

*Convolvulus caput-medusae* Lowe on Fuerteventura  
(Canary Islands, Spain)

DIETMAR BRANDES

*Arbeitsgruppe für Vegetationsökologie und experimentelle  
Pflanzensoziologie*

*Botanisches Institut und Botanischer Garten*

*Technische Universität Braunschweig, D-38023 Braunschweig*

BRANDES, D. (2001). *Convolvulus caput-medusae* Lowe on Fuerteventura (islas Canarias). *VIERAEA* 29: 79-88.

**ABSTRACT:** *Convolvulus caput-medusae* is an endemic plant species of the Canary Islands growing only on Fuerteventura and Gran Canaria. Because this species is highly threatened, the till now little known populations of Fuerteventura have been investigated. The population is minimum 50.000 individuals. The size distribution has been investigated by certain parts of subpopulations. The maximum height was 56 cm, the maximum diameter 125 cm. *Convolvulus caput-medusae* is associated with other shrubs and subshrubs in communities belonging probably to the class *Pegano-Salsoletea* respectively to the new class *Polycarpaceo niveae-Traganetea moquini*. It grows on rocky plateaus covered with a shallow layer of carbonate sand in the *Convolvulus caput-medusae* - *Ononis natrix ssp. ramosissima* community, whereas on steep rocky slopes in direct contact to the sea it grows in the *Chenoleo tomentosae-Suaedetum vermiculatae*. Both communities are documented by plant sociological relevés. The need for further investigations is pointed out.

**Keywords:** *Convolvulus caput-medusae*, Fuerteventura, vegetation ecology, phytosociology, Canary Islands.

**RESUMEN:** *Convolvulus caput-medusae* es una planta endémica de las islas Canarias y se encuentra sólo en Fuerteventura y Gran Canaria. Ya que este tipo de planta está muy amenazada serán investigadas las poblaciones de Fuerteventura hasta ahora poco conocidas. El tamaño de la población es de como mínimo 50.000 individuos. La distribución de los distintos tamaños de la población ha sido estimada a partir de una subpoblación escogida. La altura máxima fue de 56 cm, y el diámetro máximo del arbusto de 125 cm. *Convolvulus caput-medusae* se asocia con otros arbustos y matorrales pertenecientes a comunidades de la clase *Pegano-Salsoletea*, o que se encuentran próximas en la clasificación. Sobre mesetas llanas rocosas con una fina superficie carbonatada esta especie crece conjuntamente con *Ononis natrix ssp. ramosissima* formando una única población,

mientras que en acantilados escarpados en contacto directo con el mar lo hace con *Chenoleo tomentosae* - *Suaedetum vermiculatae*.

Palabras clave: *Convolvulus caput-medusae*, vegetación, ecología, fitosociología, Fuerteventura, islas Canarias.

## INTRODUCTION

The following 10 species of *Convolvulus* are endemic to the Canary Islands:

*Convolvulus canariensis* L.

*Convolvulus caput-medusae* Lowe

*Convolvulus floridus* L. fil.

*Convolvulus fruticosus* (Webb) Link

*Convolvulus glandulosus* (Webb) Hall.

*Convolvulus scoparius* L. fil.

*Convolvulus lopezsocasi* Svent.

*Convolvulus perraudieri* Coss.

*Convolvulus subauriculatus* Burch.

*Convolvulus volubilis* Link [= *Convolvulus diversifolius* Mend.-Heuer]

In addition to this Hohenester & Weiß (1993) note *Convolvulus massonii* Dietr. and the African species *Convolvulus farinosus* L. Also growing are the wide spread ruderal resp. segetal species:

*Convolvulus althaeoides* L.

*Convolvulus arvensis* L.

*Convolvulus siculus* L.

*Convolvulus tricolor* L.

*Convolvulus caput-medusae* is only growing in Fuerteventura and Gran Canaria (Bramwell & Bramwell, 1990; Hansen & Sunding, 1993; Schönfelder & Schönfelder, 1997); a question mark is given to Lanzarote by Hohenester & Weiß (1993). Recently published papers deal with the category of protection (Gómez Campo *et al.*, 1996; Beltrán Tejera *et al.*, 1999, BOC 2001/097). *Convolvulus caput-medusae* is strictly protected in the European Union (Convention of Berne 1998; Natura 2000 program). According to the literature this species is very sensitive for alterations of its habitats and is threatened to die out, which was the reason for us to investigate the stands on Fuerteventura.

Fuerteventura is the oldest of the Canary Islands, the climate is arid and shows similarities to those of deserts. The biodiversity of the island is outlined by La Roche & Rodríguez (1994), Del Arco Aguilar & Rodríguez Delgado (2000), and Wildpret de la Torre & Martín Osorio (2000). The species number of vascular plants is according to Kunkel (1993) 580. Hansen & Sunding (1993) reported 667 taxa; our own checklist contains some 780 species (Brandes & Fritsch, 2000).

## DESCRIPTION OF THE SPECIES

*Convolvulus caput-medusae* is a dwarf cushion shrub (shrublet) with branches terminating in spines. The small leaves are alternate, entire, linear to spatulate. They

are greyish-green and densely pubescent. The flowers are small (about 10 mm), solitary, white and pale pink on the outside.

The height of *Convolvulus caput-medusae* is often understated in the literature:

Bramwell & Bramwell (1974): 10-15 cm

Bramwell & Bramwell (1990): 10-30 cm

Hohenester & Weiß (1993): - 20 cm

Schönfelder & Schönfelder (1997): 10-30 cm

Our measurements gave a maximal height of 56 cm – in windswept areas (!).

The shape of older plants reminds on spherical segments, even if the basal surface is not a circle in any case but more an ellipse (fig. 1). *Convolvulus caput-medusae* is strongly reminiscent of the tragacanthic dwarf-shrubs of the high mountain zone throughout the Middle East. The wind velocity is probably strongly reduced inside the shrub, so that an inner area with higher humidity is created which reduces the transpiration loss (see Hager, 1985). So this shape seems to be a preadaptation to dry and wind exposed places with high radiation intensity. Measurements are not yet done in the case of *Convolvulus caput-medusae*, they are however planned by us for spring 2002.

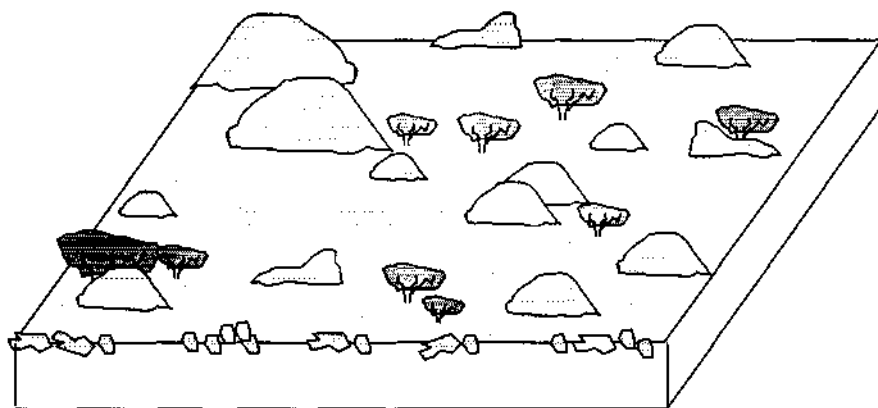


Fig. 1. Patterns of vegetation southwest of La Pared (schematic, length 7 m x 7 m). *Convolvulus caput-medusae* (dotted), *Ononis natrix ssp. ramosissima* (dark grey).

## SIZE AND STRUCTURE OF THE POPULATIONS

On Fuerteventura exist at least two large populations of *Convolvulus caput-medusae*:

(I) Istmo de la Pared (ca. 2km southwest of La Pared)

(II) coastal rocks near the mouths of Barranco Garcey and Barranco de Vigocho (ca. 10 km north of La Pared, near the wreck of the „Star of America“)

Beyond it there are some small sub-populations to be found in ravines of episodic torrents (see also Beltrán *et al.*, 1999).

We investigated the big population growing in windswept areas of the Istmo de la Pared in 1999 and 2001. The estimated number of all individuals is about 49.000.

The average number of individuals per m<sup>2</sup> was 0,25. The demographic analyses of the population is done by a size distribution instead of an age distribution (see below).

Height h, maximum diameter a and [smaller] diameter b (rectangular to a) of all 348 plants of 14 plots are measured. The maximum diameter a was found to be 125 cm, b varies between 50 % and 100 % of a. The maximum diameter was also understated in the literature: 60 cm (Kunkel & Kunkel, 1978). Fig. 2 shows the size distribution (maximum diameter a) for the population of La Pared in the year 1999. Fig. 3 shows the corresponding height distribution. The relatively low numbers of small [= young] plants suggest that the population is not recruiting sufficient new members to maintain the population. 104 individuals showed flowers (43 %). In general, the portion of flowering plants increases with increasing diameter or height.

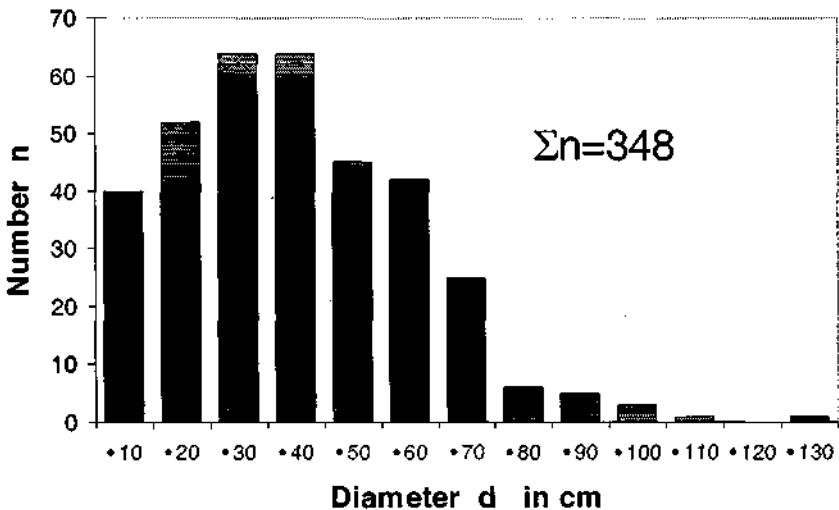


Fig. 2. Size distribution of *Convolvulus caput-medusae* (subpopulation SW La Pared in 1999).

Fig. 4 shows a spot-test of spring 2001. The very dry winter 2000/2001 is deemed to be the reason why only a few plants have been flowering (4,8 %). Also outside our plot we found only few flowering specimen of *Convolvulus caput-medusae*. The portion of smaller plants (14,3 % with a  $\leq$  20 cm) is also reduced compared to our results in 1999 (26,4 % with a  $\leq$  20 cm).

We found no seedlings in the studied areas in spring 2001 [after the very dry winter 2000/2001]. The seedlings need sufficient water and nutrients and are sensitive against desiccation and overgrazing by goats. The open structure of the vegetation causes a lack of safer sites. The analysis of the patterns of distribution support the hypothesis that younger plants are only in the neighbourhood of older individuals.

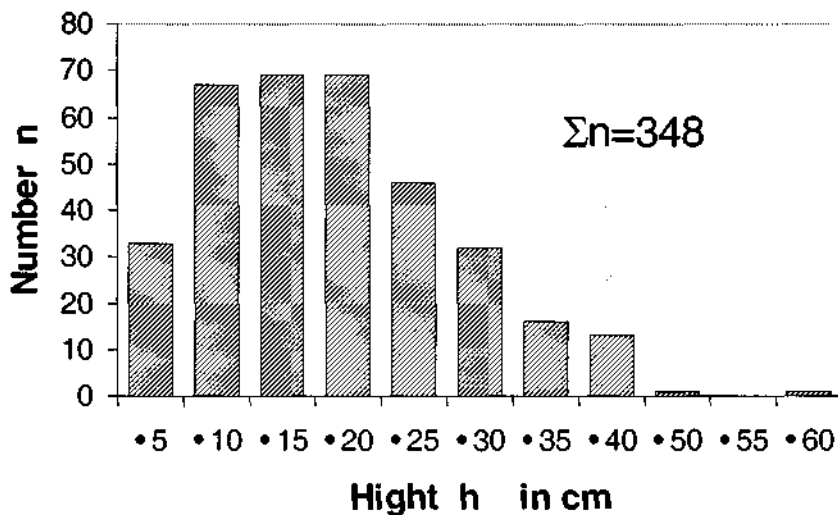


Fig. 3. Height distribution of *Convolvulus caput-medusae* (subpopulation SW La Pared in 1999).

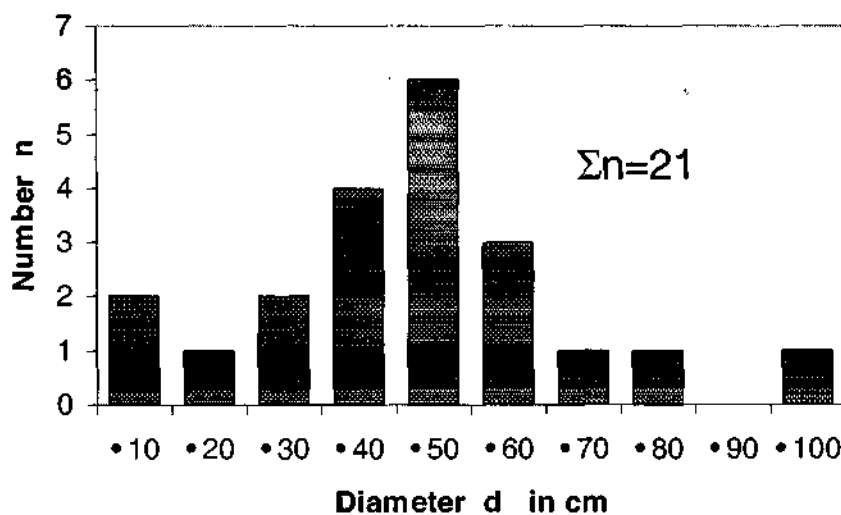


Fig. 4. Size distribution of *Convolvulus caput-medusae* (subpopulation SW La Pared in 2001).

The germination of *Convolvulus caput-medusae* was studied by González-Martín (1998) using seeds from Gran Canaria. The seeds are protected by a hard testa. Whilst the percentage of germination without any preliminary treatment was only about 17 till 25 %, mechanical seed coat scarification with a scalpel yielded germination about 90 %.

## PHYTOSOCIOLOGY

We investigated the phytosociological structure of both large populations of *Convolvulus caput-medusae* on Fuerteventura. All sites are unshaded and are exposed to the full wind. The vegetation cover is between 5 and 20 %, mostly 10 %. *Convolvulus caput-medusae* is associated with other shrubs and subshrubs like: *Artemisia reptans*, *Atriplex glauca* ssp. *Ifniensis*, *Chenoleoides tomentosa*, *Frankenia laevis*, *Helianthemum canariense*, *Launaea arborescens*, *Lycium intricatum*, *Ononis ramosissima*, *Polycarpea nivea*, *Salsola divaricata*, *Salsola vermiculata*, *Suaeda vermiculata*.

Hemicryptophytes like *Heliotropium ramosissimum* (= *H. erosum*) or *Lotus lancerottensis* have only a minor role in these dwarf shrub communities. Therophytes of the alliance *Carrichtero-Amberboion* appear only after humid winters.

The species combination of *Convolvulus caput-medusae* stands on rocks covered by a shallow layer of carbonate sand (tab. I) is very similar to the *Polycarpeo niveae-Lotetum lancerottensis* Esteve 1968 (syn.: *Launaea arborescens-Ononidetum ramosissimae* Biondi, Allegrezza, Taffettani & Wildpret De La Torre 1994), which was recently put to the new class *Polycarpeo niveae-Traganetea moquini* (Rivas-Martínez *et al.*, 2001). Our community may be considered as variant of *Convolvulus caput-medusae* of the subassociation of *Ononis natrix* ssp. *ramosissima* of the *Polycarpeo niveae-Lotetum lancerottensis*. However the community contains so many species of the class *Pegano-Salsoletea* (according to Rivas-Martínez *et al.*, 1993), it seems also possible to put it to this class. *Ononis ramosissima* is besides *Convolvulus caput-medusae* the most frequent species. It is remarkable that in general parts of the population are dead. Probably *Ononis ramosissima* lives in this habitat for only a few years.

On gentle slopes directed to the interior of the island and in depressions covered by a thick layer of sand there exists a variant of *Artemisia reptans* (tab. II), which is replaced by the *Salsola divaricata* community in the adjacent dunes.

On the steep slopes of the coastal rocks near the mouths of Barranco Garcey and Barranco de Vigocho *Convolvulus caput-medusae* grows above all in the *Chenoleo tomentosae-Suaedetum vermiculatae* (tab. III) or in fragments of this plant community without *Suaeda vermiculata* and *Chenoleoides tomentosa*. [It is reported from Gran Canaria that *Convolvulus caput-medusae* is growing there in the subassociation of *Atractylis preauxiana* of the *Chenoleo-Suaedetum vermiculatae*.]

An unusual stand with *Convolvulus caput-medusae* is documented by the following relevé:

Barranco above El Cardón. 18.2.2001. Area 50 m<sup>2</sup>, vegetation cover 70 %:

3.3 *Opuntia dillenii*, 3.2 *Launaea arborescens*, 2.2 *Asphodelus tenuifolius*, 2.1 *Kleinia neriifolia*, 1,1 *Lycium intricatum*, 1.1 *Forsydia angustifolia*, + *Convolvulus caput-medusae*, + *Salvia aegyptiaca*, + *Lotus lancerottensis*.

## FURTHER NEED FOR INVESTIGATION

(a) Our knowledge of life cycle, of establishing of the seedlings, and of the growth rate is still poor. We intend to investigate the kinetics of growth by means of permanent plots with marked individuals.

(b) Also the questions about the connections between life form, water stress, and pre-adaptation are open.

(c) Although growing near the sea, the salt tolerance of our species is still unknown (see Fritzscht & Brandes, 1999).

Number of relevé	1	2	3	4	5	6	7	8	9
Exposition	NW	NW	NW	-	W	-	-	NW	-
Inclination	5	5	5	-	5	-	-	5	-
Area [m <sup>2</sup> ]	60	100	50	100	100	100	100	100	60
Vegetation cover [%]	10	10	10	10	10	10	10	10	15
Species number	{15}	{15}	12	13	16	13	{15}	14	13
<hr/>									
<i>Convolvulus caput-meduse</i>	2.1	2.1	1.1	2.1	2.1	2.2	2.1	2.2	2.2
<i>Ononis natrix ssp. ramosissima</i>	1.1	1.1	1.1	1.1	+	+	.	+	+
<i>Ononis natrix ssp. ramosissima</i> (dead)	1.1	1.1	1.1	+	1.1	1.1	2.1	+	+
<u>Species of the class Pegano-Salsolatea:</u>									
<i>Polycarpha nivea</i>	1.1	+2	+2	1.1	+	+	1.1	1.2	+
<i>Heliotropium ramosissimum</i>	1.2	1.2	1.2	1.2	+	1.2	1.2	1.2	1.2
<i>Lycium intricatum</i>	+	1.1	1.1	1.1	+	.	1.1	1.1	.
<i>Launaea arborescens</i>	+	.	1.1	1.1	+	.	+	.	1.1
<i>Lotus lancerottensis</i>	.	.	+	+	.	+	.	r	.
<i>Atriplex glauca ssp. ifniensis</i>	.	.	+	r	.	.	+	+	.
<i>Salsola divaricata</i>	.	.	.	.	.	.	.	.	+
<u>Other perennials:</u>									
<i>Frankenia laevis</i>	+	+	.	1.1	+	+	+	+	+°
<i>Helianthemum canariense</i>	1.1	1.1	.	1.1	+	+	1.2	+	.
<i>Kickxia heterophylla</i>	+	.	+	.	+	.	+	+	.
<i>Launea nudicaulis</i>	.	1.2	+	+	+	1.2	.	.	.
<u>Therophytes:</u>									
<i>Calendula aegyptiaca</i>	+	r	.	+	+	+	+	+	r
<i>Reseda lancerotae</i>	1.2	+	1.2	+	1.2	.	r	.	+
<i>Mairetis microsperma</i>	1.2	+	.	.	1.1	1.2	+2	+	+
<i>Medicago laciniata</i>	+	.	.	.	r	+	.	r	.
<i>Trachynia distachya</i>	+	+2	1.2	.	+2	+2	+	.	.
<i>Lobularia libyca</i>	+	+	.	.	.	.	.	.	1.1
<i>Astragalus hamosus</i>	.	+	.	.	.	+	.	.	r
Seedlings indet.	+	+	.	.	.	.	.	.	.
<i>Ifloga spicata</i>	.	.	.	.	+	.	.	.	.
<i>Emex spinosa</i>	.	.	.	.	.	.	.	r	.

Nr. 1 - 8: February 1998, Nr.9: February 1997.

Table I: *Convolvulus caput-medusae* - *Ononis natrix ssp. ramosissima* community, typical variant.

Nummer der Aufnahme:	1	2	3	4	5	6	7
Fläche [m <sup>2</sup> ]	50	50	50	50	50	60	100
Vegetationsbedeckung [%]	10	10	10	5	10	10	8
Artenzahl	11	11	{14}	{14}	{13}	{17}	14
<hr/>							
<i>Convolvulus caput-medusae</i>	2.1	2.1	2.1	2.1	2.1	2.1	2.1
<i>Ononis natrix</i> ssp. <i>ramosissima</i>	1.1	+	+	+	+	1.1	.
<i>Ononis natrix</i> ssp. <i>ramosissima</i> (dead)	+	1.1	1.1	1.1	1.1	+	+
<hr/>							
<u>Differential species of the variant:</u>							
<i>Artemisia reptans</i>	+	{+}	+	1.2	1.1	+	+
<hr/>							
<u>Other species of the class <i>Pegano-Salsolatea</i>:</u>							
<i>Polycarpha nivea</i>	+	+	+	+	1.1	+	1.2
<i>Lotus lancerottensis</i>	+	+	+	.	+	r	+
<i>Lycium intricatum</i>	.	r°	.	+	+	+	1.1
<i>Heliotropium ramosissimum</i>	.	.	.	+2	+2	1.2	+
<i>Salsola divaricata</i>	.	.	+	.	+j	+	.
<i>Launaea arborescens</i>	.	.	.	+	.	+	.
<i>Atriplex glauca</i> ssp. <i>ifniensis</i>	.	.	+	.	.	.	.
<hr/>							
<u>Other perennials:</u>							
<i>Helianthemum canariense</i>	1.1	1.1	1.2	1.2	1.1	1.2	1.2
<i>Frankenia laevis</i>	+	+	+	+	+	1.1	+
<i>Kickxia heterophylla</i>	+	+	+	.	.	+	+
<i>Launaea nudicaulis</i>	.	.	+	.	r	1.2	.
<hr/>							
<u>Therophytes:</u>							
<i>Medicago laciniata</i>	1.°1	.	1.°2	1.°2	1.°2	.	1.°2
<i>Astragalus hamosus</i>	.	.	r	+	.	+	.
<i>Emex spinosa</i>	r	+°	.	.	.	.	.
<i>Mairetis microsperma</i>	.	.	.	1.2	.	.	+
<i>Reseda lancerotae</i>	.	.	.	.	.	+	+
<i>Trachynia distachya</i>	.	.	.	.	.	+	+
<i>Lobularia libyca</i>	r°	.	.	.	.	.	.
<i>Calendula aegyptiaca</i>	.	r	.	.	.	.	.
<i>Illoga spicata</i>	.	.	.	r	.	.	.
Seedlings of <i>Poaceae</i> indet.	.	.	r	r	r	r	.

Nr. 1-7: February 1998.

Table II: *Convolvulus caput-medusae* - *Ononis ramosissima* community, variant of *Artemisia reptans*.

Number of the relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Area (m <sup>2</sup> )	100	50	100	60	50	50	50	100	80	40	100	80	80	25
Vegetation cover [%]	10	20	<10	10	15	15	15	10	10	10	15	15	20	20
Exposition	S	S	SW	N	NE	NE	N	N	NE	E	N	NE	N	N
Inclination [°]	15	20	30	20	35	35	20	30	15	20	30	25	10	20
Species number	9	5	5	6	8	5	7	6	6	5	9	8	7	10
<b>Character species of the association:</b>														
<i>Suaeda vermiculata</i>	+	2.2	.	2.2	2.1	.	2.2	+	1.2	1.2	+	+	2.2	+
<i>Bassia tomentosa</i>	.	.	+	.	.	1.2	.	.	.	.	2.1	1.2	.	+
<b>Differential species of the variant:</b>														
<i>Convolvulus caput-medusae</i>	1.1	1.1	2.2	2.1	1.1	2.2	2.1	2.2	2.2	1.1	2.2	1.1	2.2	2.1
<b>Other species of Pegano-Salsoletea:</b>														
<i>Salsola vermiculata</i>	1*1	2.2	1.1	2.2	+°	1.1	+	1.2	1.2	1.2	1.2	2.2	2.2	+
<i>Launaea arborescens</i>	2.1	1.1	+	1.1	+	1.2	2.1	.	+	.	+	.	1.1	2.1
<i>Polycarpha nivea</i>	1.1	.	+2	.	+2	.	+2	+2	+	+2	1.2	+	1.1	1.2
<i>Lycium intricatum</i>	.	.	.	.	+	.	+	+	+°	.	1.1	+	1.1	1.1
<i>Salsola divaricata</i>	+	.	.	.	.	.	.	.	+	.	+	1.1	.	.
<i>Suaeda fruticosa</i>	.	.	.	.	.	1.1	.	.	.	.	.	.	.	1.1
<i>Heliotropium ramosissimum</i>	1*2	.	.	.	.	.	.	.	.	.	.	.	.	.
<b>Companions:</b>														
<i>Frankenia laevis</i>	1.1	1.1	.	1.2	1.1	.	+	+	+	1.2	1.2	1.1	1.2	.
<i>Helianthemum canariense</i>	+	.	.	.	.	.	.	.	.	.	.	.	.	1.2
<i>Zygophyllum fontanesii</i>	.	.	.	+	+	.	.	.	.	.	.	.	.	.
<i>Salvia aegyptiaca</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+2

Nr. 1-14: February 2001.

Table III: *Chanoletum tomentosae-Suaedetum vermiculatae*, variant of *Convolvulus caput-medusae*.

## ACKNOWLEDGMENTS

The author thanks Dr. Elisabeth Brandes and all participants of the excursion of our Botanical Institute to Fuerteventura in 1999 for their help in the field work, especially Mrs. Sophia Kürkcüoğlu and Mr. Tobias Gremmel. I am very grateful to the reviewers for valuable comments and also to Mrs. Susana Basilio (Sevilla), who is Sokrates/Erasmus student at our faculty, for translating the resúmen.

## REFERENCES

- BELTRÁN TEJERA, E., W. WILDPRET DE LA TORRE, M. C. LEÓN ARENCIBIA, A. GARCÍA GALLO & J. REYES HERNÁNDEZ (1999). *Libro Rojo de la Flora Canaria contenida en la Directiva-Hábitats Europea*. Ministerio de Medio Ambiente. 694 pp.
- BIONDI, B., M. ALLEGREZZA, F. TAFFETANI & W. WILDPRET DE LA TORRE (1994). La vegetazione delle coste basse sabbiose delle isole di Fuerteventura e Lanzarote (Isole Canarie, Spagna). *Fitosociologia* 27: 107-121.
- BOC.2001/097. <http://www.gobiernodecanarias.org/boc/2001/097/004.html>
- BRAMWELL, D. & Z. BRAMWELL (1974). *Wild flowers of the Canary Islands*. Cheltenham. X, 261 pp.
- BRAMWELL, D. & Z. BRAMWELL (1990). Flores silvestres de las Islas Canarias. Madrid. XIV, 376 pp.

- BRANDES, D. & K. FRITZSCH (2000). Alien plants of Fuerteventura, Canary Islands. – <http://opus.tu-bs.de/opus/volltexte/2000/79>
- DEL ARCO AGUILAR, M. J. & O. RODRÍGUEZ DELGADO (2000). Fuerteventura: Flora y vegetación. – Canarias Isla a Isla: 182-184. Centro de la Cultura Popular Canaria.
- FRITZSCH, K. & D. BRANDES (1999). Flora und Vegetation salzbeeinflusster Habitate auf Fuerteventura. In: Brandes, D. (ed.): *Vegetation salzbeeinflusster Habitate im Binnenland*. Braunschweig, p. 205-219. (Braunschweiger Geobotanische Arbeiten 6.)
- GÓMEZ CAMPO, C. *et al.* (1996). *Libro Rojo de Especies Vegetales Amenazadas de las Islas Canarias*. Viceconsejería de Medio Ambiente, Consejería de Política Territorial, Gobierno de Canarias. 663 pp.
- GONZÁLEZ-MARTÍN, M. (1998). Germinación de especies endémicas canarias del género *Convolvulus* L. en Gran Canaria (islas Canarias). – *Invest. Agr. Prod. Veg.* 13 (3): 307-318.
- HAGER, J. (1985). Pflanzenökologische Untersuchungen in den subalpinen Dornpolsterfluren Kretas. *Dissertationes Botanicae* 89: 196 pp.
- HANSEN, A. & SUNDING, P. (1993). Flora of Macaronesia. Checklist of vascular plants. 4<sup>th</sup> rev. ed. *Sommerfeltia* 17: 283 pp.
- HOHENESTER, A. & W. WELSS (1993). *Exkursionsflora für die Kanarischen Inseln*. Stuttgart. 374 pp.
- KUNKEL, G. (1993). *Die Kanarischen Inseln und ihre Pflanzenwelt*. 3. Aufl. – Stuttgart. 239 pp.
- KUNKEL, M. A. & KUNKEL, G. (1978). Flora de Gran Canaria. T. II: Enredaderas, trepadoras y rastreras. – Las Palmas. 121 pp.
- LA ROCHE, F. & J. C. RODRÍGUEZ (1994). Aproximación al número de taxones de la flora vascular silvestre de los archipiélagos macaronésicos. – *Rev. Acad. Canar. Cienc.* 6 (2-4): 77-98.
- REYES BETANCORT, J. A., W. WILDPRET DE LA TORRE & M. C. LEÓN ARENCIBIA (2001). The vegetation of Lanzarote (Canary Islands). *Phytocoenologia* 31 (2): 185-247.
- RIVAS-MARTÍNEZ, S., W. WILDPRET DE LA TORRE, M. DEL ARCO AGUILAR, O. RODRÍGUEZ, P. L. PÉREZ DE PAZ, A. GARCÍA-GALLO, J. R. ACEBES GINOVÉS, T. E. DÍAZ GONZÁLEZ & F. FERNÁNDEZ-GONZÁLEZ. (1993). Las comunidades vegetales de la isla de Tenerife (islas Canarias). *Itinera Geobotanica* 7: 169-374.
- RIVAS-MARTÍNEZ, S., F. FERNÁNDEZ-GONZÁLEZ, J. LOIDI, M. LOUS? & A. PENAS (2001). Syntaxonomical checklist of vascular plant communities of Spain and Poturgal to association level. *Itinera Geobotanica* 14: 5-341.
- RODRÍGUEZ DELGADO, O., A. GARCÍA GALLO & J. A. REYES BETANCORT (2001). Estudio fitosociológico de la vegetación actual de Fuerteventura (Isla Canarias). *Vieraea* 28: 61-98.
- SCHÖNFELDER, P. & I. SCHÖNFELDER (1997). *Die Kosmos-Kanarenflora*. Kosmos. Stuttgart. 319 pp.
- WILDPRET DE LA TORRE, W. & V. E. MARTÍN OSORIO (2000). Biodiversität der Kanarischen Inseln am Beispiel Fuerteventura. *Berichte der Reinhold-Tüxen-Gesellschaft* 12: 253-262.