bands	Latitude
A. TROPICAL (warm) 0° - 36° N & S	1. EUTROPICAL 0° - 23° N & S	1a. Equatorial	7° N - 7° S
		1b. Low eutropical	7° - 15° N & S
		1c. High eutropical	15° - 23° N & S
	2. SUBTROPICAL 23° - 36° N & S	2a. Low subtropical	23° - 29° N & S
		2b. High subtropical	29° - 36° N & S
B. TEMPERATE 36° - 66° N & S	3. EUTEMPERATE 36° - 51° N & S	3a. Low eutemperate	36° - 43° N & S
		3b. High eutemperate	43° - 51° N & S
	4. SUBTEMPERATE 51° - 66° N & S	4a. Low subtemperate	51° - 59° N & S
		4b. High subtemperate	59° - 66° N & S
C. POLAR 66° - 90° N & S	5. POLAR 66° - 90° N & S	5a. Low polar	66° - 78° N & S
		5b. High polar	78° - 90° N & S

Table 2. Thermic latitudinal zones and latitudinal bands of Earth

- M: Mean temperature of the maxima of the coldest month in C°.
- m: Mean temperature of the minima of the coldest month in C°.
- Tr₁: Quarter corresponding to the winter solstice (winter, N: 12-2, S: 6-8).
- Tr₂: Quarter corresponding to the spring equinox (spring, N: 3-5, S: 9-11).
- Tr₃: Quarter corresponding to the summer solstice (summer, N: 6-8, S: 12-2).
- Tr₄: Quarter corresponding to the autumn equinox (autumn, N: 9-11, S: 3-5).
- Cm₁: Warmest consecutive four months of the year.
- Cm₂: Four months after the warmest four months of the year.
- Cm₃: Four months before the warmest four months of the year.
- Pav: Period of plant activity, months of the year $T_i \geq 3^\circ\text{C}$.
- Io: Annual ombrothermic index (Pp/Tp) 10.
- Io_i: Monthly ombrothermic index (Pp_i/Tp_i) 10, where i: 1 = January, ..., 12 = December
- Ios: Ombrothermic index of the summer quarter (Pps/Tps) 10.
- Ios₁: Ombrothermic index of the warmest month of the summer quarter (Tr₃).
- Ios₂: Ombrothermic index of the warmest two months of the summer quarter (Tr₃).
- Ios₃: Ombrothermic index of the summer quarter (Tr₃).
- Ios₄: Ombrothermic index of the four-month period adding the summer quarter (Tr₃) and the month preceding it.
- It: Thermicity index (T+M+m) 10 $\cong (T+T_{min} \times 2)$ 10.
- Itc : Compensated thermicity index.
- Aim: Aridic monthly index. $Aim_i = 200 - 100 Io_i$, where i: 1 = January, ..., 12 = December
- Aiy: Aridic annual index. Aridic is the ombrothermic expresionof aridity range. (0.0-2.0). $Aiy = \sum Aim_i$, where i: 1 = January, ..., 12 = December
- Oxiy: Ombroxeric annual index. Ombroxeric is the ombrothermic expresion of xericity range. (2.0-3.6). $Oxiy = \sum Oxim_i$, where i: 1 = January, ..., 12 = December
- Oxim: Ombroxeric monthly index. $Oxim_i = 160 - 100 Io_i$, where i: 1 = January, ..., 12 = December

1bc. Keys for bioclimatic classification

With simple dichotomous keys using latitudinal zones, bands and thermic zones (table 2), bioclimatic parameters and indexes, we have prepared an easy key to classify macrobioclimates, bioclimates and bioclimatic variants. that we recognize. As well as a synoptical “Worldwide bioclimatic classification system”, updated by S. Rivas-Martínez, S. Rivas-Sáenz, A. Penas & S. del Río (30-08-2017, pg. 5).

Key for macrobioclimates

1. Intertropical territories between parallels 23° N and S (eutropical latitudinal zone)..... TROPICAL
1. Territories north and south of these latitudes 2
2. Territories between parallels 23° and 36° N & S (subtropical zone)..... 3
2. Territories to the N & S of parallel 36° (eutemperate, subtemperate, and polar zones) 11
3. Eurasia: 26° to 36° N, longitude 70° E to 120° E, altitude ≥ 2.000 m 10
3. Does not meet the conditions 4
4. In subtropical territories (parallels 23° to 36° N & S) at least two of the thermicity parameters or indexes must have the following values: average annual temperature $T \geq 25^\circ$, average temperature of the minimums of the coldest month $m \geq 10^\circ$, thermicity index It, Itc ≥ 580 TROPICAL
4. Does not meet the conditions 5
5. In territories with altitudes less than 200 m (●) at least two of the thermicity parameters or indexes must have the following values: average annual temperature $T > 21^\circ$, average temperature of the maximums of the coldest month $M > 18^\circ$, thermicity index, It, Itc ≥ 470 ... 6
5. Does not meet the conditions 8
6. Subtropical zone (parallels 23° to 36° N & S): precipitation for the warmest 6-month period of the year should be higher that of the coldest 6-month period, $P_{ss} > P_{sw}$ TROPICAL
6. Does not meet the conditions 7

7. Summer without hydric deficit; ombrothermic index of the hottest two months of the summer quarter $Ios_2 > 2$ or ombrothermic summer index resulting from the compensation $Iosc > 2$ TROPICAL
7. Does not meet the conditions 9
8. Summer without hydric deficit; ombrothermic index of the hottest consecutive two months of the summer quarter $Ios_2 > 2$ or ombrothermic summer index resulting from the compensation $Iosc > 2$ TEMPERATE
8. Does not meet the conditions MEDITERRANEAN
9. Maximum precipitation during the warmest four months of the year, $Pcm3 < Pcm1 > Pcm2$ TROPICAL
9. Does not meet the conditions MEDITERRANEAN
10. Summer without hydric deficit; ombrothermic index of the hottest two months of the summer quarter $Ios_2 > 2$ or ombrothermic summer index resulting from the compensation $Iosc > 2$ TEMPERATE
10. Does not meet the conditions MEDITERRANEAN
11. In territories of northern latitude $> 72^\circ$ or southern latitude $> 56^\circ$. In territories outside of this latitude and altitudes of less than 200m (●): positive annual temperature $Tp < 380$ POLAR
11. In territories with altitudes less than 200 m (●): positive annual temperature $Tp > 380$ 12
12. In territories with altitudes less than 200m (●): continentality index $Ic < 11$, positive temperature of the summer quarter $Tps > 320$, average annual temperature $< 6^\circ$, positive annual temperature 320-720 BOREAL
12. Does not meet the conditions 13
13. In territories with altitudes less than 200 m (●): depending on the continentality index Ic , the values for the average annual temperature T and positive annual temperature Tp , must be for: $Ic < 21$, $T < 5.3^\circ$ and $Tp < 720$; for: $Ic = 21-28$, $T < 4.8^\circ$ to and $Tp < 740$; for: $Ic > 28$, $T < 3.8^\circ$ and $Tp < 800$ BOREAL
13. Does not meet the conditions 14
14. Summer without hydric deficit; ombrothermic index of the hottest two months of the summer quarter $Ios_2 > 2$ or ombrothermic summer index resulting from the compensation $Iosc_4 > 2$ TEMPERATE
14. Does not meet the conditions MEDITERRANEAN
- (●) If the locality has an altitude of more than 200 m, the temperature values must be calculated theoretically: increasing T by 0.6° , M by 0.5° , and It or Itc by 13 units for every 100 m in excess of this altitude. If it is situated to the north of parallel 48° N or south of 51° S, the theoretical values of the average annual temperature and positive annual temperature Tp must be calculated, increasing T by 0.4° and Tp by 12 units for each 100 m in excess of this altitude. When $Ic \geq 21$ (continental) or when It or $Itc < 120$ the thermotype must be calculated based on the positive annual temperature Tp at 200 m increasing 55 units for each 100 m.

Key for tropical bioclimates

1. Annual ombrothermic index $Io \leq 3.6$ (ultrahyperarid: < 0.2 , hyperarid: $0.2-0.4$, arid: $0.4-1.0$, semiarid: $1.0-2.0$, dry: $2.0-3.6$) 3
1. Annual ombrothermic index $Io > 3.6$ (subhumid: $3.6-6.0$, humid: $6.0-12.0$, hyperhumid: $12.0-24.0$, ultrahyperhumid > 24.0) 2
2. Driest two-monthly ombrothermic index of the driest quarter of the year $Iod_2 \leq 2.5$ (when Ic : $0-11$ hyperoceanic, $1-21$ oceanic, > 21 continental) TROPICAL PLUVISEASONAL
2. Driest two-monthly ombrothermic index of the driest quarter of the year $Iod_2 > 2.5$ 5
3. Annual ombrothermic index $Io < 0.2$ (ultrahyperarid) TROPICAL HYPERDESERTIC
3. Annual ombrothermic index $Io \geq 0.2$ 4
4. Annual ombrothermic index $Io 0.2-1.0$ ($0.2-0.4$ hyperarid, $0.4-1.0$ arid) TROPICAL DESERTIC
4. Annual ombrothermic index $Io 1.0-3.6$ ($1.0-2.0$ semiarid, $2.0-3.6$ dry) TROPICAL XERIC
5. $Tp > 1000$ TROPICAL PLUVIAL
5. $Tp < 1000$ (oro-cryotropical) 6
6. At least three consecutive months per year $Pi < 10$ mm TROPICAL PLUVISEASONAL
6. Without three consecutive months per year $Pi < 10$ mm TROPICAL PLUVIAL

Key for mediterranean bioclimates

1. Continentality index ≤ 21 [when $Ic \leq 11$ hyperoceanic: ultrahyperoceanic ($0-4$), euhyperoceanic ($4-8$), semihyperoceanic ($11-14$), euoceanic ($14-17$) and semicontinental ($17-21$)] 2
1. Continentality index > 21 [when Ic : $21-28$ subcontinental, $28-46$ eucontinental, $46-66$ hypercontinental] 5
2. Annual ombrothermic index $Io > 2.0$, ombrotype: dry-extreme hyperhumid MEDITERRANEAN PLUVISEASONAL OCEANIC
2. Annual ombrothermic index $Io \leq 2.0$ 3
3. Annual ombrothermic index $Io < 0.2$ (ultrahyperarid) MEDITERRANEAN HYPERDESERTIC
3. Annual ombrothermic index $Io \geq 0.2$ (hyperarid: $0.2-0.4$, arid: $0.4-1.0$, semiarid: $1.0-2.0$) 4
4. Annual ombrothermic index $Io: 0.2-1.0$ MEDITERRANEAN DESERTIC OCEANIC
4. Annual ombrothermic index $Io: 1.0-2.0$ MEDITERRANEAN XERIC OCEANIC
5. Annual ombrothermic index $Io < 0.2$ MEDITERRANEAN HYPERDESERTIC CONTINENTAL
5. Annual ombrothermic index $Io \geq 0.2$ (dry: $2.0-3.6$, subhumid: $3.6-6.0$, humid: $6.0-12.0$, hyperhumid: $12.0-24.0$, ultrahyperhumid $24.0-48.0$, extreme hyperhumid > 48.0) 6

- 6. Annual ombrothermic index $I_o > 2.0$
 MEDITERRANEAN PLUVISEASONAL CONTINENTAL
- 6. Annual ombrothermic index $I_o \leq 2.0$ 7
- 7. Annual ombrothermic index $I_o: 0.2 - 1.0$
 MEDITERRANEAN DESERTIC CONTINENTAL
- 7. Annual ombrothermic index $I_o: 1.0-2.0$
 MEDITERRANEAN XERIC CONTINENTAL 5.

Ibd. Thermotypes, ombrotypes and continentality

It will be useful to make easily relationship between plant communities and bioclimatic data, to remember the worldwide types and values of the thermotypes (table 3), ombrotypes (table 4), aridic and xeric ombric levels and vegetation types (table 6) as well as the continentality types (table 5).

Tropical thermotypes and horizons

<i>Thermotype horizons</i>	<i>Abb</i>	<i>Tp values</i>	<i>It</i>	<i>T^a C</i>
Lower infratropical	litr	>3200	780-890	26.8°
Upper infratropical	uitr	2860-3200	670-780	23.8°-26.8°
Lower thermotropical	ltr	2580-2860	590-670	21.3°-23.8°
Upper thermotropical	uttr	2300-2580	490-590	18.8°-21.3°
Lower mesotropical	lmtr	2000-2300	405-490	16.5°-18.8°
Upper mesotropical	umtr	1700-2000	320-405	14.2°-16.5°
Lower supratropical	lstr	1350-1700	240-320	11.3°-14.5°
Upper supratropical	ustr	1000-1350	160-240	8.3°-11.3°
Lower orotropical	lotr	800-1000	<160	6.7°-8.3°
Upper orotropical	uotr	600-800		5.0°-6.7°
Lower cryrotropical	lctr	300-600		2.5°-5.0°
Upper cryrotropical	uctr	1-300		>0°-2.5°
Gelid tropical-	gtr	≤0	-	≤0°

Mediterranean thermotypes and horizons

<i>Thermotypic horizons</i>	<i>Abbr.</i>	<i>It, Itc</i>	<i>Tp: Ic≥21, Itc<120</i>
Lower inframediterranean	lime	515-580	>2600
Upper inframediterranean	uime	450-515	2400-2600
Lower thermomediterranean	ltme	400-450	2250-2400
Upper thermomediterranean	utme	350-400	2100-2250
Lower mesomediterranean	lmme	285-350	1800-2100
Upper mesomediterranean	umme	220-285	1500-1800
Lower supramediterranean	lsme	150-220	1200-1500
Upper supramediterranean	usme	(120)-150	900-1200
Lower oromediterranean	lome	-	675-900
Upper oromediterranean	uome	-	450-675
Lower cryromediterranean	lcme	-	100-450
Upper cryromediterranean	ucme	-	1-100
Gelid mediterranean	gme	-	0

Temperate thermotypes and horizons

<i>Thermotypic horizons</i>	<i>Abbr.</i>	<i>It, Itc</i>	<i>Tp: Ic≥21, Itc<120</i>
Infratemperate	ite	>410	>2351
Lower thermotemperate	lite	350-410	2176-2350
Upper thermotemperate	utte	290-350	2000-2175
Lower mesotemperate	lmte	240-290	1700-2000
Upper mesotemperate	umte	190-240	1400-1700
Lower supratemperate	lste	(120)-190	1100-1400
Upper supratemperate	uste	-	800-1100
Lower orotemperate	lote	-	590-800
Upper orotemperate	uste	-	380-590
Lower cryrotemperate	lcte	-	100-240-380
Upper cryrotemperate	ucte	-	1-50-100
Gelid temperate	gte	-	0

Table 3. Thermotypic horizons and values of the tropical, mediterranean and temperate macrobioclimates

Ombrotypes (worldwide)

<i>Ombric types</i>	<i>Ombric horizons</i>	<i>Abr.</i>	<i>Io, Iom</i>
1. Ultrahyperarid	1a. Lower ultrahyperarid 1b. Upper ultrahyperarid	luha uuha	0.0-0.1 0.1-0.2
2. Hyperarid	2a. Lower hyperarid 2b. Upper hyperarid	lha uha	0.2-0.3 0.3-0.4
3. Arid	3a. Lower arid 3b. Upper arid	lar uar	0.4-0.7 0.7-1.0
4. Semiarid	4a. Lower semiarid 4b. Upper semiarid	lsa usa	1.0-1.5 1.5-2.0
5. Dry	5a. Lower dry 5b. Upper dry	ldry udry	2.0-2.8 2.8-3.6
6. Subhumid	6a. Lower subhumid 6b. Upper subhumid	lshu ushu	3.6-4.8 4.8-6.0
7. Humid	7a. Lower humid 7b. Upper humid	lhum uhum	6.0-9.0 9.0-12.0
8. Hyperhumid	8a. Lower hyperhumid 8b. Upper hyperhumid	lhh uhh	12.0-18.0 18.0-24.0
9. Ultrahyperhumid	9a. Lower ultrahyperhumid 9b. Upper ultrahyperhumid	luhh uuhh	24.0-36.0 36.0-48.0
10. Extreme ultrahyperhumid	10a. Lower extreme hyperhumid 10b. Upper extreme hyperhumid	lehh uehh	48.0-96.0 >96.0

Table 4. Threshold values of the ombric types and horizons recognised on Earth*Continentalities types.*

<i>Types</i>	<i>Subtypes</i>	<i>Levels</i>	<i>Values</i>
1. Hyperoceanic (0-11)	Ultrahyperoceanic (0-4)	1.1a. Strong	0-2.0
		1.1b. Weak	2.0-4.0
	Euhyperoceanic (4-8)	1.2a. Strong	4.0-6.0
		1.2b. Weak	6.0-8.0
	Subhyperoceanic (8-11)	1.3a. Strong	8.0-10.0
		1.3b. Weak	10.0-11.0
2. Oceanic (11-21)	Semihyperoceanic (11-14)	2.1a. Strong	11.0-12.0
		2.1b. Weak	12.0-14.0
	Euoceanic (14-17)	2.2a. Strong	14.0-15.0
		2.2b. Weak	15.0-17.0
	Semicontinental (17-21)	2.3a. Weak	17.0-19.0
		2.3b. Strong	19.0-21.0
3. Continental (21-66)	Subcontinental (21-28)	3.1a. Weak	21.0-24.0
		3.1b. Strong	24.0-28.0
	Eucontinental (28-46)	3.2a. Weak	28.0-37.0
		3.2b. Strong	37.0-46.0
	Hypercontinental (46-66)	3.3a. Weak	46.0-56.0
		3.3b. Strong	56.0-66.0

Table 5. Types, subtypes and levels of simple continentality (Ic) recognised on Earth

For the simplicity, availability of data and excellent global correlation we always utilize the “simple continentality index” (Ic = Tmax-Tmin, in degrees centigrade)

Ibe. Vegetation formations of the aridic and xeric types

In the aridic (0.0-2.0) and xeric (2.0-3.6) mediterranean and tropical bioclimates and less commonly in polar, boreal and temperate ombic types, the values correspond with the following vegetation formations (table 6). In tropical macrobioclimate on prefer utilize the term savanna.

1bf. Bioclimatic variants

The bioclimatic variants are very informative and interesting typological units, that are recognized within the specific bioclimates, and which allow to identify climatic peculiarities of ombic and occasionally thermic nature. Within the eleven bioclimatic variants: steppic, submediterranean, bixeric, antitropical, seropluvial, polar semiboreal, tropical semimediterranean desertic, semipolar subantarctic, polar euhyperoceanic, boreal subantarctic and temperate subantarctic, only four works in the tropical thermic zone (*). (table 7).

Aridic and xeric types	Vegetation formations	Io
Dry moderate and strong	xeric woodland or taiga	2.0-3.6
Moderate semiarid	moderate semidesert	1.5-2.0
Strong semiarid	strong semidesert	1.0-1.5
Moderate arid	moderate desert	0.7-1.0
Strong arid	strong desert	0.4-0.7
Moderate hyperdesertic	moderate hyperdesert	0.2-0.4
Strong hyperdesertic	strong hyperdesert	0.1-0.2
Extreme hyperdesertic	extreme hyperdesert	0.0-0.1

Table 6. Relationship between the aridic and xeric types and the vegetation formations according with the ombrothermic index (Io= 0.0-3.6)

<i>Bioclimatic variants</i>	<i>Abb.</i>	<i>Tr</i>	<i>Me</i>	<i>Te</i>	<i>Bo</i>	<i>Po</i>
Steppic	stp	—	●	●	●	●
Submediterranean	sbm	—	—	●	●	●
Bixeric (*)	bix	●	—	—	—	—
Antitropical (*)	ant	●	—	—	—	—
Seropluvial (*)	spl	●	—	—	—	—
Polar semiboreal	posbo	—	—	—	●	—
Tropical semimediterranean desertic (*)	trsm	●	●	—	—	—
Semipolar subantarctic	sepos	—	—	●	●	—
Polar euhyperoceanic	poeuhy	-	-	-	-	●
Boreal subantarctic	bosuba	-	-	-	●	-
Temperate subantarctic	tesuba	-	-	●	-	-

Table 7. Distribution of the bioclimatic variants in the five macrobioclimates of Earth. *Tr*: Tropical, *Me*: Mediterranean, *Te*: Temperate, *Bo*: Boreal, *Po*: Polar.

Bixeric (bix). Tropical bioclimatic variant, in which there are two annual periods of aridity of at least one month ($P < 2T$), corresponding to both solstices or both equinoxes, separated by another two rainier periods during solstices at least with one month $P \geq 2T$. This variable does not occur in the tropical pluvial and tropical hyperdesertic bioclimates. Bixeric tropical plant formations have structural and occasionally corionomic and phylogenetic relationships with those of mediterranean pluviseasonal, xeric or desertic bioclimates.

Antitropical (ant). Tropical bioclimatic variant, restricted to the equatorial and low eutropical latitudinal bands (15° N & S), in which rainfall during the winter solstice quarter is higher than that of the summer quarter. This variable does not occur in the pluvial tropical or in the hyperdesertic tropical bioclimates.

The antitropical plant formations are not very different in their structure to the tropical formations from the equivalent seropluvial or typical ombrotype (normal monsonic rains), although the floristic element that comprises them has a large number of endemisms, obviously caused by a phenological rainy period that is practically opposite to the normal tropical environment, which has favoured its isolation and therefore its speciation.

Seropluvial (spl). Tropical bioclimatic variant in which the rainfall of the first two months of the summer solstice is at least 1.3 times less the rainfall corresponding to the two following months. This bioclimatic variant does not occur in the pluvial tropical bioclimate or in the hyperdesertic tropical bioclimate, (Io: 0.0-2.0); (the prefix sero-, means autumnal or late in the year round).

This bioclimatic variant indicates monsonic bioclimates (pluviseasonal, xeric or desertic) in which the rains coming

from the East arrive the territory late in the summer. This late rains occurs regularly towards the western of the continents in tropical and subtropical Africa, Hindustan, N & S America and Australia, increasing the dry season and aridic and xeric conditions.

Tropical semimediterranean desertic (trsm). In the subtropical latitudinal zone (23° - 36° N & S) an arid, hyperarid or ultrahyperarid mediterranean territory (Io: 0.0-1.0) must be considered belong to tropical semimediterranean desertic variant when the precipitation of the warmest six-month consecutive period in the year is at least 0.6 times lower than the precipitation in the coldest six-month period of the year ($P_{ss} \leq 0.6 P_{sw}$); this is the case of the most hottest subtropical deserts of California, Atacama deserts of South America, and in the African Saharan and Namibian deserts. Ombrosestral desertic index $Id_{ss} = P_{ss}/P_{sw}$, where $Io \leq 1.0$ Types: Not tropical semimediterranean (Id_{ss} 0.1-0.6), moderately semimediterranean (Id_{ss} 0.6-0.8), scarcely semimediterranean (Id_{ss} 0.8-1.0), full tropical ($Id_{ss} \geq 1.0$).

1c. Bioclimatic types, maps and data of Cabo Verde Islands

Cabo Verde has a tropical macrobioclimate; all belonging to the seropluvial bioclimatic variant; with rainfall of the two first months of the summer solstice: june and july, in Northern Hemisphere, are at least 1.3 times less than the two following months: august and september; this bioclimatic variant operate quite well in the western of the big continents, between 10° - 36° N & S with tropical bioclimates from pluviseasonal to desertic. More than 90% of the territory is tropical desertic and tropical xeric going from upper infratropical to upper mesotropical,

and may be supratropical above 2400 m (Pico do Fogo 2829 m), and from upper ultrahyperarid to upper dry, particularly in Fogo: Monte Velha, Santo Antão: Cova, Chã de Lagoa, Santiago: Serra da Malagueta and Pico da Antónia. The annual and interannual strong variation of the rainfall, torrential precipitations, shallow stony and andic soils, and existence in last centuries of frequent year periods without or few precipitations, has block the migratory conditions of much of the xeric and pluviseasonal tropical african flora, as well as extinctions parti-

cularly plants and trees infra-thermotropical xeric and pluviseasonal dry-subhumid species of sahelian, guinean or angolan regions, mainly of forest/savanna. biomes, of Sahelian, Guinean or Angolan regions.

Ica. Thermotype and ombrotypes of Cabo Verde Islands

In Cabo Verde Islands on recognize six thermotypes hoprizons (table 8), ten ombrotypes horizons (table 9), as well as surface (%) in every island (table 10) [S. Rivas-Martínez, A. Penas, S. Rivas-Sáenz & S. del Río].

Nº	Thermotype horizons	Tp values	It	Tª C	Abb	C.V.I
1a	Lower infratropical	3200-3600	780-890	26.9°-30.0°	litr	-
1b	Upper infratropical	2860-3200	670-780	23.8°-26.8°	uitr	●
2a	Lower thermotropical	2580-2860	590-670	21.3°-23.8°	lttr	●
2b	Upper thermotropical	2300-2580	490-590	18.8°-21.3°	uttr	●
3a	Lower mesotropical	2000-2300	405-490	16.5°-18.8°	lmtr	●
3b	Upper mesotropical	1700-2000	320-405	14.2°-16.5°	umtr	●
4a	Lower supratropical	1350-1700	240-320	11.3°-14.5°	lstr	●
4b	Upper supratropical	1000-1350	160-240	8.3°-11.3°	ustr	-
5a	Lower orotropical	800-1000	<160	6.7°-8.3°	lotr	
5b	Upper orotropical	600-800		5.0°-6.7°	uotr	
6a	Lower cryorotropical	300-600		2.5°-5.0°	lctr	
6b	Upper cryorotropical	>0-300		>0°-2.5°	uctr	
	Gelid Tropical-	0	Tp, Tpmáx	<-10°0	gtr	-

Table 8. Thermotypes and values occurring in Cabo Verde Islands (●).

Nº	Ombric horizons	Io values	C. V. I	Abb
1a	Lower ultrahyperarid	0.0-0.1	-	luha
1b	Upper ultrahyperarid	0.1-0.2	●	uuha
2a	Lower hypearid	0.2-0.3	●	lha
2b	Upper hypearid	0.3-0.4	●	uha
3a	Lower arid	0.4-0.7	●	lar
3b	Upper arid	0.7-1.0	●	uar
4a	Lower semiarid	1.0-1.5	●	lsa
4b	Upper semiarid	1.5-2.0	●	usa
5a	Lower dry	2.0-2.8	●	ldry
5b	Upper dry	2.8-3.6	●	udry
6a	Lower subhumid	3.6-4.8	●	lsh
6b	Upper subhumid	4.8-6.0	-	ush
7a	Lower humid	6.0-9.0	-	lhu
7b	Upper humid	9.0-12.0	-	uhu
8a	Lower hyperhumid	12.0-18.0	-	lhh
8b	Upper hyperhumid	18.0-24.0	-	uhH
9a	Lower ultrahyperhumid	24.0-36.0	-	luhh
9b	Upper ultrahyperhumid	36.0-48.0	-	uuhh
10a	Lower extreme hyperhumid	48.0-96.0	-	lehh
10a	Upper extreme hyperhumid	>96.0	-	Uehh

Table 9. Ombrotypes, horizons, index values and abbreviations, occurring in Cabo Verdes (●). [S. Rivas-Martínez, A. Penas & S. del Río]

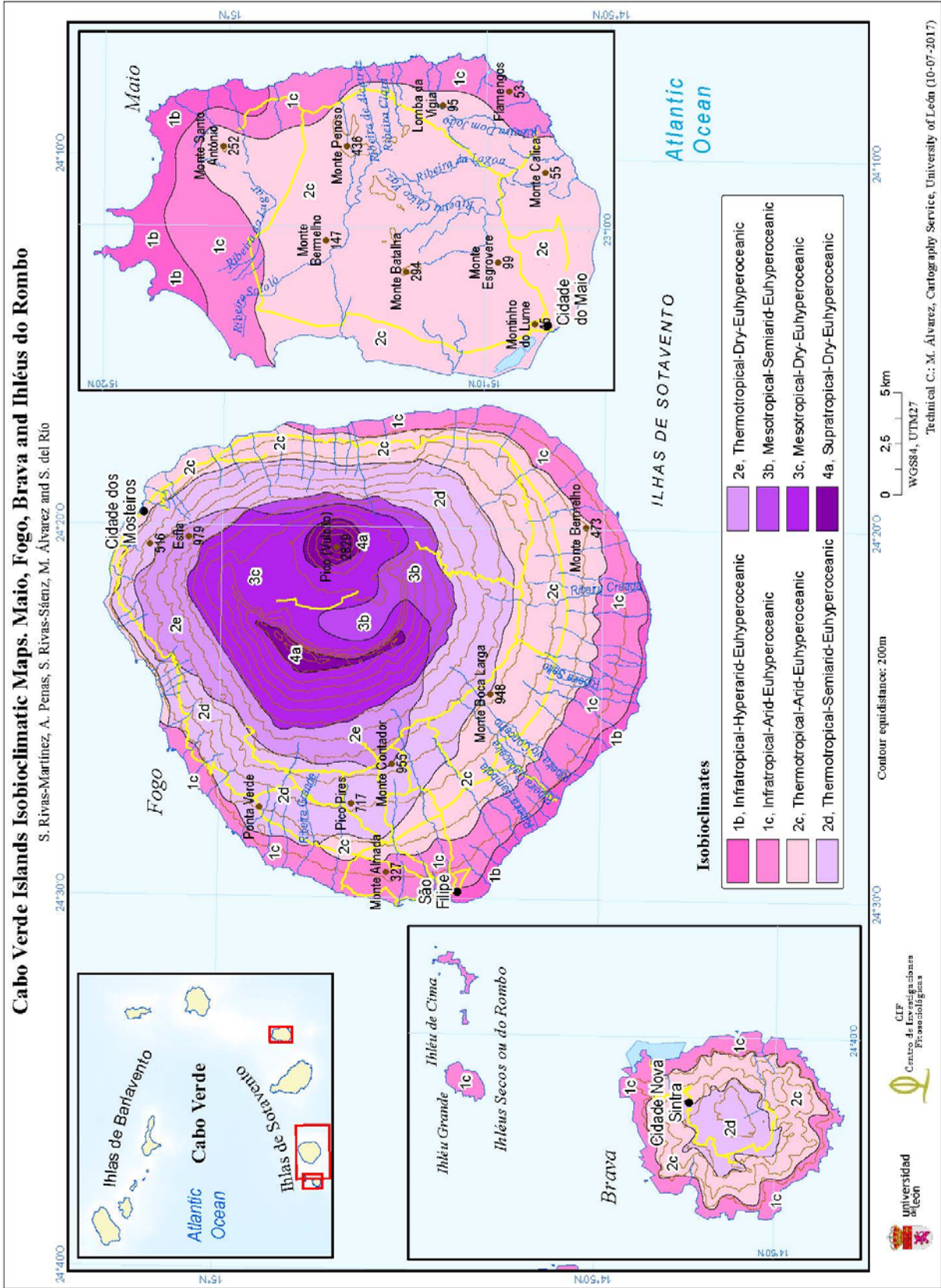
Icb. Bioclimatic data of Cabo Verde Islands

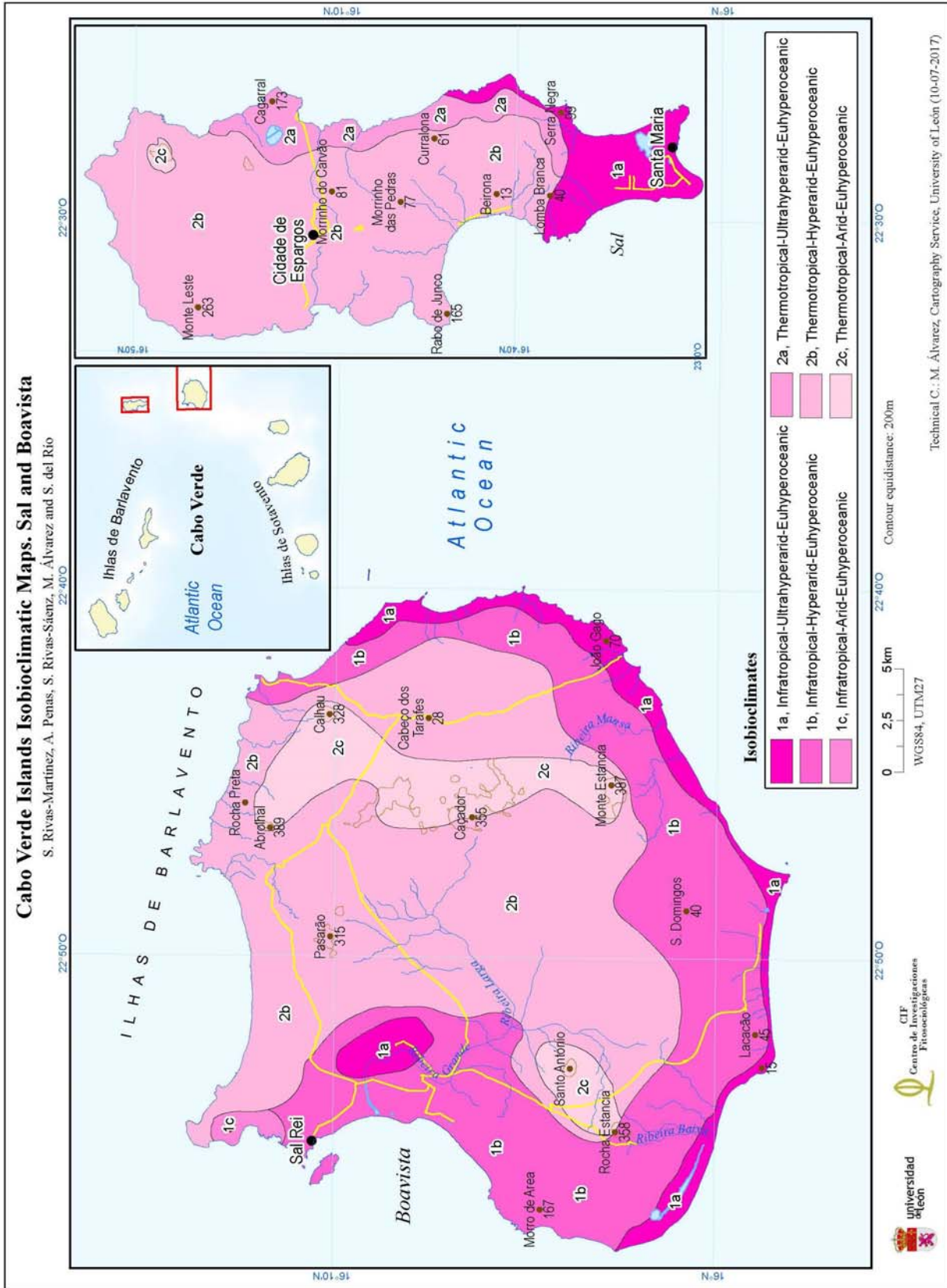
Nº	Locality	Island	Altit.	Latitude	Longitude	Years	T°C	P	Io	IT	Tp	Ic	AIY	Bioclimatic Diagnosis. Isobioclimates
v1	Praia Aeroporto	SN	64	14° 55' N	23° 29' W	60-05	25,1	150,8	0,50	709	3013	4,5	1865,2	Trop. Des. lo. infratr. lo. arid euhyperoc. st. lo. arid
2	Santa Cruz	SN	84	15° 8' N	23° 33' W	61-05	23,9	260,3	0,91	670	2868	5,4	1660,0	Trop. Des. lo. infratr. up. arid euhyperoc., we. up. arid
3	Rui Vaz	SN	798	15° 2' N	23° 36' W	78-05	20,3	384,6	1,58	533	2436	5,2	1556,9	Trop. Xe. up. thermotr. up. semiarid, euhyperoc. st. up. arid
4	Serra Malagueta	SN	765	15° 11' N	23° 41' W	61-05	20,3	656,7	2,70	553	2436	5,2	1397,0	Trop. Pst. up. thermotr. lo. dry, euhyperoc. we. lo. sarid
8	S. Filipe	F	48	14° 54' N	24° 29' W	78-05	25,1	123,0	0,41	709	3012	4,5	1927,4	Trop. Des. lo. infratr. lo. arid, euhyperoc. st. lo. arid
6	Mosteiros	F	52	15° 1' N	24° 19' W	93-05	23,3	224,0	0,80	643	2796	5,2	1650,6	Trop. Des. lo. thermotr. up. arid, euhyperoc. st. up. arid
5	Achada Furna	F	829	14° 52' N	24° 22' W	61-05	21,6	249,1	0,96	609	2592	4,5	1763,0	Trop. Des. up. thermotr. up. arid, euhyperoc. st. up. arid
7	Monte Velha	F	1245	15° 0' N	24° 40' W	78-03	17,8	717,7	3,36	478	2136	5,2	1200,0	Trop. Xe. lo. mesotr. up. dry, euhyperoc. st. up. sarid
9	Figueral	BR	68	14° 52' N	24° 43' W	93-05	25,1	221,6	0,74	743	3013	4,5	1811,1	Trop. Des. lo. infratr. Up. arid euhyperoc., we. lo. arid
10	Mato	BR	725	14° 51' N	24° 41' W	93-05	22,1	259,0	0,98	619	2653	4,5	1564,6	Trop. Des. up. thermotr. Up. arid euhyperoc., we. up. arid
11	Monte Trigo	A	10	16° 57' N	25° 18' W	60-91	26,2	93,9	0,29	748	3144	5,4	2039,0	Trop. Des. lo. infratr. hyperarid euhyperoc., st. lo. harid
12	Cha da Igreja	A	20	17° 9' N	25° 9' W	51-10	24,4	193,3	0,66	680	2929	5,4	1783,1	Trop. Des. lo. infratr. lo. arid euhyperoc., st. up. arid
13	Pedro Diaz	A	1100	17° 6' N	25° 1' W	93-05	18,6	449,7	2,02	494	2232	5,2	1370,3	Trop. Xe. lo. mesotr. lo. dry euhyperoc., we. lo. sarid
14	Pico da Cruz	A	1480	17° 6' N	25° 2' W	90-05	17,4	432,3	2,15	470	2088	5,2	1396,6	Trop. Xe. lo. mesotr. lo. dry euhyperoc., we. lo. sarid
15	Mindelo	V	16	16° 53' N	25° 18' W	62-94	23,1	960	0,35	643	2772	4,4	1976,0	Trop. Des. lo. thermotr. up. hyperarid euhyperoc., we. lo. harid
16	Calhao	V	10	16° 50' N	24° 54' W	94-05	24,2	67,2	0,23	678	2904	4,8	1886,2	Trop. Des. lo. infratr. lo. hyperarid euhyperoc., we. lo. harid
17	Monte Verde	V	750	16° 50' N	25° 12' W	85-05	19,4	130,9	0,56	540	2328	4,4	1379,0	Trop. Des. up. thermotr. lo. arid euhyperoc., we. lo. sarid
18	Cachaco	N	724	16° 37' N	24° 20' W	93-05	19,5	396,3	1,69	591	2340	4,5	975,0	Trop. Des. up. thermotr. up. sarid euhyperoc., st. lo. sarid
19	Juncalinho	N	65	16° 36' N	24° 8' W	78-05	22,5	105,7	0,38	631	2820	4,5	1966,8	Trop. Des. up. thermotr. up. hyperarid euhyperoc., we. up. harid
20	Carrical	N	2	16° 33' N	24° 4' W	79-91	24,1	58,4	0,20	681	2892	4,6	2159,1	Trop. Des. lo. infratr. lo. hyperarid euhyperoc., we. lo. harid
21	Pedra de Lume	SL	10	16° 45' N	22° 53' W	67-94	23,6	48,8	0,17	656	2832	5,2	2209,0	Trop. Des. up. thermotr. ultrahyperarid euhyperoc., we. lo. harid
22	Santa Maria	SL	7	16° 35' N	22° 54' W	63-97	24,1	50,2	0,17	676	2892	5,2	2204,0	Trop. Des. lo. infratr. up. ultrahyperarid euhyperoc., we. lo. harid
23	Fundo das Figueiras	BO	20	16° 8' N	22° 43' W	61-01	23,3	65,5	0,23	643	2796	5,2	2141,2	Trop. Des. lo. thermotr. lo. hyperarid euhyperoc., we. lo. harid
24	Sal Rei	BO	10	16° 10' N	22° 55' W	61-01	24,2	101,8	0,34	680	2904	5,2	1835,0	Trop. Des. lo. infratr. up. hyperarid euhyperoc., we. lo. arid
25	Cascabulho	M	22	15° 16' N	23° 10' W	78-05	24,4	132,8	0,47	690	2928	5,0	1902,4	Trop. Des. lo. infratr. lo. arid euhyperoc., we. up. hyperarid
26	Pedra Vaz	M	39	15° 11' N	23° 7' W	78-05	24,4	145,8	0,50	732	2930	5,0	1887,0	Trop. Des. lo. infratr. lo. arid euhyperoc., we. up. Hyperarid

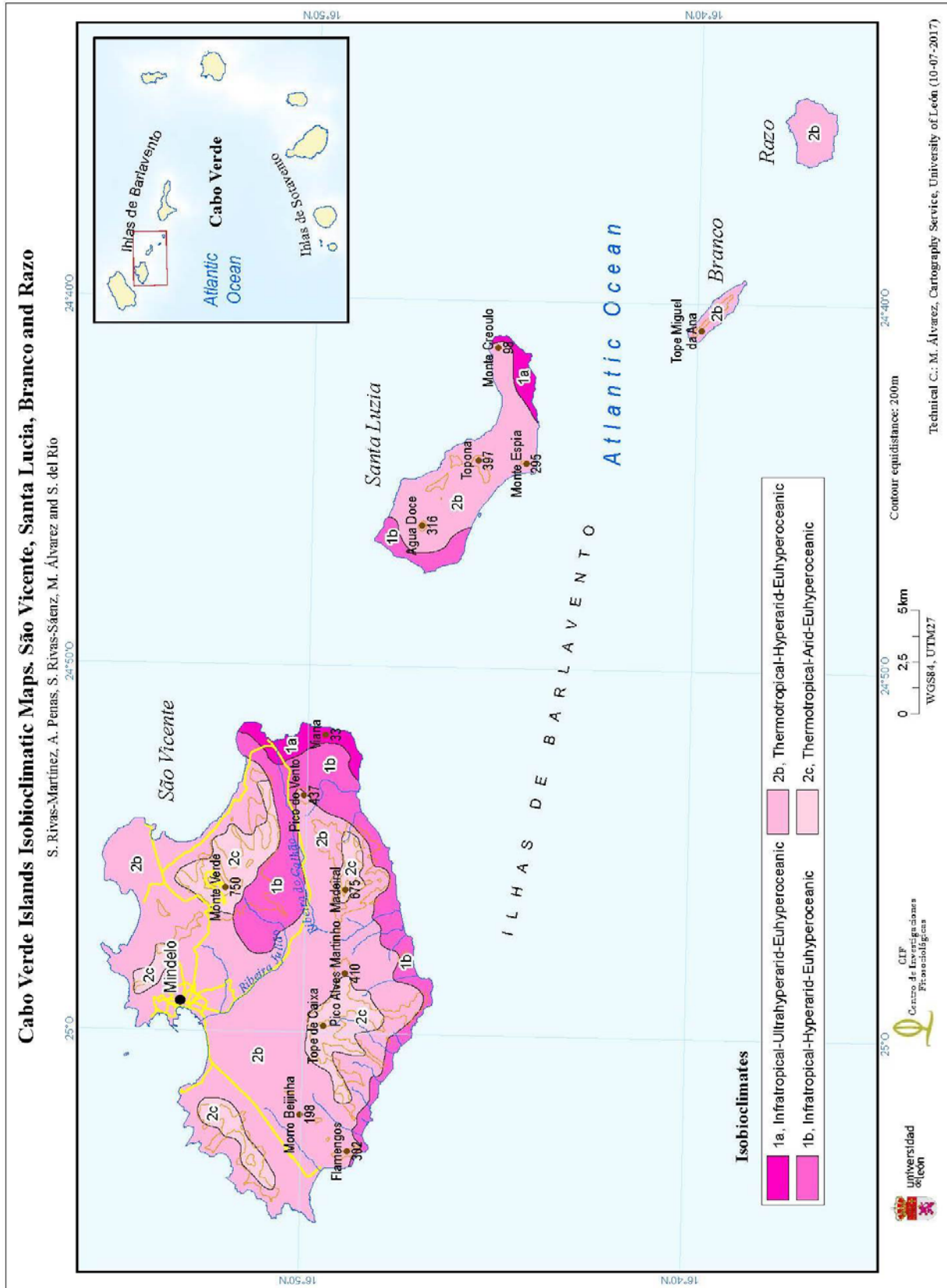
T= Average annual temperature; P= Average annual precipitation; Tp= Positive annual temperature; Itc= Compensated thermicity index, Io=Annual ombrothermic index; Ic=Continentality index; AIY=Aridic annual index; BO= Boavista Island; BR= Brava Island; F= Fogo Island; M= Maio Island; A= São Anton; N=São Nicolau Island; V= São Vicente; SL= Sal Island; SN= Santiago island

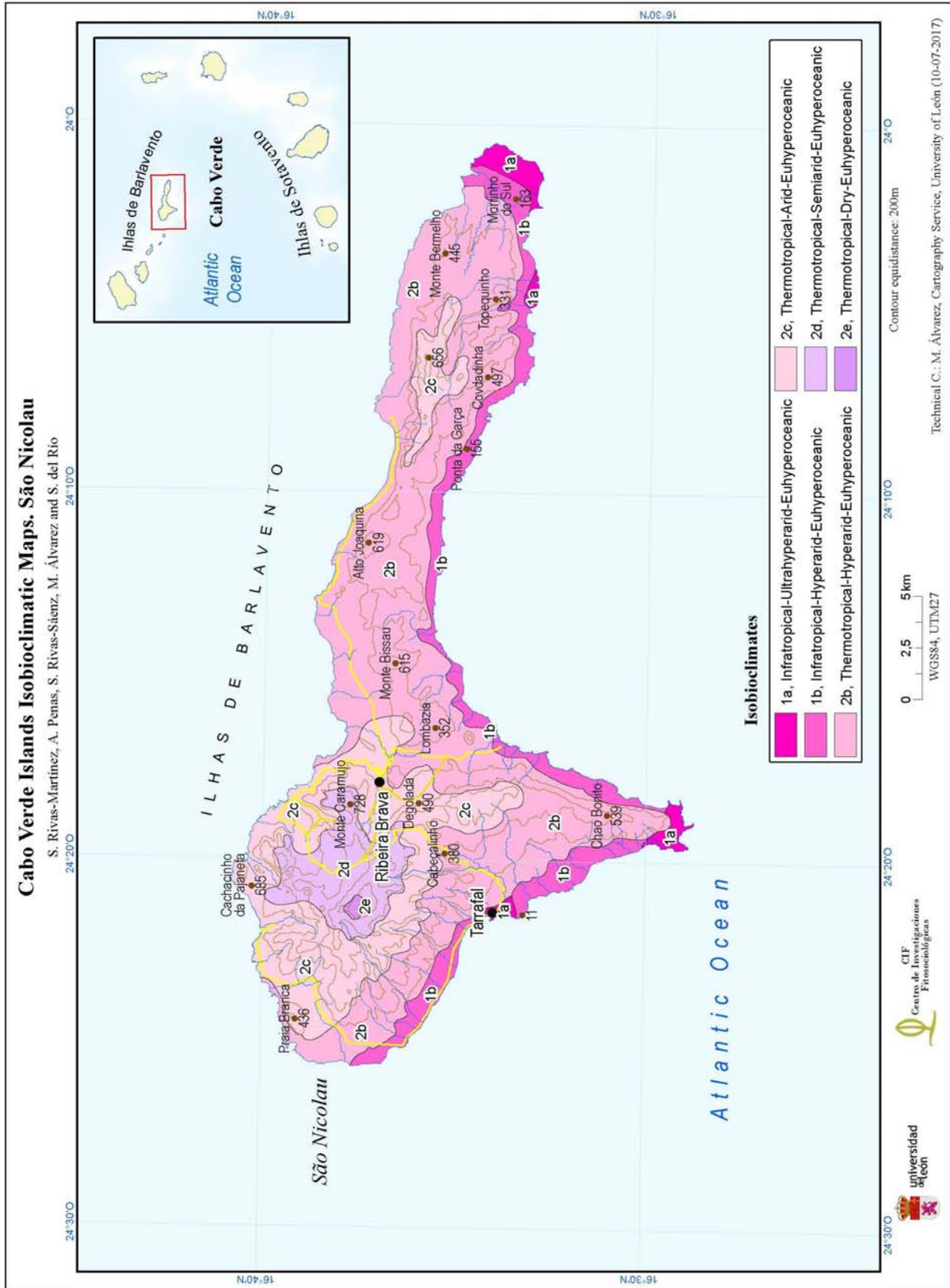
Cabo Verde Islands Isobioclimatic Maps. Maio, Fogo, Brava and Ilhéus do Rombo

S. Rivas-Martínez, A. Penas, S. Rivas-Sáenz, M. Álvarez and S. del Río











Biogeography			Thermtypes (%)				Ombrotypes (%)						
Abbr.	Districts	Sector	Abbr.	In	Th	M	S	Abbr.	Uha	Ha	Ar	Sa	Dr
A	Santo Antão	North Cabo Verde	A	22	71	7	-	A	1	32	42	25	1
V	São Vicente		V	19	81	-	-	V	3	84	13	-	-
N	São Nicolau		N	14	86	-	-	N	2	65	25	7	-
SL	Sal	East Cabo Verde	SL	13	87	-	-	SL	24	75	1	-	-
BO	Boavista		BO	42	58	-	-	BO	7	82	11	-	-
M	Maio		M	28	72	-	-	M	-	8	92	-	-
SN	Santiago	South Cabo Verde	SN	31	69	-	-	SN	-	-	59	40	1
F	Fogo		F	19	58	21	2	F	-	2	41	30	27
BR	Brava		BR	33	67	-	-	BR	-	-	80	20	-

Table 10a. Thermtypes and ombrotypes surfaces (%) Cabo Verde Islands, To V (São Vicente I) belongs Santa Luzia, Branco and Razo Islets and to Br (Brava): Rombo Islets

Nº	Thermtypes		Nº	Ombrotypes		Isobioclimates (%)								
1	Infratropical	Itr	1a	Ultrahyperarid	Uha	1	3	2	13	7	-	-	-	-
			1b	Hyperarid	Ha	19	16	11	-	34	8	-	2	-
			1c	Arid	Ar	2	-	-	-	1	21	31	17	33
2	Thermotropical	Ttr	2a	Ultrahyperarid	Uha	-	-	-	11	-	-	-	-	-
			2b	Hyperarid	Ha	13	68	54	75	48	-	-	-	-
			2c	Arid	Ar	36	13	25	1	10	72	29	24	47
			2d	Semiarid	Sar	22	-	7	-	-	-	40	25	20
			2e	Dry	Dry	-	-	-	-	-	-	1	9	-
3	Mesotropical	Mtr	3a	Arid	Ar	3	-	-	-	-	-	-	-	
			3b	Semiarid	Sa	3	-	-	-	-	-	-	5	-
			3c	Dry	Dry	-	-	-	-	-	-	-	16	-
4	Supratropical	Str	4a	Dry	Dry	-	-	-	-	-	-	2	-	
Cabo Verde Islands						A	V	N	SL	Bo	M	SN	F	BR

Table 10b. Surface (%) of the twelve isobioclimates (ombrotype + thermttype+ continentality type units) existing in the nine Cabo Verde Islands, where the Continentality Index is always euhyperoceanic, Ic (4.0-8.0), and mostly belongs to the strong level (Ic 4.0-6.0)

Biogeography

2a. Biogeographical notions

Biogeography is the science that studies the distribution of species, communities, habitats, biocoenosis, ecosystems, and ecoregions on the Earth, as well as the relationships between them and their causes. It takes into account the areas of taxa, syntaxa, plant communities, formations, biomes and ecoregions, as well as information coming from other natural sciences (geography, soil science, bioclimatology, geology, etc.). The biogeography also attempts to establish a hierarchical biogeographic typology of the territories on the Planet (isles and continents), whose main units in decreasing rank are: kingdom, region, province, sector, district, country, landscape cell and tesela (Rivas-Martínez & al., 2007, 2011). Terrestrial biogeography has been twinned with phytogeography due to the value as bioindicators of vascular and non-vascular plant species and communities in its definition and delimitation. The oceanic biogeography

should be study mostly with oceanographic scientific methods.

The elementary biogeographic terrestrial unit or model of lowest rank is the tesela, which we define as a geographic space with a greater or lesser extension, ecologically homogeneous, what means that it has only a single type of potential natural vegetation (climax) and, as result, an unique sequence of substitution seral communities.

The permatesela is also an elementary model of lowest rank located in exceptional sites or cenotopes: polar, fluvial, lake and coast marine landscapes, deserts, high cold mountains, dunes, volcanic tephra, cohesive rock formations, coastal cliffs, etc., in which the permanent vegetation growing in these spaces lacks of perennial substitution communities in the sere. The tesela and permatesela are the only two biogeographical units which can be repeated in disjointed distribution. Thelandscape cells, such as peni-plains in horst, river valleys, lake systems, connected marshes, mountain summits, ridges, steep slopes, etc., are broad geographic

spaces characterized by an important group of teselas or permateselas and their corresponding complexes, assembled by networks of geosigmeta and geopermasigmeta distributed in function of the relief, the soil conditions or related isobioclimates of the territory.

The biogeographic country (in Spanish: comarca biogeográfica) must be a broad, coherent and clearly delimited territory that has an abundant group of landscape cells, species, communities, associations, and above all particular topographic geosigmeta. The district must be a group of biogeographic countries, characterized by the existence of numerous differential species and even endemic taxa, particularly in coastal, oradic rocky areas and interior saline or ultramafic soils, which permit easy recognition from the adjacent districts; it also includes communities, associations, and vegetation series, geoseries and geoclinoseries, which are absent in nearby districts.

The sector is a group of districts with a large-scale geographic entity, that have its own endemic taxa, associations, vegetation series, as well as original topographic and geoclinosequential geoseries, which are generally due to the existence of exclusive climatophilous, permanent and subserial communities, with their particular isobioclimates, as well as topographic paleoclimates and migratory routes.

The biogeographic province is a vast geographic territory which, out of latitudinally flat and cold territories, has a high number of endemisms and differential species (its own subelement), macroseries and geomacroseries; also, is characteristic of each province to have a particular vegetation zonation, climax and succession; generally, in northern boreal and hemiboreal big territories, could assemble a several broad of biogeographic sectors.

The biogeographic region is a very extend territory, formed by a group of provinces which, out of polar and cold territories of Earth, has an original and very rich flora or regional floristic element with species, genera or even endemic families; in addition, it has its own particular megaseries, geomegaseries and geomegapermaseries and in consequence, its own vegetational belt sequences (Rivas-Martínez, 2005). Finally, the kingdom is the supreme typological unit of the biogeography, generally pluricontinental and multi-insular, which in addition of taxonomic and ecosystematic considerations addresses the origins of the flora and fauna, the vegetational formations ways and migration of the great continents, orogenies, and its own bioclimate: at present and in former times.

As is by now traditional in this science: Engler (1924), Braun-Blanquet (1928), Dice (1943), Takhtajan (1986), Rivas-Martínez, Navarro, Costa & Penas (2011), the denominations of the biogeographic units – both primary and auxiliary from the kingdoms to the biogeographic countries – are given based on more or less well-known geographical, orographic or historical designations, which are treated as rather coincident with the area they are intending to represent. Grammatically, all the biogeographical units are considered to be proper nouns identifying the zone. The names formed by juxtaposition of two geographical nouns are joined by means of a hyphen, maintaining the initial capital in both and keep their condition of proper nouns.

It must be emphasized that the biogeographical units can only be accurately delimited through their diagnosis and, of course, by the corresponding maps. All the territories – except for the tesela and permatesela – must be contiguous by land, lake or sea routes, and include all the orographic accidents and lithological diversity which may exist inside the area. Sometimes in the biogeographical territories, as a whole, there are introgressions of other adjacent territories, and these “islands” frequently occur in areas with a diverse lithology or near regional or provincial boundaries. Their possible typological independence, always of a lower rank than the area into which they introgress, depends on their geological or edaphic originality, floristic richness and phytocoenotic biodiversity, as well as on their extension isolation and bioclimate.

One of the criteria traditionally used to recognize and delimit biogeographic units with their own entity is to distinguish and mapping the taxa and syntaxa: families, genera, species and subspecies, as well associations and plant communities, whose territorial distribution is closely restricted to one particular typological area (Aleksandrova, 1977, Bolòs & Vigo, 1984, Chevalier & Emberger, 1937, Diels, 1908, Drude, 1890, Dupont, 1962, Engler, 1879-82, 1924, Engler & Gilg, 1919, Good, 1947, Lavrenko, 1964, Mattic, 1964, Meusel, Jaeger & Weinert, 1965, Quezel, 1978, Raven & Axelrod, 1974, Skottsberg, 1913, 1921, 1945, 1960, Szafer, 1952, Takhtajan, 1986 and Walter & Straka, 1970). These taxa and syntaxa are termed endemisms. Endemisms have been successfully used to define and delimit many chorological or biogeographical units (provinces, sectors and districts), as they form part of the phytogeographical subelement which characterize. Moreover, the endemisms (taxa, syntaxa and sigmataxa) which have a greater area or are regionals, and those which for migratory reasons are dispersed across diverse biogeographical provinces or regions, constitute the phytogeographical element or geoelement.

2b. Biogeographic typology of Cabo Verde and surrounding territories

The archipelago of Cabo Verde, despite his traditional biogeographic obsolete location in the “Macaronesia Region”, conforms a paleotropical insular atlantic high eutropical saharan province – Cabo Verde –, that belongs to the Tropical Sahara Region (Rivas-Martínez, 2009: 259). The global biogeographical typology of Cabo Verde Islands and the rest of Macaronesian geographic isles (Canary, Madeira, and Azores), as well as African and European more or less surrounding geovicariant territories are synthesized at province level; but the Cabo Verde archipelago biogeographic typology are summarized in this paperat sector and district range.

B. PALEOTROPICAL Kingdom. (Tropical Old World).

Ba. PALEOTROPICAL AFRICA Subkingdom. (Tropical Africa).

II. TROPICAL SAHARA Region. (Tropical ultrahyperarid and arid African Sahara, with their aridic island and high mountains summits and theirs foothills open or wadi savannas).

1.1. **Cabo Verde** Province. (Cabo Verde Islands, serotropical mostly aridicand strong euhypero-

- oceanic, with local dry high summits mountains).
- 1.1a. North Cabo Verde Sector. (Barlovento Islands).
 - 1.1.1. *Santo Antão Island* District.
 - 1.1.2. *São Vicente Island* District. (include with Santa Luzia, Branco and Raso Islets).
 - 1.1.3. *São Nicolau Island* District.
 - 1.1b. East Cabo Verde Sector. (Eastern flat mostly hyperarid islands).
 - 1.1.4. *Sal Island* District.
 - 1.1.5. *Boavista Island* District.
 - 1.1.6. *Maio Island* District.
 - 1.1c. South Cabo Verde Sector. (Sotavento Islands).
 - 1.1.7. *Santiago Island* District.
 - 1.1.8. *Fogo Island* District.
 - 1.1.9. *Brava Island* District. (with Rombo Islets)
 - 1.2. **West Tropical Sahara** Province. (Mauritania and western tropical hyperdesertic Sahara from north Senegal to Dra river in North Morocco).
 - 1.3. **Central Tropical Sahara** Province. (Hoggar and Tibesti aridic mountains with adjacent tropical Sahara hyperdeserts).
 - 1.4. **East Tropical Sahara** Province. (Sudan and Nubian tropical Sahara hyperdesertics).
- III. SAHEL Region. (Senegal to South Sudan, upper arid low dry woodland eutropical savanna).
- 2.1. **West Sahel** Province. (Senegal-High Niger Sahel semiarid and dry savanna).
 - 2.2. **Central Sahel** Province. (Lake Chad Basin Sahel semiarid and low dry savanna).
 - 2.3. **Sudanese Sahel** Province. (Sudan Sahel semiarid to low dry savanna).
- A. Holarctic Kingdom. (Extratropical northern hemisphere).
- I. MEDITERRANEAN Region. (Mediterranean South Europe and North Africa).
- Ia. WEST MEDITERRANEAN Subregion. (Mediterranean Europe).
- 4.1. **Coastal Lusitanian-Andalusian** Province. (Mediterranean Lusitania and Andalusia Atlantic coasts).
- Ib. MAGREB MEDITERRANEAN Subregion. (Mediterranean North Africa, excl. Mediterranean Sahara deserts).
- 4.2. **Rif Mountain** Province. (Rif mountains with their foothills from the Loukos to lower Moulouya basin).
 - 4.3. **Atlantic Mediterranean Morocco** Province. (Atlantic Mediterranean Morocco basins, excl., inner high mountains from Sidi Ifni to Larache).
 - 4.4. **Atlas** Province. (Middle Atlas, High Atlas and AntiAtlas with winter rainy season).
- Ic. MEDITERRANEAN DESERTIC SAHARA Subregion. (Mediterranean arid to ultrahyperarid northern Sahara).
- 3.1. **Mediterranean Sahara Atlas** Province. (Mediterranean Sahara include Atlas deserts).
 - 3.2. **Mediterranean Libya-Egypt Sahara** Province. (Mediterranean Libya and Egypt Sahara deserts).
- Id. CANARY AND MADEIRA Subregion. (Canaries and Madeira Islands).
- 4.7. **Madeira** Province. (Madeira Islands).
 - 4.8. **Canary** Province. (Canary Islands).
- II. EUROSIBERIAN Region. (Temperate and boreal Europe with Azores and West Siberia).
- IIa. ATLANTIC-CENTRAL EUROPEAN Subregion. (Temperate oceanic and subcontinental Europe).
- 5.1. **Atlantic European** Province. (Temperate oceanic Atlantic Europe from North Portugal to South Norway).
 - 5.2. **Azores** Province. (Azores Islands).

3. Cabo Verde flora

Documentation about the plant diversity of the Cape Verde dates from the 19th century with the pioneer works of Webb (1849), Spicilegia Gorgonea, and Schmidt (1852), Beiträge zur Flora der Cap Verdischen Inseln. In the XX century, it should be highlighted Chevalier (1935), the works of Lobin (1986), Lobin & Zizka (1987) and Hansen & Sunding (1993). In the mid-1990s several volumes of Flora de Cabo Verde were published (Martins et al. 1995, 1996, 2002), but this Flora it is still incomplete. Other relevant work is that of Brochmann et al. (1997), devoted to the endemic flora. The latest comprehensive catalogue is that of Arechavaleta et al. (2005) and more recently several taxonomic studies have been made in particular groups (e.g. Romeiras et al. 2011, 2015, 2016, Marrero & Almeida Pérez 2012 and Sukhorukov & Nilova 2016). For us detailed insular (ined.) Caboverdian Checklist of M. Duarte has been essential. A long list of publications is also presented in the references.

3a. New taxa and combinatio novae. Endemic of Cabo Verde [●]

Species novae

Acacia caboverdeana Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *sp. nova* [*hoc loco*] [●]

A Acacia albida Del., *afrotropicalis siccis silvis savannae arboris species differt: arborescens vel arbusculis 3-6 m, ramis tortuosis spinoscentis, spineae brevis sed non curvatis, leguminis minoris valvis subcremaceis.*

Typus: LISC. Leg.: J. S. Orey & R. Rosado, Cabo Verde: Santiago, S. Francisco, 4-IX-1961, n° 14; *holotypus*.

Asphodelus mariolousae Rivas Mart., J.C. Costa & Maria C. Duarte *sp. nova* [*hoc loco*] [●] *A Asphodelus fistulosus* L., *differt: caulibus pluribus; foliis glabris nervatis (atque 12 nervis); bracteis minoribus quam pedicellis; floribus fasciculiformis pluribus cum tepalis minoribus (6-9 mm); capsulis minoris (3-3.5 mm) subglobosis et nervatis; seminibus papilosis albidis.*

Typus: LISC. Leg.: Maria C. Duarte, José C. Costa, Mário Lousã & Salvador Rivas-Martínez, Cabo Verde: Fogo, Montinho, 1810 m, 25-XI-2006, n° 3617; *holotypus*.

Frankenia pseudoericifolia Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *sp. nova* [*hoc loco*] [●]

Frankenia ericifolia auct. cabov. pl. non C. Sm.

A Frankenia ericifolia C. Sm. ex DC. Prodr. 1: 350. 1824 (*Insulae Canariae*), *differt: caulis prostratis, saepe ramosissimis, dense microspiculosis et pube-*

rulis, foliis ericoidi-filiformis sparse vestitis; floribus in cymas brevis dichotomis subsessilibus dispositis; calycis parce spiculosis in maturitate helicoidalis et profundae costatis, subduplo minoris (2.5-4.5 mm) et petalis pallidae violaceis eroso-denticulatis.

Typus: LISC. Leg.: Maria C. Duarte, José C. Costa, Mário Lousã & Salvador Rivas-Martínez, Cabo Verde: S. Vicente, Baía Norte, 6-XII-2005, n° 3022; *holotypus*.

Hyparrhenia caboverdeana Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *sp. nova* [*hoc loco*]

A Hyparrhenia hirta (L.) Stapf., *differt: culmis vaginis pilosis, cum pilis subtriplo majoris; ligulis fimbriatis; spiculis majoris, longe pedunculatis, cum lema et palea dense pilosae; aristae tortiliformis et longioris (5-8 quo palea).*

Typus: LISC. Leg.: Maria C. Duarte, José C. Costa, Mário Lousã & Salvador Rivas-Martínez, Cabo Verde: Santo Antão, Espungeiro, 9-XII-2005, n° 3127; *holotypus*.

Lotus chevalieri Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *sp. nova* [*hoc loco*] [●]

Lotus bollei Christ var. *argenteus* A. Chev. in Rev. Bot. Appl. Agric. Trop. 15: 965. 1935 (*syn. subst.*)

Typus: Herb. Mus. Nat. Hist. Nat. Paris. Archipel des Isles du Cap Vert: Boavista. Aug. Chevalier, 7-9 Juillet 1934, Plantes de l'Afrique Tropical, n° 44360 bis.

Polycarpaea caboverdeana Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *sp. nova* [*hoc loco*]

Polycarpaea nivea auct. cabov. non (Ait.) Webb
A Polycarpaea nivea (Aiton) Webb, *differt: caulis flexuosis, internodiis elongatis et subduplo majoris (1.5-4.0 cm); foliis subincanis linear-lanceolatis, sed non dense niveis, ovato-lanceolatis; stipulis villosis, subtriangularis, acuminatis ad marginem obsolete fimbriatis; inflorescentiae compactis (1.5-2 cm) et bracteis obtusis.*

Typus: LISC. Leg.: Maria C. Duarte, José C. Costa, Mário Lousã & Salvador Rivas-Martínez, Cabo Verde: S. Vicente, Baía das Gatas, dunas, 16-XI-2004, n° 2808; *holotypus*.

Suaeda caboverdeana Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *sp. nova* [*hoc loco*]

Suaeda vermiculata auct. cabov. non Forssk. ex J.F. Gmel.

A Suaeda mollis Delile, *differt: foliis subglobosis glabris, breviter abaxialis petiolatis in dissectionis spathulato-cocculatis; floribus subsolitaris, subsessilibus, roseo-viridis; stigmae trifidae > 0.7 mm, breviter pilosis.*

Typus: LISC. Leg.: Maria C. Duarte, José C. Costa, Mário Lousã & Salvador Rivas-Martínez, Cabo Verde: Maio, Banco da Antónia, 28-XII-2006, n° 3730; *holotypus*.

Tetraena vicentina Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *sp. nova* [*hoc loco*] [●]

A Tetraena fontanesii (Webb & Berthel) Beirr. & Thulin (= *Zygophyllum fontanesii* Webb & Berthol.), *differt: follis trifoliatis cum foliolis rotundo-globulosis, 3-4 mm; capsulis globulosis ad apicem truncatis et ad maturitatem pentacarpis, minoris (4-6 mm).*

Typus: LISC. Leg.: Cardoso Matos et S. Gomes, Cabo Verde: São Vicente, Calhau, Viana, próximo do vulcão do mesmo nome; sufrutice formando coxim, na cobertura arenosa que reveste a base do cone; alt. 60 m, 15-X-1990, n° 6575; *holotypus*.

Combinatio novae

Adiantum capillus-veneris L. subsp. *trifidum* (Willd. ex Bolle) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Adiantum trifidum* Willd. ex Bolle in Bonplandia 3(10): 121. 1851.

Brachiaria caboverdeana (Conert & C.Köhler) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Brachiaria lata* (Schumach.) C.E. Hubb. subsp. *caboverdeana* Conert & C.Köhler in Senckenberg. Biol. 67:440. 1987. [●]

Carex hansenii (Lewej. & Lobin) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Carex paniculata* Jusl. ex L. subsp. *hansenii* Lewej. & Lobin in Senckenberg. Biol. 67: 432. 1987.

Centaurium viridense (Bolle) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Erythraea viridense* Bolle in Bonplandia 9: 52. 1861. [●]

Cressa salina (J.A. Schmidt) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Cressa cretica* L. var. *salina* J.A. Schmidt, Beitr. Fl. Cap Verd Ins.: 229. 1851.-

Daucus humilis (Lobin & K.H. Schmidt) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Tornabenea humilis* Lobin & K.H. Schmidt in Sommerfeltia 24: 83. 1997. [●]

Daucus ribeirensis (Schmidt & Lobin) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Tornabenea ribeirensis* K.H. Schmidt & Lobin, Feddes Repert. 110(1-2): 8. 1999. [●]

Diplotaxis brochmannii (Rustan) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Diplotaxis gorgadensis* Rustan subsp. *brochmannii* Rustan in Nord. J. Bot. 16: 41. 1996. [●]

Dracaena caboverdeana (Marrero Rodr. & R.S. Almeida) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Dracaena draco* (L.) L. subsp. *caboverdeana* Marrero Rodr. & R.S. Almeida in Int. J. Geobot. Res. 2(1): 36. 2012. [●]

Frankenia caboverdeana (Brochmann, Lobin & Sunding) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Frankenia ericifolia* C. Sm. ex DC. subsp. *caboverdeana* Brochmann, Lobin & Sunding in Nord. J. Bot. 15: 620. 1995. [●]

Frankenia montana (Brochmann, Lobin & Sunding) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Frankenia ericifolia* C. Sm. ex DC. subsp. *montana* Brochmann, Lobin & Sunding in Nord. J. Bot. 15: 622. 1995. [●]

Indigofera microcarpa (A. Chev.) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Indigofera tinctoria* L. var. *microcarpa* A. Chev. in Rev. Bot. Appl. Agric. Trop. 15: 969. 1935.

Launaea arborescens (Batt.) Murb. subsp. *melanostigma* (Pett.) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Launaea melanostigma* Pett. in Commentat. Biol. XXII. No. 9 (Coll. Vasc. Pl. C. Verde Isl.): 60. 1960.

Lobularia fruticosa (Webb ex Christ) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Koniga fruticosa* Webb in Christ in Bot. Jahrb. Syst. 9: 93. 1888.

Pulicaria longifolia (Gamal-Eldin) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Pulicaria burchardii* Hutch. subsp. *longifolia* Gamal-Gaudin in Phaner. Monogr. 14: 270. 1981. [●].

Tetraena waterlotii (Maire) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte *comb. nov.* [*hoc loco*]

Basion.: *Zygophyllum waterlotii* Maire in Bull. Soc. Hist. Nat. Afr. Nord 28: 348 (1937)

3b. List of endemic plants and synonyms of Cabo Verde

In alphabetic order, on list the valid names with the authors of the endemic vascular plant of Cabo Verde Islands [●]. The valid name in italics and synonyms.

Acacia caboverdeana Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte

Aeonium gorgoneum J.A. Schmidt

Antirrhinum elegans G. Forst. (v. *Kickxia elegans*)

Aristida cardosoi Cout.

Artemisia gorgonum Webb

Arthrocnemum franzii Sukhor. & Nilova

Asparagus squarrosus J.A. Schmidt

Asphodelus mariolousae Rivas Mart., J.C. Costa & Maria C. Duarte

Asteriscus daltonii (Webb) Walp.

Asteriscus smithii (Webb) Walp.

Asteriscus vogelii (Webb) Walp.

Brachiaria caboverdeana (Conert & C.Köhler) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte

Brachiaria laeta (Schumach.) C.E. Hubb. subsp. *caboverdeana* Conert & C.Köhler (v. *Brachiaria caboverdeana*)

Campanula bravensis (Bolles) A. Chev.

Campanula jacobaea C.Sm. ex Webb

Campanula jacobaea C.Sm. ex Webb var. *bravensis* Bolles (v. *Campanula bravensis*)

Campylanthus glaber Benth

Campylanthus spathulatus A. Chev.

Carex antoniensis A. Chev.

Carex hansenii (Lewej. & Lobin) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte

Carex paniculata Jusl. ex L. subsp. *hansenii* Lewej. & Lobin (v. *Carex hansenii*)

Celsia cystolithica B. Pett. (v. *Verbascum cystolithicum*)

Centaurium viridense (Bolles) Rivas Mart., Lousã, J.C.

Costa & Maria C. Duarte

Conyza feae (Bég.) Wild

Conyza pannosa Webb

Conyza schlechtendalii Bolles

Conyza varia (Webb) Wild

Daucus annuus (Bég.) Wojew., Reduron, Banasiak & Spalik,

Daucus humilis (Lobin & K.H. Schmidt) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte

Daucus insularis (Parl. ex Webb) Spalik, Wojew., Banasiak & Reduron

Daucus ribeirensis (Schmidt & Lobin) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte

Daucus tenuissimus (A.Chev.) Spalik, Wojew., Banasiak & Reduron

Diplotaxis antoniensis Rustan

Diplotaxis brochmannii (Rustan) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte

Diplotaxis glauca (Schmidt) O.E. Schultz

Diplotaxis gorgadensis Rustan

Diplotaxis gorgadensis Rustan subsp. *brochmannii* Rustan (v. *Diplotaxis brochmannii*)

Diplotaxis gracilis (Webb) O.E. Schulz

Diplotaxis hirta (A. Chev.) Rustan & L.Borgen

Diplotaxis sundingii Rustan

Diplotaxis varia Rustan

Diplotaxis vogelii (Webb) Cout.

Dracaena caboverdeana (Marrero, Rodr. & R.S. Almeida) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte

Dracaena draco (L.) L. subsp. *caboverdeana* Marrero Rodr. & R.S. Almeida (v. *Dracaena caboverdeana*)

Echium glabrescens B. Pett.

Echium hypertropicum Webb

Echium lindbergii B. Pett.

Echium stenosphon Webb

Echium vulcanorum A. Chev.

Eragrostis conertii Lobin

Erysimum caboverdeanum (A. Chev.) Sunding

Erythraea viridense Bolles (v. *Centaurium viridense*)

Euphorbia tuckeyana Steud. ex Webb

Fagonia mayana Schltdl.

Forsskaolea procrisifolia Webb

Francoeuria diffusa Shuttlew (v. *Pulicaria diffusa*)

Frankenia caboverdeana (Brochmann, Lobin & Sunding) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte

Frankenia ericifolia auct. non C. Sm. (v. *Frankenia pseudoericifolia*)

Frankenia ericifolia C. Sm. subsp. *caboverdeana* Brochmann, Lobin & Sunding (v. *Frankenia caboverdeana*)

Frankenia ericifolia C. Sm. subsp. *montana* Brochmann, Lobin & Sunding (v. *Frankenia montana*)

Frankenia montana (Brochmann, Lobin & Sunding) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte

- Frankenia pseudoericifolia* Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte
- Globularia amygdalifolia* Webb
- Helianthemum gorgoneum* Webb
- Hyparrhenia caboverdeana* Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte
- Indigofera microcarpa* (A. Chev.) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte
- Indigofera tinctoria* L. var. *microcarpa* A. Chev. (v. *Indigofera microcarpa*)
- Kickxia dichondrifolia* (Benth.) Janch.
- Kickxia elegans* (G. Forst.) D.A. Sutton
- Kickxia webbiana* (J.A. Schmidt) Sunding
- Koniga fruticosa* Webb (v. *Lobularia fruticosa*)
- Koniga spathulata* J.A. Schmidt (v. *Lobularia spathulata*)
- Launaea arborescens* (Batt.) Murb. subsp. *melanostigma* (B. Pett.) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte
- Launaea gorgadensis* (Bolle) N. Kilian
- Launaea melanostigma* (v. *Launaea arborescens* subsp. *melanostigma*)
- Launaea picridioides* (Webb) Engl.
- Launaea thalassica* N. Kilian, Brochmann & Rustan
- Lavandula rotundifolia* Benth.
- Limonium braunii* (Bolle) A. Chev.
- Limonium brunneri* (Webb) Kuntze
- Limonium jovi-barba* (Webb) Kuntze
- Limonium lobinii* N. Kilian & Leyens
- Limonium sundingii* Leyens, Lobin, N. Kilian & Erben
- Linaria dichondrifolia* Benth. (v. *Kickxia dichondrifolia*)
- Linaria webbiana* J.A. Schmidt non Vis. (syn. subst.) (v. *Kickxia webbiana*)
- Lobularia fruticosa* (Webb ex Christ) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte
- Lobularia spathulata* (J.A. Schmidt) O.E. Schulz
- Lotus arborescens* Lowe ex Cout.
- Lotus bollei* Christ var. *argenteus* A. Chev. (syn. subst.) (v. *Lotus chevalieri*)
- Lotus brunneri* Webb
- Lotus chevalieri* Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte
- Lotus jacobaeus* L.
- Lotus jacobaeus* L. var. *villosus* A. Chev.
- Lotus latifolius* Brand
- Lotus purpureus* Webb
- Lotus villosus* (v. *Lotus jacobaeus* var. *villosus*)
- Matthiola caboverdeana* A. Chev. (v. *Erysimum caboverdeanum*)
- Melanoselinum bischoffii* (J.A. Schmidt) A. Chev.
- Melanoselinum tenuissimum* A. Chev. (v. *Daucus tenuissimum*)
- Micromeria forbesii* Benth.
- Odontospermum daltonii* Webb (v. *Asteriscus daltonii*)
- Odontospermum smithii* Webb (v. *Asteriscus smithii*)
- Odontospermum vogelii* Webb (v. *Asteriscus vogelii*)
- Papaver gorgoneum* Cout. subsp. *gorgoneum*
- Papaver gorgoneum* Cout. subsp. *theresias* Kadereit & Lobin
- Paronychia illecebroides* Webb
- Periploca chevalieri* Browicz
- Phagnalon melanoleucum* Webb
- Phoenix atlantica* A. Chev.
- Polycarpaea caboverdeana* Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte
- Polycarpaea gayi* Webb
- Pulicaria burchardii* Hutch. subsp. *longifolia* Gamal-Eldin (v. *Pulicaria longifolia*)
- Pulicaria diffusa* (Shuttlew.) Pett.
- Pulicaria longifolia* (Gamal-Eldin) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte
- Rhabdotheca picridioides* Webb (v. *Launaea picridioides*)
- Sapota marginata* Decne. (v. *Sideroxylon marginata*)
- Sarcostemma daltonii* Decne.
- Schmidtia farinulosa* Webb (v. *Tolpis farinulosa*)
- Sideroxylon marginata* (Decne.) Cout.
- Sinapidendron glaucum* J.A. Schmidt (v. *Diploaxis glauca*)
- Sinapidendron gracile* Webb (v. *Diploaxis gracilis*)
- Sinapidendron hirtum* A. Chev. (v. *Diploaxis hirta*)
- Sinapidendron vogelii* Webb (v. *Diploaxis vogelii*)
- Sonchus daltonii* Webb
- Sonchus gorgadensis* Bolle (v. *Launaea gorgadensis*)
- Sporobolus confertus* J.A. Schmidt
- Statice braunii* Bolle (v. *Limonium braunii*)
- Statice brunneri* Webb (v. *Limonium brunneri*)
- Statice jovi-barba* Webb (v. *Limonium jovi-barba*)
- Suaeda caboverdeana* Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte
- Tetraena vicentina* Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte
- Tetraena fontanesii* (Webb & Berthel.) Beiorr. & Thulin
- Tetraena waterlotii* (Maire) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte
- Tetrapleura insularis* Parl. (v. *Daucus insularis*)
- Tolpis farinulosa* (Webb) J.A. Schmidt
- Tornabenea annua* Bég. (v. *Daucus annuus*)
- Tornabenea bischoffii* J.A. Schmidt (v. *Melanoselinum bischoffii*)
- Tornabenea humilis* Lobin & K.H. Schmidt (v. *Daucus humilis*)
- Umbilicus schmidtii* Bolle
- Verbascum capitis-viridis* Hub.-Mor.
- Verbascum cystolithicum* (Pett.) Hub.-Mor.
- Withania chevalieri* A.E. Gonç.

3c. Cabo Verde endemic species: distribution and syntaxa

The distribution of the Cabo Verde endemic taxa considered in this publication (some of them corresponding to new taxa or new combinations, (see 3b) are presented in table 11, as well as their characteristic syntaxa

Endemic taxa // Isles	A	V	N	SL	BO	M	SN	F	BR	Nº	Characteristic syntaxa
<i>Acacia caboverdeana</i>	♦	♦	-	♦	♦	♦	♦	♦	♦	7	<i>Fico-Acacion caboverdeanae</i>
<i>Aeonium gorgoneum</i>	♦	♦	♦	-	-	-	-	-	-	3	<i>Euphorbio-Sarcostemmetalia daltonii</i>
<i>Aristida cardosoi</i>	♦	♦	♦	♦	♦	♦	♦	♦	♦	9	<i>Aristido cardosoi-Tetraenion simplicis</i>
<i>Artemisia gorgonum</i>	♦	-	-	-	-	-	♦	♦	-	3	<i>Globulario-Periplocion chevalieri</i>
<i>Asparagus squarrosus</i>	♦	♦	♦	♦	♦	♦	-	-	-	6	<i>Asparago-Sarcostemmion daltonii</i>
<i>Asphodelus mariolousae</i>	♦	-	-	-	-	-	-	♦	-	2	<i>Aristido- cardosoi-Tetraenion simplicis</i>
<i>Asteriscus daltonii</i>	-	-	-	-	-	-	♦	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Asteriscus smithii</i>	-	-	♦	-	-	-	-	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Asteriscus vogelii</i>	♦	♦	♦	-	-	♦	♦	♦	♦	7	<i>Cocculo-Sarcostemmetea daltonii</i>
<i>Brachiaria caboverdeana</i>	-	♦	♦	-	♦	-	♦	-	-	4	<i>Aristido cardosoi-Tetraenion simplicis</i>
<i>Campanula bravensis</i>	-	-	-	-	-	-	♦	♦	♦	3	<i>Adiantion trifidi</i>
<i>Campanula jacobaea</i>	♦	♦	♦	-	-	-	♦	-	-	4	<i>Kickxietalia elegantis</i>
<i>Campylanthus glaber</i>	♦	♦	♦	-	-	-	♦	♦	♦	6	<i>Kickxietalia elegantis</i>
<i>Campylanthus spathulatus</i>	♦	-	-	-	-	-	-	-	-	1	<i>Asparago-Sarcostemmion daltonii</i>
<i>Carex antoniensis</i>	♦	-	-	-	-	-	-	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Carex hansenii</i>	♦	-	-	-	-	-	-	-	-	1	<i>Adiantion trifidi</i>
<i>Centaurium viridense</i>	-	-	-	-	-	-	♦	♦	♦	3	<i>Melinio grandiflorae-Heteropogonetalia contorti</i>
<i>Cistanche brunneri</i>	♦	♦	-	♦	♦	♦	-	-	-	5	<i>Polycarpaeo-Tetraenion waterlotii</i>
<i>Conyza feae</i>	♦	♦	♦	-	-	-	♦	♦	♦	6	<i>Globulario-Periplocion chevalieri</i>
<i>Conyza pannosa</i>	♦	♦	♦	-	-	-	-	♦	♦	5	<i>Globulario-Periplocion chevalieri</i>
<i>Conyza schlechtendalii</i>	-	-	♦	-	-	-	-	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Conyza varia</i>	♦	♦	♦	-	-	-	♦	♦	-	5	<i>Globulario-Periplocion chevalieri</i>
<i>Daucus annuus</i>	-	-	-	-	-	-	♦	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Daucus humilis</i>	-	-	-	-	-	-	-	♦	-	1	<i>Fico-Acacion caboverdeanae</i>
<i>Daucus insularis</i>	-	♦	♦	-	-	-	-	-	♦	3	<i>Globulario-Periplocion chevalieri</i>
<i>Daucus tenuissimus</i>	-	-	-	-	-	-	-	-	♦	1	<i>Globulario-Periplocion chevalieri</i>
<i>Diplotaxis antoniensis</i>	♦	-	-	-	-	-	-	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Diplotaxis brochmannii</i>	♦	-	-	-	-	-	-	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Diplotaxis glauca</i>	-	-	-	♦	-	-	-	-	-	1	<i>Asparago-Sarcostemmion daltonii</i>
<i>Diplotaxis gorgadensis</i>	♦	-	-	-	-	-	-	-	-	1	<i>Kickxietalia elegantis</i>
<i>Diplotaxis gracilis</i>	-	-	♦	-	-	-	-	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Diplotaxis hirta</i>	-	-	-	-	-	-	-	♦	-	1	<i>Kickxietalia elegantis</i>
<i>Diplotaxis sundingii</i>	-	-	♦	-	-	-	-	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Diplotaxis varia</i>	-	-	-	-	-	-	♦	-	♦	2	<i>Kickxietalia elegantis</i>

<i>Diplotaxis vogelii</i>	-	♦	-	-	-	-	-	-	-	1	<i>Asparago-Sarcostemmion daltonii</i>
<i>Dracaena caboverdeana</i>	♦	♦	♦	-	-	-	♦	♦	♦	6	<i>Fico-Accacion caboverdeanae</i>
<i>Echium glabrescens</i>	-	-	♦	-	-	-	-	-	-	1	<i>Euphorbio-Sarcostemmetalia daltonii</i>
<i>Echium hypertropicum</i>	-	-	-	-	-	-	♦	-	♦	2	<i>Globulario-Periplocion chevalieri</i>
<i>Echium lindbergii</i>	♦	-	-	-	-	-	-	-	-	1	<i>Euphorbio-Sarcostemmetalia daltonii</i>
<i>Echium stenosphon</i>	-	♦	-	-	-	-	-	-	-	1	<i>Euphorbio-Sarcostemmetalia daltonii</i>
<i>Echium vulcanorum</i>	-	-	-	-	-	-	-	♦	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Eragrostis conertii</i>	♦	♦	♦	-	-	-	♦	♦	-	5	<i>Aristido cardosoi-Tetraenion simplicis</i>
<i>Erysimum caboverdeanum</i>	-	-	-	-	-	-	-	♦	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Euphorbia tuckeyana</i>	♦	♦	♦	♦	♦	-	♦	♦	♦	8	<i>Euphorbio-Sarcostemmetalia daltonii</i>
<i>Fagonia mayana</i>	-	-	-	-	♦	♦	-	-	-	2	<i>Asparago-Sarcostemmion daltonii</i>
<i>Forsskaolea procrudifolia</i>	♦	♦	♦	♦	-	♦	♦	♦	♦	8	<i>Cocculo-Sarcostemmetea daltonii</i>
<i>Frankenia caboverdeana</i>	♦	♦	♦	-	-	-	-	-	-	3	<i>Euphorbio-Sarcostemmetalia daltonii</i>
<i>Frankenia montana</i>	♦	♦	-	-	♦	-	-	-	-	2	<i>Globulario-Periplocion chevalieri</i>
<i>Frankenia pseudoericifolia</i>	♦	♦	♦	♦	♦	♦	-	♦	♦	8	<i>Polycarpaeo-Tetraenion waterlotii</i>
<i>Globularia amygdalifolia</i>	♦	-	♦	-	-	-	♦	♦	♦	5	<i>Globulario-Periplocion chevalieri</i>
<i>Helianthemum gorgoneum</i>	♦	-	-	-	-	-	-	♦	♦	3	<i>Globulario-Periplocion chevalieri</i>
<i>Hyparrhenia caboverdeana</i>	♦	♦	♦	♦	-	-	♦	♦	♦	7	<i>Melinio-Heteropogonetalia contorti</i>
<i>Indigofera microcarpa</i>	-	-	-	-	-	-	-	-	♦	1	<i>Cocculo-Sarcostemmetea daltonii</i>
<i>Kickxia dichondrifolia</i>	♦	♦	♦	-	-	-	♦	-	-	4	<i>Kickxietalia elegantis</i>
<i>Kickxia elegans</i>	♦	♦	♦	♦	♦	♦	♦	♦	♦	9	<i>Kickxietalia elegantis</i>
<i>Kickxia webbiana</i>	♦	-	-	-	-	-	-	-	-	1	<i>Kickxietalia elegantis</i>
<i>Launaea gorgadensis</i>	♦	♦	♦	-	-	-	-	-	-	3	<i>Asparago-Sarcostemmion daltonii</i>
<i>Launaea picridioides</i>	♦	♦	♦	-	-	-	-	-	-	3	<i>Euphorbio-Sarcostemmetalia daltonii</i>
<i>Launaea thalassica</i>	-	-	-	-	-	-	-	-	♦	1	<i>Kickxietalia elegantis</i>
<i>Lavandula rotundifolia</i>	♦	♦	♦	-	-	-	♦	♦	-	5	<i>Cocculo-Sarcostemmetea daltonii</i>
<i>Limonium braunii</i>	♦	-	♦	-	-	-	-	♦	♦	4	<i>Asparago-Sarcostemmion daltonii</i>
<i>Limonium brunneri</i>	-	♦	-	♦	-	-	-	-	-	2	<i>Polycarpaeo-Tetraenion waterlotii</i>
<i>Limonium jovi-barba</i>	-	♦	♦	-	-	-	-	-	-	2	<i>Asparago-Sarcostemmion daltonii</i>
<i>Limonium lobinii</i>	-	-	-	-	-	-	♦	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Limonium sundingii</i>	-	-	♦	-	-	-	-	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Lobularia fruticosa</i>	♦	-	♦	-	-	-	♦	♦	♦	5	<i>Euphorbio-Sarcostemmetalia daltonii</i>
<i>Lobularia spathulata</i>	-	♦	♦	-	-	-	-	-	-	2	<i>Globulario-Periplocion chevalieri</i>
<i>Lotus arborescens</i>	-	-	♦	-	-	-	-	-	-	1	<i>Globulario-Periplocion chevalieri</i>

<i>Lotus brunneri</i>	-	♦	-	♦	♦	♦	-	-	-	4	<i>Polycarpaeo-Tetraenion waterlotii</i>
<i>Lotus chevalieri</i>	-	-	-	-	♦	-	-	-	-	1	<i>Polycarpaeo-Tetraenion waterlotii</i>
<i>Lotus jacobaeus</i>	-	-	-	-	-	-	♦	♦	-	2	<i>Globulario-Periplocion chevalieri</i>
<i>Lotus latifolius</i>	♦	-	-	-	-	-	-	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Lotus purpureus</i>	♦	♦	♦	-	♦	-	♦	♦	♦	7	<i>Cocculo-Sarcostemma daltonii</i>
<i>Lotus villosus</i>	-	-	-	-	-	-	-	♦	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Melanoselinum bischoffii</i>	♦	-	-	-	-	-	-	-	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Micromeria forbesii</i>	♦	-	-	-	-	-	-	♦	♦	3	<i>Euphorbio-Sarcostemma daltonii</i>
<i>Papaver gorgoneum</i>	-	-	♦	-	-	-	-	♦	-	2	<i>Chenopodietalia muralis</i>
<i>Papaver thesias</i>	♦	-	-	-	-	-	-	-	-	1	<i>Chenopodietalia muralis</i>
<i>Paronychia illecebroides</i>	♦	♦	♦	-	♦	♦	♦	♦	-	7	<i>Euphorbio-Sarcostemma daltonii</i>
<i>Periploca chevalieri</i>	♦	-	♦	-	-	-	♦	♦	♦	5	<i>Euphorbio-Sarcostemma daltonii</i>
<i>Phagnalon melanoleucum</i>	♦	♦	♦	-	-	-	♦	♦	-	5	<i>Globulario-Periplocion chevalieri</i>
<i>Phoenix atlantica</i>	-	♦	-	♦	♦	♦	♦	-	-	5	<i>Phoenicion atlanticae</i>
<i>Polycarpaea caboverdeana</i>	♦	♦	-	♦	♦	-	-	♦	-	5	<i>Polycarpaeo-Tetraenion waterlotii</i>
<i>Polycarpaea gayi</i>	♦	♦	♦	♦	-	-	♦	♦	-	6	<i>Kickxietalia elegantis</i>
<i>Pulicaria diffusa</i>	-	-	-	♦	♦	♦	♦	♦	-	5	<i>Polycarpaeo-Tetraenion waterlotii</i>
<i>Pulicaria longifolia</i>	-	-	-	♦♦	-	-	-	-	-	1	<i>Polycarpaeo-Tetraenion waterlotii</i>
<i>Sarcostemma daltonii</i>	♦	♦	♦	E?	♦	-	♦	♦	♦	8	<i>Cocculo-Sarcostemma daltonii</i>
<i>Sideroxylon marginata</i>	♦	♦	♦	-	-	-	♦	♦	♦	6	<i>Fico-Acacion caboverdeanae</i>
<i>Sonchus daltonii</i>	♦	♦	♦	-	-	-	♦	♦	-	5	<i>Globulario-Periplocion chevalieri</i>
<i>Sporobolus confertus</i>	-	-	-	♦	-	♦	-	-	-	2	<i>Sesuvion sesuvioideis</i>
<i>Suaeda caboverdeana</i>	-	♦	-	♦	♦	♦	-	-	-	4	<i>Polycarpaeo-Tetraenion waterlotii</i>
<i>Tolpis farinulosa</i>	♦	♦	-	-	-	-	♦	♦	♦	5	<i>Globulario-Periplocion chevalieri</i>
<i>Umbilicus schmidtii</i>	♦	-	♦	-	-	-	♦	♦	-	4	<i>Kickxietalia elegantis</i>
<i>Verbascum capitis-viridis</i>	♦	♦	♦	-	♦	♦	♦	-	-	6	<i>Euphorbio-Sarcostemma daltonii</i>
<i>Verbascum cystolithicum</i>	-	-	-	-	-	-	-	♦	-	1	<i>Globulario-Periplocion chevalieri</i>
<i>Withania chevalieri</i>	♦	♦	-	♦	-	-	-	♦	-	4	<i>Euphorbio-Sarcostemma daltonii</i>
<i>Tetraena vicentina</i>	-	♦	-	-	-	-	-	-	-	1	<i>Polycarpaeo-Tetraenion waterlotii</i>

Table 11. Endemic plants of Cabo Verde Isles: A : Santo Antão, V : São Vicente, N : São Nicolau, SL : Sal, BO : Boavista, M : Maio, SN : Santiago, F : Fogo, BR : Brava, and their characteristic syntaxa, E: extinct

Exclusive insular endemics	A	V	N	SL	Bo	M	SN	F	BR	Syntaxa
<i>Campylanthus spathulatus</i>	◆	-	-	-	-	-	-	-	-	1.1.2
<i>Carex antoniensis</i>	◆	-	-	-	-	-	-	-	-	1.2
<i>Carex hansenii</i>	◆	-	-	-	-	-	-	-	-	11.1
<i>Diplotaxis antoniensis</i>	◆	-	-	-	-	-	-	-	-	1.2
<i>Diplotaxis brochmannii</i>	◆	-	-	-	-	-	-	-	-	1.2
<i>Diplotaxis gorgadensis</i>	◆	-	-	-	-	-	-	-	-	12.1
<i>Echium lindbergii</i>	◆	-	-	-	-	-	-	-	-	1a
<i>Kickxia webbiana</i>	◆	-	-	-	-	-	-	-	-	12.1.1
<i>Lotus latifolius</i>	◆	-	-	-	-	-	-	-	-	1.2.6
<i>Melanoselinum bischoffii</i>	◆	-	-	-	-	-	-	-	-	1.2.7
<i>Papaver theresias</i>	◆	-	-	-	-	-	-	-	-	15.1
<i>Diplotaxis vogelii</i>	-	◆	-	-	-	-	-	-	-	1.1.5
<i>Echium stenosphon</i>	-	◆	-	-	-	-	-	-	-	1.1.5
<i>Tetraena vicentina</i>	-	◆	-	-	-	-	-	-	-	4.1.1
<i>Asteriscus smithii</i>	-	-	◆	-	-	-	-	-	-	1.2.8
<i>Conyza schlechtendalii</i>	-	-	◆	-	-	-	-	-	-	1.2.8
<i>Diplotaxis gracilis</i>	-	-	◆	-	-	-	-	-	-	1.2.8
<i>Diplotaxis sundingii</i>	-	-	◆	-	-	-	-	-	-	1.2.8
<i>Echium glabrescens</i>	-	-	◆	-	-	-	-	-	-	1a
<i>Lotus arborescens</i>			◆							1.2.8
<i>Diplotaxis glauca</i>	-	-	-	◆	-	-	-	-	-	1.1.4
<i>Pulicaria longifolia</i>	-	-	-	◆◆	-	-	-	-	-	4.1
<i>Lotus chevalieri</i>	-	-	-	-	◆	-	-	-	-	4.1
<i>Daucus annuus</i>	-	-	-	-	-	-	◆	-	-	12.4
<i>Limonium lobinii</i>	-	-	-	-	-	-	◆	-	-	12.4
<i>Daucus humilis</i>	-	-	-	-	-	-	-	◆	-	1.3
<i>Diplotaxis hirta</i>	-	-	-	-	-	-	-	◆	-	12.1.2
<i>Echium vulcanorum</i>	-	-	-	-	-	-	-	◆	-	1.2.2
<i>Erysimum caboverdeanum</i>	-	-	-	-	-	-	-	◆	-	1.2
<i>Lotus villosus</i>	-	-	-	-	-	-	-	◆	-	1.2
<i>Verbascum cystolithicum</i>	-	-	-	-	-	-	-	◆	-	1.2.2
<i>Daucus tenuissimus</i>	-	-	-	-	-	-	-	-	◆	1.2
<i>Indigofera microcarpa</i>	-	-	-	-	-	-	-	-	◆	1.3
<i>Launaea thalassica</i>	-	-	-	-	-	-	-	-	◆	12.5

Table 12. List, distribution and number of characteristic syntaxa the of 33 exclusive one isle endemic taxa of Cabo Verde

4. Vegetation synthesis of Cabo Verde Islands

The first approach of the study of Cabo Verde vegetation was made by Chevalier (1935) and Barbosa (1968). Latter Diniz & Matos (1986, 1987, 1988, 1988a, 1993, 1994, 1994a, 1999, 1999a, 1999b) prepared the "Carta da zonagem agro-ecológica e da vegetação de Cabo Verde" (Agro-Ecological zoning and vegetation maps of Cabo Verde), using in most cases annual and nitrophilous species as bioindicators. Duarte (1998), Duarte & Moreira (2002) and Duarte et al. (2005) developed important works on the vegetation of Santiago Island, both in an historical and present-day perspective. Rivas-Martínez (2009: 255-296) in a geobotanical synthesis about "Macaronesia", using bioclimatical, phytosociological and floristic bioindicators and other data,

proposed the biogeographic province of Cabo Verde Islands inside the Sahara Tropical Subregion with tropical desertic and xeric bioclimates; Canary and Madeira archipelagos were placed in the Mediterranean Region as two independent provinces, with a desertic, xeric and pluviseasonal mediterranean bioclimates with submediterranean hyperhumid in orcal Madeira; and finally, the whole and high endemic Azores archipelago were considered also as a particular biogeographic Azores Province, inside the Eurosiberian Region, with a temperate hyperoceanic and submediterranean humid-hyperhumid bioclimate. Recently, Gomes et al. (2012) and Costa et al. (2014) developed studies on the plant communities of the dunes and marshes of the islands of São Vicente, Sal, Boavista and Maio.

4a. World formation types

Our interest for global vegetation classification remains a research priority. Since D. Faber-Langendoen sent to us for opinion the interesting and documented draft paper – HRWG: Hierarchy Revisions Working Group (Federal Geographic Data Committee). 2011, November 22. Classification and description of world formations types. Contributing authors: D. Faber-Langendoen, C. Josse, G. Navarro, T. Keeler-Wolf, D. Meidinger, E. Helmer, B. Hoagland, G. Fulst, S. Ponomarenko, J.P. Saucier, D. Tart and A. Weakly. FGDC Secretariat, U.S. Geological Survey. Reston, VA and NaturServe, Arlington, VA; a developed Vegetation Classification of FGDC. 1997 (2008) – our purpose was try to combine the units, names, grow forms definitions, nomenclature and the hierarchical classification of natural vegetation of this new approach, with the geobotanical systems units of Braun-Blanquet syntaxa, macrobioclimates, bioclimates and biogeographic models that we utilize since years ago. As we were at time preparing this paper about geobotanical survey of Cabo Verde Islands (West Africa), we use the opportunity for beginning to correlate the units and information of both approaches.

The classification of world formation types (Faber-Langendoen & al. 2011, Nov. 22) recognize first three

large hierarchies: A. Natural Vegetation, B. Cultural Vegetation (“anthromorphic”: agricultural and with strong human impacts), C. Non-Vegetated (hot and cold extreme hyperdeserts with less 1% of natural plant cover). Within “Natural Vegetation”, a diverse, long and ecological process has determine in coevolution at least five ecomorphic types having similar structure, grow forms of plants, habitat and vegetation types: 1. Mesomorphic (able to living in moderate moisture habitats), 2. Xeromorphic (able to prevent water loss by evaporation and living in hyperarid to low dry habitats), 3. Cryomorphic (able to survive in very cold temperature and frost damage), 4. Hydromorphic (able to living in aquatic habitats), 5. Lithomorphic (able for living on rocky habitats having limitations for rooting), 6. Anthropic (able to living in ruderal high nitrified or with strong human impact habitats). (Tables 13, 14).

The eight formation class recognized for natural and cultural vascular plant vegetation categories are show in the table 12.

Besides the six cosmopolite natural and seminatural formation class proposed by Faber-Langendoen & al. (2011, Nov. 22: 17-19), we admit in the category B, as agricultural vegetation, a new broad anthropic, cultural and ruderal formation class (7).

Natural Hierarchy Level	Level groups	Cultural Hierarchy Level
I.1 Formation Class	Upper Level	I.1 Cultural Class
I.2 Formation Subclass		I.2 Cultural Subclass
I.3 Formation		I.3 Cultural Formation
I.4 Division	Mid Level	I.4 Cultural Subformation
I.5 Macrogroup		I.5 Cultural Group
I.6 Group		I.6 Cultural Subgroup
I.7 Alliance	Lower Level	I.7 Cultural Type
I.8 Association		I.8 Cultural Subtype

Table 13. Hierarchy levels in natural and cultural vegetation (Faber-Langendoen & al. 2011, Nov. 22: 12, tb. 3)

Categories	Formation class. Level 1 (mostly cosmopolite)
A. Natural and seminatural vegetation	1. Mesomorphic forest and tall woodland vegetation
	2. Mesomorphic shrubland and grassland vegetation
	3. Xeromorphic short open woodland and desert vegetation ($I_o < 2.0$)
	4. Cryomorphic polar and high mountain vegetation ($T_p < 600$)
	5. Hydromorphic aquatic vegetation (with some wetland formations)
	6. Lithomorphic rupestrian vegetation (chasmophytic and comophytic)
B. Agricultural vegetation	7. Anthropic ruderal and agricultural vegetation

Table 14. Natural, seminatural and cultural formation classes. An outline based on FGDC (2008) and Faber-Langendoen & al. (2011), with little modifications and phytosociological additions (Rivas-Martínez, Penas & del Río in progress).

Natural hierarchy level	Ecomorphic types	Bioclimatic units	Biogeographic units	Floristic elements	Phytosociologic units	Grow forms
1. Formation class	One type	Macrobioclimate	Cosmopolite or kingdom	Many diagnostic species	Many classes	Dominant general and specific
2. Formation subclass	Same or divided type	Macrobioclimate and bioclimate	Regions and sub-regions	Many diagnostic species	Several classes	General specific dominant and diagnostic
3. Formation basic	Divided type	Bioclimate	Subregions and provinces	Many diagnostic species and endemics	Classes and orders	Dominant diagnostic and individual diagnostic
4. Division	Small divided type	Bioclimate and isobioclimates	Provinces, sectors and districts	Several diagnostic species and endemics	Orders and alliances	Dominant diagnostic and individual diagnostic

Table 15. Natural hierarchy level: formation class, subclass, basic formation and divisions

Formation Class	Phytosociological equivalent classes (syntax. equiv.)
A. Xeromorphic short open woodland, scrub and grassland (aridic and xeric tropical savanna)	1. <i>Cocculo penduli-Sarcostemmetea daltonii</i>
	2. <i>Heteropogonetea contorti</i>
	3. <i>Tetraenetea simplicis</i>
	4. <i>Frankenio pseudoericifoliae-Suaedetetea caboverdeanae</i>
B. Aquatic vegetation (hydromorphic) (included: fresh and salt-water marshes)	5. <i>Lemnetea minoris</i>
	6. <i>Potametea pectinati</i>
	7. <i>Halodulo wrightii-Talassietea testudinum</i>
	8. <i>Ruppieteae maritimae</i>
	9. <i>Magnocarici-Phragmitetea australis</i>
	10. <i>Arthrocnemetea franzii</i>
C. Lithomorphic vegetation (rupestrian)	11. <i>Adiantetea capilli-veneris</i>
	12. <i>Asplenietea trichomanis</i>
	13. <i>Parietarietea judaicae</i>
D. Ruderal vegetation (anthropomorphic)	14. <i>Polygono-Poetea annuae</i>
	15. <i>Stellarietea mediae</i>
	16. <i>Rudero-Manihotetea utilissimae</i>

Table 16. Relation between formation classes and phytosociological classes

The upper level of formations types: class (level 1), subclass (level 2) and the “basic” third level, correspond to biomes defined by his predominant growth forms, structure, physiognomy and environmental factors. The name description of the upper and mid level groups should express: geographical distribution (biogeographic unit if possible), ecomorphic type, vegetational structure and bioclimatic unit. As we try to collaborate and increase the information of the “World Formations Types”, in the upper and mid level ranks existent in Cabo Verde Islands (West Africa), we include the phytosociological syntaxa (class, order or alliances), that could be considered as equivalent (syntax. equiv.).

The most significant criteria to distinguish and define the upper hierarchical levels of the natural vegetation formations (classes, subclasses, basic types and divisions) are suggest by Faber-Langendoen & al. 2011, Nov. 22: 27-28, with some bioclimatic and biogeographic precisions, are synthesized in the table 15.

4b. Classification formation types and syntaxa of Cabo Verde Islands

All natural, seminatural and anthropic vegetation of Cabo Verde Islands (Cabo Verde Biogeographic Province) can be included in four formation classes: A. Xero-

morphic short open woodland, scrub and grassland vegetation, B. Aquatic vegetation, C. Lithomorphic vegetation and D. Agricultural and ruderal anthropic vegetation. The table 16 show the relation between formation classes and phytosociological vegetation classes in Cabo Verde Islands.

4c. Typological syntaxonomy and formation types

* Nomenclatural typus of higher syntaxon, [●] Cabo Verde endemic sintaxa

A. AFROTROPICAL XEROMORPHIC OPEN MICRO-WOODLAND HIGH DESERTIC ARIDIC AND DRY SAVANNA FORMATION CLASS

Aa. TROPICAL SAHARAN XEROMORPHIC OPEN MICRO-WOODLAND DESERTIC ARIDIC AND DRY SAVANNA FORMATION SUBCLASS

Aaa. CABO VERDE XEROMORPHIC CLIMACTIC OPEN MICRO-WOODLAND DESERTIC ARIDIC AND DRY SAVANNA FORMATION (syntax equival.:1)

1. COCCULO PENDULI-SARCOSTEMMETEA DALTONII

Aaa.1. CABO VERDE XEROMORPHIC CLIMACTIC SCRUB DESERTIC ARIDIC SAVANNA DIVISON (syntax. equiv.:1a)

1a.**EUPHORBIO TUCKEYANAE-SARCOSTEMMETALIA DALTONII* [A, V, N, SL, BO, M, SN, F, BR]. [●]

1.1.**Asparago squarrosi-Sarcostemmion daltonii* [A, V, N, SL, BO, M, SN, BR]. [●]

1.1.1. *Cocculum penduli-Sarcostemmetum daltonii* [Bo, M, SN]

1.1.2.**Campylantho spathulati-Sarcostemmetum daltonii* [A]

1.1.3. *Frankenio caboverdeanae-Asparagetum squarrosi* [A]

1.1.4. *Aeonio gogonei-Sarcostemmetum daltonii* [V, N]

1.1.5. *Echio stenosphonis-Euphorbietum tuckeyanae* [V]

1.1.6. *Suaedo caboverdeanae-Asparagetum squarrosii* [SL, BO, M]

1.1.7. *Tetraeno waterlotii-Sarcostemmetum daltonii* [BR]

1.2. *Globulario amygdalifoliae-Periplocion chevalieri* [A, N, SN, F, BR]. [●]

1.2.1.**Erysimo caboverdeanae-Periplocetum chevalieri* [F]

1.2.2. *Echietum vulcanori* [F]

1.2.3. *Actinopterido radiatae-Sarcostemmetum daltonii* [F]

1.2.4. *Echio hypertropici-Euphorbietum tuckeyanae* [SN]

1.2.5. *Launaeo thalassicae-Euphorbietum tuckeyanae* [BR]

1.2.6. *Loto latifolii-Artemisietum gogonei* [A]

1.2.7. *Melanoselino bischoffii-Globularietum amygdalifoliae* [A]

1.2.8. *Asterisco smithii-Euphorbietum tuckeyanae* [N]

Aaa.2. CABO VERDE XEROMORPHIC CLIMACTIC MICRO-WOODLAND XERIC SAVANNA DIVISION. (syntax equiv.: 1b)

1b. *DICHROSTACHYO PLATYCARPAE-ACACIETALIA CABOVERDEANAE* [A, V, N, SL, BO, M, SN, F, BR]

1.3.**Fico gnaphalocarphae-Acacion caboverdeanae* [A, V, N, BO, M, SN, F, BR]. [●]

1.3.1.**Dichrostachyo platycarpae-Acacietum caboverdeanae* [SN, F, BR]

1.3.2. *Cocculum penduli-Acacietum caboverdeanae* [BO, M, SN]

1.3.3. *Forsskaoleo procrigidifoliae-Acacietum caboverdeanae* [A, V]

1.3.4. *Cocculum penduli-Ficetum gnaphalocarphae* [BO, M, SN]

1.3.5. *Forsskaoleo procrigidifoliae-Ficetum gnaphalocarphae* [F, BR]

1.3.6. *Dichrostachyo platycarpae-Ficetum sur* [F, SN]

1.3.7. *Euphorbio tuckeyanae-Ficetum sur* [A]

1.3.8. *Sideroxyletum marginati* [A, V, N, SN, F, BR]

1.3.9. *Dracaenetum caboverdeanae* [A, N]

1.4. *Phoenicion atlanticae* [V, SL, B, M, SN]. [●]

1.4.1.**Cocculum penduli-Phoenicetum atlanticae* [V, SL, BO, M, SN]

1.5. *Tamaricion senegalensis* [A, V, N, SL, BO, M, SN, BR]

1.5.1.* *Cocculum penduli-Tamaricetum senegalensis* [A, V, N, SL, BO, M, SN, BR]

Ab. AFROTROPICAL XEROMORPHIC GRASSLAND DESERTIC AND XERIC SAVANNA FORMATION SUBCLASS. (syntax. equiv.: 2 & 3)

Aba. AFROTROPICAL XEROMORPHIC PERENNIAL GRASSLAND DESERTIC AND XERIC SAVANNA FORMATION (syntax. equiv.: 2)

2. HETEROPOGONETEA CONTORTI [A, V, N, SL, BO, M, SN, F, BR]

2a.**MELINIO GRANDIFLORAE-HETEROPOGONETALIA CONTORTI* [A, V, N, SL, BO, M, SN, F, BR]

2.1.* *Heteropogonion melanocarpo-contorti* [A, V, N, SN, F, BR]

2.1.1.**Dichanthio foveolati-Heteropogonetum contorti* [A]

2.1.2. *Heteropogonetum melanocarpi* [SN, F]

2.2.* *Enneapogonion desvauxii* [A, V, SL, SN, BO, M]

2.2.1. *Bothriochloa bladhii-Enneapogonetum desvauxii* [A, V, SL, BO, M, SN, F]

Abb. AFROTROPICAL XEROMORPHIC ANNUAL GRASSLAND DESERTIC SAVANNA FORMATION (syntax. equiv.: 3)

3. TETRAENETEA SIMPLICIS [A, V, N, SL, BO, M, SN, F, BR]

3a.* *ARISTIDO CARDOSOI-TETRAENETALIA SIMPLICIS* [A, V, N, SL, BO, M, SN, F, BR]

- 3.1.***Aristido cardosoi-Tetraenion simplicis** [A, V, N, SL, BO, M, SN, F, BR]
- 3.1.1.**Aristido cardosoi-Tetraenion simplicis* [A, V, N, SL, BO, M, SN, F, BR]
- 3.1.2. *Asphodelo mariolousae-Aristidetum cardosoi* [A, F]
- 3.1.3. *Sehimatetum ischaemoidis* [SL]
- Ac. TROPICAL SAHARA COASTAL DESERTIC SANDY DWARF-SHRUB SAVANNA FORMATION SUBCLASS. (syntax. equiv.: 4)
- Aca. TROPICAL WEST SAHARA COASTAL DESERTIC SANDY DWARF-SHRUB SAVANNA FORMATION (syntax. equiv.: 4a)
- Aca.1. CABO VERDE COASTAL DESERTIC SANDY DWARF-SHRUB SAVANNA DIVISION (syntax. equiv.: 4.1)
4. FRANKENIO PSEUDOERICIFOLIAE-SUAEDETEA CABOVERDEANAE [V, SL, BO, M, SN]
- 4a.**FRANKENIO PSEUDOERICIFOLIAE-SUAEDETALIA CABOVERDEANAE* [V, SL, BO, M, SN]
- 4.1.***Polycarpaeo caboverdeanae-Tetraenion waterlotii** [V, SL, BO, M, SN]
- 4.1.1.**Polycarpaeo caboverdeanae-Tetraenion waterlotii* [SL, BO, M, SN]
- 4.1.2. *Tetraenion vicentinae* [V]
- 4.1.3. *Sporobolo spicati-Cyperetum crassipedis* [SL, BO, M]
- 4.1.4. *Loto brunneri-Pulicarietum diffusae* [SL, BO]
- B. COSMOPOLITE HYDROMORPHIC VEGETATION FORMATION CLASS (syntax. equiv.: 5, 6, 7, 8)
- Ba. COSMOPOLITE HYDROMORPHIC FRESHWATER VEGETATION FORMATION SUBCLASS
- Baa. COSMOPOLITE HYDROMORPHIC FRESHWATER FREE FLOATING PLEUSTOPHYTE FORMATION. (syntax. equiv.: 5)
- Baa.1. HOLARCTIC HYDROMORPHIC FRESHWATER FREE FLOATING DIVISION. (syntax. equiv.: 5a)
5. LEMNETEA MINORIS [SN]
- 5a.**LEMNETALIA MINORIS* [SN]
- 5.1.***Lemnion minoris** [SN]
- 5.1.1. *Lemna minor* community [SN]
- Bab. COSMOPOLITE HYDROMORPHIC FRESHWATER SUBMERGED ROOTED HYDROPHYTE FORMATION (syntax. equiv.: 6)
6. POTAMETEA [SN]
- 6a.**POTAMETALIA PECTINATI* [SN]
- 6.1.***Potamion pectinati** [SN]
- 6.1.1. *Potamogeton pusillus* community [SN]
- Bb. NEOTROPICAL HYDROMORPHIC MARINAE SALT-WATER SUBMERGED ROOTED PERENNIAL FORMATION SUBCLASS (syntax. equiv.: 7, 8)
- Bba. NEOTROPICAL HYDROMORPHIC MARINAE SALT-WATER SUBMERGED ROOTED PERENNIAL FORMATION (syntax. equiv.: 7)
7. HALODULO WRIGHTII-THALASSIETEA TESTUDINUM [SN]
- 7a.**THALASSIO TESTUDINUM-SYRINGODIETALIA FILIFORMIS* [SN]
- 7.1. **Cymodoceion nodosae** [SN]
- 7.1.1. *Cymodocea nodosa* community [SN]
- Bbb. COSMOPOLITE HYDROMORPHIC SALTWATER TEMPORARY SUBMERGED ROOTED ANNUAL FORMATION (syntax. equiv.: 8)
8. RUPPIETEA MARITIMAE [SL, BO]
- 8a.**RUPPIETALIA MARITIMAE* [SL, BO]
- 8.1.***Ruppion maritimae** [SL, BO]
- 8.1.1. *Ruppia maritima* community [SL, BO]
- Bc. COSMOPOLITE FRESH AND SALTWATER MARSHES VEGETATION FORMATION SUBCLASS (syntax. equiv.: 9, 10)
- Bca. COSMOPOLITE RIVERINE AND HELOPHYTIC FRESHWATER MARSHLAND VEGETATION FORMATION (syntax. equiv.: 9)
9. MAGNOCARICI ELATAE-PHRAGMITETEA AUSTRALIS [A, V, N, BO, M, SN, F, BR]
- 9a.**PHRAGMITETALIA AUSTRALIS* [BO, M, SN]
- 9.1.***Phragmition australis** [BO, M, SN]
- 9.1.1. *Typha domingensis* community [BO, M, SN]
- 9b. *RORIPPO NASTURTII-AQUATICAE-GLYCERETALIA FLUITANTIS* [A, V, N, SN, F, BR]
- 9.2.***Rorippion nasturtii-aquaticae** [A, V, N, SN, F, BR]
- 9.2.1. *Rorippa nasturtium-aquaticum* community [A, V, N, SN, F, BR]
- Bcb. COASTAL AFRICAN TROPICAL SALTWATER MARSH DWARF SUCCULENT VEGETATION FORMATION (syntax. equiv.: 10)
10. ARTHROCNETEMEA FRANZII [A, V, SL, BO, M, SN]
- 10a.**ARTHROCNETETALIA FRANZII* [SL, BO, M]
- 10.1.***Arthrocnemion franzii** [SL, BO, M, SN]
- 10.1.1.**Arthrocnemum franzii* [SL, BO, M]
- 10.1.2. *Cressetum salinae* [SL, BO, M, SN]
- 10b. *SESUVIETALIA SESUVIOIDIS* [A, V, SL, BO, M, SN]
- 10.2.***Sesuvion sesuvioidis** [A, V, SL, BO, M, SN]
- 10.2.1.**Sesuvium sesuvioidis* [V, SL, BO]
- 10.2.2. *Sesuvium portulacastrum* [SL, BO, M, SN]
- 10.2.3. *Blutaparontetum vermicularis* [A, SL, BO, M, SN]
- C. LITHOMORPHIC CHASMOPHYTIC AND COMOPHYTIC HOLARCTIC AND SUBTROPICAL VEGETATION FORMATION CLASS (syntax. equiv.: 11, 12, 13)
11. ADIANTETEA CAPILLI-VENERIS [A, V, N, SN, F, BR]
- 11a.**ADIANTETALIA CAPILLI-VENERIS* [A, V, N, SN, F, BR]
- 11.1. **Adiantion trifidi** [A, V, N, SN, F, BR]
- 11.1.1. *Adiantum trifidi* [A, V, N, SN, F, BR]
- 11.1.2. *Hypodematio crenati-Campanuletum bravensis* [SN, F, BR]

12. ASPLENIETEA TRICHOMANIS [A, V, N, SL, BO, M, SN, F, BR]
 12a. *KICKXIETALIA ELEGANTIS* [A, V, N, SL, BO, M, SN, F, BR]. [●]
 12.1. **Kickxion elegantis* [A, V, N, SL, BO, M, SN, F, BR]. [●]
 12.1.1. **Kickxietum webbiana* [A]
 12.1.2. *Diplotaxio hirtae-Kickxietum elegantis* [F]
 12.1.3. *Umbilico schmidtii-Cheilanthes acrosticae* [F]
 12.1.4. *Campanuletum jacobaeae* [A, SN]
 12.1.5. *Campanulo bravensis-Launaetum thalassicae* [BR]
 13. PARIETARIETEA JUDAICAE [A, V, N, SN, F, BR]
 13a. **PARIETARIETALIA JUDAICAE* [A, V, N, SN, F, BR]
 13.1. *Adiantion incisophilippensis* [A, V, N, SN, F, BR]
 13.1.1. **Adiantetum incisophilippensis* [A, V, N, SN, F, BR]
- D. RUDERAL COSMOPOLITE ANTHROPIC VEGETATION FORMATION CLASS (syntax. equiv. 14, 15, 16)
14. POLYGONO ARENASTRI-POETEA ANNUAE [A, V, N, SL, BO, M, SN, F, BR]
 14a. *EUPHORBIETALIA PROSTRATO-HIRTAE* [A, V, N, SL, BO, M, SN, F, BR]
 14.1. *Trianthemion portulacastrum* [A, V, N, SL, BO, M, SN, F, BR]
 14.1.1. **Trianthemetum portulacastrum* [A, V, N, SL, BO, M, SN, F, BR]
 14.1.2. *Euphorbio hirtae-Boerhaviatum repens* [A, V, N, BO, M, SN]
 14.1.3. *Oldenlandietum corymbosae* [A, V, SN, F]

15. STELLARIETEA MEDIAE [A, V, N, SL, BO, M, SN, F, BR]
 15a. *CHENOPODIETALIA MURALIS* [A, V, N, SL, BO, M, SN, F, BR]
 15.1. **Chenopodium muralis* [A, V, N, SL, BO, M, SN, F, BR]
 15.1.1. *Chenopodium murale* and *Malva parviflora* community [A, V, N, SL, BO, M, SN, F, BR]
 16. RUDERO-MANIHOTETEA UTILISSIMAE [A, V, N, BO, M, SN, F, BR]
 16a. *BIDENTETALIA PILOSAE* [A, V, N, BO, M, SN, F, BR]
 16.1. *Ecliption prostratae* [A, V, N, BO, M, SN, F, BR]

4d. Description of Cabo Verde syntaxa (plant communities). [●] Endemic of Cabo Verde

Alphabetical list of phytosociological classes growing in Cabo Verde Islands

- Adiantetea capilli-veneris* (11)
Archthrocnetetea franzii (10)
Asplenietea trichomanis (12)
Cocculo penduli-Sarcostemmetea daltonii [●] (1)
Frankenio-Suaedetetea caboverdeanae (4)
Halodulo wrightii-Talassietea testudinum (7)
Heteropogonetea contorti (2)
Lemnetea minoris (5)
Magnocarici-Phragmitetea australis (9)
Parietarietea judaicae (13)
Polygono arenastri-Poetea annuae (14)
Potametea pectinati (6)
Rudero-Manihotetea utilissimae (16)
Ruppietea maritima (8)
Stellarietea mediae (15)
Tetraenetea simplicis (3)

N°	High syntaxa: Alliances	A	V	N	SL	BO	M	SN	F	BR
1.1	<i>Asparago squarrosi-Sarcostemmion daltonii</i> [●]	●	●	●	●	●	●	●	●	●
1.2	<i>Globulario amygdalifoliae-Periplocion chevalieri</i> [●]	●	-	●	-	-	-	●	●	●
1.3	<i>Fico gnaphalocarphae-Acacion caboverdeanae</i> [●]	●	●	●	●	●	●	●	●	●
1.4	<i>Phoenicion atlanticae</i> [●]	-	●	-	●	●	●	●	-	-
1.5	<i>Tamaricion senegalensis</i>	●	●	●	●	●	●	●	-	●
2.1	<i>Heteropogonion melanocarpo-contorti</i>	●	●	●	●	●	●	●	●	●
3.1	<i>Aristido cardosoi-Tetraenion simplicis</i> [●]	●	●	●	●	●	●	●	●	●
4.1	<i>Polycarpaeo caboverdeanae- Tetraenion waterlotii</i>	-	●	-	●	●	●	●	-	-
10.1	<i>Archthrocnetion franzii</i>	-	-	-	●	●	●	●	-	-
10.2	<i>Sesuvion sesuvioideis</i>	●	●	-	●	●	●	●	-	-
11.1	<i>Adiantion trifidi</i>	●	●	●	-	-	-	●	●	●
12.1	<i>Kickxion elegantis</i> [●]	●	●	●	●	●	●	●	●	●
13.1	<i>Adiantion incisophilippensis</i>	●	●	●	-	-	-	●	●	●
14.1	<i>Trianthemion portulacastrum</i>	●	●	●	●	●	●	●	●	●

Table 17. Distribution of the main alliances in Cabo Verde Islands (biogeographic districts). A: Santo Antão, V: São Vicente, N: São Nicolau, SL: Sal, BO: Boavista, M: Maio, SN: Santiago, F: Fogo and BR: Brava. [●] Endemic alliances of Cabo Verde Islands; ● Occurring in the island (district) 1.1, 1.2, 1.3, 1.4, 1.5 (1. *Cocculo penduli-Sarcostemmetea daltonii*; 2.1 (2. *Heteropogonetea contorti*); 3.1 (3. *Tetraenetea simplicis*); 4.1 (4. *Frankenio pseudoericifoliae-Suaedetetea caboverdeanae*); 10.1, 10.2 (10. *Archthrocnetetea franzii*); 11.1 (11. *Adiantetea capilli-veneris*); 12.1 (12. *Asplenietea trichomanis*); 13.1 (13. *Parietarietea judaicae*) and 14.1 (14. *Polygono arenastri-Poetea annuae*).

Núm.	Syntaxon/ District Islands	A	V	N	SL	Bo	M	SN	F	BR	CV
1.1.	<i>Asparago squarrosi-Sarcostemmion daltonii</i> [●]	●	●	●	●	●	●	●	●	●	9
1.1.1.	<i>Cocculo penduli-Sarcostemmetum daltonii</i>	-	-	-	-	●	●	●	-	-	3
1.1.2.*	<i>Campylantho spathulati-Sarcostemmetum daltonii</i>	●	-	-	-	-	-	-	-	-	1
1.1.3.	<i>Frankenio caboverdeanae-Asparagetum squarrosi</i>	●	-	-	-	-	-	-	-	-	1
1.1.4.	<i>Aeonio gogonei-Sarcostemmetum daltonii</i>	-	●	●	-	-	-	-	-	-	2
1.1.5.	<i>Echio stenosphonis-Euphorbietum tuckeyanae</i>	-	●	-	-	-	-	-	-	-	1
1.1.6.	<i>Suaedo caboverdeanae-Asparagetum squarrosii</i>	-	-	-	●	●	●	-	-	-	3
1.1.7.	<i>Tetraeno waterlotii-Sarcostemmetum daltonii</i>	-	-	-	-	-	-	-	-	●	1
1.2.	<i>Globulario amygdalifoliae-Periplocion chevalieri</i> [●]	●	-	●	-	-	-	●	●	●	5
1.2.1.*	<i>Erysimo caboverdeanae-Periplocetum chevalieri</i>	-	-	-	-	-	-	-	●	-	1
1.2.2.	<i>Echietum vulcanori</i>	-	-	-	-	-	-	-	●	-	1
1.2.3.	<i>Actinopterido radiatae-Sarcostemmetum daltonii</i>	-	-	-	-	-	-	-	●	-	1
1.2.4.	<i>Echio hypertropici-Euphorbietum tuckeyanae</i>	-	-	-	-	-	-	●	-	-	1
1.2.5.	<i>Launaeo thalassicae-Euphorbietum tuckeyanae</i>	-	-	-	-	-	-	-	-	●	1
1.2.6.	<i>Loto latifolii-Artemisietum gogonei</i>	●	-	-	-	-	-	-	-	-	1
1.2.7.	<i>Melanoselino bischoffii-Globalietum amygdalifoliae</i>	●	-	-	-	-	-	-	-	-	1
1.2.8.	<i>Asterisco smithii-Euphorbietum tuckeyanae</i>	-	-	●	-	-	-	-	-	-	1
1.3.	<i>Fico gnaphalocarphae-Acacion caboverdeanae</i> [●]	●	●	●	-	●	●	●	●	●	8
1.3.1.*	<i>Dichrostachyo platycarpae-Acacietum caboverdeanae</i>	-	-	-	-	-	-	●	●	●	3
1.3.2.	<i>Cocculo penduli-Acacietum caboverdeanae</i>	-	-	-	-	●	●	●	-	-	3
1.3.3.	<i>Forsskaoleo procrifoliae-Acacietum caboverdeanae</i>	●	●	-	-	-	-	-	-	-	2
1.3.4.	<i>Cocculo penduli-Ficetum gnaphalocarphae</i>	-	-	-	-	●	●	●	-	-	3
1.3.5.	<i>Forsskaoleo picridifoliae-Ficetum gnaphalocarphae</i>	-	-	-	-	-	-	-	●	●	2
1.3.6.	<i>Dichrostachyo platycarpae-Ficetum sur</i>	-	-	-	-	-	-	●	●	-	2
1.3.7.	<i>Euphorbio tuckeyanae-Ficetum sur</i>	●	-	-	-	-	-	-	-	-	1
1.3.8.	<i>Sideroxyletum marginati</i>	●	●	●	-	-	-	●	●	●	6
1.3.9.	<i>Dracaenatum caboverdeanae</i>	●	-	●	-	-	-	-	-	-	2
1.4.	<i>Phoenicion atlanticae</i> [●]	-	-	-	●	●	●	●	-	-	4
14.1.*	<i>Cocculo penduli-Phoenicetum atlanticae</i>	-	-	-	●	●	●	●	-	-	4
1.5.	<i>Tamaricion senegalensis</i>	-	-	-	●	●	●	●	-	-	4
1.5.1.*	<i>Cocculo penduli-Tamaricetum senegalensis</i>	-	-	-	●	●	●	●	-	-	4

Table 18. Insular distribution of syntaxa (associations and alliances) of the classis *Cocculo penduli-Sarcostemmetea daltonii* in Cabo Verde Islands districts

Bioindicator in this paper, means any endemic or non endemic native or naturalized Cabo Verde growing species, specially those of Tropical Sahara, Mediterranean Sahara, Sahel-Sudan, Afrotropical and Pantropical origin or distribution, that could be useful for characterize, evaluate or determine boundaries or ecological factors of plant communities (syntaxa) in Cabo Verde Islands. ● Cabo Verde endemic vascular plant, [●] Cabo Verde endemic syntaxa and sigmatata.

Savanna Word of Antillean origin. Strictly means a perennial tall grassland community, which can carry annual plants and grasses, scattered trees or shrubs, with tropical or subtropical (0°-36°N / S) with American, Afroasiatic, Indomalayan, Neozelandian and Polynesian distribution, and tropical pluviseasonal subhumid, tropical xeric dry or semiarid and tropical desertic arid or hyperarid bioclimate (aridic). Except in the case of savannas of the marshes or river basins, almost permanently flooded, which can represent the local edaphic climax or final stage of equilibrium in succession. The true savannas are usually seril perennial grasslands, shrublands or open woodland communities, produced by the destructive action of man, herbivores, agriculture and fires, of the regional climatophilous forests and woodlands. The subserial savannas, in turn, by the natural processes of succession and geobotanic regression, trend

to achieve equilibrium in nature. So that transformation into savanna is a common process evidenced in all tropical biogeographic regions of Earth and, as a consequence, permanently affect the appearance or structure of the natural plant communities that constitute the vegetation landscape, especially of thermoclimatic types infra, thermo and mesotropical from the hyperarid to lower subhumid ombrotype. The simple and accurate classification of the wooded, shrub and grassland savanna succession is one of the most important tropical question in physiography, geobotany, biogeography and vegetation classification.

1. COCCULO PENDULI-SARCOSTEMMETEA DALTONII classis nova hoc loco

Micro-shrubland often succulent and deciduous micro-woodland open savanna of Cabo Verde Islands, mostly with aridic tropical bioclimate; occurring in desertic, xeric, infra-thermo-meso to lower supratropical ultrahyperarid to upper dry, strongly euhyperoceanic bioclimate; growing on arenosols, andosols, leptosols (lithic, skeletal, hyperskeletal) or fluvio-regosols and sometimes on little altered volcanic materials (lava and tephra). Two savanna orders are acknowledged: 1a. *Euphorbio tuckeyanae-Sarcostemmetalia daltonii* (open bis close shrub and dwarf

scrub savanna, desertic and xeric hyperarid to dry, in-framesotropical, exceptionally lower supratropical), 1b. *Dichrostachyo platycarpae-Acacietaalia caboverdeanae* (open micro-woodlands and thickets, aridic and dry thermotropical deciduous desertic and xeric savanna). The associations of this classis of vegetation are endemic to Cabo Verde and occurring in all islands [A, V, N, SL, BO, M, SN, F, BR] [●].

Typus: Euphorbio tuckeyanae-Sarcostemmetalia daltonii ordo novus hoc loco (1a)

Characteristic species and bioindicators growing in Cabo Verde Islands: *Asteriscus vogelii* ●, *Daucus insularis* ●, *Forsskaolea procrigidifolia* ●, *Indigofera microcarpa* ●, *Lavandula rotundifolia* ●, *Lotus purpureus* ●, *Sarcostemma daltonii* ●.

Table 19

1.1.1. *Cocculo penduli-Sarcostemmetum daltonii* ass. nova hoc loco
(*Asparago-Sarcostemmion*, *Euphorbio-Sarcostemmetalia*, *Cocculo-Sarcostemmetea daltonii*)

Altitude (l=10 m)	19	20	25	22	15	20
Orientation	W	SW	W	SW	W	.
Area m ²	40	40	100	40	50	54
Nº of species	6	6	7	4	10	7
Ordinal number	1	2*	3	4	5	6
Characteristic species						
<i>Sarcostemma daltonii</i> ●	5	5	4	5	3	V
<i>Cocculus pendulus</i>	+	1	+	1	1	V
<i>Euphorbia tuckeyana</i> ●	+	2	2	.	.	III
<i>Asparagus squarrosus</i> ●	+	2	.	.	.	II
Companion species						
<i>Jatropha curcas</i>	.	1	+	1	.	III
<i>Commicarpus helenae</i>	.	.	.	3	1	II
<i>Momordica charantia</i>	.	.	1	.	1	II
<i>Nicotiana glauca</i>	+	.	.	.	1	II
<i>Sida alba</i>	+	1	.	.	.	II

Other companion species: *Ipomoea asarifolia* and *Senna bicapsularis* 2 in 5; *Spermacoce verticillata* and *Cleome brachycarpa* 1 in 5; *Portulaca oleracea* 1 in 5; *Rhynchosia minima* and *Melinis grandiflora* + in 3.

Localities: 1. Boavista: Pico de Santo António; 2. Boavista: Pico de Santo António (*holotypus* ass. reg. 2005: 192); 3, 4. Santiago: Praia, Pedregal; 5. Santiago: Cidade Velha; 6. Synthesized table

1a. *EUPHORBIO TUCKEYANAE-SARCOSTEMMETALIA DALTONII* ordo novo hoc loco

Climactical and edaphoxerophilous shrub and dwarf scrub savanna communities; occurring in infra-thermo-mesotropical and lower supratropical, ultrahyperarid to semiarid and, some times, in lower dry bioclimate. The communities of this order are rich in Cabo Verde endemic species and can be found in all islands. [A, V, N, SL, BO, M, SN, F, BR].

Typus: 1.1. Asparago squarrosi-Sarcostemmion daltonii all. nova hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Aeonium gorgoneum* ●, *Echium glabrescens* ●, *Echium stenosisiphon* ●, *Euphorbia tuckeyana* ●, *Helianthemum gorgoneum* ●, *Frankenia caboverdeana* ●, *Launaea picridioides* ●, *Micromeria forbesii* ●, *Pennisetum polystachyon*, *Periploca chevalieri* ●, *Tolpis farinulosa* ●, *Verbascum capitis-viridis* ●, *Withania chevalieri* ●.

1.1. *Asparago squarrosi-Sarcostemmion daltonii* alliancia nova hoc loco

Climactical and edaphoxerophilous desertic and hyperdesertic shrub and dwarf scrub open savanna communities; occurs in infra-thermotropical from ultrahyperarid to lower arid,

on leptosols (lithic, skeletal, hyperskeletal), under strong euhyperoceanic bioclimate; on poorly developed arenosols, andosols or regosols, arenic, skeletal, leptic or tephric. The associations of this alliance are endemic of Cabo Verde [A, V, N, SL, BO, M, SN, BR]. [●] *Typus: Campylantho spathulati-Sarcostemmetum daltonii* ass. nova hoc loco (1.1.1.)

Characteristic species and bioindicators growing in Cabo Verde Islands: *Asparagus squarrosus* ●, *Campylanthus spathulatus* ●, *Diplo-taxis glauca* ●, *Diplo-taxis vogelii* ●, *Echium stenosisiphon* ●, *Fagonia mayana* ●, *Launaea gorgadensis* ●, *Limonium jovi-barba* ●.

1.1.1. *Cocculo penduli-Sarcostemmetum daltonii* associatio nova hoc loco

Climactical and edaphoxerophilous desertic shrub savanna community, occurring in infra-thermotropical, upper ultrahyperarid, strong euhyperoceanic bioclimate, on leptic regosols and arenosols. Endemic association of East Cabo Verde Sector; in which thrive *Sarcostemma daltonii*, *Cocculus pendulus*, *Euphorbia tuckeyana* and *Asparagus squarrosus* (*holotypus* relevé nº 2, table 19). It occurs in Boavista, Maio and Santiago islands. [SN, BO, M]. [●]

1.1.2. *Campylantho spathulati-Sarcostemma daltonii* associatio nova hoc loco

Climactical and edaphoxerophilous desertic shrub savanna community, occurring in thermotropical, arid and strong euhyperoceanic bioclimate, on leptic regosols and lithosols. Occurs in north coast of Santo Antão Island, and is formed and characterized by *Sarcostemma daltonii*, *Campylanthus spathulatus* (local insular endemic), *Lavandula rotundifolia*, *Asteriscus vogelii*, *Launaea picridioides*, *Echium lindbergii*, *Paronychia illecebroides*, *Diploaxis gorgadensis*, etc. (*holotypus* relevé 3, table 20) [A]. [●]

1.1.3. *Frankenio caboverdeanae-Asparagus squarrosi* associatio nova hoc loco

Climactical and edaphoxerophilous desertic open dwarf shrub savanna community, occurring in infra-thermotropical, hyper-arid and low arid, strong euhyperoceanic bioclimate, on leptic regosols and lithosols. Endemic association of Santo Antão Island can be found facing to the sea, from sea level to 250 m. Formed and characterized by *Asparagus squarrosus*, *Campylanthus spathulatus*, *Diploaxis gorgadensis*, *Asteriscus vogelii*, *Frankenia cabover-*

deana, *Lavandula rotundifolia*, *Paronychia illecebroides*, *Launaea gorgadensis*, etc. (*holotypus* relevé n° 2, table 21); *Sarcostemma daltonii* and *Echium lindbergii* are absent [A]. [●]

1.1.4. *Aeonio gogonei-Sarcostemma daltonii* associatio nova hoc loco

Climactical and edaphoxerophilous drawf shrub savanna community rich in succulents plants well-developed in S. Nicolau and São Vicente Islands on skeletal leptosols ancient altered volcanic rocky, in tropical desertic, thermotropical arid bioclimate, often affected by the trade winds from the north, especially in winter. Besides the succulent species *Aeonium gorgoneum* and *Sarcostemma daltonii*, are present *Launaea picridioides*, *Asteriscus vogellii*, *Lotus purpureus*, *Daucus insularis*, *Echium stenosphon*, *Echium glabrescens*, *Campylanthus glaber*, *Limonium jovi-barba*, *Lobularia spathulata*, etc. (*holotypus* relevé 2, table 22). We recognize two subassociations: *typicum* (rel. 2, *typus*) and on cohesive dark basaltic steep walls of the both islands *limonietosum jovi-barbae* subass nova hoc loco (*holotypus* relevé 1, table 22) [V, N]. [●]

Table 20

1.1.2. *Campylantho spathulati-Sarcostemma daltonii* ass. nova hoc loco
(*Asparago-Sarcostemmion*, *Euphorbio-Sarcostemmetalia*,
Cocculo-Sarcostemmetea daltonii)

Altitude (1=10 m)	10	14	15	20	22	16
Orientation	NE	N	N	NW	W	
Area m ²	40	60	60	80	80	64
N° of species	9	12	8	13	18	12
Ordinal number	1	2	3*	4	5	6
Characteristic species						
<i>Sarcostemma daltonii</i> ●	2	3	4	4	4	V
<i>Campylanthus spathulatus</i> ●	3	3	2	2	2	V
<i>Asteriscus vogelii</i> ●	1	2	1	2	+	V
<i>Lavandula rotundifolia</i> ●	+	1	1	+	3	V
<i>Launaea picridioides</i> ●	+	+	1	2	.	IV
<i>Echium lindbergii</i> ●	.	+	1	+	.	III
<i>Paronychia illecebroides</i> ●	+	+	.	+	.	III
<i>Diploaxis gorgadensis</i> ●	.	.	+	1	+	III
<i>Asparagus squarrosus</i> ●	.	.	+	1	.	II
<i>Frankenia caboverdeana</i> ●	1	.	.	.	.	I
<i>Limonium braunii</i> ●	+	.	.	.	.	I
<i>Launaea gorgadensis</i> ●	.	+	.	.	.	I
Companion species						
<i>Cynodon dactylon</i>	.	2	.	+	+	III
<i>Tridax procumbens</i>	.	1	.	.	2	II
<i>Polycarpaea gayi</i> ●	.	.	.	1	1	II
<i>Kickxia elegans</i> ●	1	.	.	.	+	II

Other companion species: *Hyparrhenia caboverdeana* ● 2 in 5; *Fagonia latifolia* 1 in 2; *Heliotropium pterocarpum* 1 in 2; *Heteropogon melanocarpus* 1 in 4; *Cenchrus ciliaris* and *Tricholaena teneriffae* 1 in 5; *Furcraea foetida* + in 4; *Desmanthus virgatus*, *Lavandula coronopifolia*, *Aristida funiculata*, *Nicotiana glauca* and *Lantana camara* + in 5.

Localities: 1. *Santo Antão*: Ribeira Grande; 2. *Santo Antão*: Ponta do Sol to Fontainhas; 3. *Santo Antão*: Ponta do Sol to Fontainhas (*holotypus* ass. reg. 2005: 53); 4. *Santo Antão*: Ponta do Sol to Fontainhas; 5. *Santo Antão*: Canto da Cagarra; 6. Synthesized table.

Table 21

1.1.3. *Frankenio caboverdeanae-Asparagetum squarrosi* ass. nova hoc loco*Asparago-Sarcostemmion, Euphorbio-Sarcostemmetalia, Cocculo-Sarcostemmetea daltonii*

Altitude (1 = 10m)	7	8	14	22	0.5	0.2	8
Orientation	E	N	W	NE	E	E	-
Area m ²	100	100	100	100	60	50	<u>85</u>
Nº of species	13	12	10	14	15	15	<u>13</u>
Ordinal number	1	2*	3	4	5	6	7
Characteristic species							
<i>Asparagus squarrosus</i> ●	3	3	2	1	3	2	V
<i>Campylanthus spathulatus</i> ●	1	1	+	1	3	3	V
<i>Asteriscus vogelii</i> ●	3	3	3	3	1	.	V
<i>Frankenia caboverdeana</i> ●	1	+	1	.	3	2	V
<i>Lavandula rotundifolia</i> ●	+	+	2	.	1	+	V
<i>Paronychia illecebroides</i> ●	+	+	.	+	1	1	V
<i>Launaea gorgadensis</i> ●	+	+	.	+	.	+	IV
<i>Limonium braunii</i> ●	2	.	.	.	+	.	II
<i>Launaea picridioides</i> ●	.	.	.	.	+	1	II
Companion species							
<i>Aristida funiculata</i>	+	1	2	+	.	.	IV
<i>Aizoon canariense</i>	1	+	+	.	.	1	IV
<i>Nicotiana glauca</i>	.	+	+	1	.	+	IV
<i>Abutilon pannosum</i>	+	+	+	+	.	.	IV
<i>Polycarpaea gayi</i> ●	+	.	.	+	1	.	III
<i>Lavandula coronopifolia</i>	.	.	+	2	.	.	II
<i>Cenchrus ciliaris</i>	.	.	.	2	.	+	II
<i>Kickxia elegans</i> ●	+	+	.	.	.	.	II
<i>Heliotropium pterocarpum</i>	+	.	.	+	.	.	II
<i>Trichodesma africanum</i>	.	.	.	+	+	.	II
<i>Cynodon dactylon</i>	.	.	.	.	+	+	II
<i>Tridax procumbens</i>	.	.	.	.	+	+	II

Other companion species: *Malvastrum americanum* + in 4; *Crotalaria senegalensis*, *Cucumis anguria* and *Calotropis procera* + in 5; *Diplotaxis gorgadensis* ●, *Patellifolia patellaris* and *Tricholaena teneriffae* + in 6;

Localities: 1. *Santo Antão*: between the Faro and Ribeira da Zurinca; 2. *Santo Antão*: between the Faro and Ribeira da Zurinca (relevé J.C. Costa & I. Gomes, *holotypus* ass. reg. 2014: 44); 3. *Santo Antão*: Ribeira da Zurinca; 4. *Santo Antão*: between Ribeira da Zurinca and Ribeira Brava; 5, 6. *Santo Antão*: Cruzinha da Graça; 7. Synthesized table.

1.1.5. *Echio stenosphonis-Euphorbietum tuckeyanae* associatio nova hoc loco

Climactical shrub savanna community, growing on leptic andosols near the summit of de São Vicente Island, in topographical tropical cloudy, thermotropical, upper arid, euhyperoceanic bioclimate. The most important species of this community are *Euphorbia tuckeyana*, *Echium stenosphon* (local endemic), *Asteriscus vogelii*, *Daucus insularis*, *Lotus purpureus*, *Phagnalon melanoleucum*, *Lobularia spathulata*, *Conyza pannosa*, *Davallia canariensis*, etc. (*holotypus* relevé 1, table 23). The *Euphorbia tuckeyana* seems to be an important relict species of the former times; for this paleobioclimatical and actual situation on propose this new community as a local relict summit cloudy association of the isle, included in the hyper-

arid-arid alliance *Asparago squarrosi-Sarcostemmion daltonii* [V]. [●]

1.1.6. *Suaedo caboverdeanae-Asparagetum squarrosii* associatio nova hoc loco

Climactical and edaphoxerophilous sandy desertic open dwarf shrub community, occurring in infra-thermotropical hyperarid, strong euhyperoceanic bioclimate, on leptic regosols and arenosols. Endemic association of East Cabo Verde Sector; in which is dominant *Asparagus squarrosus*, and thrive *Tetraena waterlotii*, *Frankenia pseudoericifolia* and *Suaeda caboverdeana* (*holotypus* relevé nº 4, table 24). This chamaephic permanent sandy association is intermediate between the classis *Euphorbio-Sarcostemmetea daltonii* and *Frankenio-Suaedetea caboverdeanae*, where probably will be better placed. [SL, BO,M]. [●]

Table 22

1.1.4. *Aeonio gogonei-Sarcostemma daltonii* ass. nova hoc loco
typicum subass. nova (rel.2-6); *limonietosum jovi-barbae* subass. nova (rel.1)
(Asparago-Sarcostemmion, Euphorbio-Sarcostemmetalia, Cocculo-Sarcostemmetea daltonii)

Altitude (1=10 m)	53	44	46	40	8	15	34
Orientation	NE	W	W	SW	N	N	
Area m ²	20	40	40	40	60	60	43
N° of species	7	13	13	11	17	12	12
Ordinal number	1*	2*	3	4	5	6	7
Characteristic species							
<i>Sarcostemma daltonii</i> ●	1	4	3	4	5	5	V
<i>Launaea picridioides</i> ●	1	1	3	2	.	+	V
<i>Asteriscus vogelii</i> ●	1	2	2	.	+	2	V
<i>Lotus purpureus</i> ●	1	2	2	+	+	.	V
<i>Aeonium gorgoneum</i> ●	2	2	2	3	.	.	IV
<i>Echium glabrescens</i> ●	.	.	.	3	+	+	III
<i>Daucus insularis</i> ●	+	1	2	.	.	.	III
<i>Echium stenosphon</i> ●	.	+	1	.	.	.	II
<i>Campylanthus glaber</i> ●	.	1	+	.	.	.	II
<i>Forsskaolea procruidifolia</i> ●	.	+	.	1	.	.	II
<i>Lavandula coronopifolia</i>	.	+	.	.	2	.	II
<i>Paronychia illecebroides</i> ●	.	.	.	.	+	+	II
<i>Limonium jovi-barba</i> ● (subass.)	2	.	.	.	.	.	I
<i>Lobularia fruticosa</i> ●	.	.	.	1	.	.	I
<i>Launaea gorgadensis</i> ●	.	.	.	1	.	.	I
<i>Asparagus squarrosus</i> ●	.	.	.	.	1	.	I
<i>Frankenia caboverdeana</i> ●	.	.	.	.	.	1	I
<i>Lobularia spathulata</i> ●	.	.	+	.	.	.	I
Companion species							
<i>Lantana camara</i>	.	.	1	1	2	.	III
<i>Heteropogon contortus</i>	.	1	1	1	.	.	III
<i>Commicarpus helenae</i>	.	.	.	.	2	2	II
<i>Cynodon dactylon</i>	.	.	.	.	1	2	II

Other companion species: *Rhynchosia minima* and *Salvia aegyptiaca* 2 in 5; *Elionurus royleanus* 1 in 3; *Grewia villosa* 1 in 4; *Desmanthus virgatus*, *Indigofera tinctoria* and *Desmodium ospriostreblum* 1 in 5; *Boerhavia coccinea* 1 in 6; *Launaea intybacea* + in 2; *Kickxia elegans* ● + in 2; *Cenchrus ciliaris* + in 3; *Heliotropium crispum* + in 5; *Abutilon pannosum* and *Tetrapogon cenchriformis* + in 6.

Localities: 1. São Vicente: Monte Verde, north-east slope, dark cohesive basalt (*holotypus* subass. *limonietosum jovi-barbae* . reg. 2004: 71); 2. São Vicente: Monte Verde, west slope (*holotypus* ass. reg. 2004: 66); 3. São Vicente: Monte Verde, west slope; 4. S. Nicolau: Fajã de Baixo; 5. S. Nicolau: Belém; 6. S. Nicolau: Salto; 7. Synthesized table.

Table 23

1.1.5. *Echio stenosphonis-Euphorbietum tuckeyanae* ass. nova hoc loco
(Asparago-Sarcostemmion, Euphorbio-Sarcostemmetalia,
Cocculo-Sarcostemmetea daltonii)

Altitude (1=10 m)	75	73
Orientation	SW	W
Area m ²	10	10
N° of species	10	13
Ordinal number	1*	2
Characteristic species		
<i>Euphorbia tuckeyana</i> ●	3	4
<i>Echium stenosphon</i> ●	3	3
<i>Asteriscus vogelii</i> ●	2	3
<i>Lotus purpureus</i> ●	2	2
<i>Daucus insularis</i> ●	2	2
<i>Phagnalon melanoleucum</i> ●	+	+
<i>Lobularia spathulata</i> ●	.	2
<i>Conyza pannosa</i> ●	.	+
Companion species		
<i>Lantana camara</i>	2	1
<i>Furcraea foetida</i>	2	1
<i>Cynodon dactylon</i>	1	2
<i>Davallia canariensis</i>	+	1
<i>Paronychia illecebroides</i> ●	.	+

Localities: 1. São Vicente: Monte Verde, near summit *holotypus* ass. (reg. 2004: 73); 2. São Vicente: Monte Verde, near summit.

Table 241.1.6. *Suaeda caboverdeanae-Asparagetum squarrosi* ass. nova
hoc loco(Asparago-Sarcostemmion, Euphorbio-
Sarcostemmetalia, Cocco-Sarcostemmetea)

Altitude (1=10 m)	1	7	7	2
Orientation	SE	W	W	SE
Area m ²	4	10	10	60
N° of species	3	3	4	9
Ordinal number	1	2	3	4*

Characteristic species

Asparagus squarrosus ● 4 4 4 3Species of *Frankenio-Suaedetea caboverdeanae**Suaeda caboverdeana* ● 1 1 2 2*Tetraena waterlotii* + . . 2*Frankenia pseudoericifolia* ● . + . 2Other companion species: *Lotus brunneri* ● 1 in 3; *Lotus chevalieri* ● and *Tetraena simplex* 1 in 4; *Senna bicapsularis* + in 3; *Bulbostylis barbata*, *Fagonia latifolia* and *Heliotropium pterocarpum* + in 4Localities: 1. *Maio*: Banco da Antónia; 2, 3. *Sal*: base of Fonte Grande; 4. *Boavista*: Porto Ferreira (relevé J.C. Costa & I. Gomes, holotypus ass. reg. 2008: 19).**Table 25**1.1.7. *Tetraeno waterlotii-Sarcostemmetum daltonii* ass. nova hoc loco

(Asparago-Sarcostemmion, Euphorbio-Sarcostemmetalia, Cocco-Sarcostemmetea)

Altitude (1 = 10m)	1	30	15	29	0.5	0.7	24	14
Orientation	N	NW	N	NE	NE	E	E	
Area m ²	50	50	50	50	20	60	100	54
N° of species	4	6	8	9	10	12	16	8
Ordinal number	1	2	3	4	5	6*	7	8
Characteristic species								
<i>Sarcostemma daltonii</i> ●	3	4	3	3	4	4	3	V
<i>Campylanthus glaber</i> ●	.	1	1	1	1	1	2	V
<i>Tetraena waterlotii</i>	2	.	1	2	2	+	.	IV
<i>Lavandula coronopifolia</i>	.	.	1	.	.	1	+	III
<i>Lotus purpureus</i> ●	.	.	.	.	1	.	+	II
<i>Daucus insularis</i> ●	.	.	.	+	+	.	.	II
<i>Forsskaolea procrdifolia</i> ●	.	.	.	.	+	+	.	II
Companion species								
<i>Launaea melanostigma</i> ●	1	2	1	2	.	+	+	V
<i>Cenchrus ciliaris</i>	1	1	3	+	+	.	2	V
<i>Commicarpus helenae</i>	.	1	.	.	+	1	2	III
<i>Cynodon dactylon</i>	.	.	.	+	2	2	.	III
<i>Nicotiana glauca</i>	.	+	.	+	.	.	1	III
<i>Hyparrhenia caboverdeana</i> ●	.	.	2	.	.	.	+	II
<i>Trichodesma africanum</i>	.	.	.	.	.	1	+	II
<i>Senna bicapsularis</i>	.	.	.	.	.	1	+	II
<i>Kickxia elegans</i> ●	.	.	.	+	+	.	.	II
<i>Heliotropium pterocarpum</i>	.	.	+	.	.	.	+	II

Other companion species: *Momordica charantia* 1 in 6; *Cucumis anguria* + in 6; *Indigofera tinctoria* 2, *Ziziphus mauritiana*, *Salvia aegyptiaca* and *Leucaena leucocephala* + in 7.Localities: 1. *Brava*: Furnas; 2. *Brava*: Cruzinha; 3, 4. *Brava*: Figueiral; 5, 6. *Brava*: Fajã de Água; 6. *Brava*: Fajã de Água (relevé J.C. Costa & I. Gomes, holotypus ass. reg. 2014: 26); 7. *Brava*: Lomba; 8. Synthesized table.

1.1.7. *Tetraeno waterlotii-Sarcostemma daltonii* associatio nova hoc loco

Climactical and edafoxerophilous close dwarf shrub savanna community, occurring in Brava Island on leptosols in lower thermotropical arid, euhyperoceanic bioclimate. It is dominated by the succulent species *Sarcostemma daltonii* and *Tetraena waterlotii* accompanied by *Campylanthus glaber* ●, *Commicarpus helenae*, *Lavandula coronopifolia*, *Lotus purpureus* ●, *Trichodesma africanum*, *Daucus insularis* ●, *Launaea melanostigma* ●, etc. (*holotypus* relevé 6, table 25) [BR]. [●]

1.2. *Globulario amygdalifoliae-Periplocion chevalieri* alliancia nova hoc loco

Desertic and xeric climactical tropical and edaphoxerophilous tall shrub savanna community; growing in thermo-mesotropical and occasionally lower supratropical, from upper arid to upper dry and locally some years low subhumid (Fogo Island); developed on leptosols, andosols, colluvial and tephric soils. The

communities of this alliance are endemic of Cabo Verde Islands [A, N, SN, F, BR]. [●]

Typus: 16.2.1. *Erysimo caboverdeanae-Periplocetum chevalieri* ass. nova hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Artemisia gorgonum* ●, *Asteriscus daltonii* ●, *Asteriscus smithii* ●, *Carex antoniensis* ●, *Conyza feae* ●, *Conyza pannosa* ●, *Conyza schlechtendalii* ●, *Conyza varia*, *Daucus annuus* ●, *Daucus insularis* ●, *Daucus tenuissimus* ●, *Diplotaxis antoniensis* ●, *Diplotaxis brochmannii* ●, *Diplotaxis gracilis* ●, *Diplotaxis sundingii* ●, *Echium hypertropicum* ●, *Echium vulcanorum* ●, *Erysimum caboverdeanum* ●, *Frankenia montana* ●, *Globularia amygdalifolia* ●, *Limonium lobinii* ●, *Limonium sundingii* ●, *Lobularia spathulata* ●, *Lotus arborescens* ●, *Lotus jacobaeus* ●, *Lotus jacobaeus* var. *villosus* ●, *Lotus latifolius* ●, *Melanoselinum bischoffii* ●, *Phagnalon melanoleucum* ●, *Sonchus daltonii* ●, *Tolpis farinulosa* ●, *Verbascum cystolithicum* ●.

Table 26

1.2.1. *Erysimo caboverdeanae-Periplocetum chevalieri* ass. nova hoc loco

(*Globulario-Periplocion chevalieri* Euphorbio-Sarcostemmetalia, *Cocculo Sarcostemmetea daltonii*)

Altitude (1=10 m)	171	157	180	174	158	168
Orientation	NE	S	N	E	S	.
Area m ²	200	200	200	50	60	142.
N° of species	15	14	21	15	12	16
Ordinal number	1	2	3*	4	5	6
Characteristic species						
<i>Periploca chevalieri</i> ●	2	2	2	1	2	V
<i>Lotus purpureus</i> ●	1	1	2	2	+	V
<i>Lavandula rotundifolia</i> ●	2	3	.	3	3	IV
<i>Diplotaxis hirta</i> ●	2	.	+	1	+	IV
<i>Micromeria forbesii</i> ●	1	.	1	+	1	IV
<i>Euphorbia tuckeyana</i> ●	4	3	3	.	.	III
<i>Sarcostemma daltonii</i> ●	+	2	.	.	2	III
<i>Artemisia gorgonum</i> ●	+	+	3	.	.	III
<i>Sonchus daltonii</i> ●	.	1	1	+	.	III
<i>Erysimum caboverdeanum</i> ●	1	.	2	.	.	II
<i>Phagnalon melanoleucum</i> ●	.	.	2	1	.	II
<i>Campylanthus glaber</i> ●	.	1	.	1	.	II
<i>Withania chevalieri</i> ●	.	.	.	+	+	II
<i>Helianthemum gorgoneum</i> ●	.	2	.	.	.	I
<i>Conyza feae</i> ●	.	.	+	.	.	I
<i>Globularia amygdalifolia</i> ●	.	.	.	2	.	I
<i>Lotus jacobaeus</i> ●	.	.	.	1	.	I
<i>Verbascum cystolithicum</i> ●	.	.	.	+	.	I
Companion species						
<i>Hyparrhenia caboverdeana</i> ●	+	2	2	+	.	IV
<i>Melinis repens</i>	.	+	+	.	1	III
<i>Heteropogon contortus</i>	.	.	1	2	+	III
<i>Aristida adscensionis</i>	+	.	2	.	.	II
<i>Cosentinia vellea</i>	+	.	.	.	1	II

Other companion species: *Asphodelus mariolousae* 2 in 3; *Dichanthium annulatum* 2 in 5; *Andropogon fastigiatus* 1 in 2; *Polycarpha gayi* ● 1 in 2; *Pteridium aquilinum* 1 in 3; *Galium parisiense* 1 in 3; *Cenchrus ciliaris* + in 1; *Bidens pilosa* + in 1; *Solanum nigrum* + in 1; *Ricinus communis* in 3; *Ipomoea batatas* + in 3; *Brachypodium distachyon* + in 3; *Campanula bravensis* ● + in 4; *Tricholaena teneriffae* + in 5

Localities: 1. *Fogo*: 4 Km SW from Chã das Caldeiras; 2. *Fogo*: Chã das Caldeiras, Fernão Ferro; 3. *Fogo*: Montinho (*holotypus* ass. reg. 2006: 46); 4. *Fogo*: Chã das Caldeiras; 5. *Fogo*: Chã das Furnas; 6. Synthesized table

1.2.1. *Erysimo caboverdeanae-Periplocetum chevalieri* associatio nova hoc loco

Climactical and edaphoxerophilous tall shrub savanna community, occurring on leptosols and leptic andosols in Fogo Island, in tropical xeric, thermo-mesotropical, semiarid to upper dry, euhyperoceanic bioclimate. It's characterized by *Periploca chevalieri*, *Lotus purpureus*, *Lavandula rotundifolia*, *Diploaxis hirta*, *Micromeria forbesii*, *Euphorbia tuckeyana*, *Artemisia gorgonum*, *Erysimum caboverdeanum*, *Sonchus daltonii*, *Phagnalon melanoleucum*, *Withania chevalieri*, *Sarcostemma daltonii*, *Hyparrhenia caboverdeana*, etc. (*holotypus* relevé 3, table 26) [F]. [●]

1.2.2. *Echietum vulcanori* associatio nova hoc loco

Shrub climactical open savanna community dominated and well characterized by the local endemic *Echium vulcanorum*, accompanied by *Verbascum cystolithicum*, *Lotus purpureus*, *Periploca chevalieri*, *Artemisia gorgonum*, *Lavandula rotundifolia*, *Withania chevalieri*, *Micromeria forbesii*, *Hyparrhenia caboverdeana*, *Cenchrus ciliaris*, etc. (*holotypus* relevé 3, table 27). It can be found on lapilli soils and tephra volcanic deposits, at high altitude in Fogo Island, in tropical xeric, meso and

lower supratropical dry and some years lower subhumid, euhyperoceanic bioclimate [F]. [●].

1.2.3. *Actiniopterido radiatae-Sarcostemma daltonii* associatio nova hoc loco

Stony badlands edaphoxerophilous dwarf shrub open savanna community growing on leptosols, scree and bedrocks of recent basaltic rocks, characterized by *Sarcostemma daltonii* and particularly by the scree fern *Actiniopteris radiata* accompanied by *Forsskaolea procradifolia*, *Diploaxis hirta*, *Rhynchosia minima*, *Periploca chevalieri*, *Macrotyloma daltonii*, *Tricholaena teneriffae*, etc. (*holotypus* relevé 2, table 28). It occurs in Fogo Island in thermotropical arid to semiarid, strong euhyperoceanic bioclimate [F]. [●]

1.2.4. *Echio hypertropici-Euphorbietum tuckeyanae* associatio nova hoc loco

Edaphoxerophytic and climactical tall crowded shrub savanna community of Serra da Malagueta (Santiago Island), growing on andosols and coluvisols, in tropical xeric and occasionally some years pluvisesonal, thermotropical, semiarid to dry euhyperoceanic bioclimate. Probably, in Santiago and Fogo Islands, the climatophilous natural potential vegetation in this bioclimatic stage correspond: in the deep

Table 27

1.2.2. *Echietum vulcanori* ass. nova hoc loco

(*Globulario-Periplocion chevalieri*, *Euphorbio-Sarcostemmetalia*, *Cocculo-Sarcostemmetea daltonii*)

Altitude (1=10 m)	180	177	170	181
Orientation	NE	W	W	SW
Area m ²	200	100	100	200
N° of species	13	7	9	11
Ordinal number	1	2	3*	4
Characteristic species				
<i>Echium vulcanorum</i> ●	2	1	3	3
<i>Verbascum cystolithicum</i> ●	2	1	1	+
<i>Lotus purpureus</i> ●	+	2	+	2
<i>Periploca chevalieri</i> ●	.	2	1	4
<i>Lavandula rotundifolia</i> ●	.	.	2	2
<i>Withania chevalieri</i> ●	.	2	1	.
<i>Micromeria forbesii</i> ●	1	.	.	1
<i>Artemisia gorgonum</i> ●	3	.	.	.
<i>Diploaxis hirta</i> ●	1	.	.	.
<i>Forsskaolea procradifolia</i> ●	1	.	.	.
<i>Conyza feae</i> ●	.	.	1	.
Companion species				
<i>Hyparrhenia caboverdeana</i>	1	3	1	+
<i>Cenchrus ciliaris</i>	.	2	1	2
<i>Tricholaena teneriffae</i>	2	.	.	1
<i>Ricinus communis</i>	+	.	.	+

Other companion species: *Cajanus cajan* 1 in 4; *Solanum nigrum* + in 1; *Chloris pycnothrix* + in 1; *Bidens pilosa* + in 1

Localities: 1. Fogo: Chã das Caldeiras; 2. Fogo: Chã das Caldeiras, Pico Pequeno; 3. Fogo: Chã das Caldeiras, Pico Pequeno *holotypus* ass. (reg. 2006: 43); 4. Fogo: 2 km SW from Chã das Caldeiras

Table 28

1.2.3. *Actiniopterido radiatae-Sarcostemmetum daltonii* ass. nova hoc loco
(*Globulario-Periplocion chevalieri*, *Euphorbio-Sarcostemmetalia*
Cocculo-Sarcostemmetea daltonii)

Altitude (1=10 m)	103	53
Orientation	S	S
Area m ²	20	100
N° of species	10	14
Ordinal number	1	2*
Characteristic species		
<i>Sarcostemma daltonii</i> ●	4	5
<i>Actiniopteris radiata</i>	1	2
<i>Forsskaolea procrdifolia</i> ●	1	1
<i>Rhynchosia minima</i>	3	.
<i>Periploca chevalieri</i> ●	2	.
<i>Diplotaxis hirta</i> ●	+	.
<i>Macrotyloma daltonii</i>	.	2
<i>Euphorbia tuckeyana</i> ●	.	1
<i>Withania chevalieri</i> ●	+	.
Companion species		
<i>Tricholaena teneriffae</i>	+	1

Other companion species: *Melinis repens* 1 in 2, *Tephrosia uniflora* 1 in 2, *Tripogon minimus* 1 in 2, *Hyparrhenia caboverdeana* + in 1 *Cosentinia vellea* + in 1, *Aristida adscensionis* + in 2, *Tephrosia bracteolata* + in 2, *Eragrostis conertii* ● + in 2, *Aristida funiculata* + in 2, *Sesbania grandiflora* + in 2

Localities: 1. Fogo: Chão das Furnas; 2. Fogo: Figueira Pavão (*holotypus* ass. reg. 2006: 28)

Table 29

1.2.4. *Echio hypertropici-Euphorbietum tuckeyanae* ass. nova hoc loco
(*Globulario-Periplocion chevalieri*, *Euphorbio-Sarcostemmetalia*,
Cocculo-Sarcostemmetea daltonii)

Altitude (1=10 m)	87	80	76	95	80	85	96	74	84
Orientation	SE	W	SW	NE	N	W	E	SE	.
Area m ²	60	40	200	100	60	80	50	100	86
N° of species	13	10	13	12	13	10	6	12	11
Ordinal number	1	2	3	4	5	6*	7	8	9
Characteristic species									
<i>Euphorbia tuckeyana</i> ●	3	1	+	1	5	5	2	3	V
<i>Echium hypertropicum</i> ●	3	3	4	3	2	2	3	1	V
<i>Lotus jacobaeus</i> ●	1	+	1	+	+	+	.	1	V
<i>Lavandula rotundifolia</i> ●	2	2	2	+	.	1	.	.	IV
<i>Daucus annuus</i> ●	+	.	.	.	+	+	+	1	IV
<i>Diplotaxis varia</i> ●	1	1	1	1	.	.	.	.	III
<i>Asteriscus daltonii</i> ●	.	.	.	2	.	.	2	3	II
<i>Verbascum capitiviridis</i> ●	.	.	+	.	+	1	.	.	II
<i>Limonium lobinii</i> ●	.	.	.	.	2	.	.	.	I
<i>Globularia amygdalifolia</i>	.	.	.	.	.	.	.	1	I
<i>Forsskaolea procrdifolia</i> ●	.	+	.	.	.	.	.	.	I
<i>Campylanthus glaber</i> ●	.	.	.	+	.	.	.	.	I
<i>Conyza pannosa</i> ●	.	.	.	+	.	.	.	.	I
<i>Lobularia fruticosa</i> ●	.	.	.	.	+	.	.	.	I

Companion species

<i>Lantana camara</i>	2	2	2	2	1	2	1	2	V
<i>Furcraea foetida</i>	3	.	1	2	.	+	+	1	IV
<i>Heteropogon melanocarpus</i>	1	1	1	1	.	.	1	1	IV
<i>Polycarpaea gayi</i> ●	1	+	.	.	.	+	.	+	III
<i>Ipomoea cairica</i>	.	.	.	.	2	.	.	+	II
<i>Oxalis corniculata</i>	.	.	.	.	2	+	.	.	II
<i>Hyptis pectinata</i>	.	.	.	.	1	.	.	1	II
<i>Hyparrhenia caboverdeana</i>	1	.	+	.	.	.	.	.	II
<i>Tagetes patula</i>	1	.	.	+	.	.	.	.	II
<i>Campanula jacobaea</i> ●	+	.	+	.	.	.	.	.	II

Other companion species: *Indigofera canescens* and *Dichrostachys platycarpa* 1 in 3; *Desmodium ospriostreblum* 1 in 5; *Ageratum conyzoides* 1 in 5; *Kickxia elegans* ● + in 2; *Desmodium tortuosum* and *Sida cordifolia* + in 8.

Localities: 1, 2, 3, 4, 8 (relevés J.C. Costa), Santiago: Serra da Malagueta; 5. Santiago: Serra da Malagueta, Curral de Asnos; 6. Santiago: Serra da Malagueta, Curral de Asnos (*holotypus* ass. reg. 2005: 81); 7. Santiago: Serra da Malagueta; 9. Synthesized table.

Table 30

1.2.5. *Launaea thalassicae-Euphorbietum tuckeyanae* ass. nova hoc loco
(Globulario-Periplocion chevalieri, Euphorbio-Sarcostemmetalia, Cocculo-Sarcostemmetea)

Altitude (1=10 m)	60	68	53	57	78	63
Orientation	NW	N	W	NE	N	
Area m ²	100	200	200	200	100	160
Nº of species	17	14	19	16	11	15
Ordinal number	1	2	3*	4	5	6
Characteristic species						
<i>Euphorbia tuckeyana</i> ●	3	3	4	3	4	V
<i>Daucus insularis</i> ●	1	1	1	+	2	V
<i>Lotus purpureus</i> ●	1	1	1	+	.	IV
<i>Launaea thalassica</i> ●	+	+	+	.	.	III
<i>Echium hypertropicum</i> ●	2	+	.	.	.	II
<i>Ficus gnaphalocarpa</i>	1	.	.	1	.	II
<i>Ipomoea carica</i>	.	.	1	.	1	II
<i>Globularia amygdalifolia</i> ●	.	.	3	.	.	I
<i>Periploca chevalieri</i> ●	.	.	.	1	.	I
<i>Diplotaxis varia</i> ●	.	.	.	1	.	I
<i>Campylanthus glaber</i> ●	.	.	.	1	.	I
<i>Sarcostemma daltonii</i> ●	+	.	.	.	.	I
Companion species						
<i>Lantana camara</i>	3	3	2	+	+	V
<i>Furcraea foetida</i>	3	2	2	.	+	IV
<i>Cenchrus ciliaris</i>	1	1	1	2	.	IV
<i>Heteropogon contortus</i>	1	+	1	1	.	IV
<i>Nicotiana glauca</i>	.	1	+	+	1	IV
<i>Campanula bravensis</i> ●	+	+	+	.	.	III
<i>Desmodium ospriostreblum</i>	+	+	.	.	+	III
<i>Hyparrhenia caboverdeana</i> ●	.	.	1	2	.	II
<i>Arundo donax</i>	.	1	1	.	.	II
<i>Ageratina adenophora</i>	1	.	1	.	.	II
<i>Hyptis pectinata</i>	+	.	+	.	.	II
<i>Pteris vittata</i>	+	.	.	+	.	II
<i>Senna bicapsularis</i>	.	.	.	+	+	II

Other companion species: *Launaea melanostigma* ● 2 in 4; *Rhynchosia minima* 1 in 2; *Cynodon dactylon* and *Cyperus laevigatus* 1 in 5; *Oxalis corniculata* + in 1; *Abrus precatorius*, *Jatropha curcas* and *Psidium guajava* + in 3; *Foeniculum vulgare* + in 5.

Localities: 1. *Brava*: Espadão; 2. *Brava*: Senhora do Monte, Ribeira da Fajã de Água; 3. *Brava*: Figueira Grande (relevé J.C. Costa & I. Gomes, *holotypus* ass. reg. 2014: 21); 4. *Brava*: Ribeiro Ferreiros, Campo Baixo; 5. *Brava*: Mato, Costa Perú; 6. Synthesized table.

temporihydrophilous soils to the *Ficus sur* woodland savanna series (*Dichrostachyo-Fico sur sigmetum*) and in the shallow or thinner soils to the *Acacia caboverdeana* short woodland savanna series (*Dichrostachyo-Acacio caboverdeanae sigmetum*) both near destroyed by the men influence. The *Echio hypertropici-Euphorbietum tuckeyanae* is formed by the caboverdian endemisms: *Euphorbia tuckeyana*, *Echium hypertropicum*, *Lotus jacobaeus*, *Daucus annuus* (*Asteriscus daltonii*, *Lavandula rotundifolia*, *Verbascum capitis-viridis*, *Limonium lobinii*, *Diplotaxis varia*, *Globularia amygdalifolia*, etc., (*holotypus* relevé 6, table 29) [SN]. [●]

1.2.5. *Launaea thalassicae-Euphorbietum tuckeyanae* associatio nova hoc loco

Edaphoxerophilous closed shrub savanna community, growing on leptosols and basalt onrocks and near vertical walls exposed to moist and wet winds; is structured by *Euphorbia tuckeyana*, *Daucus insularis*, *Lotus purpureus*, *Launaea thalassica*,

Echium hypertropicum, *Ipomoea carica*, *Globularia amygdalifolia*, etc. (*holotypus* relevé 3, table 30). It occurs in tropical xeric, upper thermotropical, semiarid lower dry, euhyperoceanic bioclimate, in Brava Island [BR]. [●]

1.2.6. *Loto latifolii-Artemisietum gogonei* associatio nova hoc loco

Climactical closed shrub savanna community, growing on leptics andosols, in upper thermotropical and lower mesotropical, semiarid to lower dry, euhyperoceanic bioclimate in Santo Antão Island, with *Artemisia gorgonum*, *Lotus latifolius*, *Periploca chevalieri*, *Asteriscus vogelii*, *Helianthemum gorgoneum*, *Diplotaxis antoniensis*, *Euphorbia tuckeyana*, *Sonchus daltonii*, *Echium lindbergii*, *Globularia amygdalifolia*, *Lavandula rotundifolia*, etc., but lacking *Melanoselinum bischoffii*, *Tolpis farinulosa*, *Diplotaxis brochmannii* and *Lobularia fruticosa* (*holotypus* ass.: relevé 4, table 31) [A]. [●]

Table 31

1.2.6. *Loto latifolii-Artemisietum gogonei* ass. nova hoc loco

(Globulario-Periplocion chevalieri, Euphorbio-Sarcostemmetalia, Cocculo-Sarcostemmetea)

Altitude (1=10m)	144	139	137	134	140	175	145
Orientation	W	E	W	NW	NE	S	
Area m ²	60	100	100	60	40	100	77
N° of species	7	9	8	8	6	12	8
Ordinal number	1	2	3	4*	5	6	7
Characteristic species							
<i>Artemisia gorgonum</i> ●	3	5	4	5	4	1	V
<i>Lotus latifolius</i> ●	.	+	2	2	2	1	V
<i>Periploca chevalieri</i> ●	.	+	1	+	+	1	V
<i>Asteriscus vogelii</i> ●	.	.	3	2	+	2	IV
<i>Helianthemum gorgoneum</i> ●	.	.	3	1	.	3	III
<i>Diplotaxis antoniensis</i> ●	.	.	.	2	+	1	III
<i>Sonchus daltonii</i> ●	1	.	+	+	.	.	III
<i>Euphorbia tuckeyana</i> ●	3	1	.	.	.	.	II
<i>Globularia amygdalifolia</i> ●	2	.	.	.	.	+	III
<i>Lavandula rotundifolia</i> ●	.	.	+	.	.	+	II
<i>Echium lindbergii</i> ●	2	.	.	.	.	.	I
<i>Conyza feae</i> ●	.	2	.	.	.	.	I
<i>Conyza varia</i> ●	.	1	.	.	.	.	I
<i>Campylanthus glaber</i> ●	.	.	.	.	.	1	I
<i>Phagnalon melanoleucum</i> ●	+	.	.	.	.	.	I
Companion species							
<i>Hyparrhenia caboverdeana</i> ●	.	1	2	1	2	+	V

Other companion species: *Cynodon dactylon* 2 in 2; *Andropogon tridentatus* 1 in 1; *Aristida cardosoi* ● 1 in 6; *Lantana camara* + in 2; *Asphodelus mariolousae* ● + in 6.

Localities: 1. *Santo Antão*: Espongeiro, Casa Florestal; 2, 3. *Santo Antão*: Laginha; 4. *Santo Antão*: Chã da Companhia (*holotypus* ass. reg. 2005: 44); 5. *Santo Antão*: Espongeiro; 6. *Santo Antão*: Moroços; 7. Synthesized table.

1.2.7. *Melanoselino bischoffii-Globarietum amygdalifoliae* associatio nova hoc loco

Edaphoxerophilous nanophanerophytic short savanna community, growing on leptosols and basalt walls exposed to moist and wet winds, in tropical pluvisesonal, thermotropical, dry, euhyperoceanic bioclimate, in Santo Antão Island. It is organized by the endemisms: *Globularia amygdalifolia*, *Echium lindbergii*, *Melanoselinum bischoffii*, *Tolpis farinulosa*, *Phagnalon melanoleucum*, *Micromeria forbesii*, *Aeonium gorgoneum*, *Sonchus daltonii*, *Diplotaxis brochmannii*, *Conyza varia*, *Conyza feae*, *Euphorbia tuckeyana*, *Launaea picridioides*, *Lobularia fruticosa*, etc., but missing *Artemisia gorgonum*, *Asteriscus vogelii*, *Helianthemum gorgoneum* and *Diplotaxis antoniensis* (*holotypus* relevé 3, table 32) [A]. [●]

1.2.8. *Asterisco smithii-Euphorbietum tuckeyanae* associatio nova hoc loco

Climactical closed shrub savanna community growing on coluvisols and leptic andosols, characterized by *Euphorbia tuckeyana*, *Verbascum capitis-viridis*, *Campylanthus glaber*, *Daucus insularis*, *Conyza pannosa*, and *Asterisco smithii*, *Echium glabrescens*, *Lotus arborescens* (São Nicolau, insular endemic), etc. (*holotypus* relevé 2, table 33). It occurs in tropical pluvisesonal, upper thermotropical to lower mesotropical semiarid to dry euhy-

peroceanic bioclimate, occurring on Monte Gordo highes zones in São Nicolau Island [N]. [●]

1b. *DICHROSTACHYO PLATYCARPAE-ACACIETALIA CABOVERDEANAE* ordo novus hoco loco

Deciduous micro-woodland climactic savanna (*Fico gnaphalocarphae-Acacion caboverdeanae*), growing on lithosols, arenosols, andosols and tephros, including the edaphohydrophilous coastal palm groves (*Phoenix atlanticae*) and the temporary wet tamarisk thickets (*Tamaricion senegalensis*), occurring in infra-thermotropical and low mesotropical upper arid to dry bioclimates, and occasionally in lower subhumid; but when grows in arid bioclimates seems to be necessary a shallow temporary hydromorphism on the soils. This caboverdian order is quite poor in endemic species, but has more sahelian and angolan-zambesian tropical elements. The communities belonging to this order are found in all islands of Cabo Verde except Sal.

The thermotropical desertic and xeric micro-woodlands savannas, with deciduous or evergreen shrubby or small tree plants, represents the mature wooded stages of climactical and edaphoxerophilous vegetation series in both climactic and seasonal superficially wet soils, in favourable stations of the archipelago. They are structured by short trees: *Acacia caboverdeana*, *Dracaena caboverdeana*, *Ficus gnaphalocarpa*, *Ficus sur*, *Phoenix atlantica* and *Sideroxylon marginata*, but the secular use of wood, extensive farming and intensive grazing, has reduced severely the cover of natural tree species in the last five centuries.

Table 32

1.2.7. *Melanoselino bischoffii*-*Globularietum amygdalifoliae* ass. nova hoc loco
(*Globulario-Periplocion chevalieri*, *Euphorbio-Sarcostemma*, *Cocculo-Sarcostemma*)

Altitude (1=10m)	125	120	123	86
Orientation	SE	E	NW	SE
Area m ²	100	200	50	200
Nº of species	15	27	15	23
Ordinal number	1	2	3*	4
Characteristic species				
<i>Globularia amygdalifolia</i> ●	3	3	4	1
<i>Echium lindbergii</i> ●	3	2	1	3
<i>Phagnalon melanoleucum</i> ●	3	2	1	1
<i>Tolpis farinulosa</i> ●	1	+	+	1
<i>Micromeria forbesii</i> ●	.	2	2	1
<i>Aeonium gorgoneum</i> ●	+	+	.	2
<i>Melanoselinum bischoffii</i> ●	.	1	1	+
<i>Sonchus daltonii</i> ●	+	+	.	1
<i>Conyza varia</i> ●	.	1	.	1
<i>Euphorbia tuckeyana</i> ●	.	+	1	.
<i>Conyza feae</i> ●	.	1	.	+
<i>Launaea picridioides</i> ●	+	.	.	1
<i>Diplotaxis brochmannii</i> ●	.	+	+	.
<i>Lobularia fruticosa</i> ●	.	+	.	+
<i>Lavandula rotundifolia</i> ●	.	.	.	+
<i>Periploca chevalieri</i> ●	.	.	1	.
<i>Campylanthus glaber</i> ●	.	+	.	.
<i>Lotus latifolius</i> ●	.	+	.	.
<i>Sarcostemma daltonii</i> ●	.	+	.	.
Companion species				
<i>Polycarpaea gayi</i> ●	+	2	+	.
<i>Kickxia dichondrifolia</i> ●	1	+	.	+
<i>Lantana camara</i>	.	1	+	1
<i>Oxalis corniculata</i>	+	+	.	+
<i>Lavandula dentata</i>	1	1	+	.
<i>Campanula jacobaea</i> ●	.	+	+	1
<i>Aristida cardosoi</i> ●	2	1	.	.
<i>Hyparrhenia caboverdeana</i>	.	+	2	.
<i>Misopates orontium</i>	.	+	.	+
<i>Brachypodium distachyon</i>	.	.	+	+

Other companion species: *Grevillea robusta* 2 in 1; *Sporobolus molleri* 1 in 4; *Umbilicus schmidtii* ● and *Cynodon dactylon* + in 1; *Tricholaena teneriffae*, *Ruta chalepensis* and *Echinochloa colona* + in 2; *Kickxia webbiana* ●, *Diplotaxis gorgodensis* ●, *Nicotiana glauca* and *Furcraea foetida* + in 4.

Localities: 1, 2. *Santo Antão*: Cova; 3 *Santo Antão*: Ribeira do Paul (relevé J.C. Costa & I. Gomes, *holotypus* ass. reg. 2014: 55); 4. *Santo Antão*: Ribeira de Sanica.

This anthropogenic erosive circumstance has joined with a very irregular late summer precipitations, as well as the high frequency of droughts over several consecutive years and even decades [A, V, N, BO, M, SN, F, BR]. [●]

Typus: 1.3. *Fico gnaphalocarphae-Acacion caboverdeanae* all. nova hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Acacia caboverdeana* ●, *Daucus humilis* ●, *Dichrostachys platycarpa*, *Ficus gnaphalocarpa*, *Ficus sur* and *Ziziphus mauritiana*.

1.3. *Fico gnaphalocarphae-Acacion caboverdeanae* alliancia nova hoc loco

Deciduous open micro-woodlands savanna, climactical, edaphoxerophilous or seasonally hygrophilous with fleeting superficial temporal hydromorphy; growing in upper infra and thermotropical arid to dry bioclimates; developed on lithic or regosolic soils, occurring

in near all Cabo Verde Islands [A, V, N, M, BO, SN, F, BR]. [●]

Typus: 16.3.1. *Dichrostachyo platycarpae-Acacietum caboverdeanae* ass. nova hoc loco
Characteristic species and bioindicators growing in Cabo Verde Islands: *Dracaena caboverdeana* ●, *Sideroxylon marginata* ●.

1.3.1. *Dichrostachyo platycarpae-Acacietum caboverdeanae* associatio nova hoc loco

Climactic phanerophytic deciduous micro-woodland savanna community, growing on andosols and leptosols, in Santiago Island. It occurs in upper infra and thermotropical, upper arid, semiarid and lower dry bioclimate, formed by *Acacia caboverdeana*, *Dichrostachys platycarpa*, *Ziziphus mauritiana*, *Lotus purpureus*, *Lavandula rotundifolia*, etc. (*holotypus* relevé 3, table 34) (*acacietosum caboverdeanae*). In Fogo and Brava Island we recognize the poorer

Table 33

1.2.8. *Asterisco smithii-Euphorbietum tuckeyanae* ass. nova hoc loco
(*Globulario-Periplocion chevalieri*, *Euphorbio-Sarcostemmetalia*, *Cocculo-Sarcostemmetea daltonii*)

Altitude (1=10 m)	97	107	127	124	122	119	116
Orientation	N	N	SW	NW	S	W	.
Area m ²	20	20	30	40	50	40	<u>33</u>
Nº of species	10	10	6	8	9	9	9
Ordinal number	1	2*	3	4	5	6	7
Characteristic species							
<i>Asteriscus smithii</i> ●	1	2	3	2	3	3	V
<i>Euphorbia tuckeyana</i> ●	5	5	3	3	+	.	V
<i>Echium glabrescens</i> ●	.	+	2	+	3	3	V
<i>Campylanthus glaber</i> ●	.	.	1	.	2	+	III
<i>Verbascum capitiviridis</i> ●	.	.	.	+	1	2	III
<i>Daucus insularis</i> ●	3	3	.	.	.	.	II
<i>Conyza pannosa</i> ●	.	3	.	.	.	.	I
<i>Lotus arborescens</i> ●	.	1	.	.	.	.	I
Companion species							
<i>Lantana camara</i>	2	2	4	3	2	1	V
<i>Hyparrhenia caboverdeana</i>	1	1	1	1	1	1	V
<i>Galinsoga quadriradiata</i>	2	.	.	1	1	+	IV
<i>Oxalis corniculata</i>	2	2	.	.	.	.	II
<i>Tagetes patula</i>	.	1	.	.	1	.	II
<i>Campanula jacobaea</i> ●	.	.	.	+	.	+	II
Other companion species: <i>Galium parisiense</i> 2 in 1; <i>Furcraea foetida</i> 1 in 1; <i>Davallia canariensis</i> + in 1; <i>Paraceterach marantae</i> + in 6							
Localities: 1. São Nicolau: Cachaço; 2. São Nicolau: Monte Gordo (<i>holotypus</i> ass. reg. 2004: 131 bis); 3, 4, 5, 6. São Nicolau: Monte Gordo; 7. Synthesized table.							

Table 34

1.3.1. *Dichrostachyo platycarpae-Acacieturn caboverdeanae* ass. nova hoc loco
acacietosum caboverdeanae subass. nova hoc loco (*rel. 1-8*),
periplocetosum chevalieri subass. nova hoc loco (*rel. 9-10*)
(*Fico-Acacion caboverdeanae*, *Dichrostachyo-Acaciatalia*, *Cocculo-Sarcostemmetea daltonii*)

Altitude (1=10 m)	35	27	39	31	90	41	48	95	7	6	42
Orientation	NE	N	NE	E	S	NW	E	SW	SW	N	,
Area m ²	30	10	40	50	15	20	40	10	200	100	<u>59</u>
Nº of species	12	10	9	9	13	11	13	13	17	8	<u>12</u>
Ordinal number	1	2	3*	4	5	6	7	8	9*	10	11
Characteristic species											
<i>Acacia caboverdeana</i> ●	2	3	3	2	3	3	1	2	3	2	V
<i>Dichrostachys platycarpa</i>	4	3	3	3	2	4	4	5	1	.	V
<i>Ziziphus mauritiana</i>	2	2	2	2	1	+	2	.	2	1	V
<i>Lotus purpureus</i> ●	+	+	+	2	2	.	.	.	.	.	III
<i>Lavandula rotundifolia</i> ●	.	2	1	+	1	.	.	.	.	.	III
<i>Periploca chevalieri</i> ●	.	.	.	.	.	.	.	.	1	1	I
<i>Sideroxylon marginata</i> ●	.	.	.	.	.	.	1	.	.	.	I
<i>Daucus annus</i> ●	.	.	.	.	.	.	.	1	.	.	I
<i>Indigofera microcarpa</i> ●	.	.	.	.	.	.	.	.	1	.	I
Companion species											
<i>Lantana camara</i>	1	.	2	2	2	.	2	2	+	2	V
<i>Heteropogon melanocarpus</i>	1	1	.	1	+	.	2	.	1	1	V
<i>Hyparrhenia caboverdeana</i> ●	1	1	.	.	.	1	1	.	+	1	IV
<i>Prosopis juliflora</i>	2	1	.	.	1	.	.	+	1	3	IV
<i>Furcraea foetida</i>	2	.	2	.	+	.	2	+	.	.	III
<i>Jatropha curcas</i>	.	.	+	.	.	1	+	1	+	.	III
<i>Andropogon tridentatus</i>	1	.	.	.	.	1	.	3	+	.	III
<i>Indigofera tinctoria</i>	+	.	.	.	+	.	2	.	.	.	II
<i>Melinis repens</i>	.	.	.	.	1	1	.	2	.	.	II
Other companion species: <i>Blainvillea gayana</i> 2 in 6 and + in 9; <i>Mentzelia aspera</i> 1 in 2 and + in 6; <i>Merremia aegyptia</i> + in 3 and 1 in 6; <i>Launaea intybacea</i> + in 1 and 4; <i>Nicotiana glauca</i> + in 2 and 4; <i>Ipomoea eriocarpa</i> + in 6 and 9; <i>Desmodium tortuosum</i> + in 8 and 9; <i>Grewia villosa</i> and <i>Melhania ovata</i> 2 in 9; <i>Stylosanthes fruticosa</i> 2 in 7; <i>Momordica charantia</i> 1 in 8; <i>Pennisetum polystachyon</i> 1 in 9; <i>Panicum maximum</i> and <i>Foeniculum vulgare</i> + in 5; + in 8; <i>Grewillea robusta</i> + in 8; <i>Launaea melanostigma</i> ● + in 9.											
Localities: 1. Santiago: S. Jorge dos Orgãos; 2. Santiago: Flamengos; 3. (relevé J.C. Costa), Santiago: Montanha (<i>holotypus</i> ass. 2005: 15); 4. Santiago: Orgãos Pequenos; 5. Santiago: Chão de Tanque; 6. Santiago: Longueira; 7. Santiago: Monte Tchota; 8. Santiago: Monte Tchota; 9. Fogo: (relevé J. Costa & I. Gomes) Lagariça de S. Filipe (<i>holotypus</i> subass. <i>periplocetosum chevalieri</i> reg. 2014: 41); 10. Brava: Cachaço.											

Table 35

1.3.2. *Cocculu penduli-Acacieta caboverdeanae* ass. nova hoc loco

(Fico-Acacion caboverdeanae, Dichrostachyo-Acacieta, Cocculu-Sarcostemma daltonii)

Altitude (m)	30	25	30	350	320	30	30	161
Orientation	SE	S	S	S	S	N	N	.
Area m ²	200	180	100	60	80	100	60	111
N ^o of species	14	18	14	12	11	13	7	13
Ordinal number	1	2*	3	4	5	6	7	8
Characteristic species								
<i>Acacia caboverdeana</i> ●	3	4	4	4	5	4	5	V
<i>Cocculus pendulus</i>	2	2	4	1	1	3	3	V
<i>Ziziphus mauritiana</i>	2	2	2	3	1	1	.	V
Companion species								
<i>Commicarpus helenae</i>	2	3	+	2	2	.	+	V
<i>Lantana camara</i>	+	1	+	1	1	.	.	IV
<i>Parkinsonia aculeata</i>	.	2	1	2	.	1	.	III
<i>Prosopis juliflora</i>	1	1	.	1	.	.	.	III
<i>Desmanthus virgatus</i>	1	2	1	.	.	+	.	III
<i>Rhynchosia minima</i>	1	2	.	.	+	.	.	III
<i>Merremia aegyptia</i>	+	2	.	.	.	1	.	III
<i>Ipomoea eriocarpa</i>	+	1	.	.	.	+	.	III
<i>Jatropha curcas</i>	+	.	.	.	+	+	.	III
<i>Indigofera tinctoria</i>	+	.	+	.	.	+	1	III
<i>Salvia aegyptiaca</i>	.	.	.	2	1	.	.	II
<i>Chloris virgata</i>	+	1	.	.	.	.	.	II
<i>Momordica charantia</i>	1	.	+	.	.	+	.	II
<i>Dalechampia parviflora</i>	.	1	+	.	.	.	.	II
<i>Melinis grandiflora</i>	.	.	.	2	2	.	.	II

Other companion species: *Senna bicapsularis* 2 in 2; *Grewia villosa* 2 in 3; *Cenchrus echinatus*, *Dicliptera verticillata* and *Panicum maximum* 1 in 2, *Cajanus cajan* + in 2; *Aloe vera*, *Heteropogon melanocarpus*, *Stylosanthes fruticosa* and *Convolvulus prostratus* 1 in 3; *Hyparrhenia caboverdeana* and *Euphorbia hypericifolia* + in 3; *Nicotiana glauca* and *Cucumis anguria* + in 4; *Calotropis procera* 1 in 5; *Aerva javanica* and *Ipomoea kotschyana* + in 5; *Launaea melanostigma* ● + in 6; *Tetraena waterlotii* + in 6; *Suaeda caboverdeana* ● + in 6.

Localities: 1. *Santiago*: between Praia e Cidade Velha; 2. *Santiago*: Cidade Velha (*holotypus* ass. reg. 2006: 6); 3. *Santiago*: Cidade Velha; 4. *Santiago*: Pico Leão; 5. *Santiago*: Mato Sancho; 6. *Maio*: Pedro Vaz; 7. *Boavista*: Baía das Gatas; 8. Synthesized table.

Table 36

1.3.3. *Forsskaolea procrifoliae-Acacieta caboverdeanae* ass. nova hoc loco

(Fico-Acacion caboverdeanae, Dichrostachyo-Acacieta, Cocculu-Sarcostemma daltonii)

Altitude (1=10m)	29	23	6
Orientation	W	W	NE
Area m ²	120	200	100
N ^o of species	18	18	11
Ordinal number	1*	2	3
Characteristic species			
<i>Acacia caboverdeana</i> ●	5	2	3
<i>Sarcostemma daltonii</i> ●	+	4	2
<i>Forsskaolea procrifolia</i> ●	+	1	+
<i>Campylanthus spathulatus</i> ●	.	.	2
<i>Asparagus squarrosus</i> ●	.	1	.
<i>Lavandula rotundifolia</i> ●	.	.	+
<i>Asteriscus vogelii</i> ●	.	.	+
Companion species			
<i>Commicarpus helenae</i>	3	2	+
<i>Cenchrus ciliaris</i>	2	2	.
<i>Malvastrum coromandelianum</i>	2	2	.
<i>Fagonia cretica</i>	2	1	.
<i>Desmanthus virgatus</i>	1	1	.
<i>Brachiaria caboverdeana</i> ●	1	+	.
<i>Cynodon dactylon</i>	.	+	+

Other companion species: *Grewia villosa* 2 in 1; *Jatropha curcas* 2 in 2; *Bidens bipinnata*, *Setaria verticillata* and *Mentzelia aspera* 1 in 1; *Trichodesma africanum* 1 in 2; *Prosopis juliflora* and *Tridax procumbens* 1 in 3; *Blainvillea gayana*, *Patellifolia patellaris*, *Acanthospermum hispidum*, *Crotalaria senegalensis* and *Emex spinosa* + in 1; *Rhynchosia minima*, *Lavandula coronopifolia*, *Cynodon dactylon*, *Sida alba*, *Aloe vera* and *Lantana camara* + in 2; *Fagonia latifolia* + in 3.

Localities: 1. *S. Vicente*: Casa Velha, Monte Verde (*holotypus* ass reg. 2004: 58); 2. *S. Vicente*: Casa Velha, Monte Verde; 3. *Santo Antão*: Ponta do Sol, Casa Branca.

Table 37
 1.3.4. *Cocculu penduli-Ficetum gnaphalocarphae* ass. nova hoc loco
 (*Fico-Acacion caboverdeanae*, *Dichrostachyo-Acacietaalia*,
Cocculu-Sarcostemmaetea daltonii)

Altitude (m)	115	20	60	320	40	111
Orientation	W	W	NW	W	W	.
Area m ²	100	80	60	40	200	96
N° of species	14	16	8	7	9	11
Ordinal number	1*	2	3	4	5	6
Characteristic species						
<i>Ficus gnaphalocarpha</i>	3	3	5	4	3	V
<i>Cocculus pendulus</i>	2	+	3	3	.	IV
<i>Indigofera microcarpa</i> ●	2	3	.	.	1	III
<i>Ziziphus mauritiana</i>	+	+	.	.	.	II
<i>Phoenix atlantica</i> ●	+	.	.	.	.	I
<i>Acacia caboverdeana</i> ●	.	.	2	.	.	I
<i>Sarcostemma daltonii</i> ●	.	.	.	+	.	I
Companion species						
<i>Prosopis juliflora</i>	2	3	.	.	2	III
<i>Jatropha curcas</i>	.	2	.	1	+	III
<i>Commicarpus helenae</i>	.	2	2	.	2	III
<i>Blainvillea gayana</i>	2	2	.	.	.	II
<i>Setaria verticillata</i>	2	+	.	.	.	II
<i>Sida alba</i>	2	.	.	2	.	II
<i>Cynodon dactylon</i>	.	2	1	.	.	II
<i>Brachiaria ramosa</i>	.	1	1	.	.	II
<i>Aerva javanica</i>	.	+	.	.	1	II
<i>Arundo donax</i>	.	.	3	.	+	II

Other companion species: *Achyranthes aspera*, *Peristrophe paniculata*, 1 *Abutilon pannosum* and *Lantana camara* 1 in 1; *Desmodium tortuosum* and *Desmodium ospriostreblum* 1 in 2; *Merremia aegyptia* 1 in 3; *Parkinsonia aculeata* 1 in 5; *Calotropis procera* 1 in 5; *Panicum maximum* and *Cucumis anguria* + in 1; *Crotalaria* sp. and *Melinis repens* + in 2; *Nicotiana glauca* + in 4.

Localities: 1. Santiago: Praia Formosa, Ribeira Formosa (*holotypus* ass. reg. 2005: 93); 2. Santiago: Praia Formosa, Ribeira Formosa; 3. Boavista: Fundo Figueiras; 4. Boavista: Pico de Santo António; 5. Maio: Figueira da Horta; 6. Synthesized table.

subassociation *periplocetosum chevalieri* subass. nova hoc loco, which principal differential species is *Periploca chevalieri* (*holotypus* relevé 9, table 34). This open microforest savanna has been near destroyed by men, especially its representative small endemic tree *Acacia caboverdeana*, mostly used as firewood; however in recent years there seems to be some recovery in *Acacia* and *Dichrostachys platycarpa*, but unfortunality substituted by the alien tree *Prosopis juliflora*. [Sn, F, BR]. [●]

1.3.2. *Cocculu penduli-Acacietaum caboverdeanae* associatio nova hoc loco

Micro-woodland savanna community occurring in Santiago, Maio and Boavista Islands with *Acacia caboverdeana*, *Cocculus pendulus* and *Ziziphus mauritiana* and several afrotropical subnitrophilous lianoid herbs: *Commicarpus helenae*, *Rhynchosia minima*, *Merremia aegyptia*, *Ipomoea eriocarpa*, etc.; growing on lithosols and andosols, in tropical desertic infra-thermotropical upper arid bioclimate (*holotypus* relevé 2, table 35). Most of the natural potential vegetation area of this micro-woodland savanna community has been unfortunately occupied by the alien trees *Prosopis juliflora* and *Parkinsonia aculeata*. [SN, M, BO]. [●]

1.3.3. *Forsskaoleo procrdifoliae-Acacietaum caboverdeanae* associatio nova hoc loco

Nano and microphanerophytic climactic deciduous micro-woodland savanna community, growing on litic andosols and regosols, in São Vicente and Santo Antão Islands. This relict microforest open savanna is uncommon in North Cabo Verde Islands and is very poor in tree species, but is well characterized by *Acacia caboverdeana*, *Sarcostemma daltonii*, *Forsskaolea procrdifolia*, *Campylanthus spathulatus*, *Asparagus squarrosus*, etc. (*holotypus* relevé 1, table 36), and occurs in tropical desertic thermotropical arid bioclimate. [V, A]. [●]

1.3.4. *Cocculu penduli-Ficetum gnaphalocarphae* associatio nova hoc loco

Mesophanerophytic micro-woodland desertic savanna association, growing on seasonal temporarity mostly sandy wet soils with fleeting superficial hydromorphy in plains, depressions and torrents, formed by: *Ficus gnaphalocarpha*, *Cocculus pendulus*, *Ziziphus mauritiana*, *Indigofera microcarpa*, etc. (*holotypus* relevé 1, table 37). It occurs in tropical desertic, infra-thermotropical mostly arid bioclimate, in Santiago, Boavista and Maio Islands. [M, BO, SN]. [●]

Table 38

1.3.5. *Forsskaoleo procrdifoliae-Ficetum gnaphaloarpae* ass. nova hoc loco
(*Fico-Acacion caboverdeanae, Dichrostachyo-Acacietaalia, Cocculo-Sarcostemma daltonii*)

Altitude (1=10 m)	53	68	58	59	58	44	52	32	34	51
Orientation	W	S	N	NW	W	E	W	NW	N	
Area m ²	100	50	100	100	200	100	100	100	100	106
Nº of species	4	8	7	14	12	9	13	7	13	10
Ordinal number	1	2	3	4	5*	6	7	8	9	10
Characteristic species										
<i>Ficus gnaphalocarpa</i>	5	5	3	4	4	4	3	3	3	V
<i>Forsskaolea procrdifolia</i> ●	+	.	.	+	1	1	+	+	1	IV
<i>Euphorbia tuckeyana</i> ●	.	.	1	1	1	.	1	.	.	III
<i>Campylanthus glaber</i> ●	.	.	.	.	1	+	+	+	.	III
<i>Sarcostemma daltonii</i> ●	.	.	.	.	.	.	3	3	3	II
<i>Periploca chevalieri</i> ●	.	.	.	.	+	1	1	.	.	II
<i>Lotus purpureus</i> ●	.	.	.	+	+	.	+	.	.	II
<i>Lavandula rotundifolia</i>	.	.	.	.	.	.	.	.	2	I
<i>Diplotaxis hirta</i> ●	.	.	.	.	.	.	.	.	2	I
<i>Echium hypertropicum</i> ●	.	.	.	1	.	.	.	.	.	I
<i>Daucus insularis</i> ●	.	.	.	1	.	.	.	.	.	I
<i>Diplotaxis varia</i> ●	.	.	.	.	1	.	.	.	.	I
<i>Lavandula rotundifolia</i> ●	.	.	.	+	.	.	.	.	.	I
<i>Launaea thalassica</i> ●	.	.	.	.	.	+	.	.	.	I
<i>Daucus humilis</i> ●	.	.	.	.	.	.	.	.	+
Companion species										
<i>Lantana camara</i>	.	+	1	3	1	.	1	2	2	IV
<i>Nicotiana glauca</i>	.	1	1	.	1	1	+	1	+	IV
<i>Furcraea foetida</i>	+	+	2	2	.	+	.	1	.	IV
<i>Cenchrus ciliaris</i>	.	.	.	+	1	.	+	.	+	III
<i>Ageratina adenophora</i>	.	.	2	1	.	.	.	.	.	II
<i>Hyparrhenia caboverdeana</i> ●	.	.	.	.	2	.	1	.	.	II
<i>Cynodon dactylon</i>	.	1	.	1	.	.	.	.	.	II
<i>Arundo donax</i>	1	.	.	1	.	.	.	.	.	II
<i>Prosopis juliflora</i>	.	.	.	.	1	1	.	.	.	II

Other companion species: *Boerhavia diffusa* 1 in 9; *Senna bicapsularis* + in 2; *Passiflora edulis* and *Abrus precatorius* + in 4; *Sida rhombifolia* + in 6; *Andropogon gayanus*, *Hyptis pectinata* and *Aloe vera* + in 9;

Localities: 1. *Brava*: Figueira Grande; 2. *Brava*: Senhora do Monte; 3. *Brava*: Cova Joana; 4. *Brava*: Espadão; 5. *Brava*: Campo Baixo, Ribeira de Ferreiros (relevé J.C. Costa & I. Gomes, *holotypus* ass. reg. 2014: 36); 6. *Brava*: Nova Sintra, Ribeira Pedra Martins; 7. *Brava*: Ribeira de Ferreiros; 8. *Brava*: Figueiral; 9. *Fogo*: Santo António; 10. Synthesized table.

1.3.5. *Forsskaoleo procrdifoliae-Ficetum gnaphalocarpae* associatio nova hoc loco

Micro-mesophanerophytic woodland savanna community, growing on seasonal temporary moist shallow soils, on plains and torrents with fleeting superficial temporary hydromorph; formed by *Ficus gnaphalocarpa*, *Forsskaolea procrdifolia*, *Euphorbia tuckeyana*, *Campylanthus glaber*, *Periploca chevalieri* and the Fogo insular endemic species; *Daucus humilis* and *Diplotaxis hirta*, etc. (*holotypus* relevé 5, table 38). *Sarcostemma daltonii* can be seen as abundant on rock walls. It occurs in thermotropical arid to lower semiarid bioclimate in Brava and Fogo Islands [F, BR]. [●]

1.3.6. *Dichrostachyo platycarpae-Ficetum sur* associatio nova hoc loco

Micro-mesophanerophytic woodland savanna community, growing on near deep

soils with a temporary seasonal short moist period. Occurring in tropical xeric thermotropical semiarid to low dry bioclimate in Santiago and Fogo, structured by *Ficus sur*, *Dichrostachys platycarpa*, *Ziziphus mauritiana*, *Periploca chevalieri*, etc. (*holotypus* relevé 3, table 39) [F, SN]. [●]

1.3.7. *Euphorbio tuckeyanae-Ficetum sur* associatio nova hoc loco

Mesophanerophytic woodland savanna community, growing on temporarily seasonal deep moist soils and in rocky torrents, structured by *Ficus sur*, *Sarcostemma daltonii*, *Euphorbia tuckeyana*, *Launaea picridioides*, *Globularia amygdalifolia*, *Conyza varia*, *Artemisia gorgonum*, and the Santo Antão insular endemic species: *Echium lindbergii* and *Diplotaxis gorgadensis*. (*holotypus* relevé 3, table 40). It can be found in Santo Antão Island in thermo and mesotropical upper arid, semiarid to lower dry bioclimate [A]. [●]

Table 39
 1.3.6. *Dichrostachyo platycarpae-Ficetum sur* ass. nova hoc loco
 (*Fico-Acacion caboverdeanae*, *Dichrostachyo-Acacietaalia*,
Cocculo-Sarcostemma daltonii)

Altitude (1=10 m)	107	55	55	30
Orientation	SW	N	N	NE
Area m ²	100	100	120	100
N° of species	16	5	14	14
Ordinal number	1	2	3*	4
Characteristic species				
<i>Ficus sur</i>	1	1	3	4
<i>Dichrostachys platycarpa</i>	3	4	2	2
<i>Ziziphus mauritiana</i>	2	.	.	2
<i>Indigofera canescens</i>	.	.	2	1
<i>Euphorbia tuckeyana</i> ●	.	1	2	.
<i>Ipomoea cairica</i>	.	.	3	.
<i>Withania chevalieri</i> ●	2	.	.	.
<i>Periploca chevalieri</i> ●	2	.	.	.
<i>Echium hypertropicum</i> ●	.	.	.	+
Companion species				
<i>Jatropha curcas</i>	1	.	3	2
<i>Grewia villosa</i>	2	1	.	2
<i>Merremia aegyptia</i>	1	.	1	+
<i>Lantana camara</i>	.	.	3	3
<i>Furcraea foetida</i>	.	2	2	.
<i>Spermacoce verticillata</i>	+	.	+	.
<i>Launaea intybacea</i>	+	.	.	+
<i>Nicotiana glauca</i>	.	+	.	+

Other companion species: *Heteropogon melanocarpus*, *Aristida adscensionis* and *Hyparrhenia caboverdeana* ● 2 in 1; *Andropogon tridentatus* 2 in 3; *Panicum maximum* and *Momordica charantia* 2 in 4; *Parkinsonia aculeata* and *Rhynchosia minima* 1 in 1; *Calotropis procera*, *Desmanthus virgatus* and *Pennisetum polystachyon* 1 in 4; *Commicarpus helenae* and *Hyptis pectinata* + in 1; *Pteridium aquilinum*, *Nicandra physalodes* and *Macrotyloma daltonii* + in 3.

Localities: 1. Fogo: Miguel Gonçalves; 2. Fogo: Ribeira do Inferno; 3. Fogo: Campanas de Baixo (*holotypus* ass. reg. 2006: 40); 4. Santiago: Orgãos Pequenos.

1.3.8. *Sideroxyletum marginatae* associatio nova hoc loco

Evergreen meso-microwoodland savanna community, mostly growing on near inaccessible wall and rocky leptosols, characterized by *Sideroxylon marginata* accompanied by *Sarcostemma daltonii*, *Euphorbia tuckeyana*, *Lavandula rotundifolia*, etc. (*holotypus* relevé 5, table 41). It occurs in thermotropical arid bioclimate, in Santo Antão, São Vicente, São Nicolau, Santiago, Fogo and Brava Islands. Nowadays, practically, only can *Sideroxylon marginata* collect in inaccessible rocky cliffs. Due to the good quality of the wood it has been widely used by the population for various purposes, making this tree rare and near extinct. [A, V, N, SN, F, BR] [●].

1.3.9. *Dracaenetum caboverdeanae* associatio nova hoc loco

Evergreen micro-mesowoodland community, dominated by the endemic *Dracaena caboverdeana* accompanied by *Echium lindbergii*, *Launaea picridioides*, *Sarcostemma daltonii*, *Globularia amygdalifolia*, *Aeonium gorgoneum*, *Echium glabrescens*,

etc., (*holotypus* relevé 1, table 42). It occurs on leptosols, colluviums and rocky stations, in thermotropical and lower mesotropical subhumid to dry bioclimate, in Santo Antão and São Nicolau Islands. [A, N]. [●].

1.4. *Phoenicion atlanticae* aliancia nova hoc loco

Palms with plume woodland savanna, up to 10 m high, typical of riparian streams and depressed low stations lower and more humid than the surrounding surface, mostly near the coast, with temporary variable hydromorphic depth; in infra-thermotropical hyperarid to arid bioclimate; develop on allochthonous, arenic or regosolic fluvisols, favoured by bars or coastal dune deposits limited to exorheic runoff into the sea. Occurs in the eastern and northern islands of Cabo Verde, and are well characterized by the remarkable endemism *Phoenix atlantica*, having very pungent sharp pointed new bottom leaves tree [SL, BO, M, SN, BR]. [●]

Typus: 1.4.1. *Cocculo penduli-Phoenicetum atlanticae* ass. nova hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Phoenix atlantica* ●.

Table 40

1.3.7. *Euphorbia tuckeyanae-Ficetum sur* ass. nova hoc loco*Fico-Acacion caboverdeanae, Dichrostachyo-Acacietaalia, Cocculo-Sarcostemmaetea daltonii*)

Altitude (1=10 m)	122	125	54	50
Orientation	SE	NW	N	NE
Area m ²	100	400	50	200
Nº of species	12	13	12	14
Ordinal number	1	2	3*	4
Characteristic species				
<i>Ficus sur</i>	2	3	4	3
<i>Sarcostemma daltonii</i> ●	3	3	+	3
<i>Echium lindbergii</i> ●	+	2	2	1
<i>Euphorbia tuckeyana</i> ●	.	3	+	1
<i>Launaea picridioides</i> ●	.	.	1	1
<i>Globularia amygdalifolia</i> ●	+	1	.	.
<i>Conyza varia</i> ●	+	+	.	.
<i>Artemisia gorgonum</i> ●	+	+	.	.
<i>Asparagus squarrosus</i> ●	1	.	.	.
<i>Periploca chevalieri</i> ●	.	1	.	.
<i>Aeonium gorgoneum</i> ●	.	.	1	.
<i>Lobularia fruticosa</i> ●	+	.	.	.
<i>Phagnalon melanoleucum</i> ●	.	+	.	.
<i>Diplotaxis gorgadensis</i> ●	.	.	+	.
<i>Lavandula rotundifolia</i> ●	.	.	.	+
Companion species				
<i>Lantana camara</i>	1	1	2	2
<i>Furcraea foetida</i>	.	.	2	2
<i>Cenchrus ciliaris</i>	.	.	2	1
<i>Tricholaena teneriffae</i>	+	1	.	.
<i>Lavandula dentata</i>	+	+	.	.

Other companion species: *Desmanthus virgatus* 1 in 3; *Hyparrhenia caboverdeana*, *Desmodium tortuosum* and *Arundo donax* 1 in 4; *Echinochloa colona* + in 1; *Heteropogon contortus* + in 2; *Hypytis pectinata* + in 3; *Tridax procumbens* and *Foeniculum vulgare* + in 4.

Localities: 1. *Santo Antão*: Cova, Rocha da Mina; 2. *Santo Antão*: Cova; 3. *Santo Antão*: Cruz (relevé J.C. Costa & I. Gomes, *holotypus* ass. reg. 2014: 64); 4. *Santo Antão*: Losnas, Ribeira de Espinheiros.

Table 41

1.3.8. *Sideroxyletum marginatae* ass. nova hoc loco*(Fico-Acacion caboverdeanae, Dichrostachyo-Acacietaalia, Cocculo-Sarcostemmaetea daltonii)*

Altitude (1=10 m)	20	65	50	40	28	41
Orientation	E	SW	NW	N	NW	
Area m ²	60	60	60	60	90	67
Nº of species	5	7	6	13	16	9
Ordinal number	1	2	3	4	5*	6
Characteristic species						
<i>Sideroxylon marginata</i> ●	3	3	3	3	4	V
<i>Sarcostemma daltonii</i> ●	3	2	3	3	2	V
<i>Euphorbia tuckeyana</i> ●	.	.	+	2	1	III
<i>Lavandula rotundifolia</i> ●	.	.	.	2	1	II
<i>Lotus jacobaeus</i> ●	.	.	.	1	1	II
<i>Launaea picridioides</i> ●	+	1	.	.	.	II
<i>Daucus humilis</i> ●	.	.	.	1	+	II
<i>Echium lindbergii</i> ●	2	.	.	.	.	II
<i>Echium glabrescens</i> ●	.	2	.	.	.	I
<i>Aeonium gorgoneum</i> ●	.	2	.	.	.	I
<i>Lobularia fruticosa</i> ●	.	2	.	.	.	I
Companion species						
<i>Lantana camara</i>	.	3	+	2	1	III
<i>Nicotiana glauca</i>	.	.	+	+	1	III
<i>Pennisetum polystachyon</i>	.	.	.	2	1	II
<i>Rhynchosia minima</i>	.	.	.	2	+	II
<i>Andropogon gayanus</i>	.	.	.	1	1	II

Other companion species: *Merremia aegyptia* 2 in 4; *Ipomoea carica*, *Tamarindus indica* and *Jatropha curcas* 2 in 5; *Kickxia elegans* ● 1 in 4; *Polycarpaea gayi* ● + in 1; *Launaea melanostigma* ● + in 3; *Abrus precatorius* and *Momordica charantia* + in 5.

Localities: 1. *Santo Antão*: Paul de Baixo, Passo; 2. *São Nicolau*: Cachaço; 3. *Brava*: Ribeira de Ferreiros; 4. *Fogo*: S. Jorge; 5. *Fogo*: Galinheiros (relevé J.C. Costa & I. Gomes, *holotypus* ass. reg. 2014: 8); 6. Synthesized table.

Table 421.3.9. *Dracaenetum caboverdeanae* ass. nova hoc loco*(Fico-Acacion caboverdeanae, Dichrostachyo-Acacietaalia, Cocculo-Sarcostemmaetea daltonii)*

Altitude (1=10 m)	73	45	53	126	118	120	89
Orientation	NE	SW	N	SE	SE	NE	
Area m ²	40	60	50	100	50	100	67
Nº of species	7	7	12	6	6	5	7
Ordinal number	1*	2	3	4	5	6	7
Characteristic species							
<i>Dracaena caboverdeana</i> ●	4	3	3	5	4	4	V
<i>Echium lindbergii</i> ●	2	.	2	1	1	+	V
<i>Launaea picridioides</i> ●	1	1	2	+	.	.	IV
<i>Sarcostemma daltonii</i> ●	2	.	1	.	.	2	III
<i>Globularia amygdalifolia</i> ●	.	.	.	2	+	.	II
<i>Aeonium gorgoneum</i> ●	.	1	1	.	.	.	II
<i>Echium glabrescens</i> ●	.	1	.	.	.	.	I
<i>Forsskaolea procrisifolia</i> ●	.	+	.	.	.	.	I
<i>Lotus latifolius</i> ●	.	.	+	.	.	.	I
<i>Campylanthus glaber</i> ●	.	.	+	.	.	.	I
<i>Diplotaxis gorgadensis</i> ●	.	.	+	.	.	.	I
Companion species							
<i>Lantana camara</i>	2	2	1	1	2	2	V
<i>Furcraea foetida</i>	.	.	1	.	.	2	II

Other companion species: *Aloe vera* 3 in 5; *Heteropogon contortus* and *Leucaena leucocephala* 2 in 3; *Lavandula dentata* 1 in 4; *Echinochloa colona* 1 in 5; *Jatropha curcas* + in 2; *Desmanthus virgatus*, *Cenchrus ciliaris*, *Tridax procumbens* and *Cynodon dactylon* + in 3.

Localities: 1. *Santo Antão*: Ribeira do Penedo: Pontinha da Janela (*holotypus* ass. reg. 2005: 20); 2. *São Nicolau*: Fajã Baixa; 3. *Santo Antão*: Cruz; 4, 5. *Santo Antão*: Cova; 6. *Santo Antão*: Ribeira do Espinhadeiro, Losnas; 7. Synthesized table

Table 431.4.1. *Cocculo penduli-Phoenicetum atlanticae* ass. nova hoc loco*(Phoenicion atlanticae, Dichrostachyo-Acacietaalia caboverdeanae, Cocculo-Sarcostemmaetea daltonii)*

Altitude (1= 10 m)	1	2	0.5	1	1	1	7	6	2
Area m ²	100	60	100	120	40	50	40	50	<u>63</u>
Nº of species	11	11	9	8	7	10	7	7	9
Ordinal number	1	2	3	4*	5	6	7	8	9
Characteristic species									
<i>Phoenix atlantica</i> ●	5	4	5	5	5	5	5	5	V
<i>Cocculus pendulus</i>	1	2	1	2	1	2	1	3	V
<i>Commicarpus helenae</i>	3	2	2	3	2	2	.	2	V
<i>Ziziphus mauritiana</i>	.	2	1	1	.	2	+	.	IV
<i>Rhynchosia minima</i>	.	2	.	.	1	+	1	+	IV
<i>Merremia aegyptia</i>	.	.	2	+	.	1	.	1	III
<i>Blainvillea gayana</i>	2	1	.	.	.	.	.	.	II
<i>Pennisetum polystachyon</i>	.	.	.	.	.	1	.	.	I
<i>Acacia caboverdeana</i> ●	.	.	.	.	.	.	.	1	I
Companion species									
<i>Prosopis juliflora</i>	1	2	+	.	.	.	1	.	III
<i>Sesbania grandiflora</i>	.	1	.	2	+	+	.	.	III
<i>Setaria verticillata</i>	.	1	1	2	2	.	.	.	III
<i>Desmanthus virgatus</i>	.	.	1	.	.	1	2	.	II
<i>Parkinsonia aculeata</i>	.	.	.	+	+	+	.	.	II
<i>Cynodon dactylon</i>	.	.	2	.	.	.	.	2	II

Other companion species: *Trianthema portulacastrum* 2, *Peristrophe paniculata* 2, *Commelina benghalensis* 2, *Corchorus tridens* + and *Sida alba* 1 in 1; *Aloe vera* 1, *Senna bicapsularis* 2 and *Calotropis procera* 1 in 2; *Sesbania leptocarpa* + in 6; *Jatropha curcas* 2 in 7.

Localities: 1, 2 y 3. *Santiago*: Ribeira Formosa; 4. *Santiago*: Praia de Ribeira Formosa, (*holotypus* ass. 2005:107). 5 y 6. *Santiago*: Praia Baixo; 7. *Maio*: Pedro Vaz, Herdade do Ulisses; 8. *Boavista*: Fundo Figueiras; 9. Synthesized table.

Table 44

1.5.1. *Cocculo penduli-Tamaricetum senegalensis* ass. nova hoc loco
(*Tamaricion senegalensis*, *Dichrostachyo-Acacieta lia caboverdeanae*
Cocculo-Sarcostemmetea daltonii)

Area m ²	60	60	40	50	60	56
Number of species	9	6	6	5	5	6
Ordinal number	1	2*	3	4	5	6
Characteristic species						
<i>Tamarix senegalensis</i>	5	5	5	5	5	V
<i>Cocculus pendulus</i>	4	3	2	2	3	V
<i>Commicarpus helenae</i>	3	2	1	.	.	III
<i>Merremia aegyptia</i>	2	1	.	.	.	II
<i>Fagonia mayana</i> ●	2	.	2	.	.	II
<i>Rhynchosia minima</i>	1	.	.	.	.	I
<i>Indigofera suffruticosa</i>	1	.	.	.	.	I
Companion species						
<i>Suaeda caboverdeana</i> ●	3	.	2	1	1	III
<i>Brachiaria caboverdeana</i> ●	2	1	2	.	.	II
<i>Parkinsonia aculeata</i>	1	.	.	.	.	I
<i>Tetraena waterlotii</i>	1	.	.	.	+	I

Other companion species: *Momordica charantia* 2 in 1; *Cucumis anguria* 2 in 1; *Sesbania leptocarpa* 1 in 1; *Caylusea hexagyna* + in 3 *Acrachne racemosa* 2 in 3; *Melinis grandiflora* 1 in 4.

Localities: 1. *Santiago*: Belém; 2. *Boavista*: João Galego (*holotypus* reg. 2005:148); 3. *Boavista*: Fundo Figueiras; 4, 5. *Sal*: Santa Maria; 6. Synthesized table

1.4.1. *Cocculo penduli-Phoenicetum atlanticae* associatio nova hoc loco

Cabo Verde palm microforest savanna association, on riparian streams, near the coast, with temporary variable depth hydromorphy, on allochthonous arenic or regosolic fluvisols favoured by bars or coastal dune deposits limited to exorheic runoff into sea. Can be found in the eastern and southern islands of Cabo Verde, and is well characterized by the remarkable endangered endemism *Phoenix atlantica*, up 10 m high, with *Cocculus pendulus*, *Commicarpus helenae*, *Ziziphus mauritiana*, *Rhynchosia minima*, etc. (*holotypus* relevé n°4, table 43), occurs in infra-thermotropical hyperarid to arid bioclimate. [SL, BO, M, SN, BR]. [●]

1.5. *Tamaricion senegalensis* alliancia nova hoc loco

Nano-microphanerophytic thickets of tamarisk (*Tamarix senegalensis*), growing on temporary riparian streams and short ramblas, generally with scarce intermittent flow, in infra-thermotropical hyperarid to semiarid bioclimate; developed on allochthonous, arenic or fractopetric soils, with near deep temporal hydromorphism; occurs in all the islands of Cabo Verde, except in Fogo. In Sahara, Mauritania and Senegal are also commons the riparian thicket savannas with *Tamarix aphylla*, *T. amplexicaulis*, *T. passerinoides* and *T. getula*. Provisionally, on include the new alliance *Tamaricion senegalensis* in the ordo *Dichrostachyo platycarpae-Acacieta lia caboverdeanae*, until the Saharian and Sahelian riparian thickets of *Tamarix* where phytosociologically better

known and described [A, V, N, SL, BO, SN, BR].

Typus: 1.5.1. *Cocculo penduli-Tamaricetum senegalensis* ass. nova hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Tamarix senegalensis*.

1.5.1. *Cocculo penduli-Tamaricetum senegalensis* associatio nova hoc loco

Nano-microphanerophytic tamarisk savanna thickets of *Tamarix senegalensis* in Cabo Verde Islands, growing on temporary watercourses and torrents, with generally scarce intermittent flow, developed on allochthonous, arenic or fractopetric soils, with near permanent deep temporal hydromorphism. It occurs in all islands of Cabo Verde, except in Fogo, in infra to thermotropical hyperarid to semiarid bioclimate. *Holotypus* rel. 2 table 44 [A, V, N, SL, BO, SN, BR]. ●

2. HETEROPOGONETEA CONTORTI classis nova hoc loco

Afrotropical xeromorphic short to medium grass savanna communities with scarce shrubs and trees, structured by short to medium perennial grasses. This kind of grass vegetation with scattered short trees, occur in West Tropical Africa, in desertic and xeric infra to lower-mesotropical and from hyperarid to dry bioclimates. [A, V, N, SL, BO, M, SN, F, BR]

Typus: 2a. *Melinio grandiflorae-Heteropogonetalia contorti* ordo novus hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Bothriochloa bladhii*, *Bothriochloa insculpta*, *Brachiaria deflexa*, *Brachiaria ramosa*, *Chloris pilosa*, *Chloris virgata*, *Dichanthium annulatum*, *Dichanthium foveolatum*, *Digitaria nodosa*, *Enteropogon prieurii*, *Enteropogon rupestris*,

Heteropogon contortus, *Melinis grandiflora*, *Pennisetum pedicellatum*, *Rottboellia cochinchinensis*, *Schmidtia pappophoroides*, *Schoenefeldia gracilis*, *Stipagrostis uniplumis*, *Tephrosia bracteolata*, *Tephrosia uniflora*, *Tripogon multiflorus*.

Aba.1. Cabo Verde xeromorphic perennial short grassland savanna division (syntax. equiv.: 2a)

2a. MELINIO GRANDIFLORAE-HETEROPOGONETALIA
CONTORTI ordo novus hoc loco

Tropical desertic and xeric infra to lower mesotropical, from hyperarid to dry; afrotropical xeromorphic perennial grassland savanna communities with scarce trees.

On recognize two alliales in Cabo Verde Islands: 2.1 *Heteropogonion melanocarpo-contorti* (thermo-mesotropical arid to dry) and 2.2 *Eneapogonion desvauxii* (infra-thermotropical hyperarid to low arid)

Table 45

2.1.1. *Dichanthio foveolati-Heteropogonetum contorti* ass. nova hoc loco
(*Heteropogonion melanocarpo-contorti*, *Melinio-Heteropogonetalia*,
Heteropogonetea contorti)

Altitude (1=10 m)	110	130	138	134	61	145	120
Area m ²	50	100	40	40	100	100	
Number of species	7	8	8	11	9	9	9
Ordinal number	1	2	3	4*	5	6	7
Characteristic species							
<i>Heteropogon contortus</i>	3	2	4	3	3	4	V
<i>Dichanthium foveolatum</i>	2	+	2	1	2	.	IV
<i>Hyparrhenia caboverdeana</i> ●	.	2	3	3	2	1	IV
<i>Melinis grandiflora</i>	.	2	1	1	+	2	IV
<i>Andropogon tridentatus</i>	.	2	.	.	2	.	II
Companion species							
<i>Cynodon dactylon</i>	2	+	.	1	+	1	IV
<i>Diplotaxis antoniensis</i> ●	+	.	+	1	+	.	III
<i>Tagetes minuta</i>	.	+	+	+	.	.	III
<i>Lotus latifolius</i> ●	.	.	2	1	1	.	III
<i>Conyza feae</i> ●	+	.	.	.	.	+	II
<i>Helianthemum gorgoneum</i> ●	.	.	2	1	.	.	II
<i>Artemisia gorgonum</i> ●	.	.	.	+	.	+	II

Other companion species: *Echium lindbergii* ● + in 1; *Melhania ovata* + in 2; *Crotalaria retusa* 1 in 5; *Melanoselinum bischoffii* ● + in 5.

Localities: 1. *Santo Antão*: Corda; 2. *Santo Antão*: near Espongeiro; 3. *Santo Antão*: Espongeiro; 4. *Santo Antão*: Chã Companhia (*holotypus* reg. 2005: 43); 5. *Santo Antão*: Rachada; 6. *Santo Antão*: Pedra Rachada. 7. Synthesized table.

Table 46

2.1.2. *Heteropogonetum melanocarpi* ass. nova hoc loco
(*Heteropogonion melanocarpo-contorti*, *Melinio-Heteropogonetalia*,
Heteropogonetea contorti)

Altitude (1=10 m)	89	106	35	32	116	76
Area m ²	60	40	60	100	40	
Number of species	12	10	10	11	9	10
Ordinal number	1	2	3	4*	5	6
Characteristic species						
<i>Heteropogon melanocarpus</i>	2	2	3	2	5	V
<i>Melinis grandiflora</i>	2	2	1	2	1	V
<i>Andropogon tridentatus</i>	3	3	3	3	.	IV
<i>Pennisetum polystachyon</i>	1	.	1	2	+	IV
<i>Andropogon fastigiatus</i>	1	+	+	.	.	III
<i>Hyparrhenia caboverdeana</i> ●	.	+	.	1	2	III
<i>Rottboellia cochinchinensis</i>	.	.	+	2	.	II
<i>Tephrosia bracteolata</i>	.	.	2	.	1	II
Companion species						
<i>Lotus jacobaeus</i> ●	1	+	.	.	+	III
<i>Zinnia pauciflora</i>	+	1	.	.	+	III
<i>Aristida adscensionis</i>	+	.	1	1	.	III
<i>Cenchrus ciliaris</i>	.	.	1	1	.	III

Other characteristic species: *Bothriochloa bradhii* 1 in 1; *Chloris pycnothrix* 2 in 2; *Tephrosia uniflora* 2 in 4; *Pennisetum pedicellatum* + in 5. Other companion species: *Blainvillea gayana* 1 in 2; *Desmodium ospriostreblum* 1 in 4; *Daucus annuus* ● + in 1; *Forsskaolea procrudifolia* ● + in 4; *Stylosanthes fruticosa* + in 5.

Localities: 1. *Santiago*: Monte Tchota; 2. *Santiago*: near summit Monte Tchota; 3. *Fogo*: Santo António; 4. *Fogo*: Santo António (*holotypus* reg. 2004: 24); 5. *Fogo*: Chã das Furnas; 6. Synthesized table.

Typus: 2.1. *Heteropogonion melanocarpo-contorti* *alliancia nova hoc loco*

Characteristic species and bioindicators growing in Cabo Verde Islands: See classis.

Aba.1a. Cabo Verde xeromorphic thermo-mesotropical from upper arid to dry, short perennial grassland savanna macrogroup (syntax. equiv.:2.1)

2.1. **Heteropogonion melanocarpo-contorti** *alliancia nova hoc loco*

Desertic and xeric xeromorphic perennial short and medium grassland savanna communities, with scarce trees, growing from thermo- to low mesotropical and from upper arid to dry bioclimates in Cabo Verde Islands. [A, V, N, SN, F, BR]

Typus: 2.1.1. *Dichanthio foveolati-Heteropogonetum contorti* *ass. nova hoc loco*

Characteristic species and bioindicators growing in Cabo Verde Islands: *Andropogon fastigiatus*, *Andropogon gayanus* var. *tridentatus*, *Brachiaria xantholeuca*, *Chloris pycnothrix*, *Heteropogon melanocarpus*, *Hyparrhenia caboverdeana* ●. [A, V, N, SN, F, BR] [●]

2.1.1. ***Dichanthio foveolati-Heteropogonetum contorti*** *associatio nova hoc loco*

Xeromorphic perennial grassland savanna, growing on leptic andosols, in upper thermotropical to lower mesotropical and from lower semiarid to dry bioclimates, structured and characterized by *Heteropogon contortus*, *Dichanthium foveolatum*, *Hyparrhenia caboverdeana*, *Melinis grandiflora*, *Andropogon tridentatus*, etc., occurring in Santo Antão Island (*holotypus* relevé 4, table 45). [A] [●]

2.1.2. ***Heteropogonetum melanocarpi*** *associatio nova hoc loco*

Xeromorphic perennial short grassland savanna, occurring in thermo to lower mesotropical semiarid to dry bioclimates, in Santiago and Fogo Islands, growing on leptic andosols and characterized by *Heteropogon melanocarpus*, *Melinis grandiflora*, *Andropogon tridentatus*, *Pennisetum polystachyon*, *Andropogon fastigiatus*, *Hyparrhenia caboverdeana*, *Rottboellia cochinchinensis*, etc. (*holotypus* relevé 4, table 46). [SN, F] ●

2.2. ***Eneapogonion desvauxii*** *alliancia nova hoc loco*

Tropical desertic infra- to low thermotropical hyperarid to arid, short open grassland savanna growing on sandy regosols and lithosols in most of Cabo Verde Islands and Mauritanian Sahara. [A, V, SL, SN, BO, M]

Typus: 2.2.1. *Bothriochloo bladonii-Enneapogonetum desvauxii* *associatio nova hoc loco*

Characteristic species and bioindicators growing in Cabo Verde Islands: *Andropogon gayanus*, *Andropogon gayanus*, *Bothriochloa bladonii*, *Eneapogon desvauxii*, *Tetrapogon conchriiformis*.

2.2.1. ***Bothriochloo bladonii-Enneapogonetum desvauxii*** *associatio nova hoc loco*

Xeromorphic perennial short grassland savanna, occurring in infra-thermotropical hyperarid to arid bioclimate, growing on sandy lithosols in most of low lands of Cabo Verde Islands. It is characterized by *Enneapogon desvauxii*, *Pennisetum polystachyon*, *Bothriochloa bladonii*, *Tetrapogon cenchriformis*, *Andropogon gayanus*, etc. (*holotypus* relevé 2, table 47). [A, V, SL, BO, M, SN].

Table 47

2.2.1. ***Bothriochloo bladonii-Enneapogonetum desvauxii***
(*Eneapogonion desvauxii* *Melinio-Heteropogonetalia, Heteropogonetea contorti*)

Altitude m	10	20	25	30
Area m ²	100	20	20	20
N° of species	12	6	6	7
Ordinal number	1	2*	3	4
Characteristic species				
<i>Enneapogon desvauxii</i>	2	3	3	3
<i>Pennisetum polystachyon</i>	2	1	2	1
<i>Bothriochloa bladonii</i>	.	2	1	1
<i>Tetrapogon cenchriformis</i>	.	1	2	.
Companion species				
<i>Tetraena waterlotii</i>	.	2	1	2
<i>Suaeda caboverdeana</i> ●	.	1	1	.
<i>Fagonia isotricha</i>	+	.	.	1

Other companion species: *Cyperus conglomeratus* 2 in 1; *Aerva javanica*, *Lotus brunneri* ● and *Commicarpus helenae* 1 in 1, *Cynodon dactylon*, *Abutilon pannosum*, *Melhania ovata* and *Rhynchosia minima* + in 1, *Ophioglossum polyphyllum* and *Sehima ischaemoides* + in 4.

Localities: 1 Boavista: Varandinha; 2 Sal: near Airport (*holotypus* *ass. reg.* 2004: 175); 3, 4, Sal: South of Airport.

Table 48
3.1.1. *Aristido cardosoi-Tetraenetum simplicis* ass. nova hoc loco

(*Aristido cardosoi-Tetraenion simplicis*, *Aristido-Tetraenetalia simplicis*, *Tetraenetea simplicis*)

Altitude (m)	1	145	153	102	145	122	163	169	193	23	122
Orientation	-	-	-	-	-	-	N	SW	-	NE	.
Area m ²	4	4	4	4	10	4	4	4	4	4	4
Nº of species	5	4	6	6	4	6	7	5	7	9	6
Ordinal number	1	2	3	4	5	6	7	8	9	10*	11
Characteristic species											
<i>Tetraena simplex</i>	3	5	3	5	3	3	2	3	2	4	V
<i>Brachiaria caboverdeana</i> ●	.	.	2	1	.	+	.	.	.	1	III
<i>Cleome viscosa</i>	.	.	.	.	1	2	.	.	+	+	III
<i>Aristida cardosoi</i>	.	.	.	.	.	.	+	2	1	2	III
<i>Heliotropium pterocarpum</i>	.	1	.	+	.	+	.	.	.	.	II
<i>Dactyloctenium aegyptium</i>	.	.	.	.	1	.	.	2	.	2	II
<i>Chloris virgata</i>	.	.	.	.	.	.	+	2	.	.	II
<i>Mollugo nudicaulis</i>	+	.	.	.	.	.	.	.	1	.	II
<i>Heliotropium crispum</i>	2	.	.	.	.	.	.	.	.	+	II
<i>Cleome brachycarpa</i>	.	2	.	.	.	.	.	.	1	.	II
<i>Fagonia isotricha</i>	.	.	1	+	.	.	.	.	.	.	II
<i>Andrachne telephioides</i>	.	.	+	.	.	1	.	.	.	.	II
<i>Corchorus depressus</i>	.	.	.	.	.	.	1	.	+	.	II
Companion species											
<i>Frankenia pseudoericifolia</i> ●	1	.	.	.	+	.	.	.	.	.	II
<i>Indigastrum parviflorum</i>	.	.	.	.	.	.	1	1	.	.	II
<i>Corchorus tridens</i>	.	.	.	3	.	.	2	.	.	.	II
<i>Sclerocephalus arabicus</i>	.	.	.	.	.	2	.	.	.	.	I
<i>Crotalaria senegalensis</i>	.	.	.	.	.	.	1	.	.	.	I
<i>Indigofera senegalensis</i>	.	.	.	.	.	.	.	.	+	.	I
<i>Digitaria nodosa</i>	.	.	.	.	.	.	.	.	.	+	I
<i>Abutilon pannosum</i>	.	.	1	.	.	.	.	.	.	.	I

Other companion species: *Bulbostylis barbata* 2 in 3, *Launaea intybaceae* 2 in 10, *Sida cordifolia* 1 in 2, *Sida salviifolia* 1 in 10, *Chenopodium murale* + in 1, *Phyllanthus rotundifolius* + in 1, *Fagonia cretica* + in 4, *Portulaca oleracea* + in 9

Localities: 1. *Sal*: Palmeira; 2. *Boavista*: Ribeira do Norte, Campo Serra; 3. *Boavista*: João Galegos to Fundo Figueiras; 4. *Santiago*: Praia Formosa, Praia Baixo; 5. *São Nicolau*: Ponta da Coruja; 6. *São Vicente*: Salamasa; 7. *Sal*: Farol do Fiura; 8. *Sal*: Monte Leste; 9. *Boavista*: Pico Santo António; 10. *Fogo*: São Filipe beach (*holotypus* ass reg. 2006: 50). 11. Synthesized table.

Table 49
3.1.2. *Asphodelo mariolousae-Aristidetum cardosoi* ass. nova hoc loco
(*Aristido cardosoi-Tetraenion simplicis*, *Aristido-Tetraenetalia simplicis*, *Tetraenetea simplicis*)

Altitude (1=10 m)	173	174	180
Orientation	N	N	N
Area m ²	6	4	4
Number of species	9	8	6
Ordinal number	1	2*	3
Characteristic species			
<i>Aristida cardosoi</i> ●	3	3	3
<i>Asphodelus mariolousae</i> ●	2	3	3
Companion species			
<i>Trichodesma africanum</i>	+	1	.
<i>Themeda triandra</i>	.	3	.
<i>Tagetes minuta</i>	.	1	.
<i>Diploaxis antoniensis</i> ●	+	1	.
<i>Misopates orontium</i>	+	+	.
<i>Melinis repens</i>	+	.	+
<i>Hyparrhenia caboverdeana</i>	+	.	+

Other companion species: *Galium parisiense* 1 in 3; *Campylanthus glaber* ● + in 1; *Lobularia fruticosa* ● + in 1; *Ajuga iva* + in 2; *Brachypodium distachyon* + in 3

Localities: 1. Santo Antão: Moroços, 2. Santo Antão: Moroços (*holotypus* reg. 2005: 47), 3. Fogo: Montinho

3. TETRAENETEA SIMPLICIS classis nova hoc loco

Xeromorphic ephemeral short annual grassland savanna communities, occurring in tropical desertic and tropical xeric infra-thermotropical hyperarid to semi-arid (mostly arid) bioclimates, often but scarcely dis-

tributed in Tropical Sahara and Sahel biogeographic regions. [A, V, N, SL, BO, M, SN, F, BR, MAU, SAHEL].

Typus: 3a. *Aristido funiculatae-Tetraenetalia simplicis* ordo novus hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Aristida funiculata*, *Arthraxon lancifolius*, *Boerhavia coccinea*, *Boerhavia diffusa*, *Corchorus tridens*, *Corchorus trilocularis*, *Cleome brachycarpa*, *Cleome scaposa*, *Cleome viscosa*, *Digitaria eriantha*, *Digitaria horizontalis*, *Digitaria nuda*, *Eragrostis ciliaris*, *Leptochloa panicea*, *Melinis minutiflora*, *Melinis repens*, *Mollugo nudicaulis*, *Oldenlandia herbacea*, *Panicum laetum*, *Panicum tenellum*, *Polygala erioptera*, *Sclerocephalus arabicus*, *Sehima ischaemoides*, *Setaria barbata*, *Sporobolus minutus*, *Tripogon minimus*, *Tetraena simplex*.

3a. ARISTIDO FUNICULATAE-TETRAENETALIA SIMPLICIS ordo novus hoc loco

Xeromorphic ephemeral short annual grassland savanna communities, occurring in tropical desertic and xeric infra-mesotropical hyperarid to dry bioclimates, Sahara and Sahel Regions. [A, V, N, SL, BO, M, SN, F, BR]. *Typus*: 3.1 *Aristido cardosoi-Tetraenion simplicis* alliancia nova hoc loco

Aca.1. Cabo Verde xeromorphic infra-thermotropical hyperarid to semiarid ephemeral annual savanna divisio (syntax. equiv. 3.1)

3.1. **Aristido cardosoi-Tetraenion simplicis** alliancia nova hoc loco

Xeromorphic ephemeral annual grassland savanna communities, growing in tropical desertic and xeric, infra-mesotropical mostly aridic, occurring in all Cabo Verde Islands. [A, V, N, SL, BO, M, SN, F, BR]. [●]

Typus: *Campylantho spathulati-Sarcostemma daltonii* ass. nova hoc loco (1.1.1.)

Characteristic species and bioindicators growing in Cabo Verde Islands: *Asparagus squarrosus* ●, *Campylanthus spathulatus* ●, *Diploaxis glauca* ●, *Diploaxis vogelii* ●, *Echium stenosphon* ●, *Fagonia mayana* ●, *Launaea gorgadensis* ●, *Limonium jovi-barba* ●.

Climactical and edaphoxerophilous desertic shrub savanna community, occurring in infra-thermotropical, upper ultrahyperarid, strong euhyperoceanic bioclimate, on leptic regosols and arenosols. Endemic association of East Cabo Verde Sector; in which thrive *Sarcostemma daltonii*, *Cocculus pendulus*, *Euphorbia tuckeyana* and *Asparagus squarrosus* (*holotypus* relevé n° 2, table 48). It occurs in Boavista, Maio and Santiago islands. [SN, BO, M]. [●]

Typus: 3.1.1. *Aristido cardosoi-Tetraenion simplicis* ass. nova hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Aristida cardosoi* ●, *Asphodelus mariolousae* ●, *Brachiaria caboverdeana* ●, *Eragrostis conertii* ●.

3.1.1. **Aristido cardosoi-Tetraenion simplicis** associatio nova hoc loco

Xeromorphic ephemeral annual capverdian grassland association, occurring in all islands on desertic infra-thermotropical aridic bioclimate, characterized by *Tetrae-*

na simplex, *Brachiaria caboverdeana*, *Cleome viscosa*, *Aristida funiculata*, etc. (*holotypus* reléve 10, table 48). It can be found scarcely distributed after rain periods in all islands of Cabo Verde. [A, V, N, SL, BO, M, SN, F, BR]. [●]

3.1.2. **Asphodelo mariolousae-Aristidetum cardosoi** associatio nova hoc loco

Annual ephemeral grassland savanna association, characterized by the endemic species *Aristida cardosoi* and *Asphodelus mariolousae*, growing in high mountains of Santo Antão and Fogo Islands. It occurs on lapilli tephra and sandy soils, in tropical xeric mesotropical semiarid to dry bioclimate. (*Holotypus* reléve 2, table 49). [A, F]. [●].

3.1.3. **Sehimatetum ischaemoidis** associatio nova hoc loco

Desertic infra-thermotropical hyperarid ephemeral annual open grassland savanna association, growing on small sandy deposits during the short rainy season, in Sal Island, is frequent but are distributed in near all capverdeian islands, is characterized by the small plant *Sehima ischaemoides* accompanied by *Cleome brachycarpa*, *Heliotropium crispum*, *Lotus brunneri* ●, *Frankenia pseudoericifolia* ●, *Senna bicapsularis*, etc.. (*holotypus* reléve 3, table 50). [A, N, SL, BO, M, SN]. [●].

4. FRANKENIO PSEUDOERICIFOLIAE-SUAEDETEA CABOVERDEANAE classis nova hoc loco

Pioneer and permanent coastal high endemic chamaephyte succulent, suffruticose, prostrate and occasionally predominant rhizomatous perennial grasses savanna communities, growing in infra-thermotropical low arid to ultrahyperarid desertic coastal mobile aerohaline sand dune habitats of Eastern Cabo Verde biogeographic province. In Mauritanian and South Rio de Oro sandy coast exist a geovicarian community (*Traganion nudati* Rivas-Martínez, V. E. Martín & Wildpret *inéd.*). [V, SL, BO, M]. [●].

Typus nominis: 4a. *Frankenio pseudoericifoliae-Suaedetalia caboverdeanae* ordo novus hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Cistanche brunneri* ●, *Frankenia pseudoericifolia* ●, *Limonium brunneri* ●, *Lotus brunneri* ●, *Lotus chevalieri* ●, *Polycarpaea caboverdeana* ●, *Pulicaria diffusa* ●, *Pulicaria longifolia* ●, *Suaeda caboverdeana* ●, *Tetraena waterlotii*, *Tetraena vicentina* ●.

4a. **FRANKENIO PSEUDOERICIFOLIAE-SUAEDETALIA CABOVERDIANA** ordo novus hoc loco

Permanent succulent microphyllous chamaephyte and perennial grasses, infra-thermotropical ultrahyperarid-arid coastal sand dune communities of desertic Cabo Verde. [V, SL, BO, M]. [●].

Typus nominis: 4.1. *Polycarpaea caboverdeanae-Tetraenion waterlotii* alliancia nova hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: see classis 4.

Table 50

3.1.3. *Sehimatetum ischaemoidis* ass. nova hoc loco

Aristido cardosoi-Tetraenion simplicis, *Aristido-Tetraenetalia simplicis*, *Tetraenetea simplicis*)

Altitude (m)	10	45	30	30	20	27
Orientation				N	SE	
Area m ²	4	4	20	100	20	<u>12</u>
N° of species	3	3	7	11	7	<u>6</u>
Order number	1	2	3*	4	5	6
Characteristic species						
<i>Sehima ischaemoides</i>	3	3	3	3	2	V
<i>Cleome brachycarpa</i>	.	.	2	+	2	III
<i>Heliotropium crispum</i>	.	.	2	1	+	III
<i>Calotropis procera</i>	.	.	.	+	(+)	II
<i>Corchorus depressus</i>	.	2	.	.	.	I
Companion species						
<i>Lotus brunneri</i> ●	1	1	2	3	(+)	V
<i>Senna bicapsularis</i>	1	1	1	+	.	IV
<i>Aerva javanica</i>	.	.	+	+	.	II
<i>Citrullus colocynthis</i>	.	.	1	+	.	II
Other companion species: <i>Forsskaolea procrififolia</i> ● 3 in 5, <i>Lavandula coronopifolia</i> 2 in 4; <i>Frankenia pseudoericifolia</i> ● 1 in 5, <i>Pulicaria diffusa</i> ● + in 4						
Localities: 1. <i>Sal</i> : Bottom of Monte Grande; 2. <i>Sal</i> : from Farol Fiura to Monte Leste; 3. <i>Sal</i> : Monte Leste (<i>holotypus</i> ass. reg 2004: 174); 4. <i>Sal</i> : Calheta de Palmeira; 5. <i>Sal</i> : Monte Leão; 6. Synthesized table						

Table 51

4.1.1. *Polycarpaeo caboverdeanae-Tetraenetum waterlotii* ass. nova hoc loco

(*Polycarpaeo-Tetraenion*, *Frankenio-Suaedetalia caboverdeanae*, *Frankenio-Suaedetea caboverdeanae*)

Area m ²	8	4	2	6	4	4	8	4	2	4	4	8	8	4	4	8	6	8	
N° of species	7	3	3	2	3	3	6	2	3	2	3	5	3	3	3	4	6	3	5
Ordinal number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16*	17	18	19
Characteristic species																			
<i>Tetraena waterlotii</i>	3	2	1	3	4	2	3	3	4	4	4	2	3	3	3	4	3	2	V
<i>Suaeda caboverdeana</i>	.	4	4	3	3	3	2	3	1	2	1	2	2	.	.	.	.	.	IV
<i>Polycarpaea caboverdeana</i> ●	.	.	.	.	.	.	.	.	.	.	1	3	2	2	3	2	2	3	III
<i>Frankenia pseudoericifolia</i> ●	.	.	1	.	1	.	.	.	+	.	.	1	.	1	.	1	1	.	II
<i>Cistanche brunneri</i> ●	2	+	.	.	.	+	1	.	.	.	.	.	.	.	.	1	.	1	II
<i>Sporobolus spicatus</i>	1	.	.	.	.	.	2	.	.	.	.	.	.	.	2	.	.	.	I
<i>Lotus chevalieri</i> ●	3	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	I
<i>Pulicaria diffusa</i>	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	+
Companion species																			
<i>Heliotropium pterocarpum</i>	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	I
<i>Sesuvium sesuvioides</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	+

Localities: 1. *Boavista*: Sal Rei, Praia do Cabral; 2. *Boavista*: Sal Rei, Praia do Estoril; 3. 4. *Boavista*: Praia da Varandinha; 5. *Boavista*: Praia de St^a Mónica; 6. *Boavista*: Ponta do Porto Ferreira; 7. *Boavista*: Praia de Viana; 8. *Sal*: Murdeira; 9. *Maio*: Dunas do Montinho; 10. *Maio*: Banco da Antónia; 11. 12. 14. *Boavista*: Espongeira; 13. 17. *Sal*: SW Praia de Santa Maria; 15. *Sal*: Santa Maria, near Hotel Riu; 16. *Sal*: Santa Maria, Praia Oriental near “Mistério Grill” (*holotypus* ass. reg. 2004: 206); 18. *Sal*: Santa Maria, Igrejinha; 19. Synthesized table

4.1. **Polycarpaeo caboverdeanae-Tetraenion waterlotii** alliancia nova hoc loco

Perennial and permanent succulent microphyllous dwarf-shrub, suffruticose and rhizomatous grass, infra-thermotropical ultrahyper-arid-arid, coastal desertic mobile sand dune of south-eastern Cabo Verde communities. A geovicariant alliance *Traganion nudati* is developed in Mauritania and South Rio de Oro coastal desertic sand dunes [West Tropical Sahara biogeographic province], no far of the

tropical sandy desertic oued micro-open savanna: *Panico turgidi-Acacion raddiana*. In the mediterranean hyperoceanic south atlantic Morocco coast and central-east Canarian provinces exist an ecogeovicarian alliance: *Traganion moquini* (*Polycarpaeo niveae-Traganetea moquini*). [V, SL, BO, M]. [●]. *Typus nominis*: 4.1.1. *Polycarpaeo caboverdeanae-Tetraenetum waterlotii* associatio nova hoc loco
Characteristic species and bioindicators growing in Cabo Verde Islands: see classis 4.

Table 52

4.1.2. *Tetraenetum vicentinae* ass. nova hoc loco

(Polycarpaeo-Tetraenion waterlotii, Frankenio-Suaedetalia caboverdeanae, Frankenio-Suaedetea caboverdeanae)

Area m ²	6	8	8	10	6	8	8	4	10	10	8	8	8	8
N° of species	3	3	4	7	3	4	4	3	8	7	4	5	4	5
Ordinal number	1	2	3	4	5*	6	7	8	9	10	11	12	13	14
Characteristic species														
<i>Tetraena vicentina</i> ●	3	2	2	3	4	3	2	3	3	2	3	4	2	V
<i>Frankenia pseudoericifolia</i> ●	1	2	2	2	2	2	2	1	2	4	.	2	1	V
<i>Polycarpaea caboverdeana</i> ●	3	.	.	2	2	2	3	.	2	1	4	1	3	III
<i>Cistanche brunneri</i> ●	.	.	+	.	.	.	.	.	+	.	1	1	1	II
<i>Suaeda caboverdeana</i> ●	.	3	3	+	.	.	.	.	.	.	.	.	.	II
<i>Limonium braunii</i> ●	.	1	.	.	.	.	.	.	.	.	.	.	.	+
Companion species														
<i>Heliotropium pterocarpum</i>	.	.	.	+	.	.	.	.	+	+	1	+	.	II
<i>Lotus bollei</i> ●	.	.	.	+	.	2	.	.	+	+	.	.	.	II
<i>Aizoon canariense</i>	.	.	.	+	.	.	+	.	.	+	.	.	.	II
<i>Patellifolia patellaris</i>	.	.	.	.	.	.	.	1	+	.	.	.	.	I
<i>Tetraena simplex</i>	.	.	.	.	.	.	.	.	.	1	.	.	.	+
<i>Andrachne telephioides</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	+

Localities: 1, 7, 8, 9, 10. São Vicente: Baía Norte; 2, 3, 4, 6. São Vicente: Vila Miséria; 5. São Vicente: Vila Miséria (*holotypus* ass. reg. 2004: 114); 11, 12, 13. São Vicente: Praia Grande. 14. Synthesized table.

4.1.1. *Polycarpaeo caboverdeanae-Tetraenetum waterlotii* associatio nova hoc loco

Typical association of the Cabo Verde endemic alliance *Polycarpaeo caboverdeanae-Tetraenion waterlotii*. Perennial permanent dwarf-shrub microphyllous succulent thermo-infratropical ultrahyperarid to low arid association growing on coastal sand dunes of Sal, Boavista and Maio Islands. *Polycarpaeo caboverdeanae-Tetraenetum waterlotii* is known from Sal, Boavista and Maio Islands. [SL, BO, M] [●]. *Type relevé (holotypus)*: table 51, relevé n.16. Rivas-Martínez, reg. 2004: 206, 21.11.2004, made with Lousã, J.C. Costa & Maria C. Duarte. *Site*: Cabo Verde: Ilha Sal, Santa Maria, Praia Oriental, near "Mistério Grill". 16° 38' N, 22° 50' W. 10 m, SE, 8 m². *Physiognomy and habitat*: Sand dune open xeromorphic succulent microphyllous dwarf-shrub savannoid desert. *Estimated bioclimatic factors*: Tropical hyperdesertic to desertic, euhyperoceanic (Ic = 5.3), from upper infratropical to lower thermotropical (It = 670), lower hyperarid (Io = 0.3). *Biogeographic location*: Tropical Saharian Region, Cabo Verde Province, East Cabo Verde Sector, Sal Island District. Floristic combination: *Frankenio-Suaedetea* characteristic species: 4 *Tetraena waterlotii*, 2 *Polycarpaea caboverdeana* ●, 1 *Cistanche brunneri* ●, 1 *Frankenia pseudoericifolia* ●

4.1.2. *Tetraenetum vicentini* associatio nova hoc loco

Perennial permanent dwarf-shrub microphilous succulent hyperarid association,

growing on northwest coastal sand dunes of São Vicente Island. The local endemic *Tetraena vicentina* is a characteristic species and grows with other capverdian endemics: *Frankenia pseudoericifolia*, *Polycarpaea caboverdeana* and *Cistanche brunneri* ● in lower thermotropical and lower hyperarid bioclimate. [V]. [●].

Type relevé (holotypus): table 52, relevé n.5. Rivas-Martínez, reg. 2004: 114, 17.11.2004, made with Lousã, J.C. Costa & Maria C. Duarte. *Site*: Cabo Verde: Ilha de S. Vicente: Vila Miséria.

4.1.3. *Sporobolo spicati-Cyperetum crassipedis* associatio nova hoc loco

East Cabo Verde permanent sand dune pioneer perennial grassland dwarf savanna associatio (20-40 cm), well differentiated by the presence of two tropical African arid sandy coast savanna graminaceous species: *Cyperus crassipes* and *Sporobolus spicatus*, intermingled with some crassifolius and non-microcrassifolius sandy dwarf-scrubs characteristic species of *Frankenia pseudoericifoliae-Suaedetea caboverdeanae*. *Sporobolo spicati-Cyperetum crassipedis* association is well represented in arid and hyperarid sandy coasts of Sal, Maio and Boavista Isles [SL, BO, M]. [●].

Type relevé (holotypus): table 53, relevé n.11. Rivas-Martínez, reg. 2005: 176, 14.12.2005, made with Lousã, J.C. Costa & Maria C. Duarte. *Site*: Cabo Verde: Boavista Island, Praia das Gatas. 16° 10'

N, 22° 40' W. 10m, E, 8 m². *Physiognomy and habitat*: Sand dune pioneer xeromorphic arid grassland savanna. *Estimated bioclimatic factors*: Tropical Desertic, euhyperoceanic (Ic = 5.2), infratropical (It = 680), lower arid (Io = 0.6). *Biogeographic location*: Tropical Saharian Region, Cabo Verde Province, East Cabo Verde Sector, Boavista Island District. Floristic combination: *Fankenio-Suaedetea* characteristic species: characteristic and territorial species: 3 *Cyperus crassipes*, 3 *Sporobolus spicatus*, 1 *Lotus chevalieri* ●, + *Tetraena waterlotii*, + *Cistanche brunneri*

4.1.4. *Loto brunneri-Pulicarietum diffusae* associatio nova hoc loco

Dwarf-shrub and subshrub pioneer associatio, growing in coasts and foothills of Sal and Boavista Islands, on hard sandy dune soils and basaltic substratum slightly covered by mobile sand, in infra- to thermotropical ultrahyperarid-arid bioclimate. Well characterized by East Cabo Verde endemics like: *Pulicaria diffusa*, *Lotus chevalieri* and *Lotus bollei*, as well as other Cabo Verde and Tropical Saharian hyperoceanic elements (table 54). [SL, BO]. ●

Table 53

4.1.3. *Sporobolus spicati-Cyperetum crassipedis* ass. nova hoc loco

(*Polycarpaeo-Tetraenion waterlotii*, *Frankenio-Suaedetalia*, *Frankenio-Suaedetea caboverdeanae*)

Area m ²	8	8	8	4	4	6	8	6	6	4	4	8	6
Nº of species	5	5	4	3	4	4	5	5	4	3	3	5	4
Ordinal number	1	2	3	4	5	6	7	8	9	10	11*	12	13
Characteristic species													
<i>Sporobolus spicatus</i>	4	3	3	2	3	4	1	1	1	3	3	4	V
<i>Cyperus crassipes</i>	1	.	.	1	1	1	2	3	3	3	3	1	V
<i>Tetraena waterlotii</i>	.	2	2	2	2	1	2	1	3	.	.	.	IV
<i>Lotus chevalieri</i> ●	.	.	.	.	.	.	+	1	+	+	.	.	II
<i>Lotus brunneri</i> ●	2	.	2	.	.	.	.	.	.	.	.	+	II
<i>Cistanche brunneri</i> ●	.	1	.	.	.	.	+	.	.	.	+	.	II
<i>Suaeda caboverdeana</i> ●	.	1	.	.	1	.	.	.	.	.	.	.	II
<i>Polycarpaea caboverdeana</i> ●	.	.	+	.	.	.	.	.	.	.	.	.	I
Companion species													
<i>Heliotropium pterocarpum</i>	2	.	.	.	.	.	.	.	.	.	.	+	II
<i>Cyperus conglomeratus</i>	2	.	.	.	.	2	.	.	.	.	.	1	I

Localities: 1. *Maio*: Banco da Antónia; 2. *Boavista*: Sal Rei, Praia do Cabral; 3. *Sal*: Santa Maria, Ponta Preta; 4. *Boavista*: Sal Rei, Praia do Estoril; 5. *Boavista*: Praia das Gatas; 6,10. *Boavista*: Praia da Varandinha; 7. *Boavista*: Praia de Viana; 8. *Boavista*: Porto Ferreira; 9. *Boavista*: Praia das Gatas; 11. *Boavista*: Praia das Gatas (*holotypus* ass. reg. 2005: 176); 12 *Boavista*: Praia das Gatas. 13. Synthesized table.

Table 54

4.1.4. *Loto brunneri-Pulicarietum diffusae* ass. nova hoc loco

(*Polycarpaeo-Tetraenion waterlotii*, *Suaedetalia caboverdeanae*, *Frankenio-Suaedetea caboverdeanae*)

Area m ²	20	10	20	40	10	20
Nº of species	4	6	7	4	4	5
Ordinal number	1	2*	3	4	5	6
Characteristic species						
<i>Pulicaria diffusa</i> ●	4	3	3	3	3	V
<i>Frankenia pseudoericifolia</i> ●	1	+	+	.	.	III
<i>Suaeda caboverdeana</i> ●	.	.	.	2	1	II
<i>Lotus brunneri</i> ●	1	1	2	+	+	V
<i>Tetraena waterlotii</i>	.	.	.	2	2	II
<i>Lotus chevalieri</i> ●	.	.	.	.	+	I
Companion species						
<i>Senna bicapsularis</i>	+	2	2	.	.	III
<i>Sehima ischaemoides</i>	.	1	+	.	.	II
<i>Kickxia elegans</i> ●	.	.	1	.	.	I
<i>Cynodon dactylon</i>	.	.	.	1	.	I
<i>Calotropis procera</i>	.	+	.	.	.	I

Localities: 1. *Sal*: West foothills of Monte Grande; 2 *Sal*: Coast of Monte Grande (*holotypus* ass. reg.: 2004: 161); 3. *Sal*: Buracona, Base Monte Leste; 4. *Sal*: East of Santa Maria; 5. *Boavista*: Lagoon Porto Ferreira; 6. Synthesized table.

Type relevé (holotypus): table 54, relevé n.1. Rivas-Martínez, reg. 2004: 161, 20.11.2006, made with Lousã, J.C. Costa & Maria C. Duarte. *Site:* Cabo Verde: Sal Island, west foothills of Monte Grande, 16° 48' N, 22° 54' W. 30m, SW, 10 m². *Physiognomy and habitat:* Dwarf-shrub and subshrub open sandy or stony-basaltic desert. *Estimated bioclimatic factors:* Tropical desertic, euhyperoceanic (Ic = 5.7), lower thermotropical (It = 650), upper hyperarid (Io = 0.4). *Biogeographic location:* Tropical Saharan Region, Cabo Verde Province, East Cabo Verde Sector, Sal Island District. *Floristic combination:* *Tetraeno-Suaedetea* characteristic species: 4 *Pulicaria diffusa* ●, 1 *Lotus brunneri* ●, 1 *Frankenia pseudoericifolia* ●, Companion species: + *Senna bicapsularis*.

5. LEMNETE MINORIS Tüxen ex O. Bolós & Masclans 1955
Bryo-cormophyte freshwater free floating pleustophyte communities. Cosmopolite, occasional in Cabo Verde Islands.
Typus: (holotypus, art. 18): *Lemnetalia minoris*
Characteristic species and bioindicators growing in Cabo Verde Islands: *Lemna minor* (Lemnaceae) (doubtful native).
- 5a. LEMNETALIA MINORIS Tüxen ex O. Bolós & Masclans 1955
Single order in Cabo Verde Islands: see classis 1.
Typus: (holotypus, art. 18): *Lemnion minoris*
- 5.1. Lemnion minoris Tüxen ex O. Bolós & Masclans 1955
Small to medium size acropleustophyte cosmopolite communities
Typus: *Lemno gibbae-Azolletum filiculoides* Br.-Bl. 1952
- 5.1.1. Lemna minor community
Occasional, doubtful native. [SN]
6. POTAMETEA Klika in Klika & Novák 1991
Aquatic fresh water macrophyte communities. Rooted hydrophytes: elodeids, batraquids or nymphaeids (*Potametalia pectinati*) and non-rooted nutrient-rich: utricularids or ceratophyllids (*Utricularietalia vulgaris*). Cosmopolite.
Typus: (holotypus, art. 18): *Potametalia pectinati*.
Characteristic species and bioindicators growing in Cabo Verde Islands: *Potamogeton pusillus* (Potamogetonaceae). [A, N, SN, F].
- 6a. POTAMETALIA PECTINATI Koch 1926
Rooted hydrophytes communities.
Typus: (lectotypus, art. 20): *Potamion pectinati*
Single order in Cabo Verde Islands: see classis 6.
- 6.1. Potamion pectinati (Koch 1926) Libbert 1931
Fresh water fluvial and lacustrine elodeids mostly holarctic communities. Single alliance and community in Cabo Verde Islands.
- Typus:* (lectotypus, art. 19): *Zannichellio palustris-Potametum pectinati* Koch 1926
Characteristic species and bioindicators growing in Cabo Verde Islands: see classis 6.
- 6.1.1. Potamogeton pusillus community
Occasional in Cabo Verde Islands. [A, N, SN, F]
7. HALODULO WRIGHTII-THALASSIETEA TESTUDINUM Den Hartog ex Rivas-Martínez, Fernández-González & Loidi 1999
Benthic infralittoral zosterid and elodeid communities on muddy or sandy substrata of calm shallow coasts, lagoons, estuaries and reefs, infra-thermotropical, but attain the subtropical latitude: infra-thermomediterranean and infratempere thermotypes in not cold seas. Tropical and subtropical, occasional in Cabo Verde Islands. [SN].
Typus: (holotypus, art. 18): *Thalassio testudinum-Syringodietalia filiformis*
Characteristic species and bioindicators growing in Cabo Verde Islands: *Cymodocea nodosa* (Cymodoceaceae) (Cabo Verde Islands ?), *Zostera* sp. (Zosteraceae) (Cabo Verde ?). [SN].
- 7a. THALASSIO TESTUDINUM-SYRINGODIETALIA FILIFORMIS Borhidi, Muñiz & Del Risco in Borhidi 1996
Typus: *Syringodio-Thalassion* Borridi, Muñiz in Borridi 1996 (Caribbean; do not attain Cabo Verde Islands)
Single order in Cabo Verde Islands: see classis 7.
- 7.1. Cymodoceion nodosae Den Hartog 1976
Benthic infralittoral zosterid communities growing on calm coast of marine sandy soil. Tropical and subtropical atlantic and Mediterranean (Mauritania and Sahara coasts, Morocco and Canary Islands).
Typus: (lectotypus, art. 20): *Cymodoceetum nodosae* Feldmann 1937
- 7.1.1. Cymodocea nodosa community [SN].
8. RUPPIETEA MARITIMAE J. Tüxen 1960
Coastal and semicontinental temporarily submerged halophytic and brackish pioneer seasonal communities, from thermotropical to supratemperate. Holarctic. Cosmopolite, uncommon in Cabo Verde Islands.
Typus: (holotypus, art. 18): *Ruppialia maritimae*
Characteristic species and bioindicators growing in Cabo Verde Islands: *Ruppia maritima* (Ruppiales).
- 8a. RUPPIETALIA MARITIMAE J. Tüxen 1960 Single order: see classis 8.
Typus: (holotypus, art. 18): *Ruppion maritimae*
- 8.1. Ruppion maritimae Br.Bl. ex Westhoff in Bennema, Sissingh & Westhoff
Coastal and continental, halophytic temporarily submerged, flexible filiform leaf elodeids with spring development pioneer communities.
Typus: (lectotypus, art. 20): *Ruppium maritimae* Hocquette 1924.
- 8.1.1. Ruppia maritima community. [SL, BO].

Table 55

10.1.1. *Arthrocnemum franzii* ass. nova hoc loco
(*Arthrocnemion franzii*, *Arthrocnemetalia franzii*, *Arthrocnemetea franzii*)

Area m ²	10	10	10	10	10	10	20	20	10	20	10	10	12
N° of species	1	1	1	2	2	2	3	2	4	2	2	2	2
Ordinal number	1	2	3	4	5	6	7	8	9	10	11*	12	13
Characteristic species													
<i>Arthrocnemum franzii</i>	5	5	5	5	3	5	5	5	4	4	5	5	V
<i>Cressa salina</i>	.	.	.	3	.	.	.	.	2	.	.	.	I
Companion species													
<i>Suaeda caboverdeana</i> •	.	.	.	.	.	.	.	.	1	1	+	1	II
<i>Sesuvium sesuvioides</i>	.	.	.	.	1	1	+	.	.	.	.	.	II
<i>Tamarix senegalensis</i>	.	.	.	.	.	.	+	1	.	.	.	.	I
<i>Tetraena waterlotii</i>	.	.	.	.	.	.	.	.	+	.	.	.	I

Localities: 1, 4. *Sal*: Murdeira; 2. *Boavista*: Sal Rei, Praia de Cabral; 3. Maio: Banco da Antónia; 5, 6. *Sal*: Salinas de Santa Maria; 7, 8, 9. *Boavista*: Porto Ferreira lagoon; 10 *Boavista*: Baía das Gatas; 11. *Boavista*: Praia da Varandinha (*holotypus* ass. reg. 2005: 206); 12. *Boavista*: Praia das Gatas; 13. Synthesized table.

9. MAGNOCARICI ELATAE-PHRAGMITETEA AUSTRALIS
Klika in Klika & V. Nývák 1941 nom. inv.

Riverine cosmopolite helophytic freshwater marshland communities

Typus: (holotypus, art. 18): *Phragmitetalia australis* Koch 1926

Characteristic species and bioindicators growing in Cabo Verde Islands (probably introduced): *Phragmites australis* (Poaceae), *Rorippa nasturtium-aquaticum* (Brassicaceae), *Typha domingensis* (Typhaceae), *Veronica anagallis-aquatica* (Scrophulariaceae), *Veronica beccabunga* (Scrophulariaceae). [A, V, N, BO, M, SN, F, BR].

9a. PHRAGMITETALIA AUSTRALIS Koch 1926 [BO, M, SN].

Typus: (lectotypus, art. 20): *Phragmiton australis* Koch 1926.

9.1. Phragmiton australis Koch 1926 nom. mut.

Typus: (holotypus, art. 18): *Schoenoplecto lacustris-Phragmitetum australis* Koch 1926 nom. mut.

9.1.1 *Typha domingensis* community. [BO, M, SN].

9b. RORIPPO NASTURTII-AQUATICAE-GLYCERETALIA FLUITANTIS Pignatti 1954.

Typus: (holotypus, art. 18): *Glycerio fluitantis-Sparganion neglecti* Br.-Bl. & Sissingh in Boer 1942.

9.2. Rorippion nasturtii-aquaticae Gehu & Gehu-Frank 1987

Typus: (holotypus, art. 18): *Helosciadatum nodiflori* Maire 1924.

9.2.1 *Rorippa nasturtium-aquaticum* community. [A, V, N, SN, F, BR].

10. ARTHROCNETEA FRANZII classis nova hoc loco

Coastal saltwater marshes flooded by sea tides or occasionally interior saline waters: succulent shrub, forbs and grass communities, growing in infra-thermotropical desertic and xeric Capeverdean, West Tropical (Morocco), Saharan, Mauritanian and Senegalese and coastal Angolese biogeographic terri-

tories. [A, V, SL, BO, M, SN, MAU, SENEGAL, ANGOLA].

Characteristic species and bioindicators growing in Cabo Verde Islands: *Arthrocnemum franzii*, *Cressa salina*.

Typus: 7a. *Arthrocnemetalia franzii* ordo novo.

10a. ARTHROCNETEA FRANZII ordo novo hoc loco

Permanent succulent nanophanerophyte, chamaephyte and perennial pioneer community growing on salty occasionally flooded soils, in infra-thermotropical desertic coast of eastern Cabo Verde Islands, Atlantic Tropical Morocco, Angola and Mauritania. [SL, BO, M, MAU, SEN, ANG AND TROPICAL ATLANTIC SAHARA].

Typus: 10.1. *Arthrocnemion franzii* all. nova hoc loco

10.1. Arthrocnemion franzii allianzia nova hoc loco

Permanent succulent nanophanerophyte and chamaephyte coastal halophilous communities, occasionally flooded growing in infra-thermotropical desertic coasts of Cabo Verde and Atlantic Mauritania (Saharo Tropical biogeographical subregion). (J. C. Costa has found *Arthrocnemum franzii* in the desertic coast of South Angola (Nambib Desert) and Rivas-Martínez near the Drá river coast in Morocco and coasts of Senegal River). [SL, BO, M, MAU, SEN, ANG AND TROPICAL ATLANTIC SAHARA].

Typus: 10.1.1. *Arthrocnemetum franzii* ass. nova hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Arthrocnemum franzii* •

10.1.1. Arthrocnemetum franzii associatio nova hoc loco

Permanent succulent halophilous nanophanerophyte association, growing on coastal sandy soils only occasionally and temporarily flooded soils, in infra-thermotropical desertic arid to ultrahyperarid coasts of East Cabo Verde, Morocco Atlantic Sahara, Mauritania, Senegal coastal river and

Angola Namib Desert coast. It is well characterized by *Arthrocnemum franzii*. [SL, BO, M]

Type relevé (holotypus): table 55, relevé n.11. Rivas-Martínez, reg. 2005: 206, 15.12.2005, made with Lousã, J.C. Costa & Maria C. Duarte. *Site*: Cabo Verde, Boavista, Praia da Varandinha, 10m².

10.1.2. *Cressetum salinae* associatio nova hoc loco

Psammo-halophyte coastal annual and biennial association, growing on temporary humid halophilic sandy soils, and seral

of *Arthrocnemum franzii* shrubby sigeum, occurring in infra-thermotropical hyperarid-arid, coasts and lagoons of the eastern islands of Cabo Verde and in the littoral of tropical Sahara (Morocco, Mauritania and Senegal). It is well characterized by the small prostrate, mostly biennial *Convolvulaceae* with large flowers *Cressa salina*. [SL, BO, M, SN]

Type relevé (holotypus): table 56, relevé n.5. J.C. Costa, reg. 2007: 19.6.2007, *Site*: Cabo Verde, Boavista, Porto Ferreira lagoon, 4m².

Table 56

10.1.2. *Cressetum salinae* ass. nova hoc loco

(*Arthrocnemion franzii*, *Arthrocnemetalia franzii*, *Arthrocnemetea franzii*)

Area m ²	2	2	4	6	4	4	4	4
Number of species	1	1	2	5	2	3	2	2
Ordinal number	1	2	3	4	5*	6	7	8
Characteristic species								
<i>Cressa salina</i>	5	5	5	4	4	4	4	V
<i>Arthrocnemum franzii</i>	.	.	1	1	.	1	.	II
Companion species								
<i>Sesuvium sesuvioides</i>	.	.	.	.	1	1	.	II
<i>Sesuvium portulacastrum</i>	.	.	.	+	.	.	.	I

Other companion species: *Bulbostylis barbata* 2 in 7; *Suaeda caboverdeana* • + in 4; *Tetraena waterlotii* + in 4.

Localities: 1. 6. *Sal*: Murdeira; 2, 3, 4. *Boavista*: Porto Ferreira lagoon; 5. *Boavista*: Porto Ferreira lagoon (*holotypus* ass. reg. 2007: 22); 7 *Maio*: Banco da Antónia; 7. Synthesized table.

10b. *SESUVIETALIA SESUVIOIDIS* ordo novo hoc loco

Annual becoming rooting perennial succulent coastal communities hygrophilic and aerohalophilic, growing in infra-thermotropical ultrahyperarid-arid West Africa coasts from Morocco to South Africa. Characterized by succulent species of *Sesuvion* (*Sesuvium sesuvioides* and *S. portulacastrum*) This new ordo is now included in the class *Arthrocnemetea franzii*, but probably in the future it will need a new aridic pantropical class.

Typus: *Sesuvion sesuvioidis* all. nova hoc loco

10.2. *Sesuvion sesuvioidis* alliancia nova hoc loco

Annual becoming perennial coastal succulent communities, hygrophilic and aerohalophilic, growing in infra-thermotropical ultrahyperarid-arid West African tropical coasts. [A, V, SL, BO, M, SN, BR]

Characteristic species and bioindicators growing in Cabo Verde Islands: *Blutaparon vermiculare* [A, SL, BO, M, SN], *Sesuvium portulacastrum* [SL, BO, M, SN, M], *Sesuvium sesuvioides*. [V, SL, BO, M, BR]

Typus: 10.2.1. *Sesuvietum sesuvioidis* ass. nova hoc loco

10.2.1. *Sesuvietum sesuvioidis* associatio nova hoc loco

Association of the new alliance *Sesuvion sesuvioidis*, which thrives as common dominant plant in saline and subsaline wet coastal stations, waterlogged and flooded

by salt water. Is characterized by the annual become perennial afrotropical succulent Aizoaceae *Sesuvium sesuvioides*, which according to topography, anthropic influence and adjacent coastal vegetation, may be accompanied by other tropical annual or perennial plants. [V, SL, BO, M, BR].

Type relevé (holotypus): table 57, relevé n.7. Rivas-Martínez, reg. 2004: 119, 17.11.2004, made with Lousã, J.C. Costa & Maria C. Duarte. *Site*: Cabo Verde, São Vicente, Ribeira das Vinhas, 10m².

10.2.2. *Sesuvietum portulacastri* associatio nova hoc loco

Halophilous association on margins of temporarily flooded saline sandy in contact with *Arthrocnemum franzii*, characterized by *Sesuvium portulacastrum*, a pioneer succulent prostrate rooting plant with pantropical distribution reaching the Eastern Canaries. Sometimes is accompanied by the afrotropical small erect thin succulent annual *Blutaparon vermiculare*, which has its optimum in Cabo Verde aerohalophilic coastal stations. (v. 10.2.3. *Blutaparontetum vermicularis*). *Sesuvietum portulacastri* occurs in Sal, Boavista, Maio and Santiago islands. [SL, BO, M, SN].

Type relevé (holotypus): table 58, relevé n. 2. Rivas-Martínez, reg. 2006: 119, 13.12.2005, made with Lousã, J.C. Costa & Maria C. Duarte. *Site*: Boavista, Salinas de Sal Rei, 4m².

10.2.3. *Blutaparontetum vermicularis* associatio nova hoc loco

Coastal aereohaline Cabo Verde new association, characterized by the small thin succulent terophyte *Blutaparon vermiculare*, that may be accompanied by other small tropical chamaephytes or therophytes growing in infra-thermotropical ultra-

hyperarid to arid bioclimates. [A, SL, BO, M, SN].

Type relevé (holotypus): table 59, relevé n. 2. Rivas-Martínez, reg. 2005: 90, 11.12. 2005, made with Lousã, J.C. Costa & Maria C. Duarte. *Site*: Santiago, Biscainhos, 15 m, 4m².

Table 57

10.2.1. *Sesuvietum sesuvioideis* ass. nova hoc loco
(*Sesuvion sesuvioideis*, *Sesuvietalia sesuvioideis*, *Arthrocnemetea franzii*)

Area m ²	2	2	2	2	2	2	4	2	4	4	10	2
Nº of species	1	1	1	1	1	1	2	2	2	2	2	2
Ordinal number	1	2	3	4	5	6	7*	8	9	10	11	12
Characteristic species												
<i>Sesuvium sesuvioideis</i>	3	3	5	5	5	5	5	5	4	5	2	V
<i>Sporobolus virginicus</i>	.	.	.	.	.	.	.	.	.	.	4	+
Companion species												
<i>Suaeda caboverdeana</i> ●	.	.	.	.	.	.	.	+	2	1	.	II

Other companion species: *Heliotropium curassavicum* 1 in 8.

Localities: 1. *São Vicente*: Calhau; 2. *Brava*: Fajã d'Água; 3. *Boavista*; Praia do Cabral; 4. *Boavista*: Praia da Varandinha; 5. *São Vicente*: Mindelo; 6, 9. *Sal*: Santa Maria Ponta Preta; 7. *São Vicente*: Ribeira das Vinhas (*holotypus* ass. reg. 2004: 119); 8, 11. *Sal*: Pedra Lume; 10. *Sal*; Santa Maria: Hotel Riu; 12. Synthesized table.

Table 58

10.2.2. *Sesuvietum portulacastrum* ass. nova. hoc loco(*Sesuvion sesuvioideis*, *Sesuvietalia sesuvioideis*, *Arthrocnemetea franzii*)

Area m ²	2	4	4	4	4	4
Number of species	1	2	2	3	1	2
Ordinal number	1	2*	3	4	5	6
Characteristic species						
<i>Sesuvium portulacastrum</i>	5	5	5	5	4	V
<i>Blutaparon vermiculare</i>	.	1	.	1	.	II
Companion species						
<i>Arthrocnemum franzii</i>	.	.	+	+	.	II

Localities: 1. *Maio*: Salinas de Vila do Maio; 2. *Maio*: Salinas de Vila do Maio (*holotypus* ass. reg. 2006: 109); 3. *Boavista*: Salinas de Sal Rei; 4. *Boavista*: Salinas de Santa Mónica; 5 *Sal*: Baía de Murdeira; 6. Synthesized table.

Table 59

10.2.3. *Blutaparontetum vermicularis* ass. nova hoc loco(*Sesuvion sesuvioideis*, *Sesuvietalia sesuvioideis*, *Arthrocnemetea franzii*)

Area m ²	4	4	4	4	4	2	4
Number of species	2	3	2	3	5	4	3
Ordinal number	1	2*	3	4	5	6	7
Characteristic species							
<i>Blutaparon vermiculare</i>	4	4	3	4	3	4	3
<i>Cressa salina</i>	.	.	.	.	1	+	.
<i>Sesuvium portulacastrum</i>	.	.	.	2	.	.	.
Companion species							
<i>Tetraena simplex</i>	.	.	2	2	.	.	.
<i>Aizoon canariense</i>	.	.	.	.	1	+	1
<i>Frankenia pseudoericifolia</i> ●	.	.	.	.	2	+	.
<i>Paronychia illecebroides</i> ●	.	+	.	.	.	.	+

Other companion species: *Sporobolus robustus* 1 in 1; *Launaea melanostigma* ● + in 2; *Gymnocarpos sclerocephalus* + in 5.

Localities: 3. *Santiago*: Praia Formosa; 1. *Santiago*: Biscainhos; 2. *Santiago*: Biscainhos (*holotypus* ass. reg. 2005: 90); 4. *Maio*: Salinas of Vila de Maio; 5, 6, 7. *Santiago*: Praia de S. Francisco; 8. Synthesized table.

Table 60

11.1.1. *Adiantetum trifidi* ass. nova hoc loco
(*Adiantion trifidi*, *Adiantetalia capilli-veneris*, *Adiantetea capilli-veneris*)

Altitude (1=10 m)	4	4	4
Orientation	N	N	N
Area m ²	10	2	2
N° species	3	4	6
Ordinal number	1	2*	3
Characteristic species			
<i>Adiantum trifidum</i>	5	5	2
<i>Samolus valerandi</i>	+	+	1
Companion species			
<i>Eucladium verticillatum</i>	2	.	2
<i>Launaea picridioides</i> ●	.	1	.
<i>Sonchus oleraceus</i>	.	1	.
<i>Polypogon viridis</i>	.	.	1
<i>Cyperus involucratus</i>	.	.	1
<i>Ammannia senegalensis</i>	.	.	+

Localities: 1. *Santo Antão*: Pontinha da Janela; 2. *Santo Antão*: Pontinha da Janela, basaltic rich wall under water-flushed coming from a irrigation channel (*holotypus* ass. reg. 2005: 18); 3. *Santo Antão*: Pontinha da Janela.

Table 61

11.1.2 *Hypodematio crenati-Campanuletum bravensis* ass. nova hoc loco
(*Adiantion trifidi*, *Adiantetalia capilli-veneris*, *Adiantetea capilli-veneris*)

Altitude (1=10 m)	55	47	47	54	51	59	52
Orientation	N	NE	N	N	N	NW	
Area m ²	4	4	4	4	4	4	
N° species	2	4	5	4	4	6	4
Ordinal number	1	2*	3	4	5	6	7
Characteristic species							
<i>Hypodematum crenatum</i>	2	3	4	1	4	1	V
<i>Pteris vittata</i>	2	2	+	4	4	3	V
<i>Campanula bravensis</i> ●	.	+	1	2	2	3	IV
<i>Adiantum trifidum</i>	.	.	+	.	1	2	II
Companion species							
<i>Arthraxon lancifolius</i>	.	+	+	.	2	.	I
<i>Lavandula rotundifolia</i> ●	.	.	.	+	1	.	I
<i>Oxalis corniculata</i>	.	.	.	.	.	+	I
<i>Cyperus laevigatus</i>	.	.	.	.	.	+	I

Localities: 1. *Fogo*: Ribeira do Inferno; 2. *Fogo*: Espigão, humid and shady hard basalt wall (*holotypus* ass. reg. 2006: 30); 3. *Fogo*: Espigão, potential natural vegetation: *Dichrostachyoficetum sur*; 4, 5. *Fogo*: Campanas de Baixo. 6. *Brava*: Espadão; 7. Synthesized table.

11. ADIANTETEA CAPILLI-VENERIS Br.-Bl. in Br.-Bl., Rousine & Négre 1952

Perennial rupicolous water flow communities rich in chasmophyte ferns and seed plants, hemicyptophytes, chamaephytes and, usually, with plentiful bryophytes, growing on cliff, walls canyons and caves, with permanent or semipermanent water flow, rock crevices or tufa, with generally water-flushed or water plashed rich in calcium carbonates; infra-supramediterranean desertic to pluvioseasonal submediterranean temperate and infra-supratropical xeric and desertic bioclimatic zones, mostly in Holarctic or locally in Paleotropical African biogeographic territories. [A, V, N, SN, F, BR].

Typus: 11a. *Adiantetalia capilli-veneris*

Characteristic species and bioindicators growing in Cabo Verde Islands: *Adiantum capillus-veneris* subsp. *trifidum*, *Eucladium verticillatum*, *Didymodum tophaceus*, *Pteris vittata*, *Thamnobryum alopecurum*.

11a. ADIANTETALIA CAPILLI-VENERIS Br.-Bl. ex Horvatic 1934

Single order.

Characteristic species and bioindicators growing in Cabo Verde Islands: See classis 11.

Typus: *Adiantion capilli-veneris* Br.-Bl. 1931

11.1. *Adiantion trifidi* alliancia nova hoc loco

Perennial communities with chasmophyte ferns and seed plants, growing on permanent or temporary calcium rich water flow rock crevices or tufa, in cliffs, canyons and caves; infra-supratropical desertic to xeric; through Paleotropical Africa, in Saharan Tropical sub-region: Cabo Verde and Mauritania biogeographical provinces, well characterized by the translucent and thin leaf segments tropical desert rockyhigrophilous tufa fern: *Adiantum trifidum*.

Typus: 11.1.1. *Adiantum trifidi* ass. nova hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Adiantum capillus-veneris* subsp. *trifidum*, *Campanula bravenis* ●, *Carex hansenii* ●, *Dryopteris gorgonea* ●.

11.1.1. *Adiantum trifidi* associatio nova hoc loco

Infra-thermotropical hyperarid-semiarid association, growing on basaltic rich wall under water-flushed, characterized by the tropical fern *Adiantum capillus-veneris* subsp. *trifidum*, occurring mostly in Northern Islands (Santo Antão, São Vicente, S. Nicolau and occasionally Fogo, Santiago and Brava). (*Holotypus* reléve 2, table 60). [A, V, N, SN].

11.1.2. *Hypodematio crenati-Campanuletum bravenis* associatio nova hoc loco

Infra-thermotropical arid to semiarid community, in humid and shady hard basaltic walls, characterized by *Campanula bravenis* and quite big ferns like *Hypodematum crenatum*, *Pteris vittata* and *Adiantum capillus-veneris* subsp. *trifidum* (*holotypus* reléve n. 2, table 61). It occurs in southern islands (Fogo, Brava and Santiago). [SN, F, BR]. [●].

12. ASPLENIETEA TRICHOMANIS (Br.-Bl. in Meier & Br.-Bl. 1934) Oberdorfer 1977

Vegetation class which includes the chasmophytic mostly holarctic communities growing on vertical rocky walls and cliff narrow rock fissures, that receive direct the water of rainfall. They consist of small size perennials rupicolous plant communities: small peridophytes and seed plants hemicryptophytic

and chamaephytic not nitrophilous, whose compact root system is lodged inside of narrow fissures on steep faces rock that are wetted during the heavy rains. These rupicolous communities have a high number of characteristic species, mostly with a high climatic, geographic and edaphic bioindication values.

Typus (*lectotypus*, art. 19): *Potentilletalia caulescens* Br.-Bl. & Jenny 1926 [Denkschr. Schweiz. Naturforsch. Ges. 63: 183].

Characteristic species and bioindicators growing in Cabo Verde Islands: *Asplenium aethiopicum* subsp. *braithwaitii*, *Cheilanthes acrostica*, *Cystopteris fragilis*, *Paraceterach marantae*.

12a. *KICKXIETALIA ELEGANTIS* ordo novus hoc loco

Cabo Verde chasmophytic and chasmo-como-phytic communities rich in small local endemic species, growing on cliffs and big rocky blocks, from infra- to mesotropical and hyperarid to dry bioclimate. Occurring only in all Cabo Verde Islands.

Typus: 12.1. *Kickxion elegantis* all. nova hoc loco
Characteristic species and bioindicators growing in Cabo Verde Islands: *Campanula jacobaea* ●, *Campylanthus glaber* ●, *Diplotaxis gorgadensis* ●, *Diplotaxis hirta* ●, *Diplotaxis varia* ●, *Kickxia dichondrifolia* ●, *Kickxia elegans* ●, *Kickxia webbiana* ●, *Launaea thalassica* ●, *Polycarpaea gayi* ●, *Umbilicus schmidtii* ●. [A, V, N, SL, BO, M, SN, F, BR]. [●]

12.1. *Kickxion elegantis* alliancia nova hoc loco

Single alliance of the ordo well representate and characterized by many local endemic species in all Cabo Verde insular territories.

Typus: 12.1.1. *Kickxietum webbiana* ass. nova hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: see ordo 12a.

Table 62

12.1.1. *Kickxietum webbiana* ass. nova hoc loco
(*Kickxion elegantis*, *Kickxietalia elegantis*, *Asplenieta trichomanis*)

Altitude (1= 10 m)	3	73	6	14	13	22
Orientation	N	E	NE	N	N	
Area m ²	10	10	10	2	2	
N° species	3	6	5	3	3	4
Ordinal number	1	2	3	4*	5	6
Characteristic species						
<i>Kickxia webbiana</i> ●	3	2	2	3	4	V
<i>Diplotaxis gorgadensis</i> ●	.	.	.	+	+	II
<i>Polycarpaea gayi</i> ●	+	.	.	.	.	I
<i>Pellaea viridis</i>	.	2	.	.	.	I
Companion species						
<i>Limonium braunii</i>	+	.	2	.	.	II
<i>Paronychia illecebroides</i> ●	.	.	1	+	.	II

Other companion species: *Samolus valerandi* 2 in 5; *Campylanthus spathulatus* ● 1 in 3; *Frankenia caboverdeana* ● 1 in 3; *Launaea gorgadensis* ● + in 2; *Aeonium gorgoneum* ● + in 2; *Campylanthus glaber* ● + in 2.

Localities: 1. *Santo Antão*: Sinagoga; 2. *Santo Antão*: Delgadinha; 3. *Santo Antão*: Ponta do Sol, 4. *Santo Antão*: Ponta do Sol, Fontainhas (*holotypus* ass. reg. 2005: 55); 5. *Santo Antão*: Ponta do Sol, Fontainhas; 6. Synthesized table.

Table 63

12.1.2. *Diplotaxis hirtae-Kickxietum elegantis* ass. nova hoc loco
(*Kickxion elegantis*, *Kickxietalia elegantis*, *Asplenietea trichomanis*)

Altitude (1=10 m)	33	33	55
Orientation	N	NE	NE
Area m ²	4	4	4
N° of species	4	4	4
Ordinal number	1	2*	3
Characteristic species			
<i>Kickxia elegans</i> ●	2	3	1
<i>Diplotaxis hirta</i> ●	+	1	1
<i>Polycarpha gayi</i> ●	.	.	2
<i>Campanula bravensis</i> ●	+	.	.
Companion species			
<i>Hypodematium crenatum</i>	+	+	.
<i>Pteris vittata</i>	.	+	+

Localities: 1. Fogo: Ribeira da Cruz do Inferno; 2. Fogo: Espigão
holotypus (reg. 2006: 29 bis); 3. Fogo: Espigão.

12.1.1. *Kickxietum webbiana* associatio nova
hoc loco

Thermotropical arid to semiarid association, on mafic volcanic rocky fissures, than kept the moist for some time after periods of rainfall. It is frequent in the walls of the northern slopes of the island of Santo Antão. It is well characterized by the island local endemics: *Kickxia webbiana* ● and *Diplotaxis gorgadensis* ●. [A]. [●]

12.1.2. *Diplotaxis hirtae-Kickxietum elegantis* associatio nova hoc loco [F].

Chasmophytic thermotropical semiarid to dry association growing on ultramafic cliff rocks well exposed to the north, in Fogo Island. It is characterized by the local endemism *Diplotaxis hirta* and also by the Cabo Verde endemic chasmophytes: *Kickxia elegans*, *Campanula bravensis* and *Polycarpha gayi*. [F]. [●].

12.1.3. *Umbilico schmidtii-Cheilanthes acrosticae* associatio nova hoc loco

Growing on basalt rock crevices and men built walls in Chã das Caldeiras (mesotropical dry), we collect in november 2004 and december 2006, a particular stiff *Cheilanthes acrostica*, the only locality we know in Cabo Verde Islands, with long pseudindusia fimbriae and shine black spores (a local micro-taxon?). It was living with a small *Cosentinia vellea* (subsp. *bivalens* ?), *Umbilicus schmidtii* and the Fogo local endemic *Diplotaxis hirta*. Despite his local occurrence we propose a new association for all populations of *Cheilanthes acrostica* with *Consentinia vellea* that we know in this small but original territory of Fogo Isle. *Type relevé (holotypus)*: table 64 relevé n. 2. [F]. [●].

Table 64

12.1.3. *Umbilico schmidtii-Cheilanthes acrosticae* associatio nova hoc loco
(*Kickxion elegantis*, *Kickxietalia elegantis*, *Asplenietea trichomanis*)

Altitude (1= 10 m)	172	172	169
Orientation	E	E	N
Area m ²	2	2	10
N° of species	3	4	7
Ordinal number	1	2*	3
Characteristic species			
<i>Cheilanthes acrostica</i>	2	3	3
<i>Cosentinia vellea</i>	3	1	2
<i>Umbilicus schmidtii</i> ●	.	1	+
<i>Diplotaxis hirta</i> ●	.	.	1
Companion species			
<i>Anogramma leptophylla</i>	1	.	2
<i>Conyza pannosa</i> ●	.	+	.
<i>Micromeria forbesii</i> ●	.	.	+
<i>Wahlenbergia lobelioides</i>	.	.	+

Localities: 1. Fogo: Chã das Caldeiras; 2. Fogo: Chã das Caldeiras (*holotypus* ass. reg. 2004: 37); 3. Fogo: Chã das Caldeiras.

Table 6512.1.4. *Campanuletum jacobaeae* ass. nova hoc loco
(*Kickxion elegantis*, *Kickxietalia elegantis*, *Asplenietea trichomanis*)

Altitude (1=10 m)	86	77	144	61
Orientation	NE	NE	N	NW
Area m ²	8	6	10	4
N° of species	9	8	6	8
Ordinal number	1*	2	3	4
Characteristic species				
<i>Campanula jacobaea</i> ●	2	2	1	3
<i>Polycarpaea gayi</i> ●	2	2	.	2
<i>Diplotaxis varia</i> ●	2	2	.	.
<i>Kickxia elegans</i> ●	1	1	.	.
<i>Umbilicus schmidtii</i> ●	.	1	2	.
<i>Kickxia dichondrifolia</i> ●	.	.	.	2
Companion species				
<i>Paronychia illecebroides</i> ●	+	+	.	.
<i>Lobularia fruticosa</i> ●	+	.	.	.
<i>Phagnalon melanoleucum</i> ●	.	.	+	+
<i>Musci</i>	.	.	3	.
<i>Sonchus daltonii</i> ●	.	.	1	.
<i>Forsskaolea procrifolia</i> ●	+	.	.	.
<i>Lotus jacobaeus</i> ●	+	.	.	.
<i>Micromeria forbesii</i> ●	.	.	+	.
Localities: 1. <i>Santiago</i> : Serra da Malagueta (<i>holotypus</i> ass. reg. 2006: 14); 2. <i>Santiago</i> : Serra da Malagueta; 3. <i>Santo Antão</i> : Espongeiro; 4. <i>Santo Antão</i> : Posto.				

12.1.4. *Campanuletum jacobaeae* associatio nova hoc loco

Chasmophytic association, thermo-mesotropical semiarid to dry, growing on volcanic rocks and cliffs of Serra da Malagueta and Pico da Antónia (Santiago Island), as well as in Santo Antão Island. It is well characterized by the endemic comophyte *Campanula jacobaea* accompanied by other endemic species with similar geobotanic valence: *Polycarpaea gayi*, *Diplotaxis varia*, *Kickxia elegans*, *Umbili-*

cus schmidtii and *Kickxia dichondrifolia*.
Type relevé (*holotypus*): table 65 relevé n. 1 [A, SN]. [●].

12.1.5. *Campanulo bravensis-Launaetum thalassicae* associatio nova hoc loco

Thermotropical arid to semiarid chasmophytic association, occurs on volcanic rocks of Brava Island. Characterized by local endemism *Launaea thalassica*, as well as *Campanula bravensis*, *Kickxia elegans* and *Diplotaxis varia*. Type relevé (*holotypus*): table 66 relevé n. 2. [BR]. [●].

Table 6612.1.5. *Campanulo bravensis-Launaetum thalassicae* ass. nova hoc loco
(*Kickxion elegantis*, *Kickxietalia elegantis*, *Asplenietea trichomanis*)

Altitude (1=10 m)	59	72	62	53	59	61
Orientation	NW	N	N	W	NE	
Area m ²	4	4	4	4	4	
N° of species	6	5	6	5	5	5
Ordinal number	1	2*	3	4	5	6
Characteristic species						
<i>Launaea thalassica</i> ●	3	1	1	1	1	V
<i>Campanula bravensis</i> ●	2	2	2	2	1	V
<i>Kickxia elegans</i> ●	2	2	3	3	3	V
<i>Diplotaxis varia</i> ●	.	.	.	.	2	I
Companion species						
<i>Daucus insularis</i> ●	1	1	1	+	.	IV
<i>Pteris vittata</i>	1	.	.	1	1	III
<i>Lotus purpureus</i> ●	.	1	+	.	.	II
<i>Conyza varia</i> ●	+	.	.	.	.	I
<i>Oxalis corniculata</i>	.	.	1	.	.	I

Localities: 1. *Brava*: Espadão; 2. *Brava*: Senhora do Monte (relevé J.C. Costa & I. Gomes, *holotypus* ass. reg. 2014: 15); 3. *Brava*: Cova Joana; 4. *Brava*: Figueira Grande; 5. *Brava*: Campo Baixo; 5. Synthesized table.

13. PARIETARIETEA JUDAICAE Rivas-Martínez in Rivas Goday, Veg. Fl. Guadiana: 104. 1964

Rupicolous, nitrophilous, sometimes epiphytic plant communities, consisting in chasmophyte or comophyte species, demanding nitrates and ammonium salts of organic origin. Cosmopolite distribution, mostly in urban and rural areas.

Characteristic species and bioindicators growing in Cabo Verde Islands: *Asplenium trichomanes* subsp. *quadrivalens*, *Cymbalaria muralis*, *Ficus carica*, *Parietaria judaica*.

Typus: 13a. *Parietarietalia judaicae* (Rivas-Martínez 1960) Rivas Goday 1964

13a. PARIETARIETALIA JUDAICAE (Rivas-Martínez 1960) Rivas Goday, Veg. Fl. Guadiana: 104. 1964

[*Parietarietalia muralis* Rivas-Martínez in Anales Real Acad. Farm.: 26(1): 165. 1960 (arts. 34, 39, rec. 11c)]

Single order

Characteristic species and bioindicators growing in Cabo Verde Islands: see classis 13.

Typus: *Parietario diffusae-Centranthion rubri* Rivas-Martínez in Anales Real Acad. Farm.: 26 (2): 165. 1960

13.1. *Adiantion inciso-philippensis* alliancia nova hoc loco

Tropical desertic and xeric nitrophilous and seminitrophilous communities, growing on shadow walled urban refuges in Cabo Verde Islands, except in the hyperarid eastern isles. [A, V, N, SN, F, BR].

Characteristic species and bioindicators growing in Cabo Verde Islands: *Adiantum incisum*, *Adiantum philippense*, *Hypodematum crenatum*.

Typus: 13.1.1. *Adiantetum inciso-philippensis* ass. nova hoc loco

13.1.1. *Adiantetum inciso-philippensis* associatio nova hoc loco

Thermotropical arid to dry association, growing on nitrogen-rich urban and rural shadow and often wet walls. It is characterized by the tropical sahelic ferns: *Adiantum philippense*, *Adiantum incisum* and *Hypodematum crenatum* (*holotypus* table 67 relevé n. 1). It occurs in Santo Antão, São Vicente, S. Nicolau, Santiago, Fogo and Brava Islands. [A, V, N, SN, F, BR]

Table 67

13.1.1. *Adiantetum inciso-philippensis* ass. nova hoc loco

(*Adiantion inciso-philippensis*, *Parietarietalia*, *Parietarietea judaicae*)

Altitude (1=10 m)	34	34
Orientation	NW	NW
Area m ²	4	4
Number species	4	4
Ordinal number	1*	2
Characteristic species		
<i>Adiantum philippense</i>	3	2
<i>Adiantum incisum</i>	2	2
<i>Hypodematum crenatum</i>	+	2
Companion species		
<i>Arthraxon lancifolius</i>	+	.
<i>Forsskaolea procridifolia</i> ●	.	+

Localities: 1. Fogo: Pai António, nitrogen-rich shady wall (*holotypus* ass. reg. 2006: 33); 2. Fogo Pai António, Mosteiros.

14. POLYGONO ARENASTRI-POETEA ANNUAE Rivas-Martínez 1975

Pioneer communities of nitrophilous therophytes, with creeping annual and perennials species, adapted to compacted tramped soils due to trampling paths of urban and rural areas. Cosmopolitan distribution. [A, V, N, SL, BO, M, SN, F, BR].

Characteristic species and bioindicators growing in Cabo Verde Islands: *Lepidium didymum*, *Polycarpon tetraphyllum*.

Typus: *Polygono arenastri-Poetalia annuae* Tüxen in Géhu & al. 1972 corr. Rivas-Martínez & al. 1991

14a. EUPHORBIETALIA PROSTRATO-HIRTAE ordo novus hoc loco

Urban, ruderal rural and road nitrophilous communities formed by annual prostrate or erect small size plants, which are developed on soils subjected to continuous trampling by humans or domesticated animals. From paleotropical origin

infra-mesotropical hyperarid-subhumid, reached as neophytic infra-mesomediterranean, submediterranean, subtropical and infratempere.

Typus: *Euphorbion prostratae* Rivas-Martínez 1976

Characteristic species and bioindicators growing in Cabo Verde Islands: *Alternanthera pungens*, *Euphorbia canescens*, *Euphorbia forsskalii*, *Euphorbia glaucophylla*, *Euphorbia hirta*, *Euphorbia inequilatera*, *Euphorbia prostrata*, *Euphorbia granulata*, *Euphorbia scordiifolia*, *Euphorbia serpens*.

14.1. *Trianthemion portulacastri* alliancia nova hoc loco

Annual ruderal-road, urban and rural strong nitrified communities, formed by small erect and prostrate quick growing plants, infra-thermotropical, hyperarid to arid. Occur in all the islands of Cabo Verde.

Table 68

14.1.1. *Trianthemum portulacastrum* ass. nova hoc loco*(Trianthemion portulacastrum, Euphorbietalia prostrato-hirtae, Polygono-Poetea anuae)*

Altitude (m)	32	70	60	15	5	25	3	3	30	115	50	8	8	164	170	5	20	115	8	8	8	8	71	
Area m ²	4	2	10	10	4	4	4	4	4	2	2	4	6	4	4	2	10	2	4	4	4	4	4	
N° of species	7	7	6	7	7	5	3	5	7	5	3	4	6	6	6	4	7	4	4	3	3	5	5	
Order number	1	2	3	4	5	6*	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Characteristic species																								
<i>Trianthema portulacastrum</i>	.	.	.	.	3	3	3	2	2	1	+	2	+	3	2	3	3	2	4	2	4	2	V	
<i>Alternanthera pungens</i>	1	3	3	1	3	2	4	3	3	2	3	3	4	2	2	.	.	.	.	.	.	.	IV	
<i>Euphorbia serpens</i>	3	.	+	.	2	2	.	.	.	3	.	1	3	.	.	.	.	1	.	.	.	.	II	
<i>Talinum paniculatum</i>	.	.	.	.	.	.	.	.	.	2	.	.	1	.	.	.	.	.	3	2	3	3	4	II
<i>Eleusine indica</i>	1	+	.	.	+	+	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	+	.	II
<i>Euphorbia prostrata</i>	3	+	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	2	.	II
<i>Zaleya pentandra</i>	.	.	3	2	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
<i>Euphorbia granulata</i>	.	1	.	2	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	I
<i>Lepidium didymum</i>	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Euphorbia hirta</i>	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Eragrostis minor</i>	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Companion species																								
<i>Portulaca oleracea</i>	2	2	.	.	1	.	.	.	.	2	.	2	+	1	.	3	.	2	1	.	.	1	III	
<i>Corchorus depressus</i>	.	.	.	1	.	3	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	I
<i>Amaranthus spinosus</i>	.	.	.	.	.	.	1	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	I
<i>Chloris virgata</i>	.	.	.	.	.	.	.	+	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	I
<i>Mollugo verticillata</i>	3	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Chenopodium murale</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.	.	.	+
<i>Setaria verticillata</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	+
<i>Dactyloctenium aegyptium</i>	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	+
<i>Amaranthus caudatus</i>	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	I
<i>Sida salviifolia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.	.	.	.	+

Other companion species: *Achyranthes aspera* 3 in 17; *Amaranthus graecizans* 3 in 4; *Tetragonia tetragonioides* 2 in 2; *Bidens bipinnata* 2 in 14; *Schmidtia pappophoroides* 2 in 15; *Peristrophe paniculata* 2 in 17; *Ageratum conyzoides* 1 in 2; *Rhynchosia minima* 1 in 3; *Mollugo nudicaulis* 1 in 15; *Amaranthus cruentus* + in 1; *Digitaria horizontalis* + in 2; *Salvia aegyptiaca* + in 3; *Malvastrum coromandelianum* + in 3; *Tribulus terrestris* + in 9; *Cynodon dactylon* + in 11; *Cucumis anguria* + in 17; *Cuscuta umbellata* + 22; *Sesuvium sesuvioides* + in 22.

Localities: 1, 9. *Santiago*: Praia; 2. *São Vicente*: Monte Verde, Antenas; 3. *Boavista*: Fundo de Figueiras; 4. *Maio*: Vila de Maio; 5. *Santiago*: Praia, Porto; 6. *Santiago*: Praia, aeroporto (*holotypus* ass. reg. 2004: 18); 7, 8. *Santiago*: Tarrafal; 10, 18. *Fogo*: S. Filipe; 11. *Santo Antão*: Ponta do Sol; 12, 13. *São Nicolau*: Preguiça; 14. *São Nicolau*: Ribeira Brava; 15. *São Nicolau*: Jalunga; 16, 17. *Santiago*: S. Francisco; 19, 20, 21, 22. *São Vicente*: Mindelo; 23. Synthesized table.

Typus: *Trianthemum portulacastrum* ass. nova hoc loco

Characteristic species and bioindicators growing in Cabo Verde Islands: *Trianthema portulacastrum*, *Boerhavia repens*, *Oldenlandia corymbosa*, *Talinum paniculatum*, *Zaleya pentandra*. [A, V, N, SL, BO, M, SN, F, BR].

14.1.1. *Trianthemum portulacastrum* associatio nova hoc loco

Infra-thermotropical hyperarid-arid association, ruderal-nitrophilous urban and road, formed by small annual plants erect or prostrate (*Trianthema portulacastrum*, *Alternanthera pungens*, *Euphorbia serpens*, *Euphorbia prostrata*, *Talinum paniculatum*, *Eleusine indica*, *Zaleya pentandra*, etc.), with Sahel-Sudanic and Cabo Verde distribution. *Type* relevé (*holotypus*): table 68 relevé n. 6. [A, V, N, SL, BO, M, SN, F, BR].

14.1.2. *Euphorbia hirtae-Boerhaviatum repentis* associatio nova hoc loco

Infra-thermotropical hyperarid-semiarid association, ruderal-nitrophilous, on swampy coarse volcanic sands, characterized by small annual plants like *Boerhavia repens*, *Euphorbia hirta*, *Alternanthera pungens*, *Euphorbia prostrata*, *Eleusine indica*, etc. in Cabo Verde Islands. *Type* relevé (*holotypus*): table 69 relevé n. 2. [A, V, N, BO, M, SN].

14.1.3. *Oldenlandietum corymbosae* associatio nova hoc loco

Thermotropical hyperarid to semiarid association, growing on gravelly places, characterized by the small annual plant *Oldenlandia corymbosa*, in Cabo Verde Islands. *Type* relevé (*holotypus*): table 69 relevé n. 8. [A, V, N, BO, M, SN].

Table 69
 14.1.2. *Euphorbia hirtae-Boerhaviatum repentis* ass. nova hoc loco
 14.1.3. *Oldenlandietum corymbosae* ass. nova hoc loco

	(Trianthemion portulacastrum, Euphorbietalia prostrato-hirtae, Polygono-Poetea annuae)							
Altitude (m)	68	68	580	30	20	750	262	320
Area m ²	1	1	2	4	4	4		2
Number of species	5	7	6	6	7	9	6	5
Ordinal number	1	2*	3	4	5	6	7	8*
Characteristic species								
<i>Boerhavia repens</i>	2	4	1	1	+	.	V	.
<i>Euphorbia hirta</i>	2	2	1	1	.	2	V	.
<i>Alternanthera pungens</i>	.	.	3	3	2	3	IV	1
<i>Euphorbia prostrata</i>	2	+	1	.	2	.	IV	2
<i>Eleusine indica</i>	.	.	2	+	.	1	III	2
<i>Euphorbia serpens</i>	.	.	.	.	.	2	I	1
<i>Zaleya pentandra</i>	.	.	.	.	2	.	I	.
<i>Gomphrena globosa</i>	.	.	2	.	.	.	I	.
<i>Euphorbia canescens</i>	1	.	.	.	.	.	I	.
<i>Eragrostis minor</i>	.	.	.	+	.	.	I	.
<i>Oldenlandia corymbosa</i>	.	.	.	.	.	.	.	3
companion species								
<i>Portulaca oleracea</i>	1	1	+	.	+	.	IV	1

Other companion species: *Leucas martinicensis* 1 in 2; *Phyllanthus* sp. 1 in 2; *Amaranthus graecizans* 1 in 4; *Corchorus depressus* 1 in 5; *Heliotropium crispum* 1 in 5; *Chloris virgata* 1 in 6; *Chloris pycnothrix* 1 in 6; *Polypogon viridis* 1 in 6; *Kohautia aspera* + in 2; *Chenopodium murale* + in 6.

Localities: 1. *Santiago*: São Francisco; 2*. *Santiago*: São Francisco (*holotypus* ass. reg. 2004: 16); 3 *Santiago*: Assomada; 4. *Santo Antão*: Ribeira Grande; 5. *Santo Antão*: Porto Novo; 6. *Santiago*: Serra da Malagueta; 7. Synthesized table; 8*. *Fogo*: Pai António (*holotypus* ass. reg. 2006: 35).

15. STELLARIETEA MEDIAE Tüxen, Lohmeyer & Preising ex von Rochow 1951

Nitrophilous or semi-nitrophilous vegetation, consisting on annual ephemeral plants, that inhabit in nitrogenous rich matter substrates: usually in disturbed soils in urban and agricultural areas, including fringe of paths and roads, crops, etc. Cosmopolitan distribution, except very warm tropical territories. [A, V, N, SL, BO, M, SN, F, BR]

Characteristic species in Cabo Verde Islands: *Apium leptophyllum*, *Arabidopsis thaliana*, *Avena fatua*, *Bromus diandrus*, *Bromus madritensis*, *Centaurea melitensis*, *Cyperus rotundus*, *Digitaria sanguinalis*, *Eragrostis barrelieri*, *Galinsoga quadriradiata*, *Misopates orontium*, *Mollugo cerviana*, *Paspalum vaginatum*, *Patellifolia patellaris*, *Plantago afra*, *Polypogon viridis*, *Setaria pumila*, *Setaria verticillata*, *Solanum nigrum*, *Sonchus oleraceus*.

Typus: *Chenopodietalia muralis* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 em. Rivas-Martínez 1977

15a. *CHENOPODIETALIA MURALIS* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 em. Rivas-Martínez 1977

Nitrophilous plant communities, markedly rich in annual cosmopolitan species, common in Mediterranean region, reaching temperate or warm tropical areas, mostly dry to semi-arid bioclimate. [A, V, N, SL, BO, M, SN, F, BR]

Characteristic species in Cabo Verde Islands: *Aizoon canariense*, *Amaranthus graecizans*, *Emex spinosa*, *Patellifolia procumbens*, *Portulaca oleracea*.

Typus: 15.1 *Chenopodion muralis* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936

15.1. *Chenopodion muralis* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936

Urban and rural high nitrophilous associations, with Mediterranean optimal, Eurosiberian irradiation and reaching high populated tropical territories. [A, V, N, SL, BO, M, SN, F, BR]

Characteristic species in Cabo Verde Islands: *Amaranthus viridis*, *Chenopodium murale*, *Erigeron bonariensis*, *Datura stramonium*, *Malva parviflora*, *Tribulus terrestris*.

Typus: *Chenopodietum muralis* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936

15.1.1. *Chenopodium murale* and *Malva parviflora* community

High nitrified stations and wide spread annual ruderal cosmopolite neophitic community [A, V, N, SL, BO, M, SN, F, BR].

16. RUDERO-MANIHOTETEA UTILISSIMAE Leonard in Taton 1949

Ruderal, anthropic and nitrophilous vegetation, trampled soils, debris and road edges and arvense vegetation, thermotropical dry to humid, with pantropical distribution.

16a. *BIDENTETALIA PILOSAE* Lebrun in Mullenders 1949

Weed vegetation communities on dry and sub-humid land and grass in tropical Afro-Asiatic territories.

16.1. *Ecliption prostratae* Lebrun 1947

Afrotropical weed vegetation.

Characteristic species and bioindicators growing in Cabo Verde Islands: *Eclipta prostrata*, *Bidens pilosa*.

Indexes

5a. Alphabetic list of Cabo Verde endemic vascular plants and taxa mentioned in the text

- Abrus precatorius* L. subsp. *africanus* Verdc. (Fabaceae)
Abutilon pannosum (G.Forst.) Schldtl. (Malvaceae)
Acacia caboverdeana Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Fabaceae) ●
Acanthospermum hispidum DC. (Asteraceae)
Achyranthes aspera L. (Amaranthaceae)
Acrachne racemosa (B.Heyne ex Roth) Ohwi (Poaceae)
Actiniopteris radiata (Sw.) Link (Pteridaceae)
Adiantum capillus-veneris L. subsp. *trifidum* (Willd. ex Bolle) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Pteridaceae)
Adiantum incisum Forssk. (Pteridaceae)
Adiantum philippense L. (Pteridaceae)
Aeonium gorgoneum J.A.Schmidt (Crassulaceae) ●
Aerva javanica (Burm. f.) Juss. ex Schult. (Amaranthaceae)
Ageratina adenophora (Spreng.) R.M.King & H.Rob. (Asteraceae)
Ageratum conyzoides (L.) L. (Asteraceae)
Aizoon canariense L. (Aizoaceae)
Ajuga iva (L.) Schreb. (Lamiaceae)
Aloe vera (L.) Burm. f. (Xanthorrhoeaceae)
Alternanthera pungens Kunth (Amaranthaceae)
Amaranthus caudatus L. (Amaranthaceae)
Amaranthus cruentus L. (Amaranthaceae)
Amaranthus graecizans L. (Amaranthaceae)
Amaranthus spinosus L. (Amaranthaceae)
Amaranthus viridis L. (Amaranthaceae)
Ammannia senegalensis Lam. (Lythraceae)
Andrachne telephioides L. (Phyllanthaceae)
Andropogon fastigiatus Sw. (Poaceae)
Andropogon gayanus Kunth (Poaceae)
Andropogon gayanus var. *tridentatus* Hack. (Poaceae)
Andropogon tridentatus (v. *Andropogon gayanus* var. *tridentatus*)
Anogramma leptophylla (L.) Link (Pteridaceae)
Apium leptophyllum (Pers.) F.Muell. ex Benth. (Apiaceae)
Arabidopsis thaliana (L.) Heynh. (Brassicaceae)
Aristida adscensionis L. (Poaceae)
Aristida cardosoi Cout. (Poaceae) ●
Aristida funiculata Trin. & Rupr. (Poaceae)
Artemisia gorgonum Webb (Asteraceae) ●
Arthraxon lancifolius (Trin.) Hochst. (Poaceae)
Arthrocnemum franzii Sukhor. (Amaranthaceae) ●
Arundo donax L. (Poaceae)
Asparagus squarrosus J.A. Schmidt (Asparagaceae) ●
Asphodelus mariolousae Rivas Mart., J.C. Costa & Maria C. Duarte (Xanthorrhoeaceae) ●
Asplenium aethiopicum (Burm. f.) Bech. subsp. *braithwaitii* Ormonde (Aspleniaceae)
Asplenium trichomanes L. subsp. *quadrivalens* D.E. Mey. (Aspleniaceae)
Asteriscus daltonii (Webb) Walp. (Asteraceae) ●
Asteriscus smithii (Webb) Walp. (Asteraceae) ●
Asteriscus vogelii (Webb) Walp. (Asteraceae) ●
Avena fatua L. (Poaceae)
Bidens bipinnata L. (Asteraceae)
Bidens pilosa L. (Asteraceae)
Blainvillea gayana Cass. (Asteraceae)
Blutaparon vermiculare (L.) Mears (Amaranthaceae)
Boerhavia coccinea Mill. (Nyctaginaceae)
Boerhavia diffusa L. (Nyctaginaceae)
Boerhavia repens L. (Nyctaginaceae)
Bothriochloa bladhii (Retz.) S.T.Blake (Poaceae)
Bothriochloa insculpta (A.Rich.) A.Camus (Poaceae)
Brachiaria caboverdeana (Conert & C.Köhler) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Poaceae) ●
Brachiaria deflexa (Schumach.) C.E.Hubb. ex Robyns (Poaceae)
Brachiaria ramosa (L.) Stapf (Poaceae)
Brachiaria xantholeuca (Schinz) Stapf (Poaceae)
Brachypodium distachyon (L.) P.Beauv. (Poaceae)
Bromus diandrus Roth (Poaceae)
Bromus madritensis L. (Poaceae)
Bulbostylis barbata (Rottb.) C.B.Clarke (Cyperaceae)
Cajanus cajan (L.) Millsp. (Fabaceae)
Calotropis procera (Aiton) Dryand. (Asclepiadaceae)
Campanula bravensis (Bolle) A.Chev. (Campanulaceae) ●
Campanula feijoana Gardère (Campanulaceae) ●
Campanula hortelensis Gardère (Campanulaceae) ●
Campanula jacobaea C.Sm. ex Webb (Campanulaceae) ●
Campylanthus glaber Benth. (Plantaginaceae) ●
Campylanthus spathulatus A.Chev. (Plantaginaceae) ●
Carex antoniensis A.Chev. (Cyperaceae) ●
Carex hansenii (Lewej. & Lobin) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Cyperaceae) ●
Caylusea hexagyna (Forssk.) M.L.Green (Resedaceae)
Cenchrus ciliaris L. (Poaceae)
Cenchrus echinatus L. (Poaceae)
Centaurea melitensis L. (Asteraceae)
Centaureum viridense (Bolle) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte ●
Cheilanthes acrostica (Balb.) Tod. (Pteridaceae)
Chenopodium ambrosioides L. (Chenopodiaceae)
Chenopodium murale L. (Amaranthaceae)
Chloris pilosa Schumach. & Thonn. (Poaceae)
Chloris pycnothrix Trin. (Poaceae)
Chloris virgata Sw. (Poaceae)
Cistanche brunneri (Webb) Bég. (Orobanchaceae)
Citrullus colocynthis (L.) Schrad. (Cucurbitaceae)
Cleome brachycarpa (Forssk.) Vahl ex DC. (Cleomaceae)
Cleome scaposa DC. (Cleomaceae)
Cleome viscosa L. (Cleomaceae)
Cocculus pendulus (J.R.Forst. & G.Forst.) Diels (Menispermaceae)
Commelina benghalensis L. (Commelinaceae)
Commicarpus helenae (Roem. & Schult.) Meikle (Nyctaginaceae)
Convolvulus prostratus Forssk. (Convolvulaceae)
Conyza feae (Bég.) Wild (Asteraceae) ●
Conyza pannosa Webb (Asteraceae) ●
Conyza schlechtendalii Bolle (Asteraceae) ●
Conyza varia (Webb) Wild (Asteraceae) ●
Corchorus depressus (L.) Stocks (Malvaceae)
Corchorus tridens L. (Malvaceae)
Corchorus trilocularis L. (Malvaceae)
Cosentinia vellea (Aiton) Tod. (Hemiontidaceae)
Cressa salina (J.A. Schmidt) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Convolvulaceae) ●
Crotalaria retusa L. (Fabaceae)
Crotalaria senegalensis (Pers.) DC. (Fabaceae)
Cucumis anguria L. (Cucurbitaceae)
Cuscuta umbellata Kunth (Convolvulaceae)
Cymbalaria muralis P.Gaertn., B.Mey. & Scherb. (Plantaginaceae)
Cymodocea nodosa (Ucria) Asch.
Cynodon dactylon (L.) Pers. (Poaceae)
Cyperus conglomeratus Rottb. (Cyperaceae)
Cyperus crassipes Vahl (Cyperaceae)
Cyperus involucratu Rottb. (Cyperaceae)
Cyperus laevigatus L. (Cyperaceae)
Cyperus rotundus L. (Cyperaceae)
Cystopteris fragilis (L.) Bernh. (Cystopteridaceae)
Dactyloctenium aegyptium (L.) Willd. (Poaceae)
Dalechampia parviflora Lam. (Euphorbiaceae)

- Dalechampia scandens* var. *cordofana* (Hochst. ex Webb) Müll.Arg. (Euphorbiaceae)
Datura stramonium L. (Solanaceae)
Daucus annuus (Beg.) Wojew. et al.
Daucus annuus (Bég.) Wojew., Reduron, Banasiak & Spalik (Apiaceae) ●
Daucus humilis (Lobin & K.H. Schmidt) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Apiaceae) ●
Daucus insularis (Parl. ex Webb) Spalik, Wojew., Banasiak & Reduron (Apiaceae) ●
Daucus ribeirensis (Schmidt & Lobin) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Apiaceae) ●
Daucus tenuissimus (A.Chev.) Spalik, Wojew., Banasiak & Reduron (Apiaceae) ●
Davallia canariensis (L.) Sm. (Davalliaceae)
Desmanthus virgatus (L.) Willd. (Fabaceae)
Desmodium ospriostreblum Chiov. (Fabaceae)
Desmodium tortuosum (Sw.) DC. (Fabaceae)
Dichanthium annulatum (Forssk.) Stapf (Poaceae)
Dichanthium foveolatum (Delile) Roberty (Poaceae)
Dichrostachys cinerea (L.) Wight & Arn. subsp. *platycarpa* (W.Bull) Brenan & Brummitt (Fabaceae)
Dichrostachys platycarpa W. Bull (v. *Dichrostachys cinerea* (L.) Wight & Arn. subsp. *platycarpa* (W.Bull) Brenan & Brummitt)
Dicliptera verticillata (Forssk.) C.Ch. (Acanthaceae)
Didymodon tophaceus (Bridel) Lisa
Digitaria eriantha Steud. (Poaceae)
Digitaria horizontalis Willd. (Poaceae)
Digitaria nodosa Parl. (Poaceae)
Digitaria nuda Schumacher (Poaceae)
Digitaria sanguinalis (L.) Scop. (Poaceae)
Diploxys antoniensis Rustan (Brassicaceae) ●
Diploxys brochmannii (Rustan) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Brassicaceae) ●
Diploxys glauca (Schmidt) O.E.Schulz (Brassicaceae) ●
Diploxys gorgadensis Rustan (Brassicaceae) ●
Diploxys gracilis (Webb) O.E.Schulz (Brassicaceae) ●
Diploxys hirta (A.Chev.) Rustan & L.Borgen (Brassicaceae) ●
Diploxys sundingii Rustan (Brassicaceae) ●
Diploxys varia Rustan (Brassicaceae) ●
Diploxys vogelii (Webb) Cout. (Brassicaceae) ●
Dracaena caboverdeana (Marrero Rodr. & R.S. Almeida) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Asparagaceae) ●
Dryopteris gorgonea J.P.Roux (Dryopteridaceae) ●
Echinochloa colona (L.) Link (Poaceae)
Echium glabrescens Pett. (Boraginaceae) ●
Echium hypertropicum Webb (Boraginaceae) ●
Echium lindbergii Pett. (Boraginaceae) ●
Echium stenosphon Webb (Boraginaceae) ●
Echium vulcanorum A.Chev. (Boraginaceae) ●
Eclipta prostrata (L.) L. (Asteraceae)
Eleusine indica (L.) Gaertn. (Poaceae)
Elionurus royleanus Nees ex A.Rich. (Poaceae)
Emex spinosa (L.) Campd. (Polygonaceae)
Enneapogon desvauxii P.Beauv. (Poaceae)
Enteropogon prieurii (Kunth) Clayton (Poaceae)
Enteropogon rupestris (J.A.Schmidt) A.Chev. (Poaceae)
Eragrostis barrelieri Daveau (Poaceae)
Eragrostis ciliaris (L.) R.Br. (Poaceae)
Eragrostis conertii Lobin (Poaceae) ●
Eragrostis minor Host (Poaceae)
Erigeron bonariensis L. (Asteraceae)
Erysimum caboverdeanum (A. Chev.) Sunding (Brassicaceae) ●
Eucladium verticillatum (Hedw.) Bruch & Schimp. (Pottiaceae)
Euphorbia canescens L. (Euphorbiaceae)
Euphorbia forskalii J. Gay (Euphorbiaceae)
Euphorbia glaucophylla Poir. (Euphorbiaceae)
Euphorbia granulata Forssk. (Euphorbiaceae)
Euphorbia hirta L. (Euphorbiaceae)
Euphorbia hypericifolia (L.) Millsp. (Euphorbiaceae)
Euphorbia inequilatera Sond. (Euphorbiaceae)
Euphorbia prostrata Aiton (Euphorbiaceae)
Euphorbia scordiifolia Jacq. (Euphorbiaceae)
Euphorbia serpens Kunth (Euphorbiaceae)
Euphorbia tuckeyana Steud. ex Webb (Euphorbiaceae) ●
Fagonia cretica L. (Zygophyllaceae)
Fagonia isotricha Murb. (Zygophyllaceae)
Fagonia latifolia Delile (Zygophyllaceae)
Fagonia mayana Schldl. (Zygophyllaceae) ●
Ficus carica L. (Moraceae)
Ficus gnaphalocarpa (v. *Ficus sycomorus* L subsp. *gnaphalocarpa*)
Ficus sur Forssk. (Moraceae)
Ficus sycomorus L subsp. *gnaphalocarpa* (Miq.) C. C. Bery (Moraceae).
Foeniculum vulgare Mill. (Apiaceae)
Forsskaolea procradifolia Webb (Urticaceae) ●
Frankenia caboverdeana (Brochmann, Lobin & Sunding) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Frankeniaceae) ●
Frankenia montana (Brochmann, Lobin & Sunding) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Frankeniaceae) ●
Frankenia pseudoericifolia Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Frankeniaceae) ●
Furcraea foetida (L.) Haw. (Asparagaceae)
Galinsoga quadriradiata Ruiz & Pav. (Asteraceae)
Galium parisiense L. (Rubiaceae)
Globularia amygdalifolia Webb (Plantaginaceae) ●
Gomphrena globosa L. (Amaranthaceae)
Grevillea robusta A.Cunn. ex R.Br. (Proteaceae)
Grewia villosa Willd. (Malvaceae)
Gymnocarpus sclerocephalus (Decne.) Dahlgren & Thulin (Caryophyllaceae)
Helianthemum gorgoneum Webb (Cistaceae) ●
Helichrysum nicolai N. Kilian, Galbany & Oberpr. (Asteraceae) ●
Heliotropium crispum Desf. (Boraginaceae)
Heliotropium curassavicum L. (Boraginaceae)
Heliotropium pterocarpum (DC. & A.DC.) Hochst. & Steud. ex Bunge (Boraginaceae)
Heteropogon contortus (L.) P.Beauv. ex Roem. & Schult. (Poaceae)
Heteropogon melanocarpus (Elliott) Benth. (Poaceae)
Hyparrhenia caboverdeana Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Poaceae) ●
Hypodematium crenatum (Forssk.) Kuhn (Dryopteridaceae)
Hyptis pectinata (L.) Poit. (Lamiaceae)
Indigostrum parviflorum (Wight & Arn.) Schrire (Fabaceae)
Indigofera canescens Lam. (Fabaceae)
Indigofera senegalensis Lam. (Fabaceae)
Indigofera suffruticosa Mill. (Fabaceae)
Indigofera tinctoria L. (Fabaceae)
Indigofera tinctoria L. subsp. *microcarpa* (A. Chev.) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Fabaceae) ●
Ipomoea asarifolia (Desr.) Roem. & Schult. (Convolvulaceae)
Ipomoea batatas (L.) Lam. (Convolvulaceae)
Ipomoea cairica (L.) Sweet (Convolvulaceae)
Ipomoea eriocarpa R. Br. (Convolvulaceae)
Ipomoea kotschyana Hochst. ex Choisy (Convolvulaceae)
Jatropha curcas L. (Euphorbiaceae)
Kickxia dichondrifolia (Benth.) Janch. (Plantaginaceae) ●
Kickxia elegans (G. Forst.) D.A.Sutton (Plantaginaceae) ●
Kickxia webbiana (J.A.Schmidt) Sunding (Plantaginaceae) ●
Kohautia aspera (B.Heyne ex Roth) Bremek. (Rubiaceae)
Lantana camara L. (Verbenaceae)
Launaea arborescens (Batt.) Murb. subsp. *melanostigma* (Pett.) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Asteraceae) ●

- Launaea gorgadensis* (Bolle) N.Kilian (Asteraceae) ●
Launaea intybacea (Jacq.) Beauverd (Asteraceae)
Launaea picridioides (Webb) Engl. (Asteraceae) ●
Launaea thalassica N. Kilian, Brochmann & Rustan (Asteraceae) ●
Lavandula coronopifolia Poir. (Lamiaceae)
Lavandula dentata L. (Lamiaceae)
Lavandula rotundifolia Benth. (Lamiaceae) ●
Lemna minor L. (Araceae)
Lepidium didymum L. (Brassicaceae)
Leptochloa panicea (Retz.) Ohwi (Poaceae)
Leucaena leucocephala (Lam.) de Wit (Fabaceae)
Leucas martinicensis (Jacq.) R.Br. (Lamiaceae)
Limonium braunii (Bolle) A. Chev. (Plumbaginaceae) ●
Limonium brunneri (Webb) Kuntze (Plumbaginaceae) ●
Limonium jovi-barba (Webb) Kuntze (Plumbaginaceae) ●
Limonium lobinii N. Kilian & T. Leyens (Plumbaginaceae) ●
Limonium sundingii Leyens, Lobin, N. Kilian & Erben (Plumbaginaceae) ●
Lobularia fruticosa (Webb ex Christ) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Brassicaceae) ●
Lobularia spathulata (J. A. Schmidt) O.E. Schulz (Brassicaceae) ●
Lotus alianus J.H. Kirkbr. (Fabaceae) ●
Lotus arborescens Lowe ex Cout. (Fabaceae) ●
Lotus brunneri Webb (Fabaceae) ●
Lotus chevalieri Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Fabaceae) ●
Lotus jacobaeus L. (Fabaceae) ●
Lotus jacobaeus var. *villosus* A. Chev. (Fabaceae) ●
Lotus latifolius Brand (Fabaceae) ●
Lotus purpureus Webb (Fabaceae) ●
Lotus villosus Forssk. (Fabaceae)
Macrotyloma daltonii (Webb) Verdc. (Fabaceae)
Malva parviflora L. (Malvaceae)
Malvastrum americanum (L.) Torr. (Malvaceae)
Malvastrum coromandelianum (L.) Garcke (Malvaceae)
Melanoselinum bischoffii (J.A.Schmidt) A.Chev. (Apiaceae) ●
Melhania ovata (Cav.) Spreng. (Sterculiaceae)
Melinis grandiflora (v. *Melinis repens* subsp. *grandiflora*)
Melinis minutiflora P. Beauv. (Poaceae)
Melinis repens (Willd.) Zizka (Poaceae)
Melinis repens subsp. *grandiflora* (Hochst.) Zizka (Poaceae)
Mentzelia aspera L. (Loasaceae)
Merremia aegyptia (L.) Urb. (Convolvulaceae)
Micromeria forbesii Benth. (Lamiaceae) ●
Misopates orontium (L.) Raf. (Plantaginaceae)
Mollugo cerviana (L.) Ser. (Molluginaceae)
Mollugo nudicaulis Lam. (Molluginaceae)
Mollugo verticillata L. (Molluginaceae)
Momordica charantia L. (Cucurbitaceae)
Nasturtium officinale R.Br. (Brassicaceae)
Nicandra physalodes (L.) Gaertn. (Solanaceae)
Oldenlandia corymbosa L. (Rubiaceae)
Oldenlandia herbacea (L.) Roxb. (Rubiaceae)
Ophioglossum polyphyllum A. Braun ex Schub. (Ophioglossaceae)
Oxalis corniculata L. (Oxalidaceae)
Panicum laetum Kunth (Poaceae)
Panicum maximum Jacq. (Poaceae)
Panicum tenellum Lam. (Poaceae)
Papaver gorgoneum Cout. subsp. *gorgoneum* (Papaveraceae) ●
Papaver gorgoneum Cout. subsp. *theresias* Kadereit & Lobin (Papaveraceae) ●
Paraceterach marantae (L.) R.M. Tryon (Pteridaceae)
Parietaria judaica L. (Urticaceae)
Parkinsonia aculeata L. (Fabaceae)
Paronychia illecebroides Webb (Caryophyllaceae) ●
Paspalum vaginatum Sw. (Poaceae)
Passiflora edulis Sims (Passifloraceae)
Patellifolia patellaris (Moq.) A.J. Scott, Ford-Lloyd & J.T. Williams (Amaranthaceae)
Patellifolia procumbens (C. Sm.) A.J. Scott, Ford-Lloyd & J.T. Williams (Amaranthaceae)
Pellaea viridis (Forssk.) Prantl (Pteridaceae)
Pennisetum pedicellatum Trin. (Poaceae)
Pennisetum polystachyon (L.) Schult. (Poaceae)
Periploca chevalieri Browicz (Apocynaceae) ●
Peristrophe paniculata (Forssk.) Brummitt (Acanthaceae)
Phagnalon melanoleucum Webb (Asteraceae) ●
Phoenix atlantica A. Chev. (Arecaceae) ●
Phragmites australis (Cav.) Trin. ex Steud. (Poaceae)
Phyllanthus rotundifolius Klein ex Willd. (Phyllanthaceae)
Plantago afra L. (Plantaginaceae)
Polycarpaea caboverdeana Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Caryophyllaceae) ●
Polycarpaea gayi Webb (Caryophyllaceae) ●
Polycarpon tetraphyllum (L.) L. (Caryophyllaceae)
Polygala erioptera DC. (Polygalaceae)
Polypogon viridis (Gouan) Breistr. (Poaceae)
Portulaca oleracea L. (Portulacaceae)
Potamogeton pusillus L. (Potamogetonaceae)
Prosopis juliflora (Sw.) DC. (Fabaceae)
Psidium guajava L. (Myrtaceae)
Pteridium aquilinum (L.) Kuhn (Dennstaedtiaceae)
Pteris vittata L. (Pteridaceae)
Pulicaria diffusa (Shuttlew.) Pett. (Asteraceae) ●
Pulicaria longifolia (Gamal-Eldin) Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Asteraceae) ●
Rhynchosia minima (L.) DC. (Fabaceae)
Ricinus communis L. (Euphorbiaceae)
Rorippa nasturtium-aquaticum (L.) Hayek (Brassicaceae)
Rottboellia cochinchinensis (Lour.) Clayton (Poaceae)
Ruppia maritima L. (Ruppiales)
Ruta chalepensis L. (Rutaceae)
Salvia aegyptiaca L. (Lamiaceae)
Samolus valerandi L. (Primulaceae)
Sarcostemma daltonii Decne. (Apocynaceae) ●
Schmidtia pappophoroides Steud. ex J.A.Schmidt (Poaceae)
Schoenefeldia gracilis Kunth (Poaceae)
Sehima ischaemoides Forssk. (Poaceae)
Senna bicapsularis (L.) Roxb. (Fabaceae)
Sesbania grandiflora (L.) Pers. (Fabaceae)
Sesbania leptocarpa DC. (Fabaceae)
Sesuvium portulacastrum (L.) L. (Aizoaceae)
Sesuvium sesuvioides (Fenzl) Verdc. (Aizoaceae)
Setaria barbata (Lam.) Kunth (Poaceae)
Setaria pumila (Poir.) Roem. & Schult. (Poaceae)
Setaria verticillata (L.) P.Beauv. (Poaceae)
Sida alba L. (Malvaceae)
Sida cordifolia L. (Malvaceae)
Sida rhombifolia L. (Malvaceae)
Sida salviifolia C. Presl (Malvaceae)
Sideroxylon marginata (Decne.) Cout. (Sapotaceae) ●
Solanum nigrum L. (Solanaceae)
Solanum rigidum Lam. (Solanaceae) ●
Sonchus daltonii Webb (Asteraceae) ●
Sonchus oleraceus (L.) L. (Asteraceae)
Spermacoce verticillata L. (Rubiaceae)
Sporobolus confertus J.A. Schmidt (Poaceae) ●
Sporobolus minutus Link (Poaceae)
Sporobolus molleri Hack. (Poaceae)
Sporobolus robustus Kunth; (Poaceae)
Sporobolus spicatus (Vahl) Kunth (Poaceae)
Sporobolus virginicus (L.) Kunth (Poaceae)
Stipagrostis uniplumis (Licht.) De Winter (Poaceae)
Stylosanthes fruticosa (Retz.) Alston (Fabaceae)
Suaeda caboverdeana Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Amaranthaceae) ●
Tagetes minuta L. (Asteraceae)

Tagetes patula L. (Asteraceae)
Talinum paniculatum (Jacq.) Gaertn. (Talinaceae)
Tamarindus indica L. (Fabaceae)
Tamarix senegalensis DC. (Tamaricaceae)
Teline stenopetala (Webb & Berthel.) Webb & Berthel. subsp. *santoantaoui* Marrero Rodr. (Fabaceae) ●
Tephrosia bracteolata Guill. & Perr. (Fabaceae)
Tephrosia uniflora Pers. (Fabaceae)
Tetraena gaetula subsp. *waterlotii* (Maire) Beier & Thulin (Zygophyllaceae)
Tetraena simplex (L.) Beier & Thulin (Zygophyllaceae)
Tetraena vicentina Rivas Mart., Lousã, J.C. Costa & Maria C. Duarte (Zygophyllaceae) ●
Tetraena waterlotii Maire (v. *Tetraena gaetula* subsp. *waterlotii*)
Tetragonia tetragonioides (Pall.) Kuntze (Aizoaceae)
Tetrapogon cenchroides (A.Rich.) Clayton (Poaceae)
Thamnobryum alopecurum (Hedw.) Nieuwl. ex Gangulee (Neckeraceae)
Themeda triandra Forssk. (Poaceae)
Tolpis farinulosa (Webb) J.A.Schmidt (Asteraceae) ●
Trianthema portulacastrum L. (Aizoaceae)
Tribulus terrestris L. (Zygophyllaceae)
Trichodesma africanum (L.) Sm. (Boraginaceae)
Tricholaena teneriffae (L.f.) Link (Poaceae)
Tridax procumbens (L.) L. (Asteraceae)
Tripogon minimus (A.Rich.) Hochst. ex Steud. (Poaceae)
Tripogon multiflorus Miré & H. Gillet (Poaceae)
Typha domingensis Pers. (Typhaceae)
Umbilicus schmidtii Bolle (Crassulaceae) ●
Verbascum capitatis-viridis Hub.-Mor. (Scrophulariaceae) ●
Verbascum cystolithicum (Pett.) Hub.-Mor. (Scrophulariaceae) ●
Veronica anagallis-aquatica L. (Plantaginaceae)
Veronica becabungua L. (Plantaginaceae)
Wahlenbergia lobelioides (L.f.) Link (Campanulaceae)
Withania chevalieri A.E.Gonç. (Solanaceae) ●
Zaleya pentandra (L.) C.Jeffrey (Aizoaceae)
Zinnia pauciflora Phil. (Asteraceae)
Ziziphus mauritiana Lam. (Rhamnaceae)
Zostera sp. (Zosteraceae)

5b. Alphabetic list of Cabo Verde syntaxa

Actinopterido radiatae-Sarcostemmetum daltonii (1.2.3)
Adiantetalia capilli-veneris (11a)
Adiantetalia capilli-veneris (11)
Adiantetum inciso-philippensis (13.1.1)
Adiantetum trifidi (11.1.1)
Adiantion inciso-philippensis (13.1)
Adiantion trifidi (11.1)
Aeonio gogonei-Sarcostemmetum daltonii (1.1.4)
Aristido funiculatae-Tetraenetalia simplicis (3a)
Aristido cardosoi-Tetraenion simplicis (3.1)
Aristido cardosoi-Tetraenetum simplicis (3.1.1)
Arthrocnemetea franzii (10)
Arthrocnemetum franzii (10.1.1)
Arthrocnemion franzii (10.1)
Arthrocnemetalia franzii (10a)
Asparago squarrosi-Sarcostemmion daltonii (1.1)
Asphodelo mariolousae-Aristidetum cardosoi (3.1.2)
Asplenietea trichomanis (12)
Asterisco smithii-Euphorbietum tuckeyanae (1.2.8)
Bidentetalia pilosae (16a)
Blutaparonetum vermicularis (10.2.3)
Bothriochloa bladhii-Enneapogonetum desvauxii (2.1.3)
Campanuletum jacobaeae (12.1.4)
Campanulo bravensis-Launaetum thalassicae (12.1.5)
Campylantho spathulati-Sarcostemmetum daltonii (1.1.2)
Chenopodietalia muralis (15a)
Chenopodium muralis (15.1)
Chenopodium murale and Malva parviflora community (15.1.1)

Cocculo penduli-Sarcostemmetum daltonii (1.1.1)
Cocculo penduli-Acacieta caboverdeanae (1.3.2)
Cocculo penduli-Ficetum gnaphalocarpaceae (1.3.4)
Cocculo penduli-Phoenicetum atlanticae (1.4.1)
Cocculo penduli-Sarcostemmetum daltonii (1)
Cocculo penduli-Tamaricetum senegalensis (1.5.1)
Cressetum salinae (10.1.2)
Cymodocea nodosa community (7.1.1)
Cymodoceion nodosae (7.1)
Dichanthio foveolati-Heteropogonetum contorti (2.1.1)
Dichrostachyo platycarpae-Acacieta caboverdeanae ... (1b)
Dichrostachyo platycarpae-Acacieta caboverdeanae . (1.3.1)
Dichrostachyo platycarpae-Ficetum sur (1.3.6)
Diplotaxio hirtae-Kickxietum elegantis (12.1.2)
Dracaenetum caboverdeanae (1.3.9)
Echietum vulcanori (1.2.2)
Echio hypertropici-Euphorbietum tuckeyanae (1.2.4)
Echio stenosisiphonis-Euphorbietum tuckeyanae (1.1.5)
Ecliption prostratae (16.1)
Erysimo caboverdeanae-Periplocetum chevalieri (1.2.1)
Euphorbietalia prostrato-hirtae (14a)
Euphorbio hirtae-Boerhaviatum repentis (14.1.2)
Euphorbio tuckeyanae-Ficetum sur (1.3.7)
Euphorbio tuckeyanae-Sarcostemmetalia daltonii (1a)
Fico gnaphalocarpaceae-Acacion caboverdeanae (1.3)
Forsskaoleo procrigidifoliae-Acacieta caboverdeanae .. (1.3.3)
Forsskaoleo procrigidifoliae-Ficetum gnaphalocarpaceae ... (1.3.5)
Frankenio caboverdeanae-Asparagetum squarrosi (1.1.3)
Frankenio pseudoericifoliae-Suaedetalia caboverdeanae . (4a)
Frankenio pseudoericifoliae-Suaedetea caboverdeanae (4)
Globulario amygdalifoliae-Periplocion chevalieri (1.2)
Halodulo wrightii-Thalassietea testudinum (7)
Heteropogonetea contorti (2)
Heteropogonetum melanocarpi (2.1.2)
Heteropogonion melanocarpo-contorti (2.1)
Hypodematio crenati-Campanuletum bravensis (11.1.2)
Kickxietalia elegantis (12a)
Kickxietum webbiana (12.1.1)
Kickxietum elegantis (12.1)
Launaeo thalassicae-Euphorbietum tuckeyanae (1.2.5)
Lemna minor community (5.1.1)
Lemnetalia minoris (5a)
Lemnetea minoris (5)
Lemnion minoris (5.1)
Loto brunneri-Pulicarietum diffusae (4.1.4)
Loto latifolii-Artemisietum gogonei (1.2.6)
Magnocarici elatae-Phragmitetea australis (9)
Melanoselino bischoffii-Globularietum amygdalifoliae.. (1.2.7)
Melinio grandiflorae-Heteropogonetalia contorti (2a)
Oldenlandietum corymbosae (14.1.3)
Parietarietalia judaicae (13a)
Parietarietea judaicae (13)
Phoenicion atlanticae (1.4)
Phragmitetalia australis (9a)
Phragmition australis (9.1)
Polycarpaeo caboverdeanae-Tetraenetum waterlotii ... (4.1.1)
Polycarpaeo caboverdeanae-Tetraenion waterlotii (4.1)
Polygono arenastri-Poetea annuae (14)
Potametalia pectinati (6a)
Potametea pectinati (6)
Potamogeton pectinati (6.1)
Potamogeton pusillus community (6.1.1)
Rorippa nasturtium-aquaticum community (9.2.1)
Rorippion nasturtii-aquaticae (9.2)
Rorippo nasturtii-aquaticae-Glyceretalia fluitantis (9b)
Rudero-Manihotetea utilissima (16)
Ruppia maritima community (8.1.1)
Ruppietalia maritima (8a)
Ruppietalia maritima (8)
Ruppion maritima (8.1)

<i>Sehimatetum ischaemoidis</i>	(3.1.3)
<i>Sesuvietalia sesuvioideis</i>	(10b)
<i>Sesuvietum portulacastris</i>	(10.2.2)
<i>Sesuvietum sesuvioideis</i>	(10.2.1)
<i>Sesuvion sesuvioideis</i>	(10.2)
<i>Sideroxyletum marginati</i>	(1.3.8)
<i>Sporobolo spicati-Cyperetum crassipedis</i>	(4.1.3)
<i>Stellarietea mediae</i>	(15)
<i>Suaedo caboverdeanae-Asparagetum squarrosii</i> <i>Tamaricion senegalensis</i>	(1.5)
<i>Tetraenetea simplicis</i>	(3)
<i>Tetraenetum vicentinae</i>	(4.1.2)
<i>Tetraeno waterlotii-Sarcostemmetum daltonii</i>	(1.1.7)
<i>Thalassio testudinum-Syringodietalia filiformis</i>	(7a)
<i>Trianthemetum portulacastris</i>	(14.1.1)
<i>Trianthemion portulacastris</i>	(14.1)
<i>Typha domingensis</i> community	(9.1.1)
<i>Umbilico schmidtii-Cheilantheum acrosticae</i>	(12.1.3)

5c. Alphabetic list of syntaxa mentioned in text and pages

<i>Actinopterido radiatae-Sarcostemmetum daltonii</i>	31, 40, 41
<i>Adiantetalia capilli-veneris</i>	31, 64
<i>Adiantetea capilli-veneris</i>	31, 64
<i>Adiantetum inciso-philippensis</i>	32, 68
<i>Adiantetum trifidi</i>	31, 64, 65
<i>Adiantion inciso-philippensis</i>	32, 68
<i>Adiantion trifidi</i>	31, 64
<i>Aeonio gogonei-Sarcostemmetum daltonii</i>	30, 35, 37
<i>Aristido funiculatae-Tetraenetea simplicis</i>	30, 46
<i>Aristido cardosoi-Tetraenion simplicis</i>	31, 56
<i>Aristido cardosoi-Tetraenetum simplicis</i>	31, 55, 56
<i>Arthrocnetetea franzii</i>	31, 61
<i>Arthrocnetetum franzii</i>	31, 61
<i>Arthrocnetemion franzii</i>	31, 61
<i>Arthrocnetetalia franzii</i>	31, 61
<i>Asparago squarrosi-Sarcostemmion daltonii</i>	30, 34
<i>Asphodelo mariolousae-Aristidetum cardosoi</i>	31, 55, 56
<i>Asplenetetea trichomanis</i>	32, 65
<i>Asterisco smithii-Euphorbietum tuckeyanae</i>	30, 43, 45
<i>Bidentetalia pilosae</i>	32, 70
<i>Blutaparontetum vermicularis</i>	31, 63
<i>Bothriochloa bladhii-Enneapogonetum desvauxii</i>	30, 53
<i>Campanuletum jacobaeae</i>	32, 67
<i>Campanulo bravensis-Launaetum thalassicae</i>	32, 67
<i>Campylantho spathulati-Sarcostemmetum daltonii</i>	30, 35
<i>Chenopodietalia muralis</i>	32, 70
<i>Chenopodion muralis</i>	32, 70
<i>Chenopodium murale and Malva parviflora</i> community	32, 70
<i>Cocculo penduli-Sarcostemmetum daltonii</i>	30, 34
<i>Cocculo penduli-Acacieta caboverdeanae</i>	30, 46, 47
<i>Cocculo penduli-Ficetum gnaphalocarphae</i>	30, 47
<i>Cocculo penduli-Phoenicetum atlanticae</i>	30, 51, 52
<i>Cocculo penduli-Sarcostemmetea daltonii</i>	30, 33
<i>Cocculo penduli-Tamaricetum senegalensis</i>	30, 52
<i>Cressetum salinae</i>	31, 62
<i>Cymodocea nodosa</i> community	31, 60
<i>Cymodoceion nodosae</i>	31, 60
<i>Dichanthio foveolati-Heteropogonetum contorti</i>	30, 53, 54
<i>Dichrostachyo platycarpae-Acacieta caboverdeanae</i>	30, 43
<i>Dichrostachyo platycarpae-Acacieta caboverdeanae</i>	30, 44, 45
<i>Dichrostachyo platycarpae-Ficetum sur</i>	30, 48, 49
<i>Diplotaxio hirtae-Kickxietum elegantis</i>	32, 66
<i>Dracaenetum caboverdeanae</i>	30, 49, 51
<i>Echietum vulcanori</i>	30, 40
<i>Echio hypertropici-Euphorbietum tuckeyanae</i>	30, 40, 41
<i>Echio stenosisiphonis-Euphorbietum tuckeyanae</i>	30, 36, 37
<i>Ecliption prostratae</i>	32, 70
<i>Erysimo caboverdeanae-Periplocetum chevalieri</i>	30, 39, 40
<i>Euphorbietalia prostrato-hirtae</i>	32, 68
<i>Euphorbio hirtae-Boerhaviatum repentis</i>	32, 69, 70

<i>Euphorbio tuckeyanae-Ficetum sur</i>	30, 48, 50
<i>Euphorbio tuckeyanae-Sarcostemmetalia daltonii</i>	30, 34
<i>Fico gnaphalocarphae-Acacia caboverdeanae</i>	30, 44
<i>Forsskaoleo procrisifoliae-Acacieta caboverdeanae</i>	30, 46, 47
<i>Forsskaoleo procrisifoliae-Ficetum gnaphalocarphae</i>	30, 48
<i>Frankenio caboverdeanae-Asparagetum squarrosi</i>	30, 35, 36
<i>Frankenio pseudoericifoliae-Suaedetalia caboverdeanae</i>	31, 56
<i>Frankenio pseudoericifoliae-Suaedetea caboverdeanae</i>	31, 56
<i>Globulario amygdalifoliae-Periplocion chevalieri</i>	30, 39
<i>Halodulo wrightii-Thalassietea testudinum</i>	31, 60
<i>Heteropogonetea contorti</i>	30, 52
<i>Heteropogonetum melanocarpi</i>	30, 53, 54
<i>Heteropogonion melanocarpo-contorti</i>	30, 54
<i>Hypodematio crenati-Campanuletum bravensis</i>	31, 64, 65
<i>Kickxietalia elegantis</i>	32, 65
<i>Kickxietum webbiana</i>	31, 65, 66
<i>Kickxion elegantis</i>	32, 65
<i>Launaeo thalassicae-Euphorbietum tuckeyanae</i>	30, 42
<i>Lemna minor</i> community	31, 60
<i>Lemnetalia minoris</i>	31, 60
<i>Lemnetea minoris</i>	31, 60
<i>Lemnion minoris</i>	31, 60
<i>Loto brunneri-Pulicarietum diffusae</i>	31, 59
<i>Loto latifolii-Artemisietum gogonei</i>	30, 42, 43
<i>Magnocarici elatae-Phragmitetea australis</i>	31, 61
<i>Melanoselino bischoffii-Globularietum amygdalifoliae</i>	30, 43, 44
<i>Melinio grandiflorae-Heteropogonetalia contorti</i>	30, 53
<i>Oldenlandietum corymbosae</i>	32, 69, 70
<i>Parietarietalia judaicae</i>	32, 68
<i>Parietarietea judaicae</i>	32, 68
<i>Phoenicion atlanticae</i>	30, 49
<i>Phragmitetalia australis</i>	31, 61
<i>Phragmition australis</i>	31, 61
<i>Polycarphae caboverdeanae-Tetraenetum waterlotii</i>	31, 57
<i>Polycarphae caboverdeanae-Tetraenion waterlotii</i>	31, 57
<i>Polygono arenastri-Poetea annuae</i>	32, 68
<i>Potametalia pectinati</i>	31, 60
<i>Potametea pectinati</i>	31, 60
<i>Potamion pectinati</i>	31, 60
<i>Potamogeton pusillus</i> community	31, 60
<i>Rorippa nasturtium-aquaticum</i> community	31, 61
<i>Rorippion nasturtii-aquaticae</i>	31, 61
<i>Rorippo nasturtii-aquaticae-Glyceretalia fluitantis</i>	31, 61
<i>Rudero-Manihotetea utilissima</i>	32, 70
<i>Ruppia maritima</i> community	31, 60
<i>Ruppia maritima</i>	31, 61
<i>Ruppia maritima</i>	31, 61
<i>Ruppion maritima</i>	31, 61
<i>Sehimatetum ischaemoidis</i>	31, 56, 57
<i>Sesuvietalia sesuvioideis</i>	31, 61
<i>Sesuvietum portulacastris</i>	31, 62, 63
<i>Sesuvietum sesuvioideis</i>	31, 62, 63
<i>Sesuvion sesuvioideis</i>	31, 61
<i>Sideroxyletum marginati</i>	30, 49, 50
<i>Sporobolo spicati-Cyperetum crassipedis</i>	30, 49, 50
<i>Stellarietea mediae</i>	32, 70
<i>Suaedo caboverdeanae-Asparagetum squarrosii</i>	30, 36, 38
<i>Tamaricion senegalensis</i>	30, 52
<i>Tetraenetea simplicis</i>	30, 55
<i>Tetraenetum vicentinae</i>	31, 58
<i>Tetraeno waterlotii-Sarcostemmetum daltonii</i>	30, 38, 39
<i>Thalassio testudinum-Syringodietalia filiformis</i>	31, 60
<i>Trianthemetum portulacastris</i>	32, 69
<i>Trianthemion portulacastris</i>	32, 68
<i>Typha domingensis</i> community	32, 61
<i>Umbilico schmidtii-Cheilantheum acrosticae</i>	32, 66

6. References

- Andrade A. 1908. Notícia da flora das ilhas de Cabo Verde. – I. – Fogo e Brava. Revista Oficial da Missão Agronómica a Cabo Verde, 4: 101-144.
- Aleksandrova V.D. 1977. Vegetation types and regions of the Arctic and Antarctic. Nauka Leninegrad.
- Amaral I. 1991. Cabo Verde: Introdução Geográfica. In: Albuquerque L., Santos M. (coord.) História Geral de Cabo Verde 1: 1-22, Instituto de Investigação Científica Tropical e Direcção-Geral do Património Cultural de Cabo Verde, Lisboa e Praia.
- Arechavaleta M., Zurita N., Marrero M.C. & Martín J.L. (eds.). 2005. Lista preliminar de especies silvestres de Cabo Verde (hongos, plantas, y animales terrestres). Consejería de Medio Ambiente y Ordenación Territorial, Gobierno de Canarias.
- Baião L, Teixeira G. & Martins E.S. 2005. Tornabenea insularis: data on micromorphology and histochemistry. In: Proc. VI Simpósio Fauna e Flora das Ilhas Atlânticas, Praia, Ministério do Ambiente, Agricultura e Pescas de Cabo Verde, 7-12.
- Barbosa L.A.G.. 1968. L'Archipel du Cap-Vert. Acta Phytogeogr. Suec. 54: 94-97.
- Basto M.F. 1993. Aditamentos à flora vascular de Cabo Verde II Garcia de Orta, Série de Botânica 11: 75-82.
- Basto M.F. 1995. Flora de Cabo Verde Plantas Vasculares, 80. Globulariaceae. Lisboa-Praia.
- Basto M.F. 2002. Flora de Cabo Verde Plantas Vasculares, 8. Urticaceae. Lisboa-Praia.
- Basto M.F. 2002a. Flora de Cabo Verde Plantas Vasculares, 29. Frankeniaceae. Lisboa-Praia.
- Bolòs O. & Vigo J. 1984. Flora dels Països Catalans. Vol. I. Ed. Barcino. 736 pp. Barcelona.
- Braun-Blanquet J. 1928. Pflanzensoziologie. Grundzüge der Vegetationskunde. Springer. Berlin.
- Brochmann C & Rustan Ø.H. 1983-84. Additions to the vascular flora of Cabo Verde. Garcia de Orta, Série de Botânica 6: 89-106.
- Brochmann C & Rustan Ø.H. 1986. Additions to the vascular flora of Cabo Verde –II. Garcia de Orta, Série de Botânica 8: 9-37.
- Brochmann C & Rustan Ø.H. 1987. Distributional and ecological patterns of the endemic vascular flora of the Cape Verde Islands. Courier Forschungsinstitut Senckenberg: 95: 155-173.
- Brochmann C & Rustan Ø.H. 1993. Additions to the vascular flora of Cabo Verde -III Garcia de Orta, Série de Botânica 11: 31-62. 46
- Brochmann C & Rustan Ø.H. 2002. Additions to the vascular flora of Cabo Verde –IV. Garcia de Orta, Série de Botânica 16: 5-31.
- Brochmann C, Rustan Ø.H, Lobin W & Kilian N. 1997. The endemic vascular plants of the Cape Verde Islands, W Africa. Sommerfeltia 24: 1-356.
- Browicz K. 1966. The genus *Periploca* L. A monograph. Arboretum Kórnickie. 11: 5-104.
- Catarino S. 2014. Avaliação do estatuto de conservação da flora endémica de Cabo Verde. Master Tesis. Universidade de Lisboa.
- Chevalier A. 1935. Les îles du Cap Vert. Géographie, biogéographie, agriculture. Flore de l'archipel. Revue de Botanique Appliquée et d'Agriculture Tropicale 15: 733-1090.
- Chevalier A. & Emberger L. 1937. Les régions botaniques terrestres. In L'Encyclopédie Française V: les êtres vivants, 64/1-12, 66/ 1-7.
- Correia E. 1996. Contribuições para o conhecimento do clima de Cabo Verde. Garcia de Orta, Série de Geografia 15: 81-107.
- Costa J.C., Rivas-Martínez S., Duarte M.C. & Gomes I. 2014. Dados sobre a flora e a vegetação do litoral de Cabo Verde. In Cardoso Pinto, F. (ed.) Cabo Verde. Agronomia e Recursos Naturais: 239-255. Instituto Superior de Agronomia. ISA Press. Lisboa.
- Cronquist A. 1981. An integrated system of classification of flowering plants. Columbia University Press.
- Dice L.R. 1943. The biotic Province in North America. Ann Arbor. Univ. Michigan Press.
- Diels L. 1908. Pflanzengeographie. Sammlung Göschen N. 389.
- Diniz M.A. 1995. Flora de Cabo Verde Plantas Vasculares, 19. Caryophyllaceae. Lisboa-Praia.
- Diniz M.A. Duarte M.C. Martins E. Matos G.C. & Moreira I. 2002. Flora das Culturas Agrícolas de Cabo Verde. Lisboa, Centro de Botânica do Instituto de Investigação Científica Tropical (ICT).
- Diniz M.A. & Martins E. 2005. Biodiversidade e progresso na Flora de Cabo Verde. In: Proc. VI Simpósio Fauna e Flora das Ilhas Atlânticas, Praia, Ministério do Ambiente, Agricultura e Pescas de Cabo Verde, 7-12.
- Diniz A.C. & Matos G.C. 1986. Carta da zonagem agro-ecológica e da vegetação de Cabo Verde: I. Ilha de Santiago. Garcia de Orta. Sér. Bot. 8 (1, 2): 39-82.
- Diniz A.C. & Matos G.C. 1987. Carta da zonagem agro-ecológica e da vegetação de Cabo Verde: II. Ilha do Fogo. Garcia de Orta. Sér. Bot. 9 (1,2): 35-66
- Diniz A.C. & Matos G.C. 1988. Carta da zonagem agro-ecológica e da vegetação de Cabo Verde: III. Ilha de Maio. Garcia de Orta. Sér. Bot. 10 (1, 2): 19-48.
- Diniz A.C. & Matos G.C. 1988a. Carta da zonagem agro-ecológica e da vegetação de Cabo Verde: IV. Ilha da Boavista. Garcia de Orta. Sér. Bot. 10 (1, 2): 49-70.
- Diniz A.C. & Matos G.C. 1993. Carta da zonagem agro-ecológica e da vegetação de Cabo Verde: V. Ilha do Sal. Garcia de Orta. Sér. Bot. 11 (1, 2): 9-30.
- Diniz A.C. & Matos G.C. 1994. Carta da zonagem agro-ecológica e da vegetação de Cabo Verde: IV. Ilha de São Vicente. In: Garcia de Orta. Sér. Bot. 12 (1, 2): 69-100.
- Diniz A.C. & Matos G.C. 1994. Carta da zonagem agro-ecológica e da vegetação de Cabo Verde: VII. Ilha de Santa Luzia. Garcia de Orta. Sér. Bot. 12 (1, 2): 101-120.
- Diniz A.C. & Matos G.C. 1999. Carta da zonagem agro-ecológica e da vegetação de Cabo Verde: VIII. Ilha de S. Nicolau. Garcia de Orta. Sér. Bot. 14 (1): 1-54.
- Diniz A.C. & Matos G.C. 1999a. Carta da zonagem agro-ecológica e da vegetação de Cabo Verde: IX. Ilha Brava. Garcia de Orta. Sér. Bot. 14 (1): 55-82.
- Diniz A.C. & Matos G.C. 1999b. Carta da zonagem agro-ecológica e da vegetação de Cabo Verde: X. Ilha de Santo Antão. Garcia de Orta. Sér. Bot. 14 (2): 1-34.
- Duarte M.C. 1998. A Vegetação de Santiago (Cabo Verde). Apontamento histórico, composição florística e interpretação ecológica das comunidades. Diss. Doutoramento em Engenharia Agronómica, Instituto Superior de Agronomia, Universidade Técnica de Lisboa. 429 pp.

- Duarte M.C., Gomes I. & Moreira I. 1999. Ilha de Santiago (Cabo Verde) - Notas florísticas e fitogeográficas (I). *Garcia de Orta, Série de Botânica* 14: 107-113.
- Duarte M.C. & Moreira I. 2002. A vegetação de Santiago (Cabo Verde). *Apointamento histórico. Garcia de Orta, Sér. Bot.* 16 (1-2): 51-80.
- Duarte M.C., Rego F & Moreira I. 2005. Distribution patterns of plant communities on Santiago Island, Cape Verde. *Journal of Vegetation Science* 16: 283-292.
- Duarte M.C., Rego F, Romeiras M.M & Moreira I. 2008. Plant species richness in the Cape Verde Islands -eco-geographical determinants. *Biodiversity and Conservation* 17: 453-466.
- Duarte M.C. & Romeiras M.M. 2009. Cape Verde Islands. In: Gillespie R. & Clague D. (eds) *Encyclopedia of Islands*. Berkeley, University of California Press. pp 143-148.
- Drude O. 1890. *Handbuch der Pflanzengeographie*. Stuttgart.
- Dupont P. 1962. La flore atlantique européenne. Introduction à l'étude du secteur ibéro-atlantique. Documents pour les cartes des productions végétales Série Europe Atlantique I. Faculté des Sciences. Toulouse. 414 pp.
- Engler A. 1924. Übersicht über die Florenreiche und Florengebiete der Erde. In A. Engler & E. Gilg. *Syllabus der Pflanzenfamilien*, 9-10 Aufl. Berlin.
- Engler A. 1879-82. Versuch einer Entwicklungsgeschichte der extratropischen Florengebiete der nördlichen Hemisphäre. I Theil. Die extratropischen Gebiete der nördlichen Hemisphäre. II Theil. Die extratropischen Gebiete der südlichen Hemisphäre. Berlin.
- Engler A. & Gilg E. 1919. Übersicht über die Florenreiche und Florengebiete der Erde von A. Engler. In: Engler, A. (ed.). *Syllabus der Pflanzenfamilien* 8th ed.: 352-364. Berlin.
- Estrela F. 1996. *Flora de Cabo Verde Plantas Vasculares*, 54. Euphorbiaceae. Lisboa-Praia.
- Faber-Langendoen D., Josse C., Navarro G., Keeler-Wolf T., Meidinger D., Helmer E., Hoagland B., Fults G., Ponomarenko S., Saucier J.P., Tart D., Weakly A. 2011. Classification and description of world formations types. FGDC Secretariat, U.S. Geological Survey, Reston, VA and NaturServe, Arlington, VA; HRWG: Hierarchy Revisions Working Group (Federal Geographic Data Committee) 2011, November 22.
- Géhu J.M. 2006. *Dictionnaire de sociologie et sinécologie végétales*. J. Cramer. Belin Stuttgart.
- Gomes I. 1995. *Flora de Cabo Verde. Plantas vasculares*. 68. Gentianaceae. Lisboa, Centro de Botânica do Instituto de Investigação Científica Tropical (ICT).
- Gomes I. 2006. *Plantas medicinais e aromáticas de cabo verde*, Lisboa, ISA/UTL (submetido em 2006)
- Gomes I., Costa J.C., Duarte M.C. & Moreira I. 2012. Flora e vegetação da litoral da ilha da Boavista. In Monteiro A., Gomes da Silva F. & Jorge R. (eds.). *Gestão e conservação da flora e da vegetação de Portugal e da África Lusófona. "In Honorium" do Professor Catedrático Emérito Ilídio Rosário dos Santos Moreira: 195-209*. Instituto Superior de Agronomia. ISA Press. Lisboa.
- Gomes I. & Martins E. 2002. *Flora de Cabo Verde. Plantas vasculares*. 5. Papaveraceae. Lisboa, Centro de Botânica do Instituto de Investigação Científica Tropical (ICT).
- Gomes I. Gomes S. Vera-Cruz M. Kilian N. Leyens T. & Lobin W. 1995. *Plantas endêmicas e árvores indígenas de Cabo Verde*. Instituto Nacional de Investigação e Desenvolvimento Agrário. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH - Cooperação Técnica Alemã. República de Cabo Verde.
- Gonçalves A.E. 1999. Uma nova espécie de *Withania* (Solana-ceae) de Cabo Verde. *Garcia de Orta, Série de Botânica* 14: 149-151.
- Gonçalves M. 2002a. *Flora de Cabo Verde Plantas Vasculares*, 21. Plumbaginaceae Lisboa-Praia.
- Gonçalves M. 2002b. *Flora de Cabo Verde Plantas Vasculares*, 41. Crassulaceae. Lisboa-Praia.
- Gonçalves M. 2002c. *Flora de Cabo Verde Plantas Vasculares*, 70A. Periplocaceae. Lisboa-Praia.
- Gonçalves M. 2003. *Flora de Cabo Verde Plantas Vasculares*, 70. Asclepiadaceae. Lisboa-Praia.
- Good R. 1947. *The Geography of the Flowering Plants*. London
- Grandvaux-Barbosa L. 1961. Subsídios para um dicionário utilitário e glossário dos nomes vernáculos das plantas do arquipélago de Cabo Verde. *Garcia de Orta*, 9 (1): 37-91.
- Guil-Guerrero J. López-Martinez J. Navarro-Juarez R. & Gómez-Mercado F. 2006. Gamma-linolenic acid from Cape Verde Boraginaceae. *Nat Prod Res.* 20 (1): 9-12.
- Hansen A. & Sunding P. 1993. *Flora of Macaronesia. Checklist of vascular plants. Sommerfeltia* 17 (4): 1-294.
- Jarvis C. 1985. The genus *Tolpis* Adanson and its occurrence in the Cape Verde Islands (Phanerogamae: Asteraceae: Cichoreae). *Courier Forschungsinstitut Senckenberg* 68: 179-184.
- Kadereit J. & Lobin W. 1990. The taxonomy and affinities of *Papaver gorgoneum* from the Cape Verde Islands. *Nordic Journal of Botany* 9 (6): 643-648
- Kilian N. Brochmann C. & Rustan Ø. 1987. *Launaea thalassica* (Asteraceae, Lactuceae), a new species from the Cape Verde Islands, W Africa. *Willdenowia* 16: 491-496.
- Kilian N. & Leyens T. 1994. *Limonium lobinii* (Plumbaginaceae), a new species from the Cape Verde Islands, W Africa. *Willdenowia* 24: 59-63.
- Lavrenko E.M. 1964. Botanical-geographic dominions. In *Physical-Geographic Atlas of the World*.
- Leyens T. & Lobin W. 1994. *Campanula* (Campanulaceae) on the Cape Verde Islands: two species or only one? *Willdenowia* 25: 215-228.
- Leyens T. & Lobin W. 1996. *Primeira Lista Vermelha de Cabo Verde*. Courier Forschungsinstitut Senckenberg, 193: 1-140.
- Lobin W. 1986. *Eragrostis conertii* (Poaceae), eine neue Art von den Kapverdischen Inseln. *Willdenowia* 16: 143-151.
- Lobin W. 1986. *Katalog der von den Kapverdischen Inseln beschriebenen Taxa höherer Pflanzen (Pteridophyta & Phanerogamae)*. Courier Forschungsinstitut Senckenberg 81:93-164.
- Lobin W & Porembski S. 1994. The genus *Verbascum* (Scrophulariaceae) on the Cape Verde Islands, W Africa, *Willdenowia* 24: 65-81.
- Lobin W & Zizka G. 1987. Einteilung der Flora (Phanerogamae) der Kapverdischen Inseln nach ihrer Einwanderungsgeschichte. *Courier Forschungsinst. Senckenberg* 95: 127-153.
- Marrero A & Almeida Pérez R.S. 2012. A new subspecies, *Dracaena draco* (L.) L. ssp. *caboverdeana* Marrero Rodr. & R. Almeida (Dracaenaceae) from Cape Verde Islands. *International Journal of Geobotanical Research*. 2: 35-40.
- Martins E. 1995. *Flora de Cabo Verde. Plantas vasculares*. 74. Boraginaceae. Lisboa-Praia.
- Martins E. 1996. *Flora de Cabo Verde Plantas Vasculares*, 67. Apiaceae. Lisboa-Praia.
- Martins E.S., Diniz M.A., Paiva J., Gomes I., Gomes S. (eds.) 1995, 1996, 2002. *Flora de Cabo Verde*. Lisboa, Praia, ICT/INIDA.

- Mattic F. 1964. Übersicht über die Aloreneiche und Alorenggebiete der Erde. Engler's A. Syllabus der pflanzenfamilien. Bd. 2. 13. Aufl. Berlin-Nikolassee. S. 626—630
- Meusel H. & Jäger E.J. & Weinert E. 1965. Vergleichenden Chorologie der Zentraleuropäischen Flora, 583 pp.I. Jena.
- Nogueira I. 1975. Plantas colhidas pelo Eng. L. A. Grandvaux Barbosa no Arquipélago de Cabo Verde - II. Spermatoophyta. Garcia de Orta, Série de Botânica 2: 89-106.
- Nogueira I. 1976. Plantas colhidas pelo Eng. L. A. Grandvaux Barbosa no Arquipélago de Cabo Verde - III. Spermatoophyta (Rubiaceae – Gentianaceae). Garcia de Orta, Série de Botânica 3: 19-32.
- Nogueira I. 1977. Plantas colhidas pelo Eng. L. A. Grandvaux Barbosa no Arquipélago de Cabo Verde - VI. Spermatoophyta (Nyctaginaceae – Casuarinaceae). Garcia de Orta, Série de Botânica 3: 85-98.
- Nogueira I. 1978-79. Plantas colhidas pelo Eng. L. A. Grandvaux Barbosa no Arquipélago de Cabo Verde - VII. Spermatoophyta (Cannaceae - Cyperaceae). Garcia de Orta, Série de Botânica 4: 1-6.
- Nogueira I. & Ormonde J. 1981. Plantas colhidas pelo Eng. L. A. Grandvaux Barbosa no Arquipélago de Cabo Verde - IX. Spermatoophyta (Gramineae). Garcia de Orta, Série de Botânica 5: 13-30.
- Nogueira I. & Ormonde J. 1983-84. Plantas colhidas pelo Eng. L. A. Grandvaux Barbosa no Arquipélago de Cabo Verde - X. Aditamentos e correções às partes I e VII. Garcia de Orta, Série de Botânica 6: 163-176.
- Nogueira I & Ormonde J. 1985. Plantas colhidas pelo Eng. L. A. Grandvaux Barbosa no Arquipélago de Cabo Verde - XI. Aditamentos e correções à parte IX. Garcia de Orta, Série de Botânica 7:15-18.
- Ormonde J. 1976. Plantas colhidas pelo Eng. L. A. Grandvaux Barbosa no Arquipélago de Cabo Verde - IV. Spermatoophyta (Leguminosae). Garcia de Orta, Série de Botânica. 3: 33-48.
- Ormonde J. 1977. Plantas colhidas pelo Eng. L. A. Grandvaux Barbosa no Arquipélago de Cabo Verde - V. Spermatoophyta (Rosaceae – Umbelliferae). Garcia de Orta, Série de Botânica 3: 73-80.
- Ormonde J. 1980. Plantas colhidas pelo Eng. L. A. Grandvaux Barbosa no Arquipélago de Cabo Verde - V. Spermatoophyta (Buraginaceae – Plantaginaceae). Garcia de Orta, Série de Botânica 4: 171-188.
- Quezel P. 1978. Analysis of the flora of Mediterranean and Saharan Africa. Ann. Miss. Bot. Garden 65: 479-534.
- Raven P.H. & Axelrod D.I. 1974. Angiosperm Biogeography and Past Continental Movements. Annals of the Missouri Botanical Garden 61(3): 539-673.
- Rivas-Martínez S. 2005. Notions on dynamic-catenal phytosociology as a basis of landscape science. Plant Biosyst. 139(2): 135-144
- Rivas-Martínez S. 2005a. Avances en Geobotánica. Discurso de Apertura del Curso Académico de la Real Academia Nacional de Farmacia del año 2005. Real Academia Nacional de Farmacia. Available: <http://www.ranf.com/pdf/discursos/ina/2005>. via the INTERNET. Accessed 2005 Dec. 11.
- Rivas-Martínez S. 2007. Mapas de series, geoseries y geopermaseries de vegetación de España [Memoria del mapa de vegetación potencial de España]. Parte I. Itinera Geobot. 17: 5-436.
- Rivas-Martínez S. 2009. Ensayo geobotánico global sobre la Macaronesia. In Beltrán Tejera, E., I. Afonso-Carrillo, A. Garcia Gallo & O.Rodríguez Delgado (Eds.): Homenaje al Profesor Dr, Wolfredo Wildpret de la Torre. Instituto de Estudios Canarios. La Laguna (Tenerife Islas Canarias). Monografía LXXVIII: 255-296 y 2 mapas. ISBN: 978-84-88366-82-5.
- Rivas-Martínez S. & al. 2011. Mapas de series, geoseries y geopermaseries de vegetación de España [Memoria del mapa de vegetación potencial de España]. Parte II. Itinera Geobot. 18 (1, 2): 5-800.
- Rivas-Martínez S & Rivas-Sáenz S. 2009, website <http://www.globalbioclimatic.org>
- Rivas-Martínez S. Rivas-Sáenz S. & Penas A. 2011. World-wide bioclimatic classification system. Global Geobotany 1: 1-634.
- Romeiras M.M., Catarino L., Torrão M.M. & Duarte M.C. 2011. Diversity and origin of medicinal exotic flora in Cape Verde Islands. Plant Ecology and Evolution 142: 214-225.
- Romeiras M.M., Catarino S., Gomes I., Fernandes C., Costa J.C., Caujapé-Castell J. & Duarte M.C. 2016. IUCN Red List assessment of the Cape Verde endemic flora: towards a global strategy for plant conservation in Macaronesia. Botanical Journal of the Linnean Society 180: 413-425
- Romeiras M.M., Duarte M.C. & Pais M.S. 2009 Islands biodiversity: conservation strategies based on knowledge of endemic plant species from Cape Verde Islands. In: Aronoff J.B. (ed.). Nature Conservation: Global, Environmental and Economic Issues. Nova Science Publishers, Inc., New York, USA.
- Romeiras M.M., Monteiro F., Duarte M.C., Schaefer H. & Carine M. 2015. Patterns of genetic diversity in three plant lineages endemic to the Cape Verde Islands. AoB PLANTS 7: plv051.
- Romeiras M.M., Paulo O.S., Duarte M.C., Pina-Martins F., Cotrim M.H., Carine M.A. & Pais M.S. 2011. Origin and diversification of the genus *Echium* (Boraginaceae) in the Cape Verde archipelago. Taxon 60: 1375-1385.
- Schmidt J.A. 1852. Beiträge zur Flora der Cap Verdischen Inseln. Heidelberg: Akademische Buchhandlung.
- Schmidt K. & Lobin W. 1999. *Tornabenea ribeirensis* (Apiaceae) - a new species from São Nicolau, Cape Verde Islands (West Africa). Feddes Repertorium 110:7-11.
- Skottsberg C. 1913. A botanical survey of the Falkland Islands — K. Svensk. Vetensk Akad. Handl., 50 (3): 1-129.
- Skottsberg C. 1921. The phanerogams of the Juan Fernandez Islands. Leipzig, John & Kröstel
- Skottsberg C. 1945. The Falkland Islands. Chron. Bot. 7: 23-6.
- Skottsberg C. 1960. Remarks on plant geography of Southern cold temperate zone. Proc. Royal Soc., Series B, 152 (949): 447-457.
- Sunding P. 1973. Endemism in the Flora of the Cape Verde Islands, with Special Emphasis on the Macaronesian Flora Element. Monographiae Biologicae Canarienses. In: International Congress Flora Macaronesica (4). Kunkel, G. (ed.), Las Palmas, Gran Canaria: 112-117.
- Sunding P. 1974. Additions to the vascular flora of the Cape Verde islands, Botanical Garden, University of Oslo. Garcia de Orta, Série de Botânica 2: 5-30.
- Sunding P. 1981. Additions to the vascular flora of the Cape Verde Islands II, Botanical Garden and Museum, University of Oslo. Garcia de Orta, Série de Botânica 5: 31-42.
- Sunding P. 1982. Additions to the vascular flora of the Cape Verde islands III, Botanical Garden and Museum, University of Oslo (Garcia de Orta, Série de Botânica 5: 125-138.

Sukhorukov A.P. & Nilova M.V. 2016. A new species of *Arthrocnemum* (Salicornioideae: Chenopodiaceae-Amaranthaceae) from West Africa, with a revised characterization of the genus. *Botany Letters* 163(3): 240. 2016.

Teixeira A. & Barbosa L.G. 1958. *A Agricultura do Arquipélago de Cabo Verde*. Junta da Investigação do Ultramar, 177 pp. Lisboa.

Takhtajan A. 1986. *Floristic Regions of the World*. Transl. by T.J. Crovello and ed. by A. Cronquist. University of California Press. 522 pp. Berkeley.

Walter H. & Straka H. 1970. *Arealkunde. Floristisch Historische Geobotanik*. Ed. E. Ulmer.

Webb P.B. 1849. *Spicilegia gorgonea*. In: Hooker WJ (ed.), *Niger flora*. London: Pp. 89–197. Hippolyte Bailliere Publisher.

Photographic Annex



Photo 1 - *Acacia cabverdeana*



Photo 2 - *Actiniopteris radiata*



Photo 3 - *Aeonium gorgonum*



Photo 4 - *Artemisia gorgonum*



Photo 5 - *Aristida cardosoi*



Photo 6 - *Arthrocnemum franzii*



Photo7 - *Asparagus squarrosus*

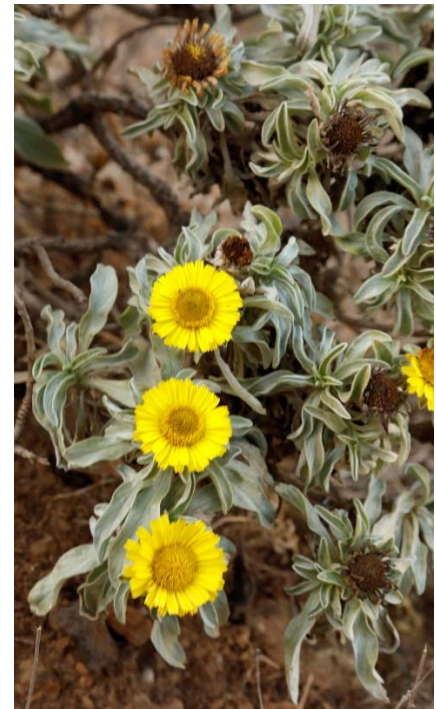


Photo 8 - *Astericus daltonii*



Photo 9 - *Asteriscus smithii*



Photo 10 - *Asteriscus vogelli*



Photo 11 - *Blutaparon vermiculare*



Photo 12 - *Campanula bravensis*



Photo 13 - *Campanula jacobaea*



Photo 14 - *Campylanthus glaber*



Photo 15 - *Cistanche brunneri*



Photo 16 - *Cocculus pendulus*



Photo 17 - *Conyza feae*



Photo 18 - *Conyza varia*



Photo 19-*Cressa salina*



Photo 20 - *Cyperus crassipes*



Photo 21 - *Daucus annuus*



Photo 22 - *Daucus insularis*



Photo 23 - *Daucus tenuissimus*



Photo 24 - *Dichrostachys cinerea* subsp. *platycarpa*



Photo 25 - *Diplotaxis glauca*



Photo 26 - *Diplotaxis hirta*



Photo 27 - *Diplotaxis varia*



Photo 28 - *Dracaena caboverdeana*



Photo 29 - *Echium glabrescens*



Photo 30 - *Echium hypertropicum*



Photo 31 - *Echium stenosphon*



Photo 32 - *Echium vulcanorum*



Photo 33 - *Erysimum caboverdeanum*



Photo 34 - *Euphorbia tuckeyana*



Photo 35 - *Ficus sycomorus* subsp. *gnaphalocarpa*



Photo 36 - *Forsskaolea procrisifolia*



Photo 37 - *Frankenia caboverdeana*



Photo 38 - *Frankenia pseudoericifolia*



Photo 39 - *Globularia amygdalifolia*



Photo 40 - *Helianthemum gorgoneum*



Photo 41 - *Hyparrhenia caboverdeana*



Photo 42 - *Indigofera tinctoria* subsp. *microcarpa*



Photo 43 - *Kickxia elegans* subsp. *dichondrifolia*



Photo 44 - *Kickxia elegans* subsp. *elegans*

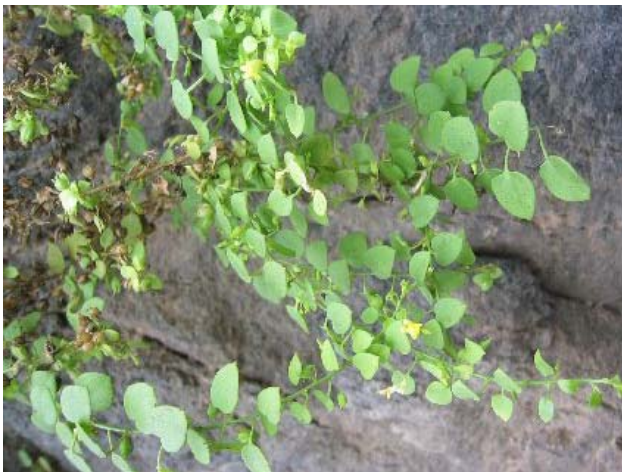


Photo 45 - *Kickxia elegans* subsp. *webbiana*



Photo 46 - *Launaea arborescens* subsp. *melanostigma*



Photo 47 - *Launaea picridioides*



Photo 48 - *Launaea thalassica*



Photo 49 - *Lavandula rotundifolia*



Photo 50 - *Limonium braunii*



Photo 51 - *Limonium jovi-barba*



Photo 52 - *Limonium lobinii*



Photo 53 - *Lobularia fruticosa*



Photo 54 - *Lobularia fruticosa*



Photo 56 - *Lotus chevalieri*



Photo 57 - *Lotus latifolius*



Photo 58 - *Lotus purpureus*



Photo 59 - *Melanoselinum bischoffii*



Photo 60 - *Micromeria forbesii*

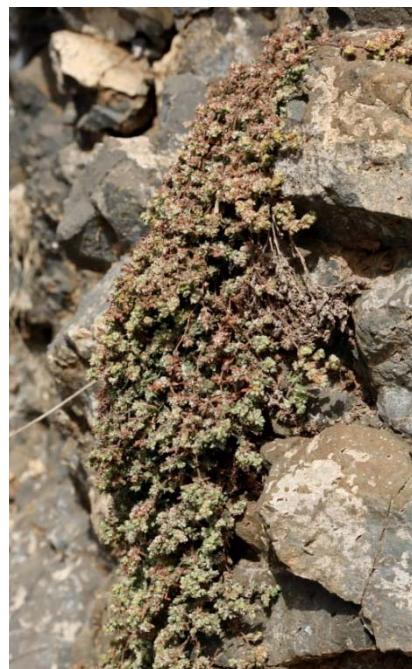


Photo 61 - *Paronychia illecebroides*



Photo 62 - *Periploca chevalieri*



Photo 63 - *Phagnalon melanoleucum*



Photo 64 - *Phoenix atlantica*



Photo 65 - *Polycarpaea caboverdeana*



Photo 66 - *Polycarpaea gayi*



Photo 67 - *Pulicaria diffusa*



Photo 68 - *Sarcostemma daltonii*



Photo 69 - *Sehima ischaemoides*



Photo 70 - *Sesuvium sesuvioides*



Photo 71 - *Sideroxylon marginata*



Photo 72 - *Sporobolus spicatus*



Photo 73 - *Suaeda caboverdeana*



Photo 74 - *Tamarix senegalensis*



Photo 75 - *Tolpis farinulosa*



Photo 76 - *Umbilicus schmidtii*



Photo 77 - *Verbascum cystolithicum*



Photo 77 - *Verbascum cystolithicum*



Photo 79 - *Ziziphus mauritiana*



Photo 80 - *Zygophyllum vicentinum*



Photo 81 - *Zygophyllum waterlotii*



Photo 82 - *Cocco pendulae-Sarcostemmetum daltonii*



Photo 83 - *Campylantho spathulati-Sarcostemmetum daltonii*



Photo 84 - *Frankenio caboverdeanae-Aspargetum squarrosi*



Photo 85 - *Aeonio gorgoni-Sarcostemmetum daltonii*



Photo 86 - *Echio stenosiphonis-Euphorbietum tuckeyanae*



Photo 87 - *Suaedo caboverdeanae-Asparagetum squarrosii*



Photo 88 - *Zygophyllo waterlotii-Sarcostemmetum daltonii*



Photo 89 - *Erysimo caboverdeanae-Periplocetum chevalieri*



Photo 90 - *Echietum vulcanori*



Photo 91 - *Actinopterido radiatae-Sarcostemmetum daltonii*



Photo 92 - *Echio hypertropici-Euphorbietum tuckeyanae*



Photo 93 - *Launaeo thalassicae-Euphorbietum tuckeyanae*



Photo 94 - *Loto latifolii-Artemisietum gorgonum*



Photo 95 - *Melanoselino bischoffii*-*Globarietum amygdalifoliae*



Photo 96- *Asterisco schmidtii*-*Euphorbietum tuckeyanae*



Photo 97 - *Dichrostachyo platycarpae*-*Acacietum caboverdeanae acacietosum caboverdeanae*



Photo 98 - *Dichrostachyo platycarpae*-*Acacietum caboverdeanae periplocetosum chevalieri*



Photo 99 - *Cocculo penduli*-*Acacietum caboverdeanae*



Photo 100 - *Forsskaoleo picridifoliae*-*Acacietum caboverdeanae*



Photo 101 - *Cocculu penduli*-*Ficetum gnaphalocarpa*



Photo 102 - *Forsskaoleo picridifoliae*-*Ficetum gnaphalocarphae*



Photo 103 - *Sideroxyletum marginatae*



Photo 104 - *Dracaenetum caboverdeanae*



Photo 105 - *Coccothraux penduli-Phoenicetum atlantis*



Photo 106 - *Coccothraux penduli-Tamaricetum senegalensis*



Photo 107 - *Dichanthio foveolati-Heteropogonetum contorti*



Photo 108 - *Heteropogonetum melanocarpi*



Photo 109 - *Bothriochloa bladhii-Eneapogonetum desvauxii*



Photo 110 - *Aristido funiculatae-Zygophylletum simplicis*



Photo 111 - *Polycarpaeo caboverdeanae-Zygophylletum waterlotii*



Photo 112 - *Zygophylletum vicentinum*



Photo 113 - *Sporobolo spicati-Cyperetum crassipedis*



Photo 114 - *Loto brunneri-Pulicarietum diffusae* (top) and *Sehimatetum ischaemoidis* (down)



Photo 115 - *Arthrocnemetum paleotropicalis*



Photo 116 - *Cressetum salinae* and *Sesuvietum portulacoidis*



Photo 117 - *Sesuvietum sesuviodis*



Photo 118 - *Blutaparonentum vermicularis*



Photo 119 - *Hypodematio crenati-Campanuletum bravensis*



Photo 120 - *Diplotaxi hirtae-Kichxietum elegantis*



Photo 121 - *Umbilico schmidtii-Cheilantheum acrosticae*



Photo 122 - *Campanuletum jacobaeae*



Photo 123 - *Campanulo bravensis-Launeatum thalassicae*



Photo 124 - *Trianthemetum portulacastri*