New data on the distribution and conservation status of some angiosperms of the Cape Verde Islands, W Africa

Authors: Gomes, Isildo, Leyens, Teresa, Luz, Berenice Da, Costa, Judith, and Gonçalves, Fatima

Source: Willdenowia, 29(1/2) : 105-114

Published By: Botanic Garden and Botanical Museum Berlin (BGBM)

URL: https://doi.org/10.3372/wi.29.2909

ISILDO GOMES, TERESA LEYENS, BERENICE DA LUZ, JUDITH COSTA, FATIMA GONÇALVES

New data on the distribution and conservation status of some angiosperms of the Cape Verde Islands, W Africa

Abstract

Gomes, I., Leyens, T., Luz, B. da, Costa, J. & Gonçalves, F.: New data on the distribution and conservation status of some angiosperms of the Cape Verde Islands, W Africa. – Willdenowia 29: 105-114. 1999. – ISSN 0511-9618.

Based on recent field work, data on the distribution and conservations status of 13 taxa of flowering plants of the Cape Verde Islands are provided. New records for single islands are *Periploca laevigata* subsp. *chevalieri* for Sta. Lucia, *Paronychia illecebroides* for the Ilhéus Rombo, *Asparagus squarrosus* and *Erodium malacoides* for Fogo, and *Cocculus pendulus* for Sal. New records noteworthy with respect to species ecology, reconstruction of the potential natural vegetation or conservation status are presented for nine endemic taxa, viz. *Periploca laevigata* subsp. *chevalieri, Sonchus daltonii, Tolpis farinulosa, Echium hypertropicum, E. vulcanorum, Lobularia canariensis* subsp. *fruticosa, Polycarpaea gayi, Euphorbia tuckeyana* and *Globularia amygdalifolia*.

Intensive field work and analysis of the state of biodiversity on all islands during the years 1993 to 1999 led to the publication of several contributions to the flora and vegetation of the archipelago of Cabo Verde (Brochmann & al. 1997, Gomes & Vera-Cruz 1993, Gomes & al. 1995a-b, 1998, Gomes 1997, Kilian & Leyens 1994, Leyens 1998, Leyens & Lobin 1995, Lobin & al. 1995) as well as to the compilation of the First Red Data List for the Cape Verde Islands (Leyens & Lobin 1996), the elaboration of the National Strategy for Biodiversity Conservation (SEPA 1999) and a compilation of all areas in urgent need of protection (Leyens unpubl. diploma thesis 1994, Gomes & al. in prep.). As part of the activities of the Instituto Nacional de Investigação e Desenvolvimento Agrário (INIDA) and the Departamento de Geociências do Instituto Superior de Educação (ISE) intensive field studies were conducted at many different localities on several islands, resulting in a thesis (Gomes 1997) and several terminal study papers (Luz 1999, Costa 1999, Gonçalvez 1999). The results show that the vegetation and flora of the islands are still not fully known and much more field work is needed.

Although Santiago is one of the islands where the first botanical investigations were carried out (Webb 1849, Schmidt 1852, Chevalier 1935) and where many intensive field studies were

conducted later (Lobin 1982, Rustan & Brochmann 1985, Nogueira & Ormonde 1981,1985), it is the island were most of the floristic discoveries and rediscoveries were made during the last years. On this island intensive investigations were conducted by the authors in the Ribeira Seca and Ribeira Principal, at Mato Gêgê and Lugar Velho from March 1998 to April 1999. On the island of Fogo the entire higher zones of the old crater rim (Bordeira) and the Regato de Pico Novo have been subject to intensive field studies since 1997. In addition investigations on the island of Boavista, Sta. Lucia and the Ilhéus do Rombo N of Brava were done. This paper presents some interesting records made during these investigations. The classification of conservation status follows the Primeira Lista Vermelha de Cabo Verde (Leyens & Lobin 1996).

Dicotyledoneae

Asclepiadaceae

Periploca laevigata subsp. *chevalieri* (Browicz) G. Kunkel

The shrub grows mainly in the semiarid and subhumid zones between 400 and 1800 m. Having disappeared from large areas of its former distribution but being still quite frequent on some islands it is classified as Endangered (EN). Its utilization for animal skin tanning mentioned by Chevalier (1935) has been confirmed by inhabitants of Fogo but is nowadays rarely practiced (obs. Leyens). On Santiago it is used as a medicinal plant to treat fever and cough (obs. Gomes).

For Santiago only one record of 1934 (Chevalier 1935) had been known before a population of three individuals was discovered at Mato Gêgê (Concelho de Santa Catarina) in October 1994 (Duarte & Gomes, in prep.). Its presence at this locality in inaccessible escarpments with *Globularia amygdalifolia, Campylanthus glaber* subsp. *glaber* and *Heteropogon contortus* was confirmed in January 1999 (obs. Kilian, Leyens & Gomes). In May 1999 two more individuals were discovered at two further localities.

The species is here recorded for the first time for Sta. Lucia, where a single shrub was found in the Ribeira dos Penedos. In agreement with Gomes & al. (1996) the species is classified as Critically Endangered (CR) for Santiago and Rare (R) for Sta. Lucia.

SANTIAGO: Ribeira da Garça, at Lugar Velho, NNW facing escarpments at 630 m, accompanied by *Sideroxylon marginata, Echium hypertropicum, Campylanthus glaber* subsp. *glaber* and *Polycarpaea gayi,* 26.5.1999, *Gomes & Mendes* (obs.); Ribeira de Batalha, NNE facing escarpments at 600 m, 26.5.1999, *Gomes & Mendes* (obs.).
STA. LUCIA: Ribeira dos Penedos, at c. 170 m, 14.9.1996, *Leyens CV-96-633* (herb. Lobin).

Asteraceae

Sonchus daltonii Webb

This endemic rosette shrub was rediscovered on Santiago in December 1993 in the NE to NW facing cliffs of the Serra da Malagueta (Gomes & al. 1995a) after it had been recorded from this island only once in 1839 (Kilian 1988: 181). In November 1998 another population of three individuals was found in the Serra da Malagueta, being threatened by a strong invasion of *Lantana camara* and *Furcraea foetida*. The species is classified as Critically Endangered (CR) for this island as the number of individuals does not seem to surpass a total of 30.

In years of low precipitation most individuals do not develop rosettes but stay totally retracted. A minimum precipitation quantity also seems necessary to induce floration as in some years no flowering could be observed (e.g. 1997 on Fogo, obs. Leyens). Thus the general classification of the population sizes is quite difficult. The species is strongly collected as it is willingly eaten by all kind of livestock. Normally the species is collected before or in flowering state so that it would not reach fruiting. As the species has been strongly over-collected on the island of Fogo a concept has been elaborated in collaboration with the local population abandoning its collection in certain regions for some years. As a combined result of these activities and of the higher precipitation in 1998 a large part of the population of the respective region reached fruiting (obs. Leyens).

Fig.1. *Tolpis farinulosa* (Webb) J. A Schmidt – Santiago, Serra da Malagueta, 850 m, NNW slope. – Photograph by I. Gomes, 5.1999.

SANTIAGO: Serra de Malagueta, concelho de Santa Catarina, Quebrada, SSW facing slopes at c. 840 m, 3 individuals, 18.11.1998, *Gomes, Luz, Costa* & *Gonçalves* (obs.).

Tolpis farinulosa (Webb) J. A. Schmidt

The woody perennial (Fig. 1) is a typical element of humid and subhumid escarpments between 800 and 1800 m, found on the islands of Sto. Antão, S. Vicente, Fogo and Brava (Kilian 1988, Brochmann & al. 1997).

On Santiago, until now not known to literature, a small population of three individuals was found in the escarpments of João Sanches in the Ribeira Seca in October 1994 (Duarte & Gomes in prep.). Intensive field work with the students of the Instituto Superior de Educação (ISE) since the end of 1998 led to the discovery of several other populations. As all known populations on Santiago are small and grow in heavily disturbed zones, the species is classified as Endangered (EN) for this island.

On Fogo the species is recorded for the first time from the southern part of the island where a small population was found in the Southeast in the subhumid zone of the Regato de Pico Novo at c. 500 m *(Gomes, Luz & Centeio)* and in the Southwest in the semiarid zone in the Ribeira Fontinho at 1850 m *(Leyens obs.)*.

As it is the case with *Sonchus daltonii,* in years of low precipitation many individuals of *Tolpis farinulosa* remain retracted and thus invisible (obs. Leyens). It is therefore assumable that the occurrence of both species in the semiarid zones will prove fairly regular.

SANTIAGO: Serra da Malagueta, at the head of the Ribeira Principal, c. 850 m, 3 individuals in the NNW facing cliffs, 18.11.1998, *Gomes, Luz, Costa* & *Gonçalves* (obs.); ibid., 720 m, c. 25 individuals, 19.1.1999, *Leyens CV-99-1089* with *Kilian* & *Gomes* (herb. INIDA); ibid., NNE facing

escarpments at c. 800 m, c. 30 individuals with well-developed woody caudex, 11.3.1999, *Gomes, Luz & Gonçalves* (obs.).
FOGO: Ribeira Fontinho in the southwestern semiarid part of the old crater rim (Bordeira) at 1920 m, 21.1.1998, *Leyens* (obs.); NNW part of the island, Montinho at a dripping spring, 1880 m, 30.12.1998, *Leyens CV-98-1057* (herb. Leyens); southeastern part of the island, Regato de Pico Novo, c. 500 m, 3.1998, *Gomes, Luz & Centeio* (obs.)

Boraginaceae

Echium hypertropicum Webb
On the strongly degraded island of Santiago only few larger populations of this endemic shrub are known to have remained (Gomes & al. 1995a). A hitherto unknown large population of several hundreds of mature individuals has been discovered in 1999. The species there grows associated with *Lavandula rotundifolia, Campylanthus glaber* subsp. *glaber, Sideroxylon marginata* and *Sarcostemma daltonii.* Still it has to be considered as Endangered (EN) on Santiago.

SANTIAGO: Ribeira Batalha and Ribeira Garça, in the NNE and NNW facing escarpments between 700 and 750 m, 26.5.1999, *Gomes & Mendes* (obs.).

Echium vulcanorum A. Chev.
This species, which is similar to *Echium hypertropicum,* is one of the six species endemic to the island of Fogo. So far it was thought to be restricted to the semiarid zone in the southern and western part of the island (Brochmann & al. 1997) but new distributional data give a somewhat different picture. Two populations have been found in the subhumid zone at 1750 and 1870 m, one of several hundreds of individuals in the south-eastern part, the other of three individuals in the north-western part. The latter stand with old and formerly impressive but now badly cut individuals is the first record of the species from the more humid northern half of the old crater rim. Even though it is not assumable that the range of *Echium vulcanorum* exceeded considerably into the northern part of the island. The factor limiting its distribution is, however, most likely not the climate but the geomorphology: where the rocky slopes replace the lapilli dominated slopes *Echium* starts to diminish and becomes replaced by *Euphorbia tuckeyana, Artemisia gorgonum, Periploca laevigata* subsp. *chevalieri* and other species (Leyens in prep). As the NNW part of the old crater rim (Bordeira) is dominated by rocky slopes it seems probable that *Echium* in that part has always been a rare component of the vegetation.

Its conservation status should be maintained as Endangered (EN) because human pressure for wood and animal fodder is quite severe. As animals prefer the soft flowering branches, the species is preferably collected in early flowering state and the achievement of seed maturity is frequently prevented, thus regeneration through seedlings is very poor (obs. T. Leyens).

FOGO: Achada Gancho, south-eastern part of the island, lapilli covered slopes at 1750 m, 2.7.1999, *Leyens CV-99-1105* (herb. Leyens); north-western part of the island, on the slopes of Montinho at 1870 m, 3 individuals, 7.6.1999, *Leyens CV-99-1102* (herb. Leyens); western part of the old crater rim (Bordeira), Ribeira Figueirinha (upper part of the Ribeira Isabel), at the Cume de Mte. Vermelho, at 2340 m, 5.12.1996, *Leyens CV-96-669* (herb. Lobin).

Brassicaceae

Lobularia canariensis subsp. *fruticosa* (Webb) Borgen
This inconspicuous, white-flowering endemic shrublet is known from the islands of Sto. Antão, S. Nicolau, Santiago, Fogo and Brava (Gomes & al. 1995b). Due to the lack of sufficient data, its general conservation status was classified as Indeterminate (I) (Gomes & al. 1996).

On Fogo too it was qualified as Indeterminate as already by Chevalier (1935) only one record is mentioned from Fogo (Espia près de Mosteiros, 1000 m, *Chevalier 45132*) and also by Borgen (1987) only two localities are indicated for the island. During the last three years of intensive field

work by T. Leyens all around the higher elevations of Fogo the species was encountered only four times (see below). All populations consisted of few or even one individual only. It was found in the semiarid zone as well as in the subhumid zones. As it is a very palatable species for all kind of livestock it can be taken for sure that its population sizes and distribution range has diminished greatly. It is therefore classified as Critically Endangered (CR) for Fogo.

FOGO: Western part of the island, path from Miguel Gonçalves up to the caldeira rim (Bordeira), S facing slopes at 1900 m, 23.1.1994, *Kilian 3325* & *Leyens* with *S. Gomes* (B, herb. Lobin); southwestern part of the island, Montado Nacional, rim of the bordeira, at the base of Estância Tola, 2220 m, 21.11.1998, *Leyens CV-98-1014* (herb. Leyens); western part of the old crater rim (Bordeira), Ribeira Figueirinha (upper part of the Ribeira Isabel), below Cume de Mte. Vermelho, at 2200 m, 5.12.1996, *Leyens CV-96-664* (herb. Lobin).

Caryophyllaceae

Paronychia illecebroides Webb

This endemic perennial herb is known from the islands of Sto. Antão, S. Vicente, Sta. Luzia, S. Nicolau, Boavista, Maio, Santiago and Fogo (Brochmann & al. 1997) and is here recorded for the first time from the Ilhéus do Rombo *(Leyens CV-94-051)*. The species has a very wide ecological amplitude, occurring from sea level to the highest elevations and in all zones of humidity except the extremely arid zone. Even though it is generally classified as Lower Risk (LR) its status on Maio is considered Endangered (EN) (Gomes & al. 1996).

For Boavista we suggest to upgrade its status to Critically Endangered (CR) due to the fact that although it is listed for this island (Hansen & Sunding 1985, Brochman & al 1997) it has not been recorded by Diniz & Matos (1988) nor collected during the intensive field work in 1993/94. Boavista is also one of the islands with severe pressure by overgrazing.

On Fogo, Brochmann & al. (1997) mention it as "absent in the lowlands". Apparently they have overseen that Diniz & Matos (1987) give the species as a typical element of the arid littoral communities in the south-eastern part of the island (e.g. Ponta da Praia Grande), in the north-western part of the island (Ponta da Salina) and probably also in the north-eastern part of the island (Fajãzinha, Ponta Queimada).

The presence of the species is confirmed for Sta. Luzia where it was collected in 1996. In former times it has probably been victim to goat grazing on Sta. Luzia but as could be observed and was confirmed by local fishermen, there have been no goats on the island in the last years. Thus the species is classified as Vulnerable (VU) for Sta. Luzia and Rare (R) for the Ilhéus Rombo.

FOGO: Ponta da Salina, rocky coast in the north-western part of the island, 4.7.1999, *Leyens CV-99-1106* (herb. Leyens); north-western subhumid part of the old crater rim (Bordeira), Boca Rocha, at 1770 m, 1999, *Leyens* (obs.); Montinho, NE facing steep escarpments of the subhumid part of the old crater rim at 1970 m, 1998, *Leyens* (obs.); ibid, SW facing slopes at 1820 m, 13.2.1999, *Leyens CV-99-1098* (herb. Leyens).
ILHÉUS DO ROMBO: ILHÉU DA CIMA: On rocky slopes, c. 70 m, 2.2.1994, *Leyens CV-94-051* (herb. Lobin).
MAIO: On the top of Mte Penoso, W facing slope at 300 m, 5.1.1994, *Leyens, Kilian & Gomes* (obs.).
SANTA LUZIA: Ribeira dos Penedos, at c. 100 m, 14.9.1996, *Leyens CV-96-619* (herb. Lobin).

Polycarpaea gayi Webb

This morphologically very variable, small, endemic (sub)shrub is known from the islands of Sto. Antão, S. Vicente, Branco, S. Nicolau, Sal, Santiago and Fogo, where it grows most frequently in the semiarid and subhumid zones (Brochmann & al. 1997). For Fogo, Brochmann & al. (1997) as well as Matos & Diniz (1987) mentioned the species as occurring mainly at elevations below 1400 m. Intensive field studies by T. Leyens have shown now that the species is also a regular though not abundant element of the higher elevations, being equally frequent in the subhumid

and semiarid zone and growing on the rocky slopes and escarpments of the old crater rim (Bordeira). Even though it is considered Extinct (EX) on S. Vicente and Sal, it is generally classified to be Lower Risk (LR) (Gomes & al. 1996).

FOGO: SW part of the island, Montado Nacional, at the rim of the old crater rim (Bordeira) semiarid, rocky zone before reaching Estância Tola, 2180 m, 21.11.1998, *Leyens CV-98-1010* (herb. Leyens); ibid., Ponto Alto do Sul, semiarid zone, 2390 m, 8.12.1998, *Leyens CV-98-1055* (herb. Leyens); Montinho, path leading to Fernão Gomes, subhumid zone, rocky slopes at 1770 m, 30.1.1999, *Leyens CV-99-1093* (herb. Leyens); Cova d'Areia, north-western part of the old crater rim (Bordeira), semiarid zone, rocky SW facing slopes at 1980 m, 29.6.1999, *Leyens CV-99-1103* (herb. Leyens).

Euphorbiaceae

Euphorbia tuckeyana Webb

The species is the only endemic *Euphorbiaceae* of the Cape Verde Islands. The spherical shrub reaches up to 3 m height and is well represented on the archipelago although its present distribution represents only a fraction of its former range. With exception of the islands of Maio, Santa Luzia and the islets it is known from all islands. It has a remarkably large ecological amplitude, growing between 100 and 2500 m (Gomes & al. 1995a).

On the island of Boavista it was collected by Fea in 1898 on the Monte Estância (Béguinot 1918, quoted by Gomes & al. 1995a). Its presence on the island was confirmed in 1993 and 1994, when populations on the Rocha de Santo António and the Rocha Povoação Velha growing between 250-300 m were found (Gomes & al. 1995a). In November 1998 a further population of several hundreds of individuals, associated with *Cocculus pendulus*, different ferns and overgrown by lichens (*Usnea* sp.), was discovered. So it can be considered quite well represented on this island. It is therefore suggested that its classification for the island is reduced from Endangered (EN) to Vulnerable (VU).

BOAVISTA: NE part of the island at Fonte/Monte Tortolho, c. 300 m, 5.11.1998, *Gomes & Ramos* (obs.).

Geraniaceae

Erodium malacoides (L.) L'Hér.

Up to now this fairly recent introduction to the archipelago was known only from the island of Sto. Antão, where it was first collected in 1982 by Brochmann & Rustan (Rustan & Brochmann 1985). On Fogo it has now been observed naturalized at two localities, occupying large patches.

FOGO: Montinho, NW part of the island, at the casa rícino where the road ends, at c. 1700 m, 30.1.1999, *Leyens CV-99-1095* (herb. Leyens); in the village of Bangaeira in Chã das Caldeiras, c. 1650 m, 1998/99, *Leyens* (obs.).

Globulariaceae

Globularia amygdalifolia Webb

This endemic shrub of up to 2 m height (Fig. 2A) grows on Sto. Antão, S. Nicolau, Santiago, Fogo and Brava, on slopes and escarpments mainly in the subhumid and humid montane zones (Brochmann & al. 1997). It is one of the species that have suffered severely due to excessive wood-cutting and has been classified as Endangered (EN) on S. Nicolau, Vulnerable (VU) on Sto. Antão, Fogo and Brava, and Critically Endangered (CR) on Santiago (Gomes & al. 1996). On Santiago only very few populations (Brochmann & al. 1997), all of them very small, are known from the southern part of the island, in particular from the Serra de Pico de António. In January 1999 the species was recorded for the first time from the northern part of the island, when one individual was encountered in the Serra da Malagueta growing in association with

Fig. 2. *Globularia amygdalifolia* Webb – A: habit; B: dense population occupying an area of approximately 1.5 ha. – Serra da Malagueta, NNW facing slope, 780-900 m, 4.1999, photographs by I. Gomes.

Tolpis farinulosa, Polycarpaea gayi and *Campanula jacobaea*. In April 1999 a large population of some hundreds of individuals was discovered nearby, covering an area of approximately 1.5 ha *(Gomes, Luz, Costa & Gonçalves)*. This mat-forming scrub (Fig. 2B) was free of any invasion of *Furcraea foetida* and *Lantana camara*. This largest known population is strongly threatened by extensive goat and donkey grazing as was proven by the findings of fresh excrements. Urgent measures are necessary to avoid the destruction of this probably last remnant of a scrub of this kind on the archipelago. As this only known larger population has a very limited distribution the conservation status Critically Endangered (CR) is maintained.

On Fogo *Globularia amygdalifolia* is by far not restricted to the subhumid and humid zone, but occurs as frequently in the semiarid zone, being a regular component of the vegetation of the old crater rim (Bordeira).

SANTIAGO: Serra do Pico da Antonia, humid bluffs at Mte. Chota at c. 1000 m, W of Rui Vaz, 16.12.1995, *Leyens CV-95-530* (herb. Lobin); Serra da Malagueta, NNW facing escarpments of the Ribeira Principal, 720 m, 19.1.1999, *Leyens CV-99-1086* with *Kilian & Gomes* (herb. Leyens) ibid., NNW facing slope, 780-900, 4.1999, *Gomes, Luz, Costa & Gonçalves* (obs.).
FOGO: Old crater rim in the SE, between Mte. Cruz and 24°23.4'W, on black lapilli, 2200-2300 m, 22.1.1994, *Kilian 3293* & *Leyens* (B, herb. Lobin); western part of the island, path from Miguel Gonçalves up to the old crater rim (Bordeira), S facing, rocky slopes at 2200 m, shortly below ridge, 23.1.1994, *Kilian 3307* & *Leyens* (B, herb. Lobin); western part of the old crater rim (Bordeira), Ribeira Figueirinha (upper part of the Ribeira Isabel), at the Cume de Mte. Vermelho, at 2340 m, 5.12.1996, *Leyens CV-96-666* (herb. Lobin).

Menispermaceae

Cocculus pendulus (Forst.f.) Diels
This very variable subshrub is known on the Cape Verde Islands from Boavista, Maio and Santiago, and grows in a rather wide range of habitats. The plants may hang from steep cliffs, climb in trees, or creep on the ground in dry stony planes and on sand dunes (see also Duarte 1995). Vegetation analysis show that the species was probably a characteristic element of drier planes.

In 1995 W. Lobin found this species also on the island of Sal, in similar conditions. Only few plants were observed in the vicinity of the village of Espargos. Pending further data it is classified as Indeterminate (I) for Sal.

SAL: Terra Boa, trockene Ebene nahe der Ortschaft Espargos, 10.8.1995, *W. Lobin 7591* (herb. Lobin).

Monocotyledoneae

Asparagaceae

Asparagus squarrosus J. A. Schmidt
Endemic shrub up to now known from the islands of Sto. Antão, S. Vicente, Raso, S. Nicolau, Sal, Boavista and Maio (Brochmann & al. 1997). Its indication without specimen citation for Sta. Luzia by Diniz & Matos (1994), which was overseen by Brochmann & al (1997), could be confirmed in 1996 by T. Leyens.

For the first time *Asparagus squarrosus* is recorded here for Fogo, where only *A. scoparius* was known to occur. *A. scoparius* was collected at an elevation of c. 940 m near Achada Furna (leg. *Leyens CV-98-973*), whereas *A. squarrosus* was observed and collected two times at sea-level.

STA. LUZIA: Tope dos Penedos, c. 220 m, 14.9.1996, *Leyens CV-96-626* (herb. Lobin).
FOGO: NW part of the island, close to Ponta da Salina, on cliffs above the beach called Outra Banda at c. 70 m, 5.12.1998, *Leyens CV-98-1053* (herb. Leyens); Ponta da Salina, on cliffs at sea level, 2.10.1999, *Leyens CV-99-1110* (herb. Leyens).

Acknowledgements

The authors wish to thank the Departamento de Ciências do Ambiente of the Instituto Nacional de Investigação e Desenvolvimento Agrário (INIDA) for the logistic support granted and the Departamento de Geociências of the Instituto Superior de Educação (Praia) for the integration of the final years students into the working group. I. Gomes is very grateful to Luzia Mendes, final year's student in the natural sciences class at the Instituto Superior de Educação for excellent and indispensable collaboration during the conduction of the inventories at Lugar Velho on Santiago. Special thanks are due to Mr Ildo Ramos for his help during the field work on Boavista. T. Leyens is very grateful to the Tropical Ecology Support Program (TÖB) of the Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, whose grant has enabled her to study the flora and vegetation and its threats and conservational aspects since March 1997. It is gratefully acknowledged that this grant also facilitated the field studies for the thesis of B. da Luz. T. Leyens thanks Dr W. Lobin and Prof. W. Barthlott of the Friedrich Wilhelms University of Bonn for their support. Special thanks are due to Dr B. Zimmermann, H. Mahler and Liliana Ferreira of the Projecto Desenvolvimento Comunal Fogo e Brava – GTZ for logistic and professional support since 1997. Last but not least T. Leyens is deeply thankful to the inhabitants of the higher zones of Fogo, especially to Germano F. Centeio and Danilo Montrond for their continuous support, encouragement and friendship, without whose help many localities would probably still be unknown.

References

Borgen, L. 1987: *Lobularia (Cruciferae)*. A biosystematic study with special reference to the Macaronesian region. – Opera Bot. **91.**

Brochmann, Ch., Rustan, Ø. H., Lobin, W. & Kilian, N. 1997: The endemic vascular plants of the Cape Verde Islands, W Africa. – Sommerfeltia **24.**

Chevalier, A. 1935: Les îles du Cap Vert. Flore de l'archipel. – Rev. Bot. Appl. Agric. Trop. **15:** 733-1090.

Costa, J. 1999: Vegetação da bacia hidrográfica da Ribeira Principal e Serra da Malagueta, Santiago. – Praia, Cabo Verde.

Da Luz, B. 1999: Vegetação do Regato de Pico Novo e zonas limítrofes, Fogo. – Praia, Cabo Verde.

Diniz, A. C. & Matos, G. C. de 1987: Carta de zonagem agro-ecológica e da vegetação de Cabo Verde II. Ilha do Fogo. – Garcia de Orta, Sér. Bot. **9:** 35-70, with col. map 1: 50.000.

— 1988: Carta de zonagem agro-ecológica e da vegetação de Cabo Verde IV. Ilha da Boavista. – Garcia de Orta, Sér. Bot. **10:** 49-72, with col. map 1: 50.000.

— 1994: Carta de zonagem agro-ecológica e da vegetação de Cabo Verde VII. Ilha de Santa Luzia. – Garcia de Orta, Sér. Bot. **12:** 69-100, with col. map 1: 50.000.

Duarte, M. C. 1995: *Menispermaceae*. – In: Paiva, J. (ed.), Flora de Cabo Verde. Plantas vasculares **4.** – Lisboa & Praia.

— & Gomes, I. (in prep.): Notas florísticas sobre a Ilha de Santiago.

Gomes, I. 1997: Vegetação da bacia hidrográfica da Ribeira da Garça, Santo Antão. – Tese mestrado. Inst. Sup. Agr. Lisboa/Inst. Nac. Inv. Des. Agr. Praia. – Praia, Cabo Verde.

— & Vera-Cruz, M. T. 1993: A situação da biodiversidade em Cabo Verd. – Mindelo, Cabo Verde.

— , Gomes, S., Kilian, N., Leyens, T., Lobin, W. & Vera-Cruz, M. T. 1995a: Notes on the flora of the Cape Verde Islands, W Africa. – Willdenowia **25:** 177-196.

— , — , — , — , — & — 1995b: Plantas endémicas e árvores indígenas de Cabo Verde. – Praia, Cabo Verde.

— , — , — , — , — & — 1996: Primeira Lista Vermelha para as Angiospérmicas de Cabo Verde. – [In: Leyens, T. & Lobin, W. (ed.), Primeira Lista Vermelha de Cabo Verde]. – Courier Forschungsinst. Senckenberg **193:** 43-62.

— , Leyens, T. & Lobin, W. (in prep.): Catálogo das áreas a serem protegidas em Cabo Verde.
— , — & Levy, J. G. V. 1998: Biodiversidade terrestre. – Praia, Cabo Verde.
Gonçalvez, F. 1999: Vegetação da bacia hidrográfica da Ribeira Seca. – Praia, Cabo Verde.
Hansen, A. & Sunding, P. 1993: Flora of Macaronesia. Checklist of vascular plants, ed. 4. – Sommerfeltia **17.**
Kilian 1988: Die *Lactuceae (Compositae)* der Kapverdischen Inseln (W-Afrika). – Willdenowia **18:** 113-216.
— & Leyens, T. 1994: *Limonium lobinii (Plumbaginaceae)*, a new species from the Cape Verde Islands, W Africa. – Willdenowia **24:** 59-63.
Leyens, T. 1998: Plant conservation makes progress in Cape Verde. – Plant Talk **13:** 24-26.
— & Lobin, W. 1995: *Campanula (Campanulaceae)* on the Cape Verde Islands – two species or only one? – Willdenowia **25:** 215-228.
— & — (ed.) 1996: Primeira Lista Vermelha de Cabo Verde. – Courier Forschungsinst. Senckenberg **193.**
— (in prep.): Elaboration of programs and measures necessary for the sustainable conservation of the biodiversity of the area "Bordeira, Chã das Caldeiras and Pico Novo" on the island of Fogo. – PhD thesis.
Lobin, W. 1982: Untersuchungen über Flora, Vegetation und biogeographische Beziehungen der Kapverdischen Inseln. – Courier Forschungsinst. Senckenberg **53.**
— , Leyens, T., Kilian, N., Erben, M. & Lewejohann, K. 1995: The genus *Limonium (Plumbaginaceae)* on the Cape Verde Islands, W Africa. – Willdenowia **25:** 197-214.
Martins, E. S. 1995: *Boraginaceae*. – In: Paiva, J. (ed.), Flora de Cabo Verde. Plantas vasculares **74.**
Nogueira, I. & Ormonde, J. 1981, 1985: Plantas colhidas pelo Eng.º L. A. Grandvaux Barbosa no archipélago de Cabo Verde IX, X. – Garcia de Orta, Sér. Bot. **5:** 13-29, **6:** 163-176.
Rustan, Ø. H. & Brochmann, Ch. 1985: Additions to the vascular flora of Cabo Verde. – Garcia de Orta, Sér. Bot. **6:** 89-106.
Schmidt, J. A. 1852: Beiträge zur Flora der Kapverdischen Inseln. – Heidelberg.
SEPA (Secretariado Executivo para o Ambiente) 1999: Estratégia Nacional e Plano de Acção sobre a Biodiversidade. – Praia, Cabo Verde.
Soares, E., Gomes, I. & Vera-Cruz, M. T. 1998: Pressão antrópica sobre a biodiversidade. – Praia, Cabo Verde.
Vera-Cruz, M. T. 1999: Plantas medicinais existentes em Santiago. – Praia, Cabo Verde.
Webb, P. B. 1849: Spicilegia gorgonea. – Pp. 89-197 in: Hooker, W. J., Niger Flora. – London.

Addresses of the authors:
Isildo Gomes, Departamento Ciências do Ambiente do Instituto Nacional de Investigação e Desenvolvimento Agrário (INIDA), C. P. 84, Praia, República de Cabo Verde; e-mail: igg@mail.cvtelecom.cv or inida@mail.cvtelecom.cv

Teresa Leyens, C. P. 52, S. Filipe, Fogo, República de Cabo Verde; e-mail: tetele@mail.cvtelecom.cv

Berenice da Luz, Judith Costa & Fátima Gonçalves, Departamento de Geociências do Instituto Superior de Educação, Praia, República de Cabo Verde.