CONTRIBUTIONS TO THE VASCULAR FLORA AND VEGETATION OF THE ISLAND OF CORVO (AZORES)

WITH AUTECOLOGICAL AND SYNECOLOGICAL REMARKS

by Erik Sjögren *

With 6 figures

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(Photographs by the author)

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Uppsala in February 1979
Erik A. Sjögren

Introduction

Flora and vegetation of the Azores islands was investigated by the author in 1965, 1968 and 1975. These investigations were continued in 1978 (June, July) on the islands of Corvo, Graciosa and S. Jorge. The present paper deals with botanical data obtained during a two week stay on Corvo. Information is mainly given on the vascular flora and vegetation; the bryophytes will be treated eventually in another paper when the examination of collected material has been terminated.

The botanical expedition to the island of Corvo was aimed to provide complementary information to the knowledge of Azorean vegetation principally within the following fields:

(1) Until 1975 the flora of Corvo was much less known than in other parts of the Azorean archipelago; most earlier records date from times before this century and additional species could thus be expected to have invaded the island, alternatively some species might have disappeared.

(2) no vegetational notes from Corvo have been found in literature, and would consequently be interesting to obtain for comparison with communities recorded on other Azorean islands.

(3) the westernmost islands in the Azores (Flores and Corvo) are climatically different from the other islands, as precipitation increases towards W in the archipelago; this condition would help to provide valuable information on the ecological preference and ranges of vascular plants and groups of plants if their zonation registered on the other islands were found to be different on Corvo.

(4) the isolated position of Corvo, and the comparatively small percentage of the total surface covered with fields, was suspected to influence the presence of plants which are generally restricted to the cultivated landscape.

Nomenclature: In general the nomenclature of the vascular plants follows Flora Europaea 1-4. The Check-list of vascular plants by Eriksson et al. (1974) was also considered.

Corvo

The island of Corvo, the smallest of the nine Azorean islands, is situated at W 31° 05′, N 36° 40′. The surface is about 17 km²; it is 6.5 km long from N to S and 4 km wide at its widest point. It has about 16 km of coast. Approximately in the center of Corvo is the highest point of 718 m (Morro dos Homens). The northern part is dominated by a caldera, the so called Caldeirão. The bottom of this caldera is at 413-442 m; the steap slopes are 590-718 m high. The nearly round caldera is about 2.2 km wide from the top of the northern to the southern rim and the nearly plane bottom has a maximum extension of about 1.3 km. The distance from Corvo southward to Flores (the westernmost island in the Azores) is about 18 km.

Corvo has 312 inhabitants (1978); in 1960 the number was 683 and has never been more than 950. There is only one village (Vila Nova do Corvo), situated in the southernmost fairly level part of the island. The principal income of the people of Corvo comes from the fairly large stock of cattle (± 3000 cows). Sheep are not raised any more but were rather numerous on the island up to about 20 years ago. Fishing is carried on practically only to provide for houshold requirements.

On approximately 15 km² of Corvo are fields, about 9 km² are covered by more or less improved open pastures and the remaining part consists of the numerous ravines, the lakes in the caldera, the open not pastured *Sphagnum* dominated areas, and of the steap coastal slopes. Several ravines, especially in the eastern part of the island, have forest plantations. The steep coastal slopes from 100-500 m inland (Fig.1) are of no use for cultivation nor for the raising of cattle.

Communication in summer is mainly by small boats between Corvo and Flores. A small combined cargo and passanger ship from other Azorean islands arrives every 1-2 weeks. In winter frequently no communication at all with other islands can be maintained for 1-3 months. An airstrip for small aircraft has been under construction on the island since 1977. There are no factories on Corvo and communication facilities on the island are restricted to two tractors and a few motorcycles. Mainly donkeys and horses are used for transport. The sea around the island and the air is probably freer from pollution than in any other part of Europe.

Climate: In the field of climatic conditions on Corvo some information ought to be given. The island is considered as very windy. Calm days are few in the year. Wind directions alter very frequently, even during 24h, according to the position of the low and high pressures around the Azores. Winters are usually very stormy. Wind velocities of > 30 m/sec. occur fairly frequently. The rocky coasts of split up lava cliffs contribute to the formation during stormy weather of salt-water rains. These rains, which are injurious to crops, mainly fall below

300 m a.s.l. but may accidentally be carried to even higher altitudes on the island.

Precipitation on Corvo is according to measurements at the meteorological station in the SW of the island ± 1200 mm/year at sea level. Considering the position of this meteorological station, however, in an open place on a gently sloping part of the coast, this amount may be at least 200 mm higher in other parts of the island, below 50 m. Precipitation in the Azores shows an average increase from the sea level upwards by 25% per 100 m. In the case of 1200 mm/year at sea level, thus 2100 mm is reached at 300 m a.s.l. and 3000 mm at 600 m; if the more probable amount of 1400 mm/year is chosen, 2100 mm is reached at 200 m and 3500 mm at 600 m. An increase by 29% per 100 m of altitude (as on Flores) and 1400 mm at sea level means a rainfall at 200 m of about 2200 mm. For further information on precipitation features in the Azores see Agostinho (1942) and Sjögren (1973a, 1979).

Annual rainfall is evidently largely responsible for the zonation of plant communities as well as of individual species in the Azores. Therefore a comparison with some other islands in the island group will be given below. There is an increase from E to W in the archipelago, as well as from the coast upwards to higher altitudes on the individual islands. Correlations of zonation of plants and plant communities may thus be established. Actually these zonations appear very clearly different in the eastern, central and western part of the Azores island groups respectively.

The amount of rainfall of 2100 mm/year on the central Azorean islands is reached at about 500 m of altitude (somewhat lower on Pico), and on S. Miguel in the E at about 750 m. The amount of 3000 mm/year is reached at 800-1000 m on the central islands whereas 2700 mm may be the maximum amounts on the highest peaks of S. Miguel. These figures mean that the same rainfall climate as at 500 m in the central Azores prevails at about 200 m a.s.l. on Corvo and at 600-700 m on S. Miguel. Differences in the rainfall climate between different parts of the island group will be further treated below, where the zonation of plants and plant communities on Corvo is discussed.

Floristic remarks

During my 14 days stay on Corvo in 1978 I was able to record 207 taxa of vascular plants. An additional 57 taxa were cited by Eriksson et al. (1974) from the island and 25 other taxa by Eng.° I. B. Gonçalves. The total number of species (not cultivated) growing today on Corvo may not exceed 300. This number should be compared to the total number of vascular plants in the Azores, which may today be about 750. Out of the taxa recorded most are also recorded in the central and eastern part of the archipelago. Only *Carex vulpina* and *Euphrasia azorica* are restricted to Corvo and Flores and only *Frankenia laevis* has been recorded on no other island in the Azores than on Corvo.

More than 50% of the species on Corvo are now known from all the nine Azorean islands. Considering the very small size of the island of Corvo, the number of recorded species is high compared to the number present in the archipelago.

There are on the other hand a great number of species known as widespread on several Azorean islands which have nowadays a very local distribution on Corvo, for example *Platanthera micrantha;* several are present with very few specimens, for example *Ilex perado* ssp. *azorica* (see list of species below).

Several species of weeds, very widespread in the Azores, such as *Galactites tomentosa, Urospermum picroides, Lepidium virginicum, Bidens pilosa* have not yet been recorded on Corvo. Other species of the anthropogeneous vegetation along roads, in and between fields and around houses, which are widespread in the Azores as a whole, are rare on Corvo, such as *Cerastium glomeratum, Stellaria media, Erigeron karwinskianus, Capsella rubella, Poa annua, Lythrum hyssopifolia, Misopates orontium, Solanum nigrum.*

A large number of species, which are widespread in the non-anthropogeneous communities such as *Microderis filii, Frangula azorica, Daboecia azorica, Serapias cordigera, Elaphoglossum paleaceum, Lactuca watsoniana, Lepidotis cernua, Viburnum tinus* ssp. *subcordatum, Anagallis tenella* also seem to be absent on the island.

Within the group of species with differential value of natural plant communities (cf. Sjögren 1973a) not recorded by the author but cited by either Eriksson et al. (1974) or to be found in the notes by Gonçalves are at low levels such species as *Spergularia azorica, Euphorbia azorica, Tolpis fruticosa, Scabiosa atropurpurea,* and at high levels for example *Culcita macrocarpa, Lycopodium madeirense, Pteris arguta, Asplenium scolopendrium, Bellis azorica, Euphorbia stygiana, Ranunculus cortusifolius.* These differential species must in any case be considered as very local probably present with few specimens or in some cases as probably extinct on Corvo. Among the widespread species of the cloud-zone vegetation of the Azores, which are rare on Corvo, ought to be mentioned also *Hymenophyllum tunbrigense, H. wilsonii, Microderis rigens, Tolpis azorica, Calluna vulgaris, Laurus azorica, Myrsine africana, Picconia azorica.*

Abbreviations

(geographical names)

Az. Azores
W Az. western part of the Azores (Flores, Corvo)
C Az. central part of the Azores (Faial, Pico, S. Jorge, Graciosa, Terceira)
E Az. eastern part of the Azores (S. Miguel, Santa Maria)
C Corvo
Fo Flores

G Graciosa
J S. Jorge
P Pico
SM S. Miguel
SMa Santa Maria
T Terceira

(other abbreviations)

all.	alliance
ass.	associations
br.	bryophyte
COI	Instituto Botânico «Dr. Júlio Henriques», Coimbra
coll.	collected (by the author)
diff. sp.	differential species
diff. val.	differential value
distrib.	distribution
Gonç.	I. B. Gonçalves
hab.	habitat
pref.	preferentially
rec.	recorded
u.c.	together with (una cum)
UPSV	Institute of Plant Ecology (Växtbiologiska institutionen), Uppsala Universitet; Uppsala, Sweden

VEGETATION

Cultivated land and pastures

The small area of cultivated fields has been examined from the point of view of the weed vegetation. Included in this survey were the narrow strips of land between the fields, and the roadsides.

The general aspect is a poverty of species, as also suggested above in the section of floristic remarks. In other parts of the Azores there is a frequent presence of the alliance *Mercurialion annuae* Sjögren 1973. This all. could not be distinguished on Corvo, where apparently diff. spp. such as *Mercurialis annua, Parietaria* spp., *Polygonum aviculare, Lepidium virginicum, Oxalis pes-caprae, Galinsoga parviflora, Senecio vulgaris, Sherardia arvensis, Galactites tomentosa* are very rare or not present at all. There is only to be found a fraction of the group of diff. spp.: *Portulaca oleracea, Silene gallica, Sisymbrium officinale, Coronopus didymus, Polycarpon tetraphyllum, Aphanes microcarpa.* Among the frequently dominant species are *Rumex pulcher, Conyza* spp., and *Cyperus* spp. Most widespread species are *Rumex pulcher* and *Coronopus didymus.*

The most frequently recorded group of species along roads and between fields (< 250 m) consists of:

Coronopus didymus
Avena sterilis
Gnaphalium luteo-album
Cyperus spp.
Chenopodium ambrosioides
Trifolium campestre
Sonchus spp.
Rumex pulcher

Above 300 m are only few patches in heavily grazed areas, richly manured, where a weed dominated vegetation occurs with species such as *Poa annua, Stellaria media, Taraxacum officinale* s. l., *Cerastium glomeratum* and *Sonchus* spp.

In the vicinity of Vila do Corvo a large area of former fields is planned to be transformed to a landing strip. Earth was removed in 1977 for that purpose. On dumped heaps of soil a vegetation of weeds rich in species has invaded, obviously sometimes dominated by one or the other species. Among the species most frequently reaching dominance (4 m²) are *Coronopus didymus, Conyza* spp., *Rumex pulcher, Setaria glauca.*

The weed vegetation on Corvo like in other parts of the Azores forms one-layer communities. Mosses appear rarely and always with low cover values. Those species found in the vegetation are mainly *Trichostomum* spp. and *Campylopus polytrichoides.*

The fraction of the *Mercurialion annuae* on Corvo has the natural coastal community *Festucion petraeae* as its most frequent contact community. Among species which most frequently appear in the *Festucion petraeae* but also in transitions with the weed communities are *Polypogon maritimus, Festuca petraea, Plantago coronopus, Lotus suaveolens, Chenopodium ambrosioides, Gnaphalium luteo-album, Vulpia bromoides* and *Ornithopus pinnatus.*

The grazing land on Corvo extends from 100-600 m. The most valuable pastures, however, are between 300-500 m. Areas below 250 m are generally too low-productive as also above 500 m where the ground is permanently too moist and *Sphagnum* spp. become dominant.

There are former fields between 10-200 m which are now used as pastures, but apparently they yield too little and cows are therefore generally kept on the pastures above 250 m. These low altitude pastures are covered by a vegetation probably very susceptible to overgrazing. The field-layer vegetation is dominated by *Trifolium campestre, Agrostis castellana, Carex hochstetteriana, Crepis capillaris, Hypochoeris radicata, Lotus suaveolens.*

In places where grazing pressure is kept very low, the vegetation is dense and high-productive. In such places the average percentage cover of the most frequent species (25 m²) present in at least 4 of 5 sample plots is:

Lotus uliginosus 50
Lolium perenne 10
Holcus lanatus 10
Rumex pulcher < 10

Trifolium campestre 20
Plantago lanceolata < 10
Briza maxima < 10
Kyllinga brevifolia < 10

In investigated areas at 150 m, where high grazing pressure for several years was maintained, the vegetation is now low-productive, split up by patches of bare soil which are exposed to erosion. The average percentage cover (conditions as above) is quite different there:

Anthoxanthum odoratum 20
Lotus suaveolens 10
Vulpia bromoides < 10
Aira caespitosa < 10
Plantago coronopus 20
Ornithopus pinnatus 10
Hypochaeris radicata 20

In these grazing areas below 250 m, where grazing has been suspended recently, there is an invasion of low shrubs of *Erica scoparia* spp. *azorica* and by *Pteridium aquilinum,* forming eventually a vegetation very poor in species and of low or no value as pasture. *Erica* as well as *Pteridium* appear at ± 100 m of altitude. At this level, however, *Pteridium* is of low vitality, frequently appearing damaged by salty rains.

The heavily grazed areas above 550 m, where the *Sphagnum* cover is sparse and the coarse soil is not permanently kept wet, have a plant cover constituted of about the same species as below 250 m, however, mixed with high altitude species. The most frequent plants, in at least 4 out of 5 sample plots, generally appear with the following average percentages of cover (25 m²), mosses included (br.) in the list:

Agrostis castellana 30
Vulpia bromoides < 10
Lotus uliginosus 10
Potentilla erecta 10
Rumex acetosella ssp. < 10
Pseudoscleropodium purum (br.) 10
Campylopus spp. (br.) < 10
Juncus effusus 10
Holcus lanatus 10
Luzula purpureo-splendens < 10
Prunella vulgaris 20
Rhytidiadelphus squarrosus (br.) 10
Sagina procumbens < 10
Polytrichum spp. (br.) < 10

Those pastures where cows are principally kept are dominated by graminaceous plants. Herbaceous plants are in minority, frequently reaching not more than 20% of cover. These pastures derive from the former *Juniperion brevifoliae* forests which have been cut to create and improve the pastures. Trees and shrubs of any kind are totally restricted in these areas to slopes of ravines. These pastures are nowadays grazed by approximately 3 cows per hectare, and are apparently not damaged by overgrazing. They are treated continuously to keep down to a minimum the presence of *Juncus effusus* and *Pteridium aquilinum,* species which are grazed only when very young. With no treatement like that and in areas where grazing has not taken place for a few years these two species invade vigorously.

The average cover percentages (25 m²) of the most frequent species (present in at least 4 of 5 sample plots) in the managed pastures from 300-500 m are, including bryophytes (br.):

Prunella vulgaris 10
Lotus uliginosus < 10
Juncus effusus < 10
Potentilla erecta < 10
Pteridium aquilinum < 10
Thuidium tamariscinum (br.) 10
Campylopus spp. (br.) < 10
Polytrichum spp. (br.) < 10
Eleocharis multicaulis < 10
Anthoxanthum odoratum 10
Lysimachia nemorum ssp. < 10
Dryopteris aemula < 10
Agrostis castellana 40
Pseudoscleropodium purum (br.) 10
Philonotis rigida (br.) < 10

There is in this type of plant cover progressively a change of composition from 400 up to 700 m of altitude. The general feature of this change is an increase in cover of the bottom-layer species, especially of *Sphagnum* spp. The cover of field-layer species decreases and reaches in large areas above 600 m only 10-25% except on drying *Sphagnum* hummocks, where there is frequently a grass cover of more than 80%. Even at these altitudes, where apparently the pastures are extremely low-productive (but still grazed) and the ground is very moist and difficult to cross for the animals, there are no shrubs or trees of any kind.

At altitudes around 650 m I have recorded the vegetation in five sample plots (25 m²) and the average percentages of cover of the few vascular plants (present in at least 4 out of 5 plots) in a *Sphagnum* dominated bottom layer was (total < 25%):

Agrostis castellana 10
Lotus uliginosus < 10
Dryopteris aemula < 10
Deschampsis foliosa 10
Luzula purpureo-splendens < 10
Lysimachia nemorum ssp. < 10
Juncus effusus < 10
Poa trivialis < 10
Holcus rigidus <10

The degenerating *Sphagnum* hummocks appear covered with more than 75% of cover of either *Holcus rigidus, Luzula purpureo-splendens, Agrostis castellana* or *Deschampsia foliosa*. There could not be distinguished any habitat differences between hummocks dominated by one or the other of these graminaceous plants.

Coastal vegetation

During my stay on Corvo I had the opportunity to study coastal vegetation in the south of the island from Vila do Corvo to Portinho da Areia, a distance of 1.5 km. Access to other parts of the steap coast was not possible to carry out by boat because of strong winds.

Azorean coast-cliff vegetation is fairly homogeneous. The predominating community is the *Festucion petraeae* (Sjögren 1973a). On Corvo this community appears impoverished and locally with a com-

position of species, in the Azores only to be found on this island. Diff. spp. of the *F. p.* not recorded or very rare on Corvo have been listed in the section Floristic remarks.

On coastal lava cliffs in places reached by storm waves only *Crithmum maritimum* grows here and there with few specimens. A few metres inland, where some sand is kept accumulated in crevices, *Crithmum* grows accompanied by *Polypogon maritimus, Cynodon dactylon* and *Atriplex prostrata.* Further inland, where more stable sand deposists occur and protruding lava rocks do not occupy more than 25% of the ground, this group of species is frequently augmented by the presence of *Festuca petraea* and *Solidago sempervirens* (+ in the bottom layer *Campylopus polytrichoides* and *Trichostomum* spp.). These two plants frequently occur as dominants in the vegetation, where accidentally also some weeds such as *Coronopus didymus* and *Melilotus indicus* are found.

The microzonation of the coastal vegetation is most easily studied in the area of Portinho da Areia. Also in this locality vegetation is differentiated as mentioned above, but closely above the level occasionally reached by storm waves is developed a unique vegetation dominated by the Atlantic-Mediterranean plant *Frankenia laevis.* On densely packed sand deposits with few protruding lava cliffs vegetation is constituted by the following plants. The average cover percentages are given for plants which appear in at least 7 out of 9 sample plots ($25\ m^2$):

Frankenia laevis 60
Plantago coronopus 20
Festuca petraea < 10
Polpogon maritimus < 10
Solidago sempervirens < 10
Lotus suaveolens 10
Sagina maritima < 10

This low-grown vegetation type, which evidently should be referred to as an association to the *Festucion petraeae,* is almost everywhere a one-layer community, with a very dense plant cover, only accidentally with a few specimens of bryophytes. This area is grazed by a few sheep, which evidently have diminished very much the presence of *Festuca petraea.* Within the area of dominating *Frankenia laevis* are small patches ($< 16\ m^2$) where either *Polypogon maritimus* or *Melilotus indicus* reach a cover of more than 50%. This vegetation seems to be fairly resistant to grazing. The grazed area is situated close to fenced in not grazed areas, where *Festuca petraea* and *Solidago sempervirens* have strongly reduced the cover of *Frankenia laevis* to less than 20%. *F. l.* becomes still more reduced by the vigorously growing *Festuca* on coarse sand richly mixed with gravel, and is not present at all on steeply sloping cliffs, where *Festuca* is the only dominating species.

The strictly coastbound vegetation described above becomes altered already at an altitude above sea level of 50 m. The typical vegetation

there and up to 100 m is composed as follows. Average cover percentages of species in at least 4 out of 5 sample plots (25 m²):

Erica scoparia ssp. 10
Festuca petraea 20
Lotus suaveolens 10
Trifolium campestre 10
Solidago sempervirens < 10
Plantago coronopus < 10
Holcus lanatus < 10
Ornithopus pinnatus < 10
Lolium perenne < 10
Gnaphalium luteo-album < 10
Pteridium aquilinum 10
Carex hochstetteriana 10
Briza maxima < 10
Hypochoeris radicata 10
Silene vulgaris ssp. < 10

This vegetation type evidently becomes invaded at this altitude by plants of low altitude pastures and abandoned fields. However, weeds were found to appear most rarely. *Erica* specimens are rarely higher than 50 cm. *Pteridium* seems to be suffering from salt impregnation and has low vitality.

Myrica faya is only accidental and low-grown in this southern part of Corvo around 100 m (Fig. 2). The main presence of this shrub is in the eastern part of the island around 200-250 m where it grows locally very dense and high. It is, however, apparently like on almost all the other Azorean islands severely threatened by the strongly competitive *Pittosporum undulatum*. In some ravines *Myrica* is almost extinct due to invasion by *Pittosporum* or is cut for plantation of *Cryptomeria japonica*.

The *Festucion petraeae* on Corvo is represented by the associations *Euphorbietum azoricae (E. a.) and Ornithopo-Gaudinietum (O.-G.)*, whereas the loose sand association *Polygonetum maritimi* is missing. The *Frankenietum laevis* n. p. forms an additional ass. only existing on Corvo. It is to be looked upon as a micro-association as only distinguished from other ones by the *Frankenia laevis*. The simplified position of the associations is *E. a.* very near the coast, followed inland by the *O.-G.*, and still further inland followed by a *Myrica faya* scrub.

The *E. a.* appears impoverished on Corvo, deprived of the diff. spp. *Polystichum falcatum, Anogramma leptophylla, Euphorbia azorica, Salsola kali, Scabiosa atropurpurea, Spergularia azorica, Tolpis fruticosa* and *Juncus acutus*. The diff. spp. present are only *Atriplex prostrata, Silene vulgaris* ssp. *maritima, Azorina vidalii, Crithmum maritimum, Solidago sempervirens, Frankenia pulverulenta* and *Sagina maritima*. The diff. val. of *Chenopodium ambrosioides* and *Gnaphalium luteo-album* is very much reduced though not towards the *Juniperion brevifoliae*. Among the diff. spp. of the *Festucion petraeae* with almost maintained diff. val. (in comparison to their diff. val. on other Azorean islands) are *Solidago sempervirens, Polypogon maritimus, Plantago coronopus, Asplenium marinum*, and *Festuca petraea*. The *E. a.* has the *O.-G.* and fractions of the *Mercurialion perennae* as contact communities. Transi-

tions are only frequently recorded with the *O.-G.* The *E. a.* appears on Corvo much less frequently than on other islands invaded by species of anthropogeneous vegetation, such as *Cynodon dactylon, Coronopus didymus* and *Carpobrotus edulis.*

The *Ornithopo-Gaudinietum* is on Corvo a contact community with the *Juniperion brevifoliae,* with the *E. a.* and the *Frankenietum laevis* and with sociologically not yet distinguished associations of low altitude pastures (partly occupying abandoned fields). The most frequent transitions are towards other associations of the *Festucion petraeae.* Transitions with the *Juniperion brevifoliae* are almost restricted to isolated dry habitats, to the rim of ravines and to places where a more or less dense shrub layer of *Myrica faya* and *Pittosporum undulatum* exists.

In other parts of the Azores for example on Faial, Pico and S. Jorge these transitions are scattered within the altitude range of 300-600 m. They appear at much lower altitudes on Corvo. The *O.-G.* on Corvo has the same dominants as on other Azorean islands, such as *Lotus suaveolens, Ornithopus pinnatus, Thymus caespititius.* The ass. is not invaded by introduced plants such as *Polygonum capitatum* as for example on Pico and Terceira. Diff. spp. of the ass. with almost maintained diff. val. are *Bromus madritensis, Rumex acetosella* ssp. *angiocarpus, Aira caryophyllea, Lotus suaveolens, Ornithopus pinnatus, Hypericum humifusum, Thymus caespititius.* Species not appearing in the ass. as diff. spp. are *Geranium purpureum,* and *Gaudinia fragilis.* Species with very much reduced diff. val. are *Vulpia bromoides* and *Gnaphalium luteo-album.*

The general features of the *Festucion petraeae* as a whole on Corvo are:

(1) lower number of species than on other Azorean islands;
(2) more frequent transitions with other plant communities, even at altitudes down to ± 100 m;
(3) reduction of the number of diff. spp. of the all. and its associations;
(4) reductions of the diff. val. of diff. spp. of the all. and its associations;
(5) much less frequent intrusion of weeds and of species fairly recently introduced to the Azores;
(6) some dominant species of the all. on Faial or Terceira (cf. Sjögren 1973a, p. 19, 20) do not appear as such on Corvo;
(7) much more frequent local presence of diff. spp. of the all. and its associations at altitudes above 250 m than in other parts of the archipelago, except Flores.

Cloud-zone vegetation

Considering its total surface Corvo is the Azorean island where the original high altitude vegetation, the so called cloud-zone vegetation *(Juniperion brevifoliae* Sjögren 1973), is restricted to the smallest

areas and is most impoverished in species. In other parts of the Azores this vegetation has been in large areas substituted by forest plantations, spontaneously spreading introduced species and by more or less intensively improved pastures at altitudes above the forest plantations. On Corvo forest plantations stand for a very small percentage of the substitution of original cloud-zone vegetation, whereas the improved open pastures with no shrubs and trees now cover more than half of the island surface, where a dense *Erica-Juniperus* forest earlier dominated, only here and there mixed with small patches of open grassland vegetation.

There are on Corvo no «young» lava fields (younger than 500 years) as for example on S. Jorge, Terceira, Faial and Pico. On such lava fields the cloud-zone forest has been maintained to a large extent unspoiled as it is impossible to exploit it for other purposes than forest plantations *(Pinus pinaster)*. This feature greatly influenced the gradual transformation of the landscape and the destruction of the high altitude forest on Corvo. Earlier time periods of over-population with more than 900 people living on the small island, where no successfull crops of cereal except maize can be grown, certainly accelerated proceedings of creation of new grazing land. Lack of fuel and lately a decrease of incomes from fishing also influenced in that direction. The recent decrease of the population (emigration) has apparently not meant any recolonization of any areas by junipers or by other tree species caracteristic of the *Juniperion brevifoliae (J. b.)*.

Today's remains of this community on Corvo are to be found in ravines and on steep exterior or interior slopes of the caldera. The following earlier distinguished diff. spp. of the all. can not be considered as such on Corvo, as they are very infrequent or even not present at all: *Lepidotis cernua, Laurus azorica, Ilex perado* ssp. *azorica, Platanthera micrantha, Frangula azorica, Daphne laureola, Viburnum tinus* ssp. *sucordatum, Carex peregrina, Huperzia selago, Culcita macrocarpa, Pteris arguta* and *Senecio malvifolius*. In the group of diff. spp. of the all. with reduced diff. val. are: *Hedera helix* ssp. *canariensis, Tolpis azorica, Hypericum foliosum, Luzula purpureo-splendens*. The following species have totally or nearly so lost their diff. val. of the *J. b.: Dryopteris aemula, Polystichum setiferum, Rubus hochstetterorum*. This means, that only few diff. spp. are left as such on Corvo namely *Juniperus brevifolia* and *Vaccinium cylindraceum*. Other diff. spp. confined to the *J. b.* have to be looked upon among the diff. spp. of the associations of the all. Dominant species and contact communities of the *J. b.* will be treated below under association.

In other parts of the Azores the *J. b.* is split into at least three associations, namely the *Erico-Myrsinetum (E.-M.), Festucetum jubatae (F. j.)* and the *Anagallidetum tenellae (A. t.)* (Sjögren 1973a). The *E.-M.* is the least frequent and most impoverished of the associations on Corvo. A large stand of the caracteristic tree species of the ass.,

Juniperus brevifolia, was recorded as low as at 200 m but in this locality (fairly level ground in the south of the island) no diff. spp. of the ass. are present. There is heavy grazing going on between the trees, which even eliminated nearly all specimens of *Erica*. The epiphytic moss cover on the trees does not hold the caracteristic species of the *E.-M.* Some sheltered ravines with *Erica* at 175-200 m in the south of Corvo were exmined and found to hold a plant cover (25 m^2) with fractions both of the *Festucion petraeae* (right) and the *Juniperion brevifoliae* (left):

Asplenium marinum
Vulpia bromoides
Lotus suaveolens
Deschampsia foliosa
Luzula purpureo-splendens
Asplenium azoricum

In one *Erica*-sheltered ravine at 375 m in the western part of the island the coastal plants were not present and a poorely developed *E.-M.* in transition with the *Festucetum jubatae* was recorded. The average cover percentages of diff. spp. of both associations present in at least 4 of 5 sample plots (25 m^2) were:

Woodwardia radicans < 10
Microderis rigens 10
Cardamine caldeirarum < 10
Luzula purpureo-splendens 10
Festuca jubata 50
Trichomanes speciosum < 10
Deschampsia foliosa 20

The only localities with locally dense shrub-tree layer are the ravines in the bottom of the caldera and on its interior N-facing slopes. In these ravines the following average cover percentages were recorded for diff. spp. present in at least 4 of the 5 sample plots:

Deschampsia foliosa 30
Osmunda regalis 10
Luzula purpureo-splendens 10
Tolpis azorica < 10
Diplazium caudatum 20
Woodwardia radicans 10
Holcus rigidus < 10
Trichomanes speciosum < 10
Festuca jubata 10

The shrub-tree layer consisted of *Vaccinium cylindraceum* (40%) and *Erica scoparia* ssp. *azorica* (30%). Only accidental presence of *Laurus azorica* and *Ilex perado* ssp. *azorica, Juniperus brevifolia* and *Microderis rigens* could be recorded. Epiphyllous moss cover had the caracteristic composition for the *E.-M.* but the caracteristic epiphytic community, *Echinodio-Lepidozietum cupressinae* on *Erica* was extremely poorely developed (cf. Sjögren 1979). This phytocoenotic feature is remarkable, as earlier investigations in the Az. by the author have shown, that this epiphytic vegetation is nearly always present, where the *Juniperion brevifoliae* forest is rich in diff. spp. in the field layer and never missing in habitats where an epiphyllous moss vegetation rich in species can be registered.

Vaccinium and *Myrsine africana* are still more infrequent on the exterior slopes of the caldera, where only very few localities could be

recorded. The two species were nearly always found growing on very steep slopes and on tops of boulders, where they cannot be reached by grazing animals. Only young specimens could be seen.

The most typical remnants of the *E.-M.* on Corvo are from a sociological point of view fairly isolated. Transitions with the *Festucetum jubatae* and the *Anagallidetum tenellae* are frequent, and these transitions frequently appear mixed with coastal plants of the *Festucion petraeae.* As dominant species in the *E.-M.* (25 m²) ought to be mentioned as frequent only *Luzula purpureo-splendens, Erica scoparia* ssp. *azorica, Polystichum setiferum, Hedera helix* ssp. *canariensis, Holcus rigidus, Osmunda regalis, Woodwardia radicans* and *Deschampsia foliosa.*

The diff. spp. of the *E.-M.* are few on Corvo as compared to records of the ass. from other parts of the Az. The following species are missing in that group as they do not occur at all on the island or are most infrequent: *Lycopodium madeirense, Dryopteris borreri, Sanicula azorica, Euphrasia grandiflora, Hymenophyllum tunbrigense, Arceuthobium oxycedri, Elaphoglossum paleaceum, Daboecia azorica, Calluna vulgaris.* Diff. spp. with reduced diff. val. are: *Juncus effusus. Holcus, rigidus, Rubia peregrina, Cardamine caldeirarum, Osmuda regalis, Deschampsia foliosa.*

Fractions of the *Festucetum jubatae* were more frequently recorded than those of the *E.-M.* on Corvo, This ass. is, however, like the *E.-M.* very much impoverished of diff. spp. on the island. The following earlier distinguished diff. spp. do not occur at all on Corvo or are too infrequent to be used as such: *Bellis azorica, Euphorbia stygiana, Chaerophyllum azoricum, Lactuca watsoniana, Hymenophyllum wilsonii, Phyllitis scolopendrium, Ranunculus cortusifolius, Prunus lusitanica* ssp. *azorica, Smilax excelsa, Lycopodum madeirense, Dryopteris borreri, Sanicula azorica, Euphrasia grandiflora, Microderis rigens, Arceuthobium oxycedri, Elaphoglossum paleaceum* (cf. Sjögren 1973a, Table 6). Diff. spp. with clearly reduced diff. val. on Corvo are: *Diplazium caudatum, Hymenophyllum tunbrigense, Cardamine caldeirarum* and *Deschampsia foliosa.* Diff. spp. with maintained diff. val. or almost so are: *Festuca jubata, Trichomanes speciosum, Woodwardia radicans.*

The main feature of the *Festucetum jubatae* on Corvo as compared to recordings of the ass. in other parts of the Az. is the much more poorely developed shrub-tree layer on Corvo and the much higher cover values of *Sphagnum* spp. in the bottom layer. The *Sphagnum* presence is from about 350 m, gradually increasing up to 700 m. The ass. *F. j.* or rather fractions of it, are on Corvo restricted to narrow river ravines and to the S-facing interior slopes of the caldera. At 600 m in that locality, the average cover percentages of plants present in at least 4 out of 5 sample plots (16 m²) on the steep slopes ($> 45°$) are:

Festuca jubata 50
Myrsine africana < 10
Potentilla erecta < 10
Centaurium scilloides < 10
Calluna vulgaris < 10
Microderis rigens < 10
Euphrasia azorica < 10
Luzula pulpureo-splendens 10
Dryopteris aemula 10
Erica scoparia spp. < 10
Lysimachia nemorum ssp. < 10
Cardamine caldeirarum < 10
Tolpis azorica < 10
Platanthera micrantha < 10
Deschampsia foliosa 10

In the vicinity is a quite different drought resistant plant cover on boulders and tops of cliffs with *Aira praecox, A. caryophyllea, Erica scoparia* ssp. *azorica, Thymus caespititius, Ornithopus perpusillus, Umbilicus rupestris.*

In ravines in the caldera the strongly exposed fraction of the *F. j.* is added to by *Woodwardia radicans, Diplazium caudatum* and *Trichomanes speciosum,* which means a reduction of *Festuca jubata* to a cover of not more than 30%.

Even down at 400 m on the exterior slopes of the caldera are ravines with the *F. j.* The average cover percentages of species present there in at least 4 out of 5 sample plots (16 m²) were:

Blechnum spicant 20
Deschampsia foliosa 20
Tolpis azorica < 10
Woodwardia radicans < 10
Potentilla erecta < 10
Sagina procumbens < 10
Sibthorpia europaea < 10
Cardamine caldeirarum < 10
Dryopteris aemula 10
Luzula purpureo-splendens 10
Trichomanes speciosum < 10
Festuca jubata 30

The *Festucetum jubatae* on Corvo is transitional only with other associations of the *Juniperion brevifoliae.* As seen from these lists of groups of plants above, the ass. is very much impoverished of species on Corvo, although it might have been richer of diff. spp. and widespread at times when more of the *Juniperus-Erica* forest was still left on the island.

The *Anagallidetum tenellae* is the ass. of the *J. b.* with a less densely developed shrub-tree layer. Actually this layer may frequently appear with a cover percentage of less than 10% (16 m²) and frequently the shrubs are low-grown, not higher than 0.5 m. On Corvo, which might be understood from description of vegetation and other information already given, the *A. t.* rarely has any shrub-tree layer at all. The largest areas of the *Juniperion brevifoliae* nowadays on Corvo, above 300-350 m, are those with the *A. t.*

The *A. t.* is not sharply limited, physiognomically, or sociologically from the two other associations of the all. Transitions with these associations are frequent in other parts of the Az., less frequent on Corvo due to the low frequency of remaining localities with *E.-M.* and *F. j.* The *A. t.* is also in contact with anthropogeneous vegetation and appears in several places mixed with so called weeds, close to

paths and roads and fields, and in overgrazed areas. There are also transitions with the *Ornithopo-Gaudinietum* of the coastal *Festucion petraeae.*

Like the other associations of the cloud-zone vegetation, *A. t.* is also impoverished of species on Corvo. The following earlier distinguished diff. spp. do not occur or are too infrequent to be treated as such: *Origanum virens, Carex pilulifera, Hydrocotyle vulgaris, Anagallis tenella, Scirpus fluitans, Carex tumidicarpa* ssp. *cedercreutzii* (cf. *Carex serotina* Mérat; in Hansen 1971, p. 105), *Viola palustris* ssp. *juressi, Serapias cordigera, Bellis azorica, Daboecia azorica, Calluna vulgaris.* In the group of diff. spp. with maintained diff. val. or nearly so are *Agrostis castellana, Fragaria vesca, Potentilla erecta, P. anglica, Juncus effusus, Prunella vulgaris* and *Holcus rigidus.* Species which occur fairly frequently as dominants (16 m²) in the *A. t.* are *Agrostis castellana, Holcus rigidus, Juncus effusus, Luzula purpureo-splendens.*

The open areas from 300-350 m, dominated by improved pastures, are poor in herbaceous plants and the development of the *A. t.* there is very much held back by grazing and improving activities. These are mainly concentrated on removing of *Pteridium aquilinum* and *Juncus effusus* stands and of hummocks. From 500 m, locally already from 450 m, the pastures become richer and richer in *Sphagnum* spp. and the field layer becomes very poor in species. The frequency of *Sphagnum* hummocks increases, the soft ground is nearly permanently moist. The *Sphagnum* cover is at least 1 m deep above 650 m and up to the highest points on the island (southern rim of the caldera), locally forming large hummocks more than 3 m high which give rise to the rim of the caldera. On the N-facing interior slopes of the caldera *Sphagnum* is totally dominant and the moss cover frequently erodes, sliding down the slopes.

The growth of the *Sphagnum* cover in thickness is held back by erosion on sloping ground, and on fairly level ground by colonization for example of *Polytrichum* spp. This colonization seems to be followed by an invasion of *Luzula purpureo-splendens, Deschampsia foliosa, Holcus rigidus, Agrostis castellana.* Generally only one of these graminaceous plants, apparently accidentally, dominates to more than 80% on each single hummock. On sloping ground, the *Sphagnum* cover may also, though rarely, be outcompeted by *Festuca jubata* and *Deschampsia foliosa.*

It has been shown (cf. Sjögren 1973a, p. 23 ff. and Table 6) that the *A. t.* also appears in the Az. as transitional with the lake shore all. the *Littorello-Eleocharion (L.-E.).* On Corvo these transitions are mainly found around lakes and *Sphagnum* dominated depressions in the bottom of the caldera, but also accidentally in small depressions on the exterior slopes.

Out of the diff. spp. of the *L.-E.* only *Isoetes azorica, Littorella uniflora, Callitriche stagnalis, Potamogeton oblongus* are also present

as such on Corvo. The following species in common with the *Juniperion brevifoliae (Anagallidetum tenellae)* also occur: *Potentilla erecta, Juncus effusus, Prunella vulgaris.* On the other hand *Dryoteris aemula* and *Eleocharis multicaulis* have lost their diff. val. on Corvo and *E. palustris* nearly so. Other diff. spp. of the *L.-E.* not present as such on Corvo are numerous (cf. op. cit.)

Five sample plots (16 m²) of the *L.-E.* were recorded in the caldera. The average cover percentages of the species present in at least 4 out of the 5 plots, were:

Juncus effusus 60	*Poa trivialis* < 10
Eleocharis palustris < 10	*Holcus rigidus* 10
E. multicaulis < 10	*Dryopteris aemula* < 10
Lotus uliginosus < 10	*Polytrichum commune* (br.) < 10
Lysimachia nemorum spp. < 10	*Sphagnum squarrosum* (br.) 20
Luzula purpureo-splendens < 10	

These plots were recorded at the margins of depressions. *Juncus effusus* becomes less frequently dominant towards the center of the depressions, where *Polytrichum* appears in the *Sphagnum* carpet with higher cover percentages and the field-layer plants are the same as listed above but with a total cover of not more than 20%. Vegetation in the depressions, however, varies very much according to their water holding capacities. Some appear comparatively dry, probably due to a locally more rapid water penetration down through coarse volcanic deposits. In such places the dominance of *Juncus effusus* is not less than 50% even in the centre. In moist-wet depressions on fine volcanic deposits *J. effusus* reaches cover percentages of 50% or more only at the margins. The total field-layer cover is frequently recorded as less than 20% from halfway between the margin and centre and towards the centre of the depressions.

The following group of plants is rather frequently recorded (16 m²) in small depressions or around very small brooks on the exterior slopes of the caldera: *Lotus uliginosus, Callitriche stagnalis, Polygonum salicifolium, Poa trivialis, Dryopteris aemula, Juncus effusus.*

The main features of the *Juniperion brevifoliae* on Corvo are:

(1) the all. appears only rarely with a shrub-tree layer;
(2) the number of species, regularly appearing in the all. is comparatively low;
(3) the number of recorded species with diff. val. of the all. is much lower than in other parts of the Azores; the frequency of shrub-tree diff. spp. is especially low;
(4) the total area of the three associations of the all. is small, considering the potential area available for them;
(5) in the potential area of the all. influences such as cutting, grazing, improving of pastures have considerably transformed the composition

of the all., both its spectrum of species and the cover values of individual species;
(6) patches with transitional vegetation of the cloud-zone all. with the coastal all., are much more frequent on Corvo than in other parts of the Azores.

Some ecological remarks

In this section a few data in the fields of autecology and synecology will be discussed. The rainfall climate of Corvo was described above, as compared to other parts of the Az. Annual rainfall of around 2100 mm is reached at 600-750 m in the E (on S. Miguel), in the central islands at about 500 m, but on Corvo already at about 200 m a. s. l. The influence of these conditions were found to be clearly reflected in the presence of individual plants (see also the following list of recorded plants).

The following species more or less confined to the cloud-zone vegetation *(Juniperion brevifoliae)* grow preferentially (pref.) above 400-500 m (some other altitudes also listed) in the central part of the Azores. (C Az.) and preferentially above 200-300 m on Corvo (C); for some of the plants the preferences could not be distinguished so altitude ranges recorded were listed instead:

	C	C Az.
Dryopteris aemula	pref. > 200 m	pref. > 400 m
Diplazium caudatum	pref. > 250	pref. > 400
Blechnum spicant	pref. > 200	pref. > 300
Woodwardia radicans	250-450	pref. > 400
Trichomanes speciosum	pref. > 300	pref. > 500
Osmunda regalis	pref. > 250	pref. > 450
Selaginella kraussiana	pref. > 200	pref. > 300
Hedera helix ssp. *canariensis*	200-250	pref. > 400
Microderis rigens	350-600	pref. > 500
Tolpis azorica	pref. > 300	pref. > 600
Cardamine caldeirarum	pref. > 350	pref. > 500
Juniperus brevifolia	pref. > 200	pref. > 500
Erica scoparia ssp. *azorica*	pref. > 200	pref. > 300
Deschampsia foliosa	pref. > 300	pref. > 500
Festuca jubata	pref. > 300	pref. > 500
Holcus rigidus	pref. > 250	pref. > 400
Centaurium scilloides	pref. > 150	pref. > 300
Hypericum foliosum	pref. > 250	pref. > 400
Luzula purpureo-splendens	pref. > 250	pref. > 500
Myrsine africana	pref. > 250	pref. > 400
Potentilla erecta	pref. > 250	pref. > 450
Rubus hochstetterorum	pref. > 200	pref. > 400

These figures show, that the lower level of the preferred altitude ranges

for the plants listed is on an average ± 180 m lower on Corvo than in the C Az. The difference amounts to 200 m or more for 50% of the taxa. The lower level of the preferred ranges were all delimited considering altitude intervals of 50 m. For these high altitude plants the lower level of the preferred altitude range was chosen, starting with the lowermost localities where the first increase from one 50 m interval to another above by 100% or more of the number of recorded localities appeared. However, only such a 100% percentage rise was considered from 4 localities and more; consequently a rise from 2 to 4 localities was not considered as relevant for determination of the preferred altitude range. For example: a species is recorded between 100-150 m in two localities, between 150-200 m in four, between 200-250 m in 6, and between 250-300 m in 18; the lower level of the preferred altitude range is then put at 250 m.

The higher level of the preferred altitude ranges of coastal plants were calculated in the same way, starting from the highest recorded localities and comparing 50 m intervals in coastal direction. The following coastal plants confined to the coastal all. *Festucion petraeae* were found with diverging levels of their preferred altitude ranges:

	C Az.	C
Asplenium marinum	pref. < 250 m	pref. < 100 m
Azorina vidalii	pref. < 100	pref. < 50
Gnaphalium luteo-album	pref. < 300	pref. < 200
Solidago sempervirens	pref. < 400	pref. < 250
Festuca petraea	pref. < 300	pref. < 200

The figures above clearly show a correlation between the presence of cloud-zone species and amounts of rainfall. The earlier recorded preferential presence of cloud-zone species in C Az. above 500 m coincided with an average amount of rainfall of > 1900 mm/year. The same preferential presence appears on Corvo, where rainfall of > 1900 mm/year is probably reached already at 200 m and where cloud-zone plants nowadays seem to have the lower levels of their preferred altitude ranges at 200-300 m a. s. l. Probably this lower level was earlier even 50-100 m lower in times of less intense cultivation within the range from the coast to 300 m. Unusually low altitude presence of cloud-zone species are recorded also on Flores both for vascular plants and bryophytes (Sjögren 1973a, 1979).

The extended distribution of coastal plants to higher altitudes on Corvo than in the C Az. is more difficult to correlate with differences in environmental factors between the W Az. and the C Az. Whether the coastal plants, such as *Festuca petraea* and *Asplenium marinum*, are favoured by salty rains causing higher pH values or just resistant to the salt supply is not possible to say. However, according to informa-

tion by the farmers on Corvo, salty rains principally occur up to 300 m and this level coincides with either the highest recorded levels or the highest preferred levels of several coastal plants. These salty rains, which are injurious to several cultivated plants, are probably much more frequent and longlasting in the W Az. than in other parts of the Az. In the C Az. I only heard complaints by farmers as to salt damages on crops at levels below 100 m.

The presence of some Azorean plants, most frequent in the *Juniperion brevifoliae,* is regulated by exposure and inclination of the ground and amounts of rainfall, apparently in an interactive way. For example, weak exposure may compensate for lack of rainfall. Slopes are more efficiently kept permanently moist than level ground, which means that slopes become preferentially colonized by *Juniperion* plants in habitats with weak shelter towards exposure or/and lack of rainfall. On Corvo for example *Deschampsia foliosa* is growing much more frequently above 300 m on fairly level ground than in the C Az. *Hypericum foliosum* is recorded much more frequently on Corvo above 300 m in strongly exposed habitats than in the C Az. *Festuca jubata* is more frequent on Corvo in strongly exposed habitats than in the C Az., where it grows even within its preferred altitude range in habitats generally on steep sheltered slopes. *Woodwardia radicans* was recorded in a non-sheltered habitat at 250 m, whereas sheltered habitats are distinctly preferred in the C Az., even above 400 m. *Trichomanes speciosum* grows on Corvo in several localities between 200-350 m on slopes of ravines with only weak shelter of shrubs or trees; the presence in the C Az. is preferentially in ravines strongly sheltered by tree-shrub canopies, even above 500 m.

The descriptions of the *Festucion petraeae* and the *Juniperion brevifoliae* above indicate the difficulties to suggest a lower altitude limit of the cloud-zone vegetation on Corvo, as both alliances nowadays appear fragmentarily developed on the island. The records of single diff. spp. and of localities, where they grow together, however, indicate a potential presence of the cloud-zone vegetation down to at least 250-300 m. The range from 100-300 m is caracterized by a large number of localities with a mixture of diff. spp. of the two alliances, not seen on any other island in the Az. except on Flores. For example, records of sample plots were made at 100 m with *Holcus rigidus* and *Festuca petraea,* and at 150 m of *Tolpis azorica, Erica scoparia* ssp. *azorica, Holcus rigidus* growing together with *Festuca petraea, Silene vulgaris* ssp. *maritima, Solidago sempervirens.*

The landscape on Corvo, being extensively changed by man has meant that impoverished *Erico-Myrsinetum* vegetation is now only present in a few localities, whereas the *Festucetum jubatae* and the *Anagallidetum tenellae* or rather fractions of these two associations have been favoured. Clean cutting of trees and shrubs, followed by heavy grazing of remaining young specimens of *Erica, Vaccinium,*

Myrsine and *Juniperus* has apparently favoured the creation over large areas above 450 m of *Sphagnum* dominated vegetation. In places where the *Sphagnum* cover is deep, both on fairly level ground and on steep slopes, succession of the plant cover has probably by cultural activities been held back, as the now frequently eroding *Sphagnum* cover may not provide a suitable substratum for recolonization of shrubs and trees. This feature becomes especially evident above 600 m and on the N-facing interior slopes of the caldera.

From the point of view of conservation of nature just a few small areas on Corvo should be considered. They comprise:

(1) the area with the unique coastal vegetation type of the *Festucion petraeae* with dominating *Frankenia laevis,* situated in the SW between Portinho up towards the whaling observation post;
(2) the only remaining stand of *Juniperus brevifolia* (± 3 hectars) situated at Morro da Fonte, 200 m;
(3) the N-facing *Sphagnum* dominated interior slope of the caldera with deep ravines with *Erico-Myrsinetum* and *Festucetum jubatae;* purpose to conserve the last remains of fairly completely (with several diff. spp.) developed *Juniperion brevifoliae;*
(4) the S-facing upper part of the interior slope of the caldera, up to the rim of the slope; completely developed *Festucetum jubatae* or nearly so, with remaining specimens of the remarkable plants *Euphrasia azorica* (endemic to Corvo and Flores) and *Platanthera micrantha* (endemic to the Azores).

LIST OF PLANTS RECORDED ON CORVO IN 1978

Information

Abbreviations and nomenclature. See 'Information'.
Coll. Specimens leg. by the author in 1978 (in UPSV). Information on localities and altitudes. Only altitude differences of 25 m and more have been considered. Localities treated separately are at a minimum distance of 250 m apart; localities closer to each other than 250 m have been treated separately only if altitude differences are more than 25 m.

Distrib. Information on recorded presence of the taxa in the Azores (with names of the islands) according to Eriksson et al. (1974) and documentations by the author. Taxa not listed by Eriksson were defined as new to Corvo, with the remark (Gonç.) if listed as present on the island in notes, not published, by Eng.° I. B. Gonçalves.

Rec. The earlier in literature documented presence of the plants was confirmed by the author with information on localities if rare and local; with information only on the altitude ranges of recorded localities if widespread. Other comments on the taxa include: brief information

about preferred habitat conditions, differential values from a sociological point of view, principally in comparison with the presence of the plants in other parts of the Azores.

Information has been given about the plants on their preference to grow above or below a certain altitude, also with comparison as to their preference in that aspect, earlier recorded in other parts of the Azores (mainly in the central part of the island group). How such preferences were defined has been explained in the section on 'Cloud-zone vegetation'. The most frequently associated species were informed about; these species were located at a maximum distance of 3 m from a plant in question. Information on these associated species indirectly provide data in the fields of synecology and sociology, if compared to other types of information given and to descriptions in the chapter 'Vegetation'.

PTERIDOPHYTA

ASPIDIACEAE

Dryopteris aemula (Ait.) O. Kuntze — *Distrib.* all islands in the Az. except G. *Rec.* from 150-600 m.

A very common plant. In a very wide range of different habitats. No diff. val. In C Az. pref. above 400 m, on C pref. above 200 m. The diff. val. of the *Juniperion brevifolia* and the lake-shore *Littorello-Eleocharion* in C Az. seems on C to be totally lost.

Polystichum setiferum (Forssk.) Woynar — *Distrib.* all islands in the Az. except J. *Rec.* several localities, concentrated to the eastern part of the island, 200-275 m.

In sheltered habitats in ravines or under *Erica* and *Myrica* as well as in strongly exposed habitats on moist sloping ground. The weak diff. val. of the *Juniperion brevifoliae* in C Az. and E Az. is not maintained on C, where *P.s.* occurs frequently u.c. diff. spp. of the *Festucion petraeae,* provided there is some shelter or more or less continuously irrigating water.

ASPLENIACEAE

Asplenium azoricum Lovis, Rasbach et Reichstein — *Coll.* N of Vila do Corvo, 150 m (780625-50). *Distrib.* SM, T, J, P, F, Fo. New to Corvo.

Only one locality with few specimens. Sheltered habitat on steep slope in ravine. U.c. for example *Rumex conglomeratus, Ammi trifoliatum, Deschampsia foliosa, Dryopteris aemula, Cerastium azoricum, Luzula purpureo-splendens.* In other parts of the Az. general above 500 m, most frequently in the *Juniperion brevifoliae.* Specimens collected by Trelease in 1894 and by Gonçalves in 1971, sub *A. trichomanes,* should be referred to *A. azoricum,* according to Lovis et al. (1977, p. 89).

Asplenium billotii F. W. Schultz — *Coll.* 3 km N of Coroa do Pico, 200 m (780703-31); Coroa do Pico, 250 m (780623-44). *Distrib.* all islands in the Az. except. SMa. *Rec.* Vila do Corvo; N of Coroa do Pico, 250 m.

Common species on stone fences in strongly exposed habitats. Frequently u.c. for example *Asplenium marinum, Umbilicus rupestris.*

Asplenium hemionitis L. — *Coll.* 2 km NNE of Coroa do Pico, 200 m (780703-C XII). *Distrib.* all islands in the Az. except G.

Well-sheltered very dark habitat under dense canopy of *Pittosporum undulatum* and *P. tobira,* between stones and on stone fence in bottom of river ravine. U.c. for example *Athyrium filix-femina, Diplazium caudatum, Polystichum setiferum, Centaurium scilloides.* Apparently very rare species on C as this was the only recorded locality. In C Az. pref. above 400 m; only in W Az. recorded at or below 200 m (cf. Sjögren 1973a, p. 81).

Asplenium marinum L. — *Distrib.* all islands in the Az. *Rec.* from the coast - 425 m; the record at 425 m is inside the Caldeirão.

On cliffs, stone fences, isolated boulders; always in strongly exposed habitats. Only accidentally above 300 m but frequent up to 250 m. In the Az. as a whole generally below 100 m. The high frequency of *A.m.* also above 100 m on C may be attributed to the effect of saltcarrying winds. In winter at strong wind velocities saltwater rain may fall all over the island and especially below 300 m. *A.m.* below 250 m occurs as a frequent constituent of the *Festucion petraeae.*

Asplenium onopteris L. var. **onopteris** — *Coll.* S of Coroa do Pico, 225 m (780623-47). *Distrib.* all islands in the Az. *Rec.* from the coast - 300 m.

Common species on cliffs, and stone fences, nearly always in strongly exposed habitats. Frequently in the *Festucion petraeae.* On other islands in the Az. rarely above 300 m.

ATHYRIACEAE

Athyrium filix-femina (L.) Roth — *Coll.* close to the white tool-house, 300 m (780622-1); Vila do Corvo, in the southwest, 150 m (780624-2); 2.5 km N of Coroa do Pico, 300 m (780627-11); NE of Portinho, 125 m (780624-10); Coroa do Pico, 250 m (780623-3). *Distrib.* all islands in the Az. *Rec.* from 150-450 m.

This species was recorded both in sheltered and strongly exposed habitats. The morphology is a little different from Central-European plants according to H. Rasbach and T. Reichstein. On C generally met with below the preferred altitude range of the plant in C Az. In C Az. more closely confined to the *Juniperion brevifoliae* or at least to the preferred altitude range of that all. than on C.

Cystopteris fragilis (L.) Bernh. — *Distrib.* all islands in the Az. except G. *Rec.* NW of Vila do Corvo, 100 m.

On stone fence, only one locality; probably overlooked in other places.

Diplazium caudatum (Cav.) Jermy — *Distrib.* all islands in the Az. except G. *Rec.* from 200-450 m; at 450 m in the Caldeirão.

This fern is rare on C and fairly strictly confined to well-sheltered habitats, in ravines, where the shrub-tree layer is dense. Most frequently u.c. *Polystichum setiferum, Selaginella kraussiana, Trichomanes speciosum, Cardamine caldeirarum, Festuca jubata.* In C Az. pref. above 400 m as diff. sp. of the *Festucetum jubatae* of the *Juniperion* all. On C no diff. val. The *D. allorgei* Tard.-Blot (now *Lunathyrium petersenii* (Kunze) H. Ohba) earlier recorded on all islands except G (cf. Atlas Florae Europaeae I) was not recorded on C (cf. Vasconcellos 1968).

BLECHNACEAE

Blechnum spicant (L.) Roth — *Distrib.* all islands in the Az. *Rec.* from 200-500 m.

In C Az. and E Az. pref. above 300 m. On several types of substrata. No nead for shelter. In the Az. I have only been able to record this fern on C as fairly frequently growing in the endemic coastal grass community *Festucion petraeae* or at least fractions of that alliance.

Woodwardia radicans (L.) J. E. Sm. — *Distrib.* SMa, SM, T, J, P, F, Fo. New to Corvo (Gonç.). *Rec.* fairly widespread between 250-450 m.

In C Az. and E Az. pref. above 400 m. On C pref. in sheltered habitats, generally in ravines. Associated species are most frequently diff. spp. with some diff. val. of the *Juniperion brevifoliae.*

HYPOLEPIDACEAE

Pteridium aquilinum (L.) Kuhn ssp. **capense** (Thunb.) Bonap. — *Distrib.* all islands in the Az. *Rec.* very widespread from 100-400 m.

Pref. in open grassland vegetation, locally with high (> 50%) cover degrees (100 m^2). Invading the managed grasslands and becoming a threat to their productivity as pastures. Only very young sprouts are grazed in spring by the cows. *P.a.* does not reach lower altitudes than 100 m. Even at 100-150 m specimens get severely damaged probably by saltspray; salty rains fall especially in the winter during times of heavy storms.

HYMENOPHYLLACEAE

Hymenophyllum tunbrigense (L.) J. E. Sm. — *Distrib.* SM, T, J, P, F, Fo. New to Corvo (Gonç.). *Rec.* S of Morro dos Homens, epilithic on isolated boulder, 600 m; southern part of the Caldeirão, interior, epigeic-epixylic, 425 m.

Apparently much rarer on C than on other Azorean islands So the diff. val. of associations of the *Juniperion brevifoliae* is not maintained on C. Associated for example with *Vaccinium cylindraceum, Holcus rigidus, Lysimachia nemorum* ssp. *azorica, Dryopteris aemula, Osmunda regalis, Rubia peregrina.*

Hymenophyllum wilsonii Hook. — *Distrib.* SM, T, J, P, Fo, C. *Rec.* epilithic at the northern rim of the Caldeirão, 600 m.

Like *H. tunbrigense* rare species on C. In strongly sheltered habitat. The surrounding plant cover is dominated to more than 75% by *Festuca jubata,* with sparse presence for example of *Cardamine caldeirarum, Blechnum spicant, Myrsine africana, Lysimachia nemorum* ssp. *azorica, Erica scoparia* ssp. *azorica, Euphrasia azorica.*

Trichomanes speciosum Willd. (≡ Vandenboschia speciosa (Willd.) Kunk.) — *Coll.* W of Coroinha, 350 m (780628-6); in the southern part of the Caldeirão, 425-450 m (780629-7,-8,-9,-53,-54); northern rim of the Caldeirão, 600 m (780702-39); 2 km N of Coroa do Pico, 200 m (780627-40); S of Morro dos Homens, 425 m (780626-41). *Distrib.* SM, T, J, P, F, Fo, C. *Rec.* several localities in ravines above 200 m.

All records in very sheltered habitats, in ravines. In all localities large numbers of specimens. In other parts of the Az. rarely below 500 m, in W Az. down to 100 m. Like in C Az. and E Az. diff. sp. the *Juniperion brevifoliae: Festucetum jubatae.* Associated species on C are most frequently *Deschampsia foliosa, Dryopteris aemula, Woodwardia radicans, Tolpis azorica, Festuca jubata, Diplazium caudatum, Polystichum setiferum.*

LYCOPODIACEAE

Huperzia selago (L.) Bernh. ex Schrank & Mart. ssp. **dentata** (Herter) Valentine — *Distrib.* SM, T, J, P, F, Fo. New to Corvo (Gonç.). *Rec.* Morro dos Homens, 700 m.

Few specimens within a very small area close to the highest peak of the island. Growing on hummocks of *Sphagnum* with a very sparse colonization of plants such as *Deschampsia foliosa, Luzula purpureo-splendens, Lysimachia nemorum* ssp. *azorica, Potentilla erecta, Holcus rigidus.*

OSMUNDACEAE

Osmunda regalis L. — *Distrib.* all islands in the Az. except G. *Rec.* widespread above 250 m, also at 100 m.

Pref. in ravines and on moist slopes, where some shelter is available. In E Az. and C Az. generally above 450 m but on C generally above 250 m. The diff. val. of the *Erico-Myrsinetum* of the *Juniperion brevifoliae* in C Az. is not maintained on C. Frequently u.c. for example

Woodwardia radicans, Deschampsia foliosa, Luzula purpureo-splendens, Lysimachia nemorum ssp. *azorica, Holcus rigidus, Hypericum foliosum, Polystichum setiferum.*

POLYPODIACEAE

Polypodium azoricum (Vasc.) R. Fern. — *Coll.* S of Coroa do Pico, 225 m (780623-49). *Distrib.* all islands in the Az. *Rec.* widespread above 100 m.

Pref. on stone fences, boulders; less frequent as epigeic. Pref. in strongly exposed habitats.

SELAGINELLACEAE

Selaginella kraussiana (G. Kunze) A. Br. — *Distrib.* all islands in the Az. *Rec.* very widespread from 150-500 m.

On cliffs, stone fences, sand, thick humus layer of field-layer plants and bryophytes. In C Az. pref. above 300 m, on C pref. above 200 m.

SPERMATOPHYTA

AIZOACEAE

Aptenia cordifolia (L. f.) N. E. Br. — *Distrib.* SMa, SM, T, J, P, F, Fo, C. *Rec.* Vila do Corvo.

Fairly frequent at low altitudes, along roads and in waste places. Originally only known from T (Palhinha 1966). In the last 50 years reaching all islands, except G, in the archipelago.

Carpobrotus edulis (L.) N. E. Br. — *Distrib.* SM, T, G, P, F, Fo. New to Corvo (Gonç.). *Rec.* N of Vila do Corvo, 50 m.

Abundant in the locality. Roadside, u.c. for example *Briza maxima, Silene vulgaris* ssp. *maritimus, Holcus rigidus, Festuca petraea, Lotus suaveolens.* Eeasily outcompeting other plants. First cit. by Trelease (1907). Now in all parts of the archipelago.

AQUIFOLIACEAE

Ilex perado Ait. ssp. **azorica** (Loes.) Tutin — *Distrib.* SMa, SM, T, J, P, F, Fo. New to Corvo. *Rec.* bottom of the Caldeirão, southern part, 425 m.

One specimen in shallow ravine. Cuttings of the natural *Juniperion* shrub-forest may have extinguished *I.p.* in several localities on the island, where favourable habitat conditions for this lignose are present in large coherent areas and in several isolated places (ravines). In the locality u.c. for example *Microderis rigens, Diplazium caudatum, Vaccinium cylindraceum, Osmunda regalis, Erica scoparia* ssp. *azorica, Tolpis azorica, Deschampsia foliosa, Luzula purpureo-splendens.*

ARACEAE

Colocasia esculenta (L.) Schott — *Distrib.* all islands in the Az. *Rec.* S of Coroinha, 275 m.

Slopes of ravine. Introduced and escaped. U.c. for example *Hypericum foliosum, Aira caryophyllea, Brachypodium sylvaticum, Centaurium scilloides, Deschampsia foliosa.*

Zantedeschia aethiopica (L.) Spreng. — *Distrib.* SMa, SM, T, J, P. New to Corvo (Gonç.). *Rec.* Coroa do Pico, 250 m; N of Coroa do Pico, 250 m; along the easternmost road, 2.5 km N of Coroa do Pico, 200 m.

In anthropogeneous vegetation along roads and between fields.

ARALIACEAE

Hedera helix L. ssp. **canariensis** (Willd.) Cout. — *Distrib.* all islands in the Az. *Rec.* Coroa do Pico and northward, 200-250 m.

Both in strongly and weakly exposed habitats. Localities are below the preferred range (400-900 m) of the species in C Az. (cf. Sjögren 1973a, p. 232). The weak diff. val. attributed to the the species of the *Juniperion* is not maintained on C.

BORAGINACEAE

Myosotis maritima Hochst. ex Seub. — *Coll.* N of Vila do Corvo, 100 m (780623-51). *Distrib.* T, P, F, C. *Rec.* Vila do Corvo, on cliffs, 10 m; Portinho, on sandy deposits in dry abandoned pasture, 100 m.

Specimens of large size, with pale coloured flowers, with rounded not cordate segments of the corolla (cf. Trelease 1897). Thus not to be referred to *M. azorica* Wats. According to Schuster (1967), however, identical with *M. azorica* (cf. Hansen 1972). U.c. for example *Lotus suaveolens, Plantago coronopus, Festuca petraea, Hypochoeris radicata, Briza maxima, Silene vulgaris* ssp. *maritima.*

CALLITRICHACEAE

Callitriche stagnalis Scop. — *Distrib.* all islands in the Az. except G. *Rec.* SE of Morro dos Homens, 350 m; along the main road, 450 m.

Frequent in wet places, even in very small shallow depressions. Often reaching high cover degrees. Recorded u.c. for example *Polygonum salicifolium, Lotus uliginosus, Selaginella kraussiana.* In C Az. generally above 500 m, around lakes, in the *Littorello-Eleocharion.*

CAMPANULACEAE

Azorina vidalii (Wats.) Feer (≡ Campanula vidalii Wats.) — *Distrib.* SMa, SM, T, J, P, Fo, C. *Rec.* coast - 150 m.

A coastal plant, most frequently below 100 m, only accidentally above 100 m. On cliffs, stone fences. First cit. by Watson (1844) from

Fo, whence this plant is said to have been introduced as a garden plant to other islands.

CANNACEAE

Canna indica L. — *Distrib.* T, G, J, F, Fo. New to Corvo (Gonç.). *Rec.* Vila do Corvo.

Old member of the Azorean flora (cf. Scubert 1844). Now spreading in the archipelago, mainly as escaped from gardens.

CAPRIFOLIACEAE

Sambucus nigra L. — *Distrib.* SM, T, J, P, F, Fo, C. *Rec.* N of Vila do Corvo, 75, 100, 150 m.

A few specimens recorded on the island close to roads.

Viburnum tinus L. ssp. **subcordatum** (Trel.) P. Silva — *Distrib.* SMa, SM, T, P, F, Fo, C. *Rec.* in ravine crossing the easternmost road, 2 km N of Coroa do Pico, 200 m.

Few specimens in ravine, u.c. *Pittosporum undulatum, Myrica faya.* Probably extinct in many places as several other species of the *Juniperion brevifoliae* on C, and now only surviving in ravines, where the natural vegetation has been almost substituted by introduced species.

CARYOPHYLLACEAE

Cerastium azoricum Hochst. — *Coll.* Coroa do Pico, 250 m (780624-52). *Distrib.* J, Fo, C. *Rec.* N of Vila do Corvo, 150 m; W of Coroinha, 350 m.

Pref. on moist slopes, such as in ravines, sheltered in some way or other from exposure. U.c. for example *Cardamine caldeirarum, Dryopteris aemula, Selaginella kraussiana, Centaurium scilloides, Microderis rigens, Festuca jubata, Deschampsia foliosa, Ammi trifoliatum, Rumex obtusifolius.*

Cerastium glomeratum Thuill. — *Distrib.* all islands in the Az. *Rec.* S of Coroinha, 300 m.

Strongly exposed S-facing slope in overgrazed grassland, richly manured and locally eroded by trampling. Rare plant. U.c. for example *Poa annua, Stellaria media, Sagina procumbens, Trifolium dubium, Sonchus asper* ssp. *glaucescens, Hypochoeris radicata.* The plant was cit. by Watson (1844) with certainty only from F.

Polycarpon tetraphyllum (L.) L. — *Distrib.* all islands in the Az. *Rec.* several localities below 150 m.

In the cultivated zone, pref. close to roads and paths. Frequent where competition from other weeds is weak. Rarely, as in other parts of the archipelago, in the typically developed *Festucion petraeae.*

Sagina maritima G. Don F. — *Coll.* N of Vila do Corvo, 50 m (780623-56); Portinho, 25 m (780624-57). *Distrib.* T, G, J, P, F, Fo, C.

U.c. for example *Frankenia laevis, Polypogon maritimus, Plantago coronopus, Lotus suaveolens.* Crevices on cliffs, sand, gravel. Pref. where competition from other plants is weak. Diff. val. of associations of the *Festucion petraeae* is maintained on C.

Sagina procumbens L. — *Distrib.* all islands in the Az. *Rec.* very widespread from the coast - 550 m.

In several vegetation types, in non-sheltered habitats. Most records above 300 m; both on dry and moist ground. Several of the frequently associated species listed by Sjögren (1973a, p. 159) are the same on C.

Silene gallica L. — *Distrib.* all islands in the Az. *Rec.* several localities below 250 m.

Only recorded in vegetation strongly influenced by man. Along roads, in and between fields, waste places.

Silene vulgaris (Moench) Garcke ssp. **maritima** (With.) A. et D. Löve — *Distrib.* SM, T, J, P, F, Fo, C. *Rec.* N of Vila do Corvo, 25, 50, 150 m; Portinho, 100, 125 m.

Locally with high cover values (1 m²). Only in strongly exposed habitats, on cliffs and sand-gravel. Rarely in dry, level grassland. Most frequently u.c. *Ornithopus pinnatus, Holcus rigidus, Festuca petraea, Lotus suaveolens, Asplenium marinum, Plantago coronopus.* Diff. val. of the *Festucion petraeae: Euphorbietum azoricae.* Marked extension of distrib. in the Az. According to Drouet (1866) only on P.

Spergularia bocconei (Scheele) A. et Gr. — *Coll.* Vila do Corvo, 10 m (780624-65). — *Distrib.* all islands in the Az. — *Rec.* widespread in the southern coast near parts of the island.

Common in waste places u.c. several weeds. *S.b.* is also frequently present in the *Festucion petraeae. S.b.* may have been taken for *S. rubra* in some earlier records (cf. Hansen 1973). Specimens of *S.b.* from Corvo have caracteristically white petals, only pink above and pale greyish-brown seeds.

Stellaria media (L.) Cyr. — *Distrib.* now on all islands in the Az. New to Corvo (Gonç.). *Rec.* Vila do Corvo, 10 m; Coroinha, 300 m.

In waste places, in and between fields, locally in richly manured grassland vegetation. U.c. for example *Trifolium repens, Poa annua, Cerastium glomeratum, Solanum nigrum, Plantago lanceolata, Coronopus didymus.*

CHENOPODIACEAE

Amaranthus hybridus L. — *Distrib.* SMa, SM, T, J, P, F, Fo. New to Corvo. *Rec.* Vila do Corvo, 10 m.

Few specimens on newly dumped soil heaps. Growing u.c. for example *Solanum nigrum, Plantago lanceolata, P. coronopus, Trifolium arvense, T. glomeratum, Conyza bonariensis.* Young member of the Azorean flora, first mentioned by Watson (1870) and Trelease (1897). Spreading to several islands only after the 1930s.

Atriplex prostrata Bouch. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo; Portinho, 25 m.

This plant is fairly frequent along the coast, on cliffs as well as on sand and gravel, below 50 m. Several earlier records of *A. hastata* var. *salina* may have to be referred to this species as also stressed by Hansen (1971) and supported by the revisions carried out by J. do Amaral Franco of the Azorean *Atriplex* material in COI. Associated species such as *Polypogon maritimus, Crithmum maritimum, Solidago sempervirens, Plantago coronopus, Chenopodium ambrosioides* are all diff. spp. of associations of the *Festucion petraeae.*

Chenopodium ambrosioides L. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo; Portinho, 100 m; 2.5 km N of Coroa do Pico, along the easternmost road, 200 m.

On coastal cliffs, sand or gravel. The diff. val. of associations of the *Festucion petraea* in C Az. is not maintained on C, where *C.a.* occurs in severeal places in weed vegetation.

Chenopodium murale L. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo, below 50 m.

Waste places, u.c. for example *Rumex pulcher, Coronopus didymus, Setaria glauca, Solanum nigrum, Chenopodium ambrosioides.*

Chenopodium opulifolium Schrad. — *Distrib.* SM, SMa; probably on all islands in the Az. New to Corvo. *Rec.* Vila do Corvo.

Waste places, on soil heaps. Several earlier records of *Ch. album* should probably be referred to *C.o.* (cf. Hansen 1971). U.c. for example *Plantago major, Silene gallica, Sonchus tenerrimus, Rumex pulcher, Atriplex prostrata.*

COMMELINACEAE

Tradescantia fluminensis Vell. — *Distrib.* SMa, SM, T. New to Corvo (Gonç.). *Rec.* N of Vila do Corvo, 250 m.

One record along the main road. Dry habitat close to and on stone fence, u.c. for example *Hypericum humifusum, Gnaphalium luteoalbum, Aira caryophyllea, Lythrum hyssopifolia.*

COMPOSITAE

Chrysanthemum segetum L. — *Coll.* Vila do Corvo, 10 m (780705-62). *Distrib.* all islands in the Az.

Few specimens on soil heaps, u.c. *Gnaphalium luteo-album, Plantago coronopus,* and a large number of other species, mostly weeds.

Conyza bonariensis (L.) Cronq. — *Distrib.* all islands in the Az. *Rec.* from the coast - 250 m.

Very common in weed-rich vegetation.

Conyza canadensis (L.) Cronq. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo, below 50 m.

Presence like *C. bonariensis* but less abundant and widespread than that species.

Crepis capillaris (L.) Wallr. — *Coll.* along the easternmost road, 200 m (780703-24). — *Distrib.* now on all islands in the Az. New to Corvo (Gonç.). *Rec.* Vila do Corvo; Portinho, 100 m; Coroa do Pico, 250 m.

In strongly exposed habitats, in the cultivated landscape. U.c. for example *Cyperus esculentus, Prunella vulgaris, Festuca petraea, Oxalis corymbosa, Verbena officinalis, Hypochoeris radicata, Brachypodium sylvaticum.* Nowhere recorded as a component of typically developed *Festucion petraeae* or *Juniperion brevifoliae.* Very rapid recent extension of the distrib. in the archipelago (cf. Forster 1787; Drouet 1866; Trelease 1897; Palhinha 1966).

Erigeron karwinskianus DC. — *Distrib.* now on all islands in the Az. New to Coro. *Rec.* Coroa do Pico, 250 m; 2 km N of Coroa do Pico, 200 m.

Rare species close to roads; few specimens in the localities. U.c. a large number of weeds. Young member of the Azorean flora (cf. Trelease 1897), which has in a short period of time spread to all parts of the archipelago. *E.k.* has in the Az. not become such a frequent and locally dominant species as it has on Madeira both at altitudes of the cloud-zone vegetation and at altitudes below, outcompeting the natural plant communities.

Gnaphalium luteo-album L. — *Distrib.* all islands in the Az. *Rec.* from the coast - 350 m.

On other islands in the Az. occasionally above 200 m, but on C fairly frequent also from 200-300 m. This feature is typical on C of several other coastal plants of the *Festucion petraeae,* probably as a result of the comparatively much more frequent supply of salt water spray reaching higher altitudes than on other islands in the archipelago. *G.l-a.* is on C a frenquent constituent also in weed-rich vegetation in the cultivated zone up to 300 m, on sandy deposits, cliffs, and stone fences, always in strongly exposed habitats.

Hypochoeris radicata L. — *Distrib.* SMa, SM, T, P, F, Fo. New to Corvo (Gonç.). *Rec.* several localities from 100-500 m.

Widespread. In strongly exposed habitats. Roadsides, between fields, in managed grassland vegetation. Occurs associated with a large

number of species. Young species in the Az. First cit. from SM and T by Palhinha (1966).

Microderis rigens (Ait.) DC. *Distrib.* SM, T, P, F, Fo, C. *Rec.* W of Coroinha, in ravine, 350 m; southern part of the Caldeirão, ravine in bottom, 425 m; northern rim of the Caldeirão, S-facing slope, 600 m.

Very rare. Few specimens in each locality. Sheltered habitats in moist places on sloping ground. Diff. val. of associations of the *Juniperion brevifoliae*. U.c. species with their highest frequencies within that community, such as *Luzula purpureo-splendens, Festuca jubata, Cardamine caldeirarum, Euphrasia azorica, Woodwardia radicans, Trichomanes speciosum*. In C Az. rarely below 500 m.

Solidago sempervirens L. — *Distrib.* all islands in the Az. *Rec.* several localities below 250 m; N of the white tool-house, 450 m.

A coastal plant, only in W Az. and on F with scattered localities also above 250 m. As in other parts of the Az. also on C diff. sp. of the *Festucion petraeae*. However, more frequently on C and also on Fo than in C Az. also in anthropogeneous vegetation along roads, pref. close to stone fences.

Sonchus asper (L.) Hill ssp. **glaucescens** (Jord.) Ball — *Distrib.* SM, G. New to Corvo (Gonç.). *Rec.* N of Vila do Corvo, 150 m; N of Coroa do Pico, 250 m; Coroinha, 300 m.

Only in the cultivated landscape, in anthropogeneous vegetation. Few specimens recorded. Not in the typical *Festucion petraeae*.

Sonchus oleraceus L. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo, 10-25 m.

Fairly common plant, among other weeds, on soil heaps, along roads, between fields. The extension of distrib of *S.o.* reached all islands in this century (cf. Palhinha 1966).

Sonchus tenerrimus L. — *Coll.* close to road N of Coroa do Pico, 250 m (780627-32). *Distrib.* SMa, SM, G, P, F, Fo, New to Corvo (Gonç.). *Rec.* Vila do Corvo, 10 m; N of Vila do Corvo 150 m.

In all localities in anthropogeneous vegetation. U.c. for example *Crepis capillaris, Rumex pulcher, Chenopodium ambrosioides, Silene gallica, Verbena officinalis*. First cit. by Palhinha (1966) now spreading rapidly in the archipelago.

Taraxacum officinale Web. (s. lat.) — *Distrib.* SM, T, G, J, P, F. New to Corvo (Gonç.). *Rec.* N of Vila do Corvo, 150 m; Morro da Fonte, 200 m; Coroinha, 300 m.

Rare species, few specimens recorded. Only in anthropogenous vegetation. Along roads and locally in richly manured places in the managed grassland. U.c. for example *Stellaria media, Poa annua, Trifolium repens, Cerastium glomeratum, Plantago lanceolata, Prunella vulgaris*.

Tolpis azorica (Nutt.) P. Silva — *Distrib.* all islands in the Az. except G. *Rec.* Portinho, in ravine, 125 m; SE of Morro dos Homens, 350 m; Coroa do Pico, 250 m; N of Coroa do Pico, 250 and 275 m; southern part of the Caldeirão, in ravine, 425 m; northern exterior slope of the Caldeirão, 600 m.

In E Az. and C Az. generally above 600 m. On Fo and C also frequently down to 250 m. In each locality on C with few specimens. Pref. in the *Juniperion brevifoliae* with sparse or dense tree-shrub layer and in the more or less managed grassland originating from that all. Pref. on nearly continuously moist, sloping ground. The diff. val. of *T. a.* of the *Juniperion brevifoliae* in E Az. is almost maintained on C, but there is a more frequent presence of the species in transitions towards the *Festucion petraeae* than in other parts of the archipelago.

Tripleurospermum maritimum (L.) Koch (= Matricaria inodora L. var. maritima (L.) Wahlenberg) — *Coll.* Vila do Corvo, 10 m (780704-63). *Distrib.* P. (cf. Sjögren 1973b). New to Corvo.

Few specimens in only one locality, close to the harbour, on soil heaps, where competition is weak from other plants. U.c. (1 m²) *Conyza canadensis, Gnaphalium luteo-album, Chenopodium ambrosioides, Plantago coronopus.*

CONVOLVULACEAE

Convolvulus arvensis L. — *Distrib.* now on all islands in the Az. New to Corvo (Gonç.). *Rec.* Vila do Corvo.

Roadsides, between fields and on newly deposed soil heaps. U.c. for example *Chenopodium ambrosioides, Rumex pulcher, Conyza bonariensis, Lolium perenne, Coronopus didymus.*

CRASSULACEAE

Crassula tillaea Lester-Garland — *Distrib.* all islands in the Az. except SMa. *Rec.* to the N of the white tool-house, 350 m.

Pref. in dry strongly exposed habitats. Fairly widespread. Most frequently in vegetation rich in weeds but also accidentally in fractions of the *Festucion petraeae.* U.c. for example *Sagina procumbens, Ornithopus perpusillus, Aphanes microcarpa, Gnaphalium luteo-album, Plantago coronopus.* This small easily overlooked species was according to Drouet (1866) only recorded in C Az. and W Az.

Umbilicus horizontales (Guss.) DC. — *Distrib.* all islands in the Az. except G. *Rec.* eastern exterior slope of the Caldeirão, 450 m.

Few specimens in one locality. On E-facing rock slope. U.c. for example *Selaginella kraussiana, Cardamine caldeirarum, Dryopteris aemula, Thymus caespititius, Festuca jubata* and the bryophytes *Neckera intermedia* and *Herberta azorica.*

Umbilicus rupestris (Salisb.) Dandy — *Distrib.* all islands in the Az. *Rec.* very widespread between the coast - 600 m.

Pref. on boulders, cliffs, and stone fences in non-sheltered habitats. About associated species see Sjögren (1973a, p. 167). Also frequently a primarily colonizing plant on bare soil slopes of coarse sand.

CRUCIFERAE

Capsella rubella Reut. — *Distrib.* SMa, SM, T, G, J, F. New to Corvo (Gonç.). *Rec.* N of Coroa do Pico, 250 m.

Rare plant. Few specimens. Close to the road, u.c. for example *Briza minor, Vulpia bromoides, Plantago major, Misopates orontium.* Several specimens determined *C. bursa-pastoris* should rather be referred to *C. rubella* (cf. Sjögren 1973a, p. 163).

Cardamine caldeirarum Guthn. ex Seub. — *Distrib.* all islands in the Az. except G. *Rec.* from 250-260 m.

Both in strongly and weakly exposed habitats, pref. on moist slopes. Most records above 350 m. According to Seubert (1844) even down to the coast on Fo. In C Az. and E Az. pref. above 400-600 m (cf. Sjögren 1973a), where precipitation is about equally as high as at 200-300 m in W Az. In C Az. diff. sp. of associations of the *Juniperion brevifoliae.* On C also in transitions between that all. and the coastal *Festucion petraeae.*

Cardamine hirsuta L. — *Distrib.* SMa, SM, T, G, P, F. New to Corvo. *Rec.* Vila do Corvo, 10 m.

Only one locality with few specimens. On soil heaps among weeds.

Coronopus didymus (L.) J. E. Sm. — *Coll.* Vila do Corvo, 10 m (780624-12). *Distrib.* now on all islands in the Az. New to Corvo (Gonç.). *Rec.* Vila do Corvo, close to the wind-mills.

A very common weed in places near coast, especially on soil heaps where competition from other plants is weak and where *C.d.* is frequently among the first colonizing species. As in other parts of the archipelago rarely in association with the *Festucion petraeae.*

Nasturtium officinale R. Br. — *Distrib.* SMa, SM, T, J, F, Fo, C. *Rec.* N of the white tool-house, 350 m; N of Vila do Corvo, in ravine, 150 m.

Apparently rare sp. on C. On other islands widespread. Close to brooks, u.c. for example *Selaginella kraussiana, Lysimachia nemorum* ssp. *azorica, Juncus effusus, Cerastium azoricum, Deschampsia foliosa, Ammi trifoliatum, Isolepis setacea.* Rapidly spreading in the achipelago during the last 100 years (cf. Seubert & Hochstetter 1843; Drouet 1866).

Rapistrum rugosum (L.) All. s. lat. — *Distrib.* SM, T, G, J, P, F, C. *Rec.* several locolities in the southern part of the island.

Pref. in weed-rich vegetation, on soil heaps, along roads, and as a weed in fields.

Sisymbrium officinale (L). Scop. — *Distrib.* all islands in the Az. except G. *Rec.* several localities below 250 m.

Restricted to the weed vegetation along roads, between fields. Rapid extension of distrib. as mentioned by Seubert (1844) only from F.

CUPRESSACEAE

Juniperus brevifolia (Seub). Antoine — *Distrib.* SM, T, J, P, F, Fo, C. *Rec.* few specimens close to the white tool-house, 250 m; Morro da Fonte, in large ravine a large number of densely growing specimens together with *Erica* shrubs, 200 m; N of Coroa do Pico, few isolated specimens in open pasture, as a last relict of the former *Juniperion brevifoliae,* 250 m; Coroinha, few specimens in shallow ravine, 275 m.

The remains of *J.b.* on C are now small and trunks are still cut for fuel. Large areas above 200 m may in early times of colonization of the island have been covered by a dense shrub-forest of *J.b.* and *Erica. J.b.* was not even encountered either within or on the exterior slopes above 500 m of the Caldeirão. In C Az. pref. above 500 m. Associated species on C do not reflect in any of the localities a completely developed *Juniperion brevifoliae* of the type recorded in large areas above 500 m for example on F, T, P, J (cf. Sjögren 1973a).

CYPERACEAE

Carex hochstetteriana Gay ex Seub. — *Coll.* N of Vila do Corvo, 150 m (780622-68); N of Portinho, 75 m (780624-69). *Distrib.* SM, T, J, P, F, Fo. New to Corvo (Gonç). *Rec.* fairly frequent below 300 m.

In several types of vegetation, along roads, at margins of fields, on slopes of ravines. More frequently associated to species of the *Juniperion brevifoliae* than of the *Festucion petraeae.* In E Az. and C Az. probably not above 500 m, on C not recorded above 300 m.

Carex pairaei F. W. Schultz — *Coll.* Morro dos Homens, 600 m (780626-67). *Distrib.* SMa, SM, G, J, Fo. New to Corvo.

One single locality with few specimens. In a non-sheltered grassland vegetation, locally with *Sphagnum* bottom layer reaching a cover of more than 50% (1 m²). U.c. (1 m²) *Agrostis castellana, Lotus uliginosus, Juncus effusus, Dryopteris aemula, Holcus rigidus. C. bullockiana* Nelmes should likely be referred to *C.p.* according to Hansen (1971).

Carex vulpina L. — *Coll.* N of Vila do Corvo, 150 m (780623-64). *Distrib.* Fo, C (according to Palhinha 1966).

Few specimens at the base of steep slope, W-facing but sheltered towards exposure by several old *Erica* trees. U.c. for example *Hypericum foliosum, Solidago sempervirens, Osmunda regalis, Juncus effusus, Lotus uliginosus.* Specimens coll. on C by the author are not characterized by nerves at the back of the fruits, which is typical for *C. otrubae.*

However, according to Hansen (1972) it would be more likely to find the *C. otrubae* Podp. in the Az. as it is an Atlantic-Mediterranean plant (cf. also Palhinha 1966).

Cyperus esculentus L. — *Distrib.* all islands in the Az. *Rec.* from the coast - 250 m.

Growing among weeds, in strongly exposed habitats, along roads, in fields, in waste places. A very old member of the Azorean flora (cf. Seubert 1844). U.c. for example *Plantago major, Crepis capillaris, Conyza bonariensis, Verbena officinalis, Brachypodium sylvaticum, Rumex pulcher.* Not present in the *Festucion petraeae.*

Cyperus rotundus L. — *Distrib.* SMa, SM, T, P, F. New to Corvo (Gonç.). *Rec.* Vila do Corvo.

Several specimens on soil heaps, where competition is weak from other weeds u.c. *Coronopus didymus, Solanum nigrum, Stellaria media, Plantago lanceolata, P. coronopus, Trifolium arvense.*

Eleocharis multicaulis (J. E. Sm.) J. E. Sm. — *Distrib.* now on all islands in the Az. except G. New to Corvo (Gonç.). *Rec.* in the Caldeirão, southern part, 425 m.

In moist depressions around the lakes u.c. *Holcus rigidus, Dryopteris aemula, Luzula purpureo-splendens, Lysimachia nemorum* ssp. *azorica.* This plant is much rarer on C than in C Az., although it may have been overlooked in some places above 300 m during the excursions I made there. Anyhow the diff. val. of an association of the *Juniperion brevifoliae* attributed to *E.m.* (Sjögren 1973a, p. 358) may not be possible to maintain on C because of the rarity of the species there.

Eleocharis palustris (L.) R. et S. — *Distrib.* SMa, T, J, P, F, Fo, C. *Rec.* bottom of the Caldeirão, northern part, 425 m.

Rare species, more hygrophilous than *E. multicaulis.* First cit. by Seubert from C (1844). In *Sphagnum* dominated depression, u.c. *Juncus effusus, Lotus uliginosus, Poa trivialis, Holcus rigidus* and the bryophyte *Polytrichum commune.* No diff. val. of the *Littorello-Eleocharion* on C. This all. is just fragmentarily developed on C in comparison to its constitution in C Az.

Isolepis cernua (Vahl) R. et S. — *Distrib.* all islands in the Az. *Rec.* Morro dos Homens, 625 m.

Only one record, but probably overlooked by the author in several wet places in the pastures above 300 m. In strongly exposed wet shallow depression in a *Sphagnum* dominated vegetation, u.c. (1 m^2) *Juncus effusus, Lotus uliginosus, Agrostis castellana, Poa trivialis, Dryopteris aemula, Holcus rigidus* and the bryophyte *Polytrichum formosum.*

Isolepis setacea (L.) K. Br. — *Coll.* eastern exterior slope of the Caldeirão, 500 m (780629-19). *Distrib.* all islands in the Az. except T. *Rec.* to the N of the white tool-house, 350 m.

Close to small brook. Like *I. cernua* probably overlooked in several places in the pastures of the island. U.c. for example *Deschampsia foliosa, Juncus effusus, Sibthorpia europaea,* and the bryophytes *Polytrichum commune, Leucobryum albidum, Pseudoscleropodium purum, Thuidium tamariscinum.*

ERICACEAE

Calluna vulgaris (L.) Hull — *Distrib.* now on all islands in the Az. New to Corvo (Gonç.). *Rec.* N of the white tool-house, 350 m; northern rim of the Caldeirão, S-facing slope, 600 m.

An extremely rare species, present with only few specimens on the two localities. In strongly exposed habitats. On C the diff. val. of associations of the *Juniperion brevifoliae,* which can be reached in C Az., is not valid. U.c. for example *Agrostis castellana, Dryopteris aemula, Sibthorpia europaea, Deschampsia foliosa, Festuca jubata, Platanthera micrantha, Euphrasia azorica.*

Erica scoparia L. ssp. **azorica** (Hochst.) D. A. Webb — *Distrib.* all islands in the Az. *Rec.* from the coast-600 m.

Widespread but with few remaining old specimens and very small areas with dense *Erica* scrub. Pref. above 200 m; in other parts of the Az. pref. above 300 m. On C in all natural vegetation types and also in weed-rich vegetation of the cultivated landscape.

Vaccinium cylindraceum J. E. Sm. — *Distrib.* SMa, SM, T, J, P, F, Fo. New to Corvo. *Rec.* S of Morro dos Homens, 600 m; southern part of the bottom of the Caldeirão, in ravine, 425 m.

Only few recorded localities, each with few specimens of this species, which is widespread and locally dominant on most of the other islands in the archipelago. Specimens at 600 m grow on a high boulder in the open grassland-*Sphagnum* vegetation, in a position not reached by grazing animals, u.c. *Hymenophyllum tunbrigense, Holcus rigidus, Lysimachia nemorum* ssp. *azorica, Agrostis castellana.* Specimens at 425 m in the 3 m deep ravine grow u.c. for example *Osmunda regalis, Deschampsia foliosa, Woodwardia radicans, Luzula purpureo-splendens, Blechnum spicant, Dryopteris aemula, Erica scoparia* ssp. *azorica, Tolpis azorica. V.c.* is on C probably extinct in several places through extensive grazing and cutting, such as to eliminate the diff. val. of the *Juniperion brevifoliae.*

FRANKENIACEAE

Frankenia laevis L. — *Coll.* Portinho, 50 m (780624-30); N of Vila do Corvo, 100 m (780622-36). *Distrib.* C. *Rec.* Portinho, from coast-100 m.

F. l. in the Portinho area is associated mainly with *Plantago coronopus, Lotus suaveolens, Polypogon maritimus, Festuca petraea, Sagina maritima.* Frequently with more than 70% of cover (1 m²). The presence is restricted to strongly exposed habitats with no shelter from exposure in a low field layer without shrubs and with practically no bottom layer.

Frankenia pulverulenta L. — *Distrib.* all islands in the Az. except SMa. *Rec.* Vila do Corvo.

Habitat preference and associated species like that of *F. laevis* but on C apparently nearly outcompeted by this species (cf. Sjögren 1973a, p. 225).

GRAMINEAE

Agrostis castellana Boiss. et Reut. — *Coll.* Morro dos Homens, 600 m (780702-73). *Distrib.* all islands in the Az. except G. *Rec.* widespread between 300-600 m.

Pref. in open grassland. Also in *Sphagnum* dominated vegetation at altitudes above 400 m.

Aira caryophyllea L. ssp. **caryophyllea** — *Distrib.* SMa, SM, T, J, P, Fo. New to Corvo. *Rec.* N of Vila do Corvo, 250 m; Coroa do Pico, 250 m; Portinho, 150 m; Morro da Fonte, 200 m; 1 km N of Coroa do Pico, 250 m; Coroinha, 250 m and 300 m; road to the Caldeirão, 450 m; northern rim of the Caldeirão, 600 m.

Always in dry strongly exposed habitats, pref. where competition is weak from other plants. Both in pastures and on steap slopes not influenced by grazing. On cliffs with shallow soil layer. U.c. *Hypericum humifusum, Ornithopus perpusillus, Thymus caespititius, Vulpia bromoides, Aira praecox.*

Aira praecox L. — *Distrib.* SMa, T, J, P, F. New to Corvo (Gonç.). *Rec.* along the road to the Caldeirão, 450 and 500 m; Coroa do Pico, 250 m; Coroinha, 300 m; northern rim of the Caldeirão, 600 m.

In similar habitats as *A. caryophyllea* and frequently also associated with the same species.

Anthoxanthum odoratum L. — *Distrib.* SM, T, J, P, F, Fo, C. *Rec.* widespread from 150-450 m.

In a wide range of habitats as both in open and dry grassland, and in fairly moist grassland as in the bottom of the Caldeirão (cf. Sjögren 1973a, p. 411). Spreading in the archipelago since the 1840s (cf. Seubert & Hochstetter 1843).

Arrhenatherum elatius (L.) J. et C. Presl. ssp. **bulbosum** (Willd.) Hyl. — *Distrib.* SMa, SM, T, F, J, Fo. New to Corvo (Gonç.). *Rec.* N of Vila

do Corvo, 150 m; along the main road, 250 m; N of Coroa do Pico, 250 m; close to the easternmost road, 200 m.

Very common along roads, between fields and in waste places. U.c. for example *Conyza bonariensis, Erica scoparia* ssp. *azorica, Juncus effusus, Solidago sempervirens, Cyperus esculentus.*

Arundo donax L. — *Distrib.* SMa, SM, T, P, F, Fo, C. *Rec.* Vila do Corvo.

Common along roads and between fields. Old specimens used as fuel.

Avena sterilis L. — *Distrib.* SMa, F, New to Corvo (Gonç.). *Rec.* Vila do Corvo.

Waste place on soil heaps, few specimens. A fairly young member of the Azorean flora. Species with Mediterranean distrib.

Brachypodium sylvaticum (Huds.) Pr. — *Distrib.* now on all islands in the Az. New to Corvo (Gonç.). *Rec.* from 100-350 m, in several localities S of the Caldeirão.

Common plant, along roads and between fields, pref. in strongly exposed habitats.

Briza maxima L. — *Distrib.* all islands in the Az. *Rec.* from the coast-200 m.

Very common plant below 300 m. In strongly exposed habitats along roads and between fields, in waste places. Frequent constituent of the coastal *Festucion petraeae* but also frequently present in weed-rich vegetation.

Briza minor L. — *Distrib.* all islands in the Az. *Rec.* several localities between 200-300 m.

Habitat preference like *B. maxima,* but less frequent than that species in the *Festucion petraeae.*

Bromus madritensis L. — *Distrib.* SM, T, J, P, F, Fo, C. *Rec.* N of Vila do Corvo, between 100-200 m.

Coastal plant, always in strongly exposed habitats, both in the *Festucion petraeae* and among various combinations of weeds along roads on sloping ground. Recorded u.c. for example *Bromus wildenowii, Lolium perenne, Polycarpon tetraphyllum, Arrhenatherum elatius* ssp. *bulbosum, Asplenium onopteris, Brachypodium sylvaticum.* On Mad. also distinctly confined to near coast localities and diff. sp. of the coastal all. *Aeonio-Lytanthion* Sjögren 1972.

Bromus wildenowii Kunth — *Distrib.* SMa, SM, T, G, P, F. New to Corvo (Gonç.). *Rec.* Vila do Corvo; N of Vila do Corvo, 100 and 150 m; 2 km N of Coroa do Pico, close to the easternmost road, 200 m.

Along roads, between fields, in waste places. Apparently only in vegetation rich in weeds. Recorded u.c. for example *Sonchus* spp., *Rumex pulcher, Sisymbrium officinale, Silene gallica.* Species fairly recently appearing in the Az. (cf. Trelease 1897). Origin S America, now introduced in several temperate regions.

Cynodon dactylon (L.) Pers. — *Coll.* Vila do Corvo, 10 m (780701-58). *Distrib.* now on all islands in the Az. New to Corvo (Gonç.). *Rec.* Portinho, 25 m; N of Vila do Corvo, 150 m.

Dry strongly exposed habitats. In fragmentarily developed *Festucion petraeae,* as well as in weed communities. Originally a rare plant in the Az. (cf. Seubert 1844).

Deschampsia foliosa Hack. — *Coll.* Morro dos Homens, 700 m (780626-72). *Distrib.* SM, T, J, P, F, Fo, C. *Rec.* widespread from 100-700 m.

Common species, in several places reaching high cover degrees (1 m^2). Pref. on sloping ground, such as in ravines where the soil is kept almost permanently moist, but also frequent species on *Sphagnum* hummocks on only slightly sloping ground above 500 m. Pref. above 300 m, in the *Juniperion brevifoliae,* but also fairly frequenly where diff. spp. of the coastal *Festucion petraeae* are present. Most frequently u.c. *Dryopteris aemula, Rubia peregrina, Centaurium scilloides, Cardamine caldeirarum, Luzula purpureo-splendens, Lysimachia nemorum* ssp. *azorica.* In C Az. pref. above 500 m and more closely confined to the *Juniperion* all. and to sloping ground habitats than on C.

Echinochloa crus-galli (L.) PB. — *Coll.* Vila do Corvo, below 25 m (780704-22). *Distrib.* now on all islands in the Az. New to Corvo (Gonç.).

Few specimens on soil heaps, close to the harbour. U.c. weeds such as *Plantago lanceolata, Conyza bonariensis, Coronopus didymus, Sonchus tenerrimus.* Not recorded in typical *Festucion petraeae.* Rapid extension of distrib. in the archipelago (cf. Watson 1844).

Eleusine tristachya (Lam.) Lam. — *Coll.* Vila do Corvo, 10 m (780705-74). *Distrib.* SMa, SM, P, J. New to Corvo.

Few specimens in one locality. Growing on soil heaps with large patches of bare soil sparsely colonized by weeds.

Festuca jubata Lowe — *Distrib.* all islands in the Az. except G. *Rec.* from 200-600 m.

Pref. in moist habitats, on sloping ground. In C Az. pref. above 500 m, on C pref. above 300 m. Pref. u.c. *Hypericum foliosum, Rubia peregrina, Centaurium scilloides, Deschampsia foliosa, Dryopteris aemula, Cardamine caldeirarum.* The association of *F.j.* with diff. ssp. of the *Juniperion brevifoliae* and its *Festucetum jubatae* Sjögren 1973 is less pronounced on C than in C Az.

Festuca petraea Guthn. ex Seub. — *Distrib.* all islands in the Az. *Rec.* from the coast-350 m.

Pref. on sloping surfaces; only close to the coast frequently also on fairly level ground. A frequent presence of *E.p.* above 200 m like on C was not previously noted on other islands in the Az. Diff. val. of *F.p.* for the *Festucion petraeae* is still high on C but the presence in transitions with the *Juniperion* is much more frequent than in C Az. Most frequently associated species are *Lotus suaveolens, Plantago coronopus, Asplenium marinum, Chenopodium ambrosioides, Polypogon maritimus.* Species like *Euphorbia azorica, Juncus acutus, Polystichum falcatum, Spergularia azorica, Cynodon dactylon* are rarely or not at all associated with *F.p.* (as not recorded yet on C) whereas they are fairly frequently so in E Az. and C Az.

Gaudinia coarctata (Link.) Dur. et Schinz — *Coll.* Vila do Corvo, below 25 m (780705-28). *Distrib.* SM, T, J, F. New to Corvo (Gonç.).

Common species in a *Festucion petraeae* vegetation, locally mixed with a high number of weeds. U.c. for example *Frankenia pulverulenta, Lotus suaveolens, Plantago coronopus, Solidago sempervirens, Conyza canadensis, Polycarpon tetraphyllum, Poa annua, Solanum nigrum.* The species *Gaudinia fragilis* in C Az. and E Az. has similar habitat preference and also occurs most frequently associated with coastal species including weeds *(cf. Festucion petraeae: Ornithopo-Gaudinietum* Sjögren 1973).

Holcus lanatus L. — *Distrib.* all islands in the Az. *Rec.* from the coast-550 m.

Both at roadsides and between fields, in the grazed grasslands above 300 m, and in the wet *Littorello-Eleocharion* in the Caldeirão. Always in strongly exposed habitats. More frequent below 500 m than in C Az.

Holcus rigidus Hochst. ex Seub. — *Distrib.* SM, T, J, P, F, Fo, C. *Rec.* widespread from 75-700 m.

Few localities below 200 m, pref. above 250 m, in C Az. pref. above 400 m. Weak diff. val. in C Az. towards the *Festucion petraeae,* on C most frequently associated with species with differently high diff. val. of the *Juniperion brevifoliae* and the *Littorello-Eleocharion,* both in weakly and strongly exposed habitats.

Hordeum murinum L. ssp. **murinum** — *Distrib.* now on all islands in the Az. New to Corvo. *Rec.* Vila do Corvo, 10 m.

Common on soil heaps, u.c. several weeds such as *Chenopodium murale, Plantago major, Silene gallica, Rumex pulcher, Sonchus tenerrimus, Cyperus esculentus.*

Kyllinga brevifolia Rothb. — *Distrib.* SMa, SM, T, F, Fo. New to C (Gonç.). *Rec.* widespread in pastures, along roads and between fields from the coast-300 m.

This species has rapidly become a severe weed in the cultivated landscape below 300 m. It is not appreciated by grazing animals. Young member of the Azorean flora; origin in tropical parts of America.

Lolium perenne L. — *Distrib.* all islands in the Az. *Rec.* widespread below 300 m.

Only in vegetation in some way or other influenced by man.

Lophochloa cristata (L.) Hyl. — *Distrib.* SMa, SM, T, J, F. New to Corvo. *Rec.* Vila do Corvo, 25 m; close to the easternmost road in the north-eastern part of the island, 200 m.

In several localities below 300 m, pref. on moist soil. Extending distrib. since the first records by Seubert & Hochstetter (1843) and Drouet (1866) on SM and F.

Poa annua L. — *Distrib.* now on all islands in the Az. New to Corvo (Gonç.). *Rec.* Vila do Corvo, 10 m; northern part of bottom of the Caldeirão, 425 m; Coroinha, 300 m.

As far as has been recorded, a rare plant on C, both in high altitude grassland vegetation, managed or not, and in waste places on soil heaps close to the coast. In Vila do Corvo u.c. several weeds, in the Caldeirão u.c. for example *Holcus lanatus, Lotus uliginosus, Sagina procumbens, Potentilla erecta, Juncus effusus, Agrostis castellana.*

Poa trivialis L. — *Coll.* SW of Coroa do Pico, 250 (780622-70); S of Morro dos Homens (780626-71). *Distrib.* all islands in the Az. *Rec.* widespread at altitudes above 300 m.

In shallow moist depressions in open grassland vegetation and on level ground and slopes where *Sphagnum* spp. are dominant and where a few species of herbaceous and graminaceous plants reach only very low cover values (totally $< 20\%$). Most frequently associated species are *Dryopteris aemula, Holcus rigidus, Lotus uliginosus, Juncus effusus, Agrostis castellana, Luzula purpureo-splendens.*

Polypogon maritimus Willd. — *Distrib.* all island in the Az. *Rec.* Vila do Corvo, 10 m; Portinho, 50 m.

Localities rich in specimens in the southernmost part of the island near coast. Pref. on cliffs, stone fences, coarse sandy soil. Weak competitive ability. Diff. val. of the *Festucion petraeae* (Sjögren 1973a) is maintained on C. Associated species are most frequently *Frankenia laevis, Sagina maritima, Plantago coronopus, Lotus suaveolens, Festuca petraea.*

Polypogon semiverticillatus (Forssk.) Hyl. — *Distrib.* SMa, SM, T, F, Fo. New to Corvo (Gonç.). *Rec.* Vila do Corvo, 10 m.

Few specimens on soil heaps close to the harbour, u.c. several weeds. Pref. where competition from other plants is weak. U.c. for

example *Solanum nigrum, Azorina vidalii, Chenopodium ambrosioides, Holcus lanatus, Avena sterilis.*

Setaria glauca (L.) PB. — *Coll.* Vila do Corvo (780703-26). *Distrib.* now on all islands in the Az. New to Corvo (Gonç.).

Waste places, locally with high cover degrees (1 m²), along roads, in and between fields. Pref. as a primarily colonizing species. Rapidly extending distrib. Cit. by Seubert (1844) only from P.

Stenotaphrum secundatum (Walt.) O. Kuntze — *Distrib.* SMa, SM, T, P, F. New to Corvo (Gonç.). *Rec.* Vila do Corvo, 25 m.

Introduced as a lawn-grass, escaped in a few places. More frequently escaped for example on F and SM than on C.

Vulpia bromoides (L.) S.F. Gray — *Coll.* eastern exterior slope of the Caldeirão, 500 m (780629-21). *Distrib.* all islands in the Az. except G. *Rec.* very widespread from 150-550 m.

Pref. on dry sandy soil, in non-sheltered habitats. Also on tops of boulders and on stone fences. Frequently in the comparatively dry pastures at altitudes below 300 m, pref. where patches of bare soil are available for colonization. The weak diff. val. of the *Ornithopo-Gaudinietum* (ass. of the *Festucion petraeae)* is reduced to no diff. val. at all on C. Fairly rapidly extending distrib. since the species was first cit. by Seubert & Hochstetter (1843).

GENTIANACEAE

Centaurium scilloides (L.f.) Samp. — *Distrib.* all islands in the Az. except G. *Rec.* from 100-600 m.

In strongly exposed and also well-sheltered habitats. On C as well as on other islands present in all kinds of plant communities except those coastal ones in dry habitats with lots of weeds. In other parts of the Az. pref. above 300 m, on C pref. above 150 m.

HYDRANGEACEAE

Hydrangea macrophylla (Thunb.) Ser. — *Distrib.* all islands in the Az.

Cultivated and very frequently escaped.

HYPERICACEAE

Hypericum foliosum Ait. — *Coll.* N of the white tool-house, 400 m (780629-29). *Distrib.* all islands in the Az. *Rec.* from 125-600 m.

Widespread species, pref. above 250 m, in C Az. pref. above 400 m. On C more frequent in strongly exposed habitats than in E Az. and C Az. and also more frequent in a plant cover with very few diff. spp. of the *Juniperion brevifoliae*. Occurs associated with a wide variety of combinations of species.

Hypericum humifusum L. — *Distrib.* all islands in the Az. *Rec.* several places from 200-500 m.

Widespread above 250 m. Only in strongly exposed habitats on dry soil, level or sloping ground, on cliffs and stone fences. U.c. for example *Gnaphalium luteo-album, Vulpia bromoides, Festuca petraea, Aira caryophyllea, A. praecox, Prunella vulgaris, Briza minor, Anthoxanthum odoratum, Rumex acetosella* ssp. *angiocarpus, Thymus caespititius, Sagina procumbens.* Diff. val. (E Az., C Az.) towards the *Juniperion* associations is maintained on C, although *H.h.* fairly frequently occurs also surrounded by these associations in small dry isolated habitats such as on tops of cliffs and boulders.

ISOETACEAE

Isoetes azorica Dur. ex Milde — *Distrib.* T, J, P, F, Fo, C. *Rec.* lakes in the Caldeirão, 425 m.

Pref. below the low water level. Occurs pref. u.c. *Littorella uniflora* and with diff. val. of the *Littorello-Eleocharion.*

JUNCACEAE

Juncus acutus L. — *Distrib.* now on all islands in the Az. New to Corvo (Gonç.). *Rec.* NW of Portinho, 150 m.

Only one locality with few specimens in a pasture, heavily grazed, u.c. (9 m²) *Anthoxanthum odoratum, Aira caryophyllea, Plantago coronopus, Sagina procumbens, Lotus suaveolens, Ornithopus pinnatus, Erica scoparia* ssp. *azorica, Vulpia bromoides, Hypochoeris radicata.* The lack of *J.a.* along the coasts of southernmost C on cliffs and sandy deposits, where it is common in E Az. and C Az., is difficult to explain. Thus *J.a.* is not like in other parts of the archipelago to be treated as a diff. sp. of the *Festucion petraeae: Euphorbietum azoricae* on C.

Juncus articulatus L. — *Coll.* eastern exterior slope of the Caldeirão, 600 m (780629-20). *Distrib.* SM, T, J. New to Corvo.

Few specimens in one locality. On a non-sheltered grassland slope, u.c. the dominant species *Festuca jubata* and *Deschampsia foliosa.* Extension of distrib. in the archipelago has been very slow since the species was first cit. by Watson (1870).

Juncus bulbosus L. — *Distrib.* SM, T, Fo, C. *Rec.* SE of Morro dos Homens, 250 m.

In depression with brooklet, u.c. *Callitriche stagnalis, Polygonum salicifolium, Poa trivialis, Lotus uliginosus, Dryopteris aemula.*

Juncus capitatus Weig. — *Distrib.* all islands in the Az. except G. *Rec.* N of the white tool-house, 350 m.

U.c. for example *Nasturtium officinale, Juncus effusus, Isolepis setaceus* (cf. *I. setaceus*). In open grassland close to brooklet.

Juncus effusus L. — *Distrib.* all islands in the Az. *Rec.* from 125-600 m.

Widespread, locally dominant species (25 m²) in pastures. Also frequently along roads, in ravines; around lakes and at the margins of *Sphagnum* dominated depressions in the Caldeirão, u.c. for example *Holcus rigidus, Poa trivialis, Lotus uliginosus, Luzula purpureo-splendens, Dryopteris aemula, Eleocharis multicaulis. J.e.,* as well as *Pteridium aquilinum,* is considered a dangerous «weed» in the treated pastures on C as well as in other parts of the archipelago.

Juncus tenuis Willd. — *Coll.* 2.5 km N of Coroa do Pico, 200 m (780703-37). *Distrib.* SM, T, J, P, F, C.

Only one locality with few specimens. At the margin of a pasture, u.c. for example *Plantago lanceolata, Lotus uliginosus, Trifolium repens Rumex acetosella* spp. *angiocarpus, Lysimachia nemorum* ssp. *azorica.*

Luzula purpureo-splendens Seub. — *Distrib.* SM, T, J, P, F, Fo, C. *Rec.* widespread from 150-700 m.

Pref. in not at all or only slightly sheltered habitats above 250 m. In C Az. pref. above 500 m. Diff. sp. of the *Juniperion brevifoliae.* The frequency of localities increases clearly up to the highest altitudes on the island. Above 500 m frequently dominating (1 m²), especially on old drying hummocks of *Sphagnum.* The most commonly associated graminaceous plants are *Agrostis castellana, Festuca jubata, Holcus rigidus, Deschampsia foliosa.*

LABIATAE

Clinopodium vulgare L. — *Distrib.* SM, SMa, T, P, Fo. New to Corvo (Gonç.). *Rec.* Vila do Corvo, 50 m; N of Coroa do Pico, 250 m.

Roadsides and between fields in strongly exposed habitats. U.c. for example *Cyperus esculentus, Sonchus oleraceus, Plantago major, Chenopodium ambrosioides, Rumex pulcher.*

Mentha aquatica L. — *Coll.* 2.5 km N of Coroa do Pico (780703-25). *Distrib.* all islands in the Az. except G. New to Corvo (Gonç.). *Rec.* in a shallow depression in the pasture to the S of Coroa do Pico, 250 m.

Few specimens in two localities. U.c. *Juncus effusus, Blechnum spicant, Pteridium aquilinum, Agrostis castellana, Osmunda regalis.*

Mentha pulegium L. — *Coll.* along the easternmost road, 2 km N of Coroa do Pico, 200 m (780703-23). *Distrib.* all islands in the Az. except J. *Rec.* bottom of the Caldeirão, to the north, 425 m.

This fairly common species on several of the Azorean islands is rare on C. It grows as on the other islands pref. in the *Littorello-Eleocharion* around lakes and in depressions periodically more or less filled with water. U.c. (1 m²) *Littorella uniflora, Juncus effusus, Eleo-*

charis multicaulis, E. palustris, Lotus uliginosus, Holcus rigidus. However, also in anthropogeneous vegetation u.c. for example *Rumex pulcher, Oxalis corniculata, Verbena officinalis, Trifolium campestre.*

Prunella vulgaris L. — *Distrib.* all islands in the Az. except G. *Rec.* widespread from 200-550 m.

Pref. in open dry or moist grassland vegetation at altitudes above the cultivated landscape (> 300 m). Also frequently associated with weeds along roads. Diff. val. like that of *Potentilla erecta* and *P. anglica.*

Thymus caespititius Brot. — *Distrib.* all islands in the Az. *Rec.* very widespread from 150-600 m.

Wide altitude range and wide ecological range. Pref. in strongly exposed, dry habitats. Associated species are most frequently those of the open *Juniperion brevifoliae* and managed grassland originating from that all. and of the *Ornithopo-Gaudinietum* of the *Festucion petraeae.* Also on stone fences, rocks and boulders.

LAURACEAE

Laurus azorica (Seub.) Franco — *Distrib.* all islands in the Az. except G. *Rec.* in the Caldeirão, southern part, 425 m.

One specimen in sheltered habitat in ravine, bottom of the Caldeirão. Probably cut to a large extent, like *Juniperus,* and thus now nearly extinct. In the same locality was found *Ilex perado* ssp. *azorica.*

Persea indica (L.) Spreng. — *Distrib.* now on all islands in the Az. New to Corvo. *Rec.* 2.5 km N of Coroa do Pico, in deep ravine, 200 m.

One specimen in sheltered habitat. U.c. *Pittosporum undulatum, P. tobira, Erica scoparia* ssp. *azorica, Myrica faya. P.i.,* the so called vinhático, with its prized wood may have been introduced to C fairly recently.

LEGUMINOSAE

Cytisus scoparius (L.) Link — *Distrib.* all islands in the Az. *Rec.* Coroa do Pico, 250 m; 3 km N of Coroa do Pico, 200 m.

Rare plant on C. In strongly exposed habitats, u.c. for example *Hypericum foliosum, Brachypodium sylvaticum, Thymus caespititius, Polystichum setiferum, Myrica faya.* Old member of the Azorean flora (cf. Seubert & Hochstetter 1843).

Lotus parviflorus Desf. — *Coll.* N of Portinho, 125 m (780624-55). *Distrib.* SMa, SM, T, P, F, Fo, C.

Only one locality with several specimens. Non-sheltered habitat, in grassland where pasture was suspended about one year ago. Probably overlooked in many other places on the island. About associated species see *Vicia hirsuta.*

Lotus suaveolens Pers. — *Distrib.* all islands in the Az. *Rec.* widespread from the coast-275 m.

Common in dry habitats, most frequent where exposure is strong. On sand, gravel, cliffs, and boulders. Both in the man-made landscape and in the natural coastal vegetation *(Festucion petraeae),* but rarely in the most coastal vegetation *(Euphorbietum azoricae).* Most frequently u.c. *Anthoxanthum odoratum, Aira caryophyllea, Plantago coronopus, Sagina procumbens, Ornithopus pinnatus, Vulpia bromoides, Polypogon maritimus.* As in other parts of the Az., *L.s.* does not grow in vegetation with a high number of diff. spp. of the *Juniperion brevifoliae. L.s.* was earlier frequently named *L. subbiflorus,* which actually includes two taxa namely *L. subbiflorus* Lam. and *L. suaveolens* Pers. (= *L. hispidus* Desf.); cf. Heyn (1970) and Hansen (1971).

Lotus uliginosus Schkuhr — *Distrib.* all islands in the Az. *Rec.* widespread from the coast-600 m.

Pref. in pastures and in moist habitats in other vegetation types in the cultivated landscape. Around lakes and in *Sphagnum* dominated depressions in the Caldeirão.

Melilotus indica (L.) All. — *Coll.* Portinho, 50 m (780624-59). *Distrib.* all islands in the Az. except Fo. *Rec.* Vila do Corvo, 10 m.

Locally very common in waste places, on cliffs near the coast, and in dry coastal pastures. Only on SM, T, C according to Watson (1870). Obviously favoured by manuring of grazing animals, alternatively probably by salt impregnation close to the coast. Locally dominant (1 m^2) in non-sheltered vegetation, most frequently u.c. *Plantago coronopus, Festuca petraea, Lotus suaveolens, Lolium perenne, Solidago sempervirens.*

Ornithopus perpusillus L. — *Coll.* N of the white tool-house, 350 m (780622-42). *Distrib.* SMa, SM, T, J, F, Fo, C. *Rec.* widespread between 300-600 m.

A freqent constituent in managed grassland vegetation. Probably favoured by the cuttings for creation of pastures.

Ornithopus pinnatus (Mill.) Druce — *Distrib.* all islands in the Az. *Rec.* widespread from the coast-250 m.

Always in non-sheltered habitats. Both in vegetation heavily influenced by man and in the coastal natural vegetation of the *Festucion petraeae.* Frequently u.c. for example *Anthoxanthum odoratum, Aira caryophyllea, Plantago coronopus, Sagina procumbens, Lotus suaveolens, Vulpia bromoides, Hypochoeris radicata, Rumex acetosella* spp. *angiocarpus, Gnaphalium luteo-album.*

Trifolium arvense L. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo, 10 m; Portinho, 100 m.

In sparse anthropogeneous vegetation with several weeds on soil heaps; also in the comparatively dry lowproductive grassland, u.c. for example *Lotus suaveolens, Plantago coronopus, Hypochoeris radicata, Crepis capillaris, Festuca petraea, Trifolium campestre.*

Trifolium campestre Schreb. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo, 10 m; Portinho, 100 m; along the easternmost road, northeastern part of Corvo, 200 m.

Common plant in strongly exposed habitats, pref. in dry grassland vegetation below 300 m; also in anthropogeneous vegetation along roads and between fields. U.c. for example *Lotus suaveolens, Prunella vulgaris, Gnaphalium luteo-album, Hypochoeris radicata, Plantago coronopus.*

Trifolium dubium Sibth. — *Distrib.* Now on all islands in the Az. New to Corvo (Gonç.). *Rec.* several localities from 100-300 m.

Common species on Corvo. Pref. in dry grassland vegetation, managed or not. Pref. where competition is low from other plants. U.c. for example *Sagina procumbens, Potentilla erecta, Hypericum humifusum, Anthoxanthum odoratum, Aira caryophyllea, Ornithopus* spp. Extending distrib. First cit. from SMa, F, Fo by Drouet (1866).

Trifolium glomeratum L. — *Coll.* N of Vila do Corvo, 150 m (782306-4). *Distrib.* SMa, SM, G, J, P, F, Fo. New to Corvo (Gonç.). *Rec.* Vila do Corvo, 10 m; Portinho, 100 m.

In anthropogeneous vegetation at roadsides. Also in managed dry non-sheltered grassland or grassland recolonizing abandoned fields. U.c. for example *Festuca petraea, Briza maxima, Silene vulgaris* ssp. *maritima, Trifolium arvense, T. campestre, Hypochoeris radicata, Plantago coronopus.* Rapid extension of *distrib.* Cit. by Drouet (1866) only from F and Fo.

Trifolium repens L. — *Distrib.* SMa, SM, T, J, P, F, Fo. New to Corvo (Gonç.). *Rec.* several localities in all types of more or less managed grassland vegetation from 50-450 m.

Widespread species, in a few localities dominant (1 m^2). Most localities are between 150-300 m. Probably introduced, now frequently naturalized in pastures originating from the *Juniperion brevifoliae.*

Vicia bengalhensis L. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo, 50 and 100 m.

Rare plant, in anthropogeneous vegetation at the margins of pastures.

Vicia hirsuta (L.) S. F. Gray — *Coll.* N of Portinho, 100 m (780624-45). *Distrib.* all islands in the Az. *Rec.* several localities below 300 m.

In pastures; u.c. for example *Trifolium glomeratum, Briza maxima, Trifolium campestre, Hypochoeris radicata, Lotus suaveolens,* Pref. where grazing has been suspended for at least one year.

LILIACEAE

Allium ampeloprasum L. — *Distrib.* SM, J. New to Corvo (Gonç.). *Rec.* close to the easternmost road, 2 km N of Coroa do Pico, 200 m.

A few specimens in dry habitat at the roadside.

Allium vineale L. — *Coll.* 2 km N of Coroa do Pico, 225 m (780703-38). *Distrib.* SM, P, F. New to Corvo.

Only one locality with few specimens. Roadside, u.c. several widespread weeds. The rec. on P is *A.v.* var. *compactum* (Thull.) Boreau (cf. Hansen 1975).

LYTHRACEAE

Lythrum hyssopifolia L. — *Coll.* N of the white tool-house, 400 m (780622-48). *Distrib.* all islands in the Az. except G. *Rec.* N of Vila do Corvo, 250 m.

Rare plant, in moist habitats close to roads and fields for example u.c. *Luzula purpureo-splendens, Festuca petraea, Dryopteris aemula, Selaginella kraussiana, Cardamine caldeirarum.*

MALVACEAE

Lavatera cretica L. — *Coll.* 3 km N of Coroa do Pico, 200 m (780703-27). *Distrib.* now on all islands in the Az. New to Corvo (Gonç.). *Rec.* Vila do Corvo, 75 m; N of Vila do Corvo, 150 m.

In several places below 250 m as a weed between fields and along roads, in waste places. U.c. for example *Chenopodium ambrosioides, Verbena officinalis, Plantago lanceolata, Rumex acetosella* ssp. *angiocarpus, Rumex pulcher, Crepis capillaris, Sonchus tenerrimus.*

MORACEAE

Ficus carica L. — *Distrib.* all islands in the Az. *Rec.* along roads and between fields, in several localities.

Cultivated and frequently escaped.

MYRICACEAE

Myrica faya Ait. — *Distrib.* all islands in the Az. *Rec.* widespread in the eastern part of the island, at altitudes between 200-250 m.

This shrub suffers from the competition by *Pittosporum undulatum* and *Erica scoparia* ssp. *azorcia. M.f.* occurs on C more frequently associated with species which are most frequent in the *Juniperion brevifoliae* than in C Az.

MYRSINACEAE

Myrsine africana L. — *Distrib.* all islands in the Az. except G. *Rec.* Coroa do Pico, 250 m; Portinho, 125 m; N of the white tool-house, 450 m; northern rim of the Caldeirão, 600 m.

Rare plant. All localities with few specimens. In C Az. generally above 400 m. On C like in other parts of the archipelago, associated with species with some diff. val. of the *Juniperion brevifoliae* or which pref. grow in that community.

OLEACEAE

Picconia azorica (Tutin) Knobl. — *Distrib.* all islands in the Az. except G. *Rec.* Coroa do Pico, 250 m; N of Vila do Corvo, in ravine, 150 m.

Few specimens in both localities. U.c. for example *Myrica faya, Pittosporum undulatum, Cryptomeria japonica, Diplazium caudatum, Woodwardia radicans, Deschampsia foliosa, Erica scoparia* ssp. *azorica.* As *P.a.* provides a valuable wood for house fittings it has been extensively cut on all islands in the Az. Now almost extinct on several islands.

ONAGRACEAE

Oenothera biennis L. — *Distrib.* SM, T, J, P, New to Corvo (Gonç.). *Rec.* N of Vila do Corvo, 75 m.

Locality rich in specimens, at the roadside. Probably introduced and escaped. Young member of the Azorean flora, as first cit. by Palhinha (1966).

ORCHIDACEAE

Platanthera micrantha (Hochst. ex Seub.) Schlecht — *Coll.* northern rim of the Caldeirão, S-facing slope, 600 m (780702-18). *Distrib.* all islands in the Az. except G.

Only one locality with 24 recorded specimens in open grassland vegetation with thick humus layer. U.c. for example *Euphrasia azorica, Calluna vulgaris, Hypericum foliosum, Tolpis azorica, Luzula purpureo-splendens, Myrsine africana, Festuca jubata* (dominant), *Cardamine caldeirarum.* In C Az. and E Az. diff. sp. of the *Juniperion brevifoliae.* Taxonomic remarks on *P.m.* in Hansen (1972).

OXALIDACEAE

Oxalis corniculata L. — *Distrib.* all islands in the Az. *Rec.* E of the white tool-house, 225 m; S of Coroa do Pico, 225 m; close to the easternmost road, 200 m.

U.c. weeds at roadsides and between fields, in waste places. Always in non-sheltered habitats.

Oxalis corymbosa DC. — *Distrib.* SM, T, G, J, F, C. *Rec.* N of Vila do Corvo, 75m; N of Coroa do Pico, 250 m.

Young constituent of the Azorean flora, mentioned only from F by Trelease (1897). Always in non-sheltered habitats, only in vegetation influenced by man, thus not intruding the *Festucion petraeae* or the high altitude natural communities.

PAPAVERACEAE

Papaver dubium L. — *Distrib.* SM, T, J, P, F, Fo, C. *Rec.* Vila do Corvo, 10 m.

Several localities at low altitudes. Pref. where competition is weak from other plants. U.c. for example *Reseda luteola, Solanum nigrum, Coronopus didymus, Misopates orontium, Polycarpon tetraphyllum.* During the last 100 years extending distrib. in the Az.

PITTOSPORACEAE

Pittosporum tobira (Thunb.) Ait. — *Coll.* 2 km N of Coroa do Pico, 200 m (780703-60). *Distrib.* J, F, Fo. New to Corvo (Gonç.). *Rec.* few localities in ravines and along roads, in the eastern part of the island.

Introduced. Spontaneously spreading, although not at all as rapidly and vigorously as *P. undulatum.*

Pittosporum undulatum Vent. — *Distrib.* all islands in the Az. *Rec.* widespread, in ravines of the eastern side of the island, 200-275 m.

A severe threat to the survival of the *Myrica faya* scrub, as also on the other Azorean islands.

PLANTAGINACEAE

Littorella uniflora (L.) Asch. — *Distrib.* SM, T, J, P, F, C. *Rec.* lakes in the Caldeirão, 425 m.

On the bottom of lakes, up to high water level. Diff. sp. of the *Littorello-Eleocharion.* U.c. *Isoetes azorica.*

Plantago coronopus L. — *Distrib.* all islands in the Az. *Rec.* widespread below 200 m; above 200 m rare up to 450 m.

On C most frequently associated with *Frankenia laevis, Lotus suaveolens, Polypogon maritimus, Sagina maritima, Festuca petraea.* Always in strongly exposed habitats with no shelter of trees or shrubs. Diff. val. of the *Festucion petraeae* is maintained on C.

Plantago lanceolata L. — *Distrib.* all islands in the Az. *Rec.* several localities below 250 m.

Widespread in all types of vegetation influenced by man. Along roads, between fields, in waste places, in heavily grazed grasslands.

Plantago major L. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo, 10 m; 500 m N of Coroa do Pico, 250 m.

Much less frequent as a weed than *P. lanceolata.*

POLYGONACEAE

Polygonum salicifolium Brouss. ex Willd. — *Coll.* Coroa do Pico, 250 m (780623-13). *Distrib.* SMa, SM, Fo, C. *Rec.* Portinho, in ravine, 160 m; SE of Morro dos Homens, 350 m; N of Coroa do Pico, 250 m.

A few scattered localities. Moist non-sheltered habitats, such as depressions in the open grassland. U.c. for example *Lotus uliginosus, Deschampsia foliosa, Cardamine caldeirarum, Sagina procumbens, Rumex obtusifolius.*

Rumex acetosella L. ssp. **angiocarpus** (Murb.) Murb. — *Distrib.* SMa, SM, T, J, F, Fo, C. *Rec.* widespread from 200-550 m.

Pref. in dry strongly exposed habitats, where competition is weak. In grassland vegetation originating from the *Juniperion brevifoliae,* in the *Festucion petraeae* and in weed dominated vegetation. Frequently on boulders and stone fences. The diff. val. of the *Festucion petraeae: Ornithopo-Gaudinietum* towards associations of the *Juniperion brevifoliae* is maintained on C.

Rumex conglomeratus Murr. — *Coll.* lake shore in the Caldeirão, 425 m (780622-15). *Distrib.* all islands in the Az. *Rec.* NW of Vila do Corvo, in ravine, 150 m; W of Coroinha, in ravine 350 m.

Rare species, in sheltered habitats, u.c. for example *Ammi trifoliatum, Rubia peregrina, Juncus effusus, Deschampsia foliosa, Festuca jubata, Cardamine caldeirarum.*

Rumex obtusifolius L. ssp. **obtusifolius** — *Coll.* Coroa do Pico, 250 m (780623-14). *Distrib.* SM, T, P, Fo, C. *Rec.* close to most eastern road in the NE part of the island, in ravine, 200 m.

Rare species. In weakly exposed habitats. In other parts of the Az. generally above 500 m. U.c. for example *Diplazium caudatum, Polygonum salicifolium, Polystichum setiferum, Juncus effusus, Dryopteris filix femina, Selaginella kraussiana, Hedera helix* ssp. *canariensis.*

Rumex pulcher L. ssp. **pulcher** — *Distrib.* all islands in the Az. *Rec.* very widespread from 100-250 m.

One of the most frequent weeds in all types of vegetation, more or less influenced by various cultural activities.

PORTULACACEAE

Portulaca oleracea L. — *Coll.* Vila do Corvo, 10 m (780624-16). *Distrib.* all islands in the Az. except G. *Rec.* widespread below 250 m.

In several localities close to paths, between fields and in waste places with several weed species. Not present in the typically developed *Festucion petraeae.*

POTAMOGETONACEAE

Potamogeton oblongus Viv. — *Distrib.* all islands in the Az. *Rec.* lake in southern part of the Caldeirão and in brook in deep ravine nearby, 425 m.

PRIMULACEAE

Anagallis arvensis L.f. **arvensis** — *Distrib.* now on all islands in the Az. New to Corvo. *Rec.* S of Coroinha, 275 m.

Small overgrazed area in open grassland, u.c. for example *Aira caryophyllea, Lotus suaveolens, Agrostis castellana.* Spreading in the archipelago since the 1840s (cf. Seubert & Hochstetter 1843).

Lysimachia nemorum L. ssp. **azorica** (Hornem. ex Hook.) Palh. — *Distrib.* all islands in the Az. except G. *Rec.* widespread from 150-700 m.

In all vegetation types except the *Festucion petraeae* near the coast. Pref. on moist substrata where there is no shelter or just a weak one towards exposure.

RESEDACEAE

Reseda luteola L. — *Distrib.* all islands in the Az. *Rec.* widespread in the southernmost part of the island.

In a large number of localities, among other weeds. Rarely u.c. diff. spp. of the *Festucion petraeae.*

ROSACEAE

Aphanes microcarpa (Boiss. et Reut.) Rothm. — *Coll.* eastern exterior slope of the Caldeirão, 600 m (780626-66). *Distrib.* SM, T, G, J, P, F, C. *Rec.* N of the white tool-house along the main road, 350 m.

In open grassland, overgrazed spots, and on rocks and boulders, u.c. for example *Ornithopus perpusillus, Gnaphalium luteo-album, Sagina procumbens, Crassula tillaea.* During the last 100 years spreading to all parts of the archipelago. Earlier frequently mistaken for *A. arvensis* L. (cf. Palhinha 1966; Hansen 1971; Ormonde & Paiva 1973).

Eryobotrya japonica (Thunb.) Lindl. — *Distrib.* all islands in the Az. *Rec.* close to the eastermost road, in the northeastern part of the island 200 m.

Cultivated and escaped.

Fragaria vesca L. — *Distrib.* all islands in the Az. *Rec.* Coroa do Pico and to the north of that mountain, 200-250 m, several localities.

In grassland vegetation (transformed *Juniperion);* on sloping and level ground in types of anthropogeneous vegetation. Probably rare below 200 m. Not in the *Festucion petraeae.*

Potentilla erecta (L.) Räusch. — *Coll.* eastern exterior slope of the Caldeirão, 500 m (780629-33); southeastern exterior slope of the Caldeirão, 400 m (780622-43). *Distrib.* SMa, SM, T, P, F, Fo, C. *Rec.* widespread from 150-700 m.

In E Az. and C Az. rarely below 450 m, on C most frequently above 250 m. Pref. in open grassland vegetation *(Juniperion brevifoliae:*

Anagallidetum tenellae; Littorello-Eleocharion). On C at 500 m represented by a high, erect and stout forma.

Potentilla reptans L. — *Distrib.* SM, J, P. New to Corvo. *Rec.* to the E of the white tool-house, 225 m; N of Coroa do Pico, 300 m; along the easternmost road, northeastern part of the island, 200 m.

A few records in dry places in open grassland vegetation. U.c. for example *Rumex acetosella* ssp. *angiocarpus, Lysimachia nemorum* ssp. *azorica, Anthoxanthum odoratum, Thymus caespititius, Centaurium scilloides.*

Rubus hochstetterorum Seub. — *Distrib.* SM, T, J, P, F, Fo, C. *Rec.* widespread from 100-500 m.

In E Az. and C Az. pref. above 400 m, on C pref. above 200 m. *R.h.* is on C much more frequent outside typical *Juniperion* vegetation and more frequent in weakly sheltered habitats, even in transitions with the *Festucion petraeae.*

Rubus ulmifolius Schott — *Distrib.* all islands in the Az. *Rec.* widespread, especially above 250 m.

In a large number of vegetation types, both where influences of cultivation are weak and strong.

RUBIACEAE

Galium parisiense L. — *Coll.* Coroa do Pico, 250 m (780623-46). *Distrib.* all islands in the Az. *Rec.* several localities.

On a weakly exposed road side slope, u.c. for example *Centaurium scilloides, Polystichum setiferum, Hypericum foliosum, Lotus uliginosus, Thymus caespititius, Lysimachia nemorum* ssp. *azorica. Brachypodium sylvaticum.* The vegetation (in the locality above) is transitional with the *Juniperion brevifoliae.* Also present in strongly exposed habitats in the cultivated zone below 300 m.

Rubia peregrina L. — *Distrib.* all islands in the Az. except G. *Rec.* large number of localities from 150-600 m.

Wide ecological range, as both in weakly and very much sheltered habitats. Pref. on rocks and ravine slopes. In E Az. and C Az. rarely below the zone of the *Juniperion brevifoliae* and treated as a diff. sp. of the *Erico-Myrsinetum.* On C *R.p.* can not be maintained as a diff. sp. in that way, as it is also frequent in transitions with the *Festucion petraeae* and on grassland slopes where the *Juniperion* appears very depoverished.

SCROPHULARIACEAE

Euphrasia azorica Wats. — *Coll.* eastern exterior slope of the Caldeirão, 500 m (780622-34); interior slope of the Caldeirão, in the northern

part on S-facing slopes close to the rim, 600 m (780702-35). *Distrib.* Fo, C.

In strongly exposed habitats. Probably not below 500 m on C. Large number of specimens in the two localities but in both places restricted to less than 100 m². U.c. for example *Tolpis azorica, Luzula purpureo-splendens, Calluna vulgaris, Centaurium scilloides, Deschampsia foliosa, Festuca jubata, Dryopteris aemula. E.a.* is probably preferentially an open grassland plant, whereas the related *E. grandiflora,* although also a diff. sp. of the *Juniperion,* also grows in weakly exposed habitats with shrub-forest vegetation in craters and ravines in lava streams.

Kichxia spuria (L.) Dum. ssp. **spuria** — *Coll.* Vila do Corvo, 10 m (780624-75). *Distrib.* all islands in the Az. except G.

Only one locality with few specimens. On soil heaps with large patches of bare soil. Among weeds.

Misopates orontium (L.) Raf. — *Distrib.* all islands in the Az. except G. *Rec.* Vila do Corvo, 10 m; Coroa do Pico, 250 m.

Rare plant on C, in other parts of the Az. fairly common. U.c. weeds of the cultivated landscape. Extending distrib. during the last 100 years (cf. Drouet 1866).

Sibthorpia europaea L. — *Distrib.* all islands in the Az. except G. *Rec.* widespread from 275-500 m.

Both in weakly and strongly exposed habitats, pref. on moist slopes. Rarely observed u.c. diff. spp. of the *Festucion petraeae.*

Veronica arvensis L. — *Coll.* W of Coroinha, 350 m (780628-5). *Distrib.* SMa, SM, T, J, P, F, Fo. New to Corvo (Gonç.).

Only one locality with few specimens. On small open soil patches on the slopes of a ravine.

Veronica serpyllifolia L. — *Coll.* northern rim of the Caldeirão, 600 m (780702-17). *Distrib.* all islands in the Az. except G.

Few specimens in open overgrazed grassland; u.c. for example *Rumex acetosella* ssp. *angiocarpus, Holcus lanatus, Agrostis castellana, Prunella vulgaris, Sagina procumbens.*

SOLANACEAE

Solanum nigrum L. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo, 10 m; E of the white tool-house, 300 m.

Few localities and few specimens. Rapid extension of distrib. Mentioned by Seubert (1844) only from SM and by Drouet (1866) from SM, P, F.

TAMARICACEAE

Tamarix africana Poir. — *Distrib.* T, G, J, P, F, C. *Rec.* several localities in the southernmost part of the island.

Introduced to several islands in the Az. On C planted close to the coast and in abandoned fields, where after the finished cultivation the dry grassland only produced a poor pasture.

TAXODIACEAE

Cryptomeria japonica (L.f.) D. Don — *Distrib.* all islands in the Az. New to Corvo (Gonç.).

Cultivated, on C generally in ravines at the eastern side of the island, replacing the former natural vegetation of *Erica, Juniperus* and *Myrica*. The dense shade in the stands of *C.j.* older than 10 years provides habitat conditions suitable for the extrazonal presence of taxa otherwise almost restricted to the *Juniperion* zone at higher altitudes, such as *Diplazium caudatum* and several hepatics of the *Lejeuneaceae* family.

TROPAEOLACEAE

Tropaeolum majus L. — *Coll.* Vila do Corvo, 10 m (780704-61). *Distrib.* P, F, Fo. New to Corvo.

One locality with few specimens, on soil heaps almost only colonized by weeds. Maybe introduced and escaped, although not seen as cultivated.

UMBELLIFERAE

Ammi trifoliatum (Wats.) Trel. — *Distrib.* SMa, SM, J, P, Fo, C. *Rec.* NW of Vila do Corvo, 150 m, in shallow ravine close to the coast; Coroa do Pico, on the western slope, 250 m; W of Coroinha in deep ravine, 350 m.

All recorded specimens grow in fairly well-sheltered habitats, on Coroa do Pico in places where the shrub layer of *Erica* and *Myrica* is dense. Few specimens in each locality. First cit. by Watson (1844) and after that probably overlooked on several islands, as the present knowledge of the presence of this species, endemic to the Az., may not reflect any spreading within the archipelago. The second endemic *Ammi* species, *A. huntii* Wats. (cf. Hansen 1971) has not been recorded on C.

Apium graveolens L. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo.

Fairly common among weeds, along roads and between fields.

Crithmum maritimum L. — *Distrib.* all islands in the Az. *Rec.* Vila do Corvo; Portinho, below 50 m and at 100 m.

On coastal cliffs and on coarse or fine densely packed sand deposits. U.c. for example *Silene vulgaris* ssp. *maritima, Festuca petraea, Lotus suaveolens, Plantago coronopus, Polypogon maritimus, Solidago sempervirens, Frankenia laevis.* In C Az. diff. sp. of the *Euphorbietum azoricae.* In other parts of the Az. rarely above 50 m. Several diff. spp. of this ass. in CAz. are not present as such on C (cf. *Festuca petraea).*

Foeniculum vulgare Mill. ssp. **piperitum** (Ucria) Cont. — *Distrib.* all islands in the Az. *Rec.* several localities in the cultivated zone below 300 m.

Frequent member of the roadside and border of field vegetation.

Petroselinum crispum (Mill.) A. W. Hill — *Distrib.* SM, T, G, J, P, Fo. New to Corvo (Gonç.). *Rec.* widespread below 300 m.

In several localities in vegetation of the cultivated landscape, along roads, between fields. In a plant cover dominated by weeds and also accidentally in the *Festucion petraeae.*

VERBENACEAE

Verbena officinalis L. — *Distrib.* all islands in the Az. *Rec.* widespread below 250 m.

The extension of distrib. to all islands in the archipelago has probably taken place during the last 200 years. Cit. by Forster (1787). On C several recorded localities. Only in the cultivated landscape, in anthropogeneous vegetation. Not in typical *Festucion petraeae.*

APPENDIX 1

Species recorded by Eng.º I. B. Gonçalves on Corvo (according to his notes seen in 1975), not to be found in the check-list by Eriksson et al. (1974), and not recorded by the author in 1978:

SPERMATOPHYTA

AIZOACEAE

Drosanthemum candens (Haw.) P. Schwantes

CARYOPHYLLACEAE

Spergularia azorica (Kindb.) Lebel

CRUCIFERAE

Barbarea verna (Miller) Asch.
Matthiola incana (L.) R. Br. ssp. incana

COMPOSITAE
Leontodon saxatilis Lam. ssp. saxatilis
Picris echioides L.

CYPERACEAE
Carex echinata Murr.
Carex peregrina Link
Cyperus badius Desf.

DIPSACACEAE
Scabiosa atropurpurea L.

EUPHORBIACEAE
Mercurialis annua L.
Ricinus communis L.

GRAMINEAE
Anthoxanthum puelii Lec. et Lamotte
Eleusine indica (L.) Gaertn.
Paspalum distichum L.
Phalaris brachystachys Link
Trachynia distachya (Hasselq. ex L.) Link

HYPERICACEAE
Hypericum undulatum Schousb. ex Willd.

LEGUMINOSAE
Trifolium ornithopodioides L.

NYCTAGINACEAE
Mirabilis jalapa L.

POLYGONACEAE
Rumex azoricus Rech. fil.

RANUNCULACEAE
Consolida ambigua (L.) P. W. Ball et Heyw.

SCROPHULARIACEAE
Parentucellia viscosa (L.) Caruel

SOLANACEAE
Datura stramonium L.

UMBELLIFERAE
Daucus carota L. ssp. azoricus Franco
Torilis arvensis (Huds.) Link ssp. neglecta (Schult.) Thell.

APPENDIX 2

The following species have been listed by Eriksson et al. (1974) as present on Corvo, but were not recorded by the author in 1978:

PTERIDOPHYTA

ASPLENIACEAE

Asplenium scolopendrium L.
Asplenium trichomanes L. ssp. quadrivalens D. E. Meyer
Luniathyrium japonicum (Thunb.) Kurata Aggr.

CULCITACEAE

Culcita macrocarpa C. Presl

GYMNOGRAMMACEAE

Anogramma leptophylla (L.) Link

LYCOPODIACEAE

Lycopodium madeirense J. H. Wilce

PTERIDIACEAE

Pteris arguta Ait.

SPERMATOPHYTA

AIZOACEAE

Lampranthus multiradiatus (Jacq.) N.E. Br.

AMARANTHACEAE

Amaranthus lividus L.

ANACARDIACEAE

Rhus coriaria L.

BORAGINACEAE

Myosotis azorica Wats.

CARYOPHYLLACEAE

Silene vulgaris (Moench) Garcke ssp. angustifolia (Mill.) Hay.

COMPOSITAE

Anthemis cotula L.
Bellis azorica Hochst. ex Seub.
Cichorium intybus L.
Filago lutescens Jord. ssp. atlantica Wagenitz
Hypochoeris glabra L.
Sonchus asper (L.) Hill ssp. asper
Tolpis fruticosa Schrank

CONVOLVULACEAE

Calystegia sepium (L.) R. Br. ssp. sepium

CRUCIFERAE
Raphanus raphanistrum L. ssp. raphanistrum

CYPERACEAE
Cyperus eragrostis Lam.

ELATINACEAE
Elatine hexandra (Lap.) DC.

EUPHORBIACEAE
Euphorbia azorica Seub.
Euphorbia stygiana Wats.

GENTIANACEAE
Centaurium erythraea Rafn.

GRAMINEAE
Agrostis azorica (Hochst.) Tutin et Warb.
Agrostis congestiflora Tutin et Warb.
Avena barbata Pott. ex Link
Digitaria ciliaris (Retz.) Koel.
Oryzopsis miliacea (L.) Asch. et Schweinf.

JUNCACEAE
Juncus bufonius L.

LABIATE
Calamintha sylvatica Bromf. ssp. ascendens (Jord.) P. W Ball
Stachys arvensis (L.) L.

LEGUMINOSAE
Lotus angustissimus L.
Ornithopus sativus Brot.
Trifolium ligusticum Balls. ex Loisel.

MALVACEAE
Malva parviflora L.

PAPAVERACEAE
Chelidonium majus L.
Papaver somniferum L.
Papaver strigosum (Boenn.) Schur

PHYTOLACCACEAE
Phytolacca americana L.

POLYGONACEAE
Polygonum aviculare L.
Polygonum hydropiperoides Michx.
Rumex crispus L.

PRIMULACEAE
Centunculus minimus L.

RANUNCULACEAE
Ranunculus cortusifolius Willd.

RUBIACEAE
Sherardia arvensis L.

SCROPHULARIACEAE
Veronica dabneyi Hochst.

SOLANACEAE
Physalis peruviana L.

TAXACEAE
Taxus baccata L.

TETRAGONIACEAE
Tetragonia tetragonioides (Pall.) O. Kuntze

UMBELLIFERAE
Ammi huntii Wats.
Ridolfia segetum (L.) Moris

URTICACEAE
Parietaria debilis Forst. f.
Parietaria punctata Willd. (= P. judaica L.)
Urtica membranacea Poir.

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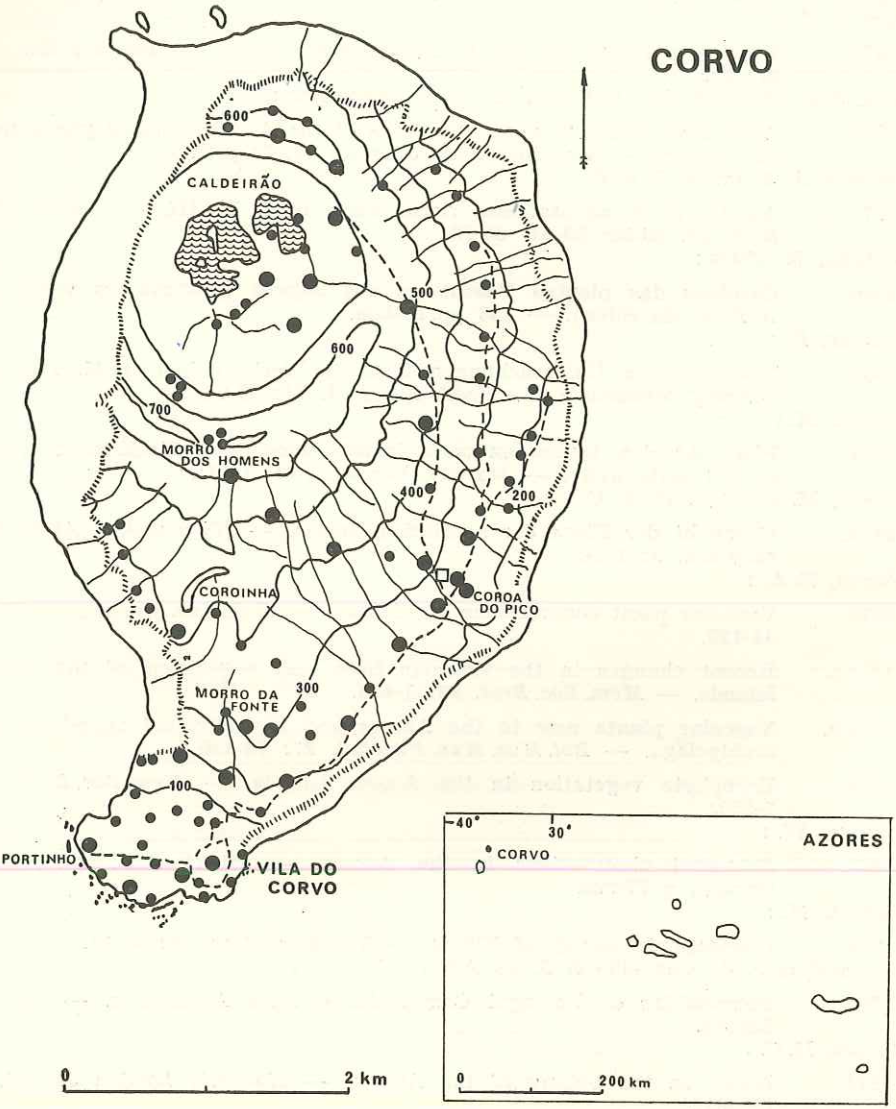

Fig. 1. — The map of Corvo shows: river ravines, 100 m contour lines (solid lines), the rim position of the coastal escarpment (stippled lines), roads (broken lines), lakes (wavy lines), the so called 'white tool-house' (□); a big black dot shows the position of an investigated area of at least 4 hectares, a small one of at least 1/4 hectare. The position of Corvo in the Azores archipelago is shown to the right, below.

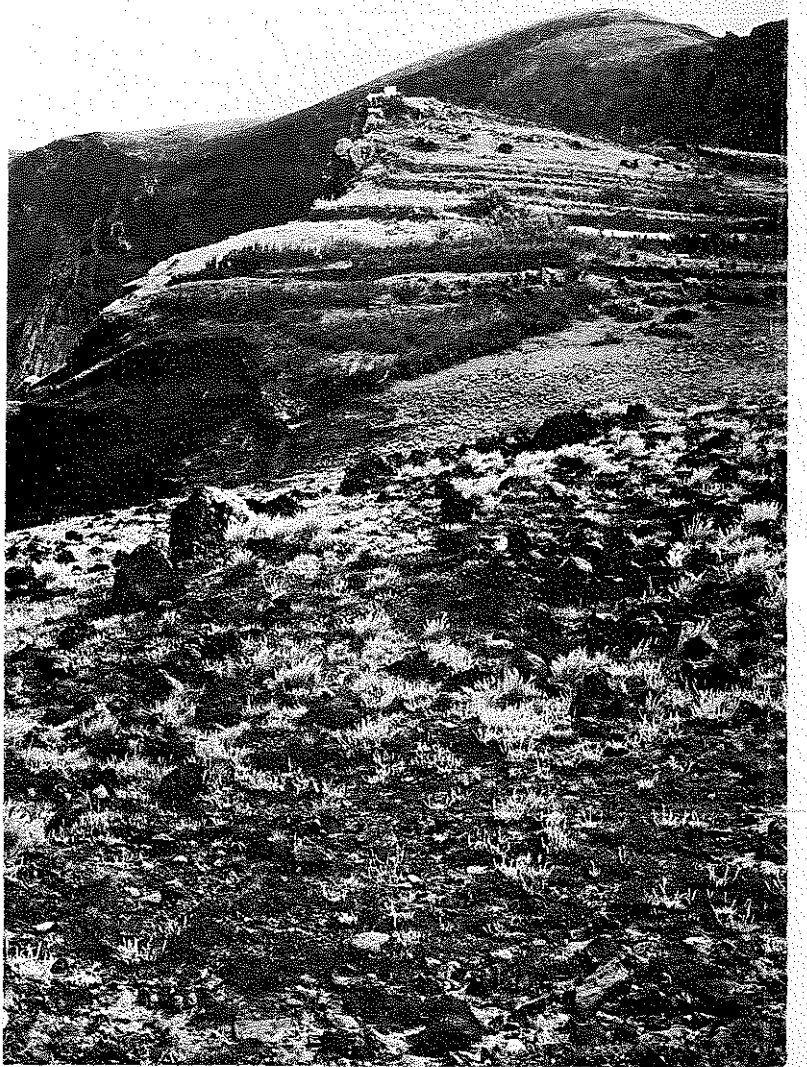

Fig. 2. — *Festucion petraeae* vegetation on stony ground. In the foreground *Frankenia laevis* is dominant, growing together with *Festuca petraea, Polypogon maritimus, Lotus suaveolens, Plantago coronopus.* In the background up to the small baleia observation house the same community, with scattered low-grown specimens of *Erica scoparia* ssp. *azorica.* — N of Portinho da Areia; altitude 50 m. June 1978.

Fig. 3. — *Festucion petraeae* vegetation on sand deposits, dominated by *Festuca petraea* with scattered specimens of *Polypogon maritimus* and *Plantago coronopus; Trichostomum* spp. and *Campylopus polytrichoides* in the bottom layer. The island of Flores is seen in the background. — N of Portinho da Areia; altitude 75 m. June 1978.

Fig. 4. — Ravine with small plantation of *Cryptomeria japonica*. The trunks are covered by several hepatics *(Lejeunea, Radula, Frullania)*. The field layer is dominated by *Woodwardia radicans*, taking advantage of the shelter from exposure, provided by the tree canopies, as the altitude is exceptionally low for this plant. The presence of *Diplazium caudatum* (not seen on the photo) in this locality is favoured in the same way. — Coroa do Pico; altitude 250 m. July 1978.

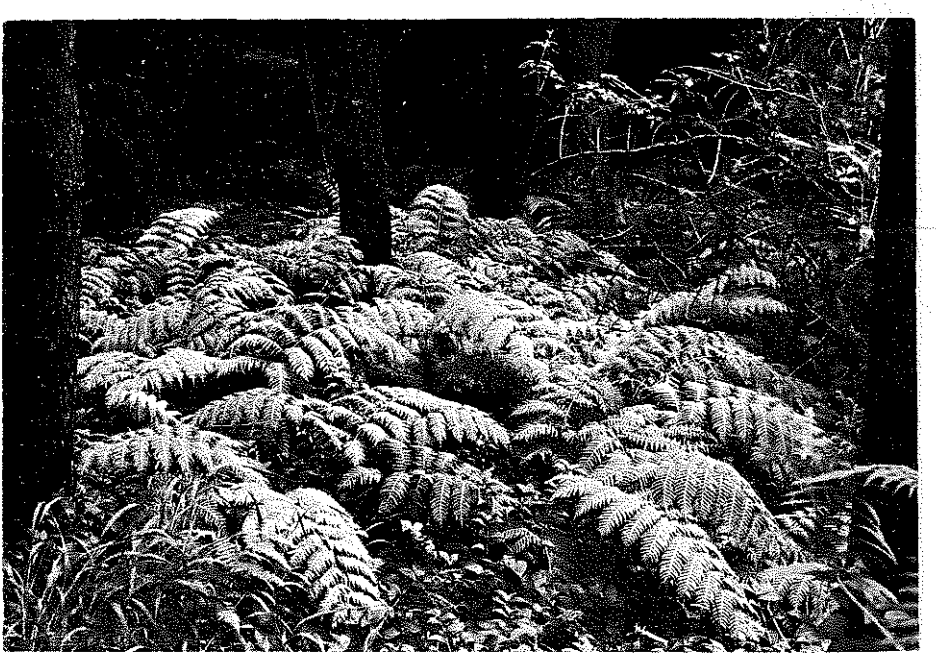

Fig. 5. — The N- and W-facing interior slopes of the caldera. Vegetation on the N-facing slopes is dominated by *Sphagnum* spp. with scattered patches of *Luzula purpureo-splendens, Deschampsia foliosa, Holcus rigidus* and *Agrostis castellana*. Into these slopes are cut down deep ravines with ramnants of the *Juniperion brevifoliae*. On the bottom of the caldera are seen lakes and depressions, filled with *Sphagnum* hummocks and a surrounding *Juncus effusus* fringe. The E-facing slope is covered by a network of fenced in pastures. — Caldeirão; photo from 450 m; the bottom of the caldera is at 425 m. July 1978.

Fig. 6. — *Festucetum jubatae,* association of the *Juniperion brevifoliae,* here on the steep S-facing interior slope of the caldera with no trees or shrubs and dominated by *Festuca jubata,* mixed with *Deschampsia foliosa, Luzula purpureo-splendens* and the remarkable species *Euphrasia azorica,* which is endemic to Corvo and Flores. — Caldeirão; altitude 600 m. July 1978.