

GIBRALTAR'S FLORA IN A EUROPEAN CONTEXT

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Abstract.

Europe is topographically and ecologically diverse, with a flora estimated at 12.000 species of flowering plants, gymnosperms and ferns. Publications on the European flora are also diverse in choice of format, taxonomy and language, although a regional synthesis is available in Flora Europaea 1-5 (1964-80), together with a second edition of volume 1 (1993). Much research remains to be carried out, notably the investigation of taxonomic problems raised in Flora Europaea and regional Floras, continued exploration of floristically rich areas of southern Europe and the elucidation of intraspecific variation, especially where species belong to genera or families that are of economic importance. The detailed floristic study of an area such as Gibraltar and the Campo de Gibraltar enables these sort of problems to be investigated thoroughly within a small area but with reference to the wider European picture.

The vegetation and flora of Gibraltar and the Campo de Gibraltar are of considerable phytogeographical interest. Gibraltar lies within the Andalucian region, which has an endemic flora of global significance. Despite the small size and urbanization of its territory, Gibraltar's flora is itself rich and contains a number of taxa endemic to the Rock or its environs or at their only European station. The status of these is being assessed and other native and alien taxa are still being recorded new to the flora. The establishment of the Gibraltar Botanic Gardens is an opportunity to establish an integrated in situ and ex situ conservation strategy for the flora of the Rock and the Campo de Gibraltar, providing a model for similar ecosystems elsewhere in the Mediterranean region.

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Resumen.

Topográficamente y ecológicamente el continente europeo es muy variado, y contiene una flora vascular calculada en 12.500 especies. Las publicaciones sobre la flora europea también son muy variadas en formato, taxonomía e idioma, aunque una síntesis regional se incluyó en Flora Europaea 1-5 (1964-1980), con una segunda edición del primer volumen (1993). Quedan todavía por hacerse muchas investigaciones, notablemente sobre los problemas taxonómicos identificados en Flora Europaea y Floras regionales, la continuación de la exploración botánica de zonas florísticamente ricas del sur de Europa y la investigación también de la variación intraespecífica, especialmente de especies de género o familias de importancia económica. El estudio florístico y detallado de una zona como la de Gibraltar y el Campo de Gibraltar permiten que estos problemas se estudien en una zona pequeña pero con referencia a las más amplia situación Europea.

La vegetación y flora de Gibraltar y del Campo de Gibraltar son de un considerable interés fitogeográfico. Gibraltar está dentro de la Región Andaluza, que tiene un endemismo florístico de importancia global. A pesar de su pequeño tamaño y de su urbanización, la flora de Gibraltar es rica y contiene un número de formas endémicas del Peñón o sus alrededores, o que están en su única localidad europea.. El estatus de éstas está siendo investigado y otras formas autóctonas o exóticas todavía se están añadiendo a su flora. El establecimiento de un jardín botánico en Gibraltar da una oportunidad para establecer una estrategia de conservación in situ y ex situ de la flora de Gibraltar y el Campo de Gibraltar, que sirva de modelo para otros ecosistemas similares en otras zonas de la región Mediterránea.

Introduction.

Europe has a flora estimated at 12,000 species of flowering plants, gymnosperms and ferns (Akeroyd & Synge 1992). Some 75 genera and 3500 (i.e. more than 25%) species are endemic, mostly in the mountains of southern and south-central Europe, although there are no endemic families (Webb 1978). This rich flora, which represents the continent's most precious natural resource, is under threat. Europe has a long history of human occupation and habitat disturbance, but the last 50 years have seen a savage acceleration of habitat loss and degradation. The continent's wild flora, both the actual species and their many intraspecific variants, is faced with increasing loss of natural, semi-natural and long-established artificial habitats. At the same time, ancient crops, together with certain garden vegetables, fruits and flowers and even weeds, are threatened by agricultural change and in some cases by insensitive European Community legislation.

The progressive losses to Europe's flora has been brought about by many factors: the development of more efficient and extensive agriculture, the loss of land through industrial, urban and suburban development, more general levels of affluence leading to expanded leisure activities, especially on the coasts and in the mountains, together with the often uncontrolled exploitation of natural resources that ought to be conserved as a wise investment for the future, notably peatlands and timber. The current political turbulence in parts of eastern and south-eastern Europe represents a major threat to the rich floras of those regions, as well as to the future of the various organisations and institutes charged with their protection. Losses and threats to the flora can be ameliorated by taking appropriate measures for *in situ* and *ex situ* conservation and carefully planned recovery programmes. Surviving habitats tend to be fragmented, often forming relict islands or strips within built-up or intensively farmed landscapes. Conservation of natural or semi-natural habitats is to be preferred, although even quite heavily damaged landscapes can exhibit high levels of floristic diversity,

probably because ironically these sort of habitats provide ecological niches for new taxa as they evolve, perhaps following episodes of hybridisation between taxa brought together by human disturbance or 'hybridisation of the habitat'.

Climatologists warn us of an even more dramatic but less tangible and predictable threat from long-term climatic change arising as a consequence of global warming. This clearly needs to be taken seriously and to be assessed. However, global warming occupies the minds of too many scientists who might be better employed in seeking remedies to more immediate problems. The main enemy of Europe's flora at present is undoubtedly continued loss of habitats, together with a lack of data about many rare and threatened plants, and in too many cases a lack of will to save them. What we need most of all is good field botanists producing thorough floral and ecological inventories and conservation plans at regional, national and local levels. Alas the botanists too are threatened, as traditional taxonomy and field botany have been completely marginalised in tertiary education in Britain and elsewhere. This unhelpful attitude of both the government and the educational establishment flies in the face of the present concern about biodiversity. Alas, to many members of the public and people in influential positions in Britain, biodiversity does not extend outside tropical rainforests. (Fortunately, in Spain there is a more enlightened attitude to taxonomy and I have no doubt that were *Flora Europaea* to be written today, it would be edited in Madrid, Málaga or Sevilla!)

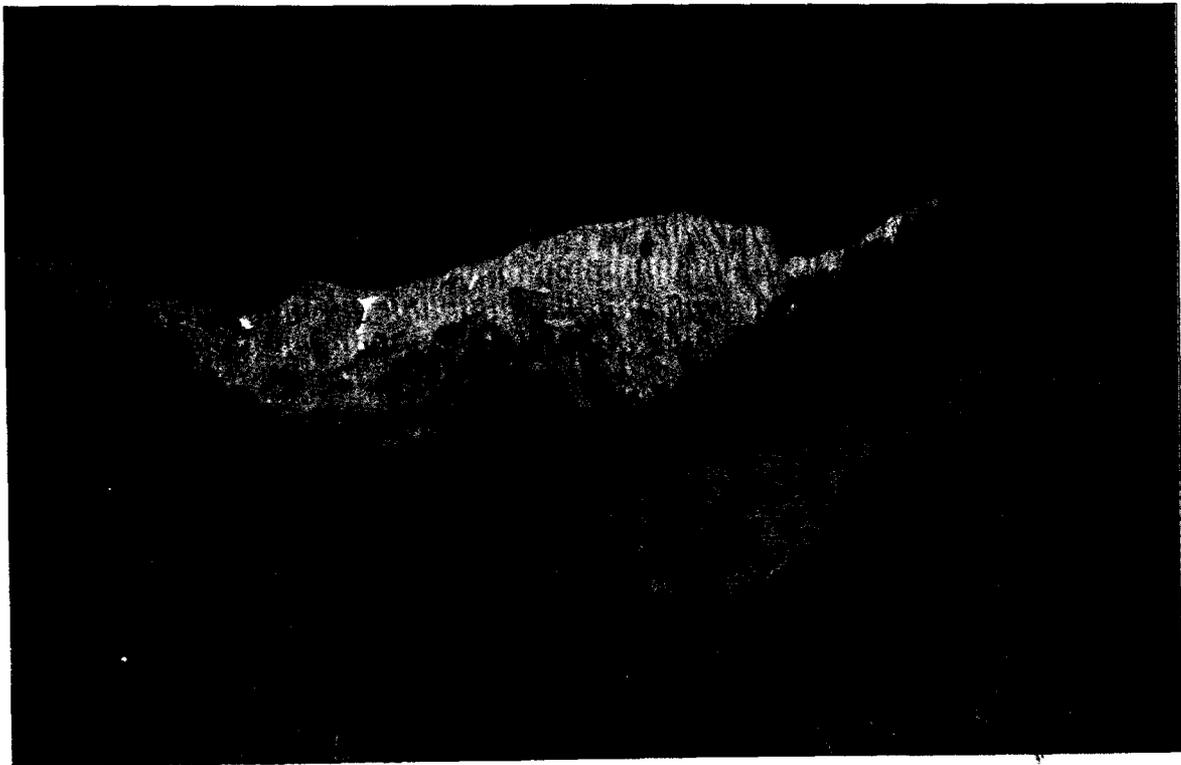


Figure 1. The rich flora of the mountains of southern Europe. Mount Olimpos in northern Greece has a flora of some 1,800 species, at least 25 of them endemic to that mountain.

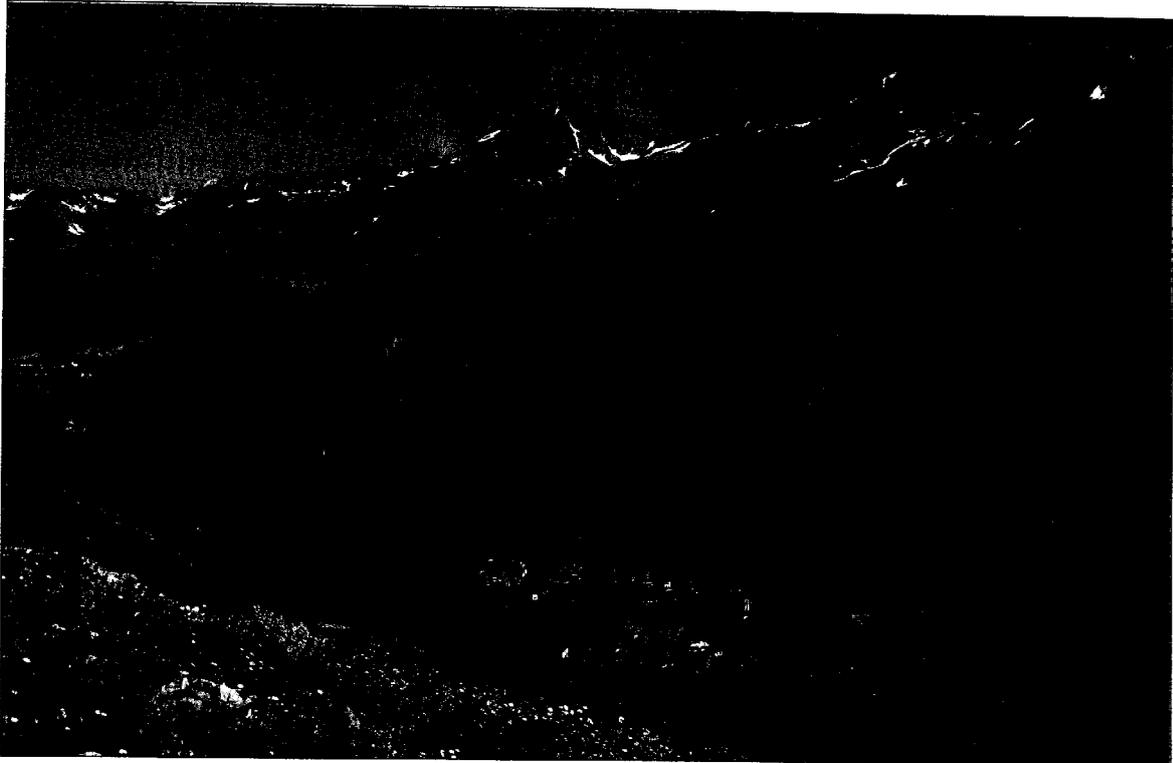


Figure 2. Most species-rich habitats in Europe are only seminatural. The flowery meadows around Obergurgl in the Austrian Tyrol are plant communities managed by Man over millenia.

and Islamic civilizations, especially in the Mediterranean region (Braudel 1973), which has modified or destroyed almost all natural plant communities and has introduced a substantial alien element into the flora from other parts of the world. The areas of greatest biodiversity in Europe represent often profoundly modified relics of the former native vegetation and flora, especially in the south. The majority of the most extensive wetlands have been drained, although a number remain, especially on coasts, for example the Coto de Doñana at the mouth of the river Guadalquivir in Spain's Cádiz province. Almost all native forest cover has been cleared from the lowlands, but substantial stands survive in the mountains and in the north.

The greatest biodiversity and the finest development of both flora and vegetation of much of Europe have been maintained by often ancient patterns of human management and exploitation of plant and animal resources. European civilisation and culture evolved from a basis of the wise, sustainable exploitation of plants and other natural riches. We still need those plants for food, medicine, timber and a whole range of natural products, as well as for our aesthetic and spiritual pleasure. In northern Europe, we are too frequently divorced from our landscape, but a walk through the scrublands and woodland pastures of southern Spain or any other rural Mediterranean region reveals a living, utilised landscape. The hilly countryside of Andalucía provides a source of grazing and winter feed for sheep, pigs and cattle (notably the famous black bulls of the region), firewood, charcoal, timber, bark for cork or for tanning, gums, oils and resins, herbs and medicines, salads and fruits for food, wild flowers for ornament, game, snails, honey and edible fungi. A visit to a country market or even a wayside *venta*, taking in a few *tapas*, can give a vivid insight into this rural economy.

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Conservationists too frequently overlook the fact that many of the most species-rich and aesthetic habitats are artefacts of this sort of careful, long-term human management. Most so-called 'ancient' woodland in Europe outside the remoter mountains and the great boreal forests has been carefully managed and exploited for centuries or millenia. Some of the richest, most beautiful and culturally important ecosystems of Europe are those managed along traditional lines. However economic pressure for agricultural change combined with a retreat from a traditional rural lifestyle greatly threaten these habitats, successional plant communities maintained by human management. They may indeed be better managed as Protected Landscapes rather than conventional Nature Reserves. This is worth bearing in mind when considering strategies for the conservation of the flora and vegetation of Gibraltar and the Campo de Gibraltar, long damaged by human activity but continuing to support a diverse flora.

Threats to the flora and vegetation do not generally arise from long-term sustainable exploitation, but from periods of over-exploitation, especially where populations rise, there is no legal control or, as in contemporary Crete, the collection of a product such as wild, spring greens becomes over-fashionable or of economic importance, and therefore done to excess. Over-grazing and fire are the most worst threast in Andalucia and other dry regions. History reveals many examples of landscape degradation as a result of the improvident use of nature's resources. There is plenty of secondary desert, for example, in south-eastern Spain and elsewhere around the shores of the Mediterranean. I recall vividly being shown an area of scrub in eastern Spain by a colleague from Madrid, who observed sadly to our visiting group from Britain that a former climax forest community of Holm Oak (*Quercus ilex* subsp. *rotundifolia*) had been another casualty of Philip II's ill-fated Spanish Armada.

Gibraltar's floristic richness.

The vegetation and flora of Gibraltar and the Campo de Gibraltar are of considerable phytogeographical interest. Gibraltar is situated in an area of floristic diversity that is of global significance. Andalucia has a dissected topography with much land over 1,000 m in altitude. To the north of the Rock lie the famous richnesses of the Serranía de Ronda and the less thoroughly explored serpentine mountains of the Sierra Bermeja. Further to the east, the Sierra Nevada has some 80 endemic species, and the Baetic Cordillera of which it comprises a part has more than 300. The total number of native plant species present in the Cordillera is probably in excess of 3,000, in other words, almost 25% of Europe's total flora. To the south lie the Rif and Atlas Mountains of Morocco, again with a rich flora, with strong affinities to that of Andalucia. The littoral of southern Spain and the adjacent hinterland are both rich in plants. The late Oleg Polunin and Bill Smythies painted a vivid picture of this region in the introductory chapters to *Flowers of South-west Europe* (Polunin & Smythies 1973). I shall myself long remember my March 1990 exploration of the Cork Oak woodland to the west of Los Barrios with Mrs Betty Molesworth Allen and other botanists, marvelling at the suite of subtropical ferns that flourish on sheltered slopes and in gullies.

Gibraltar itself has a recorded flora estimated at 500/600 species. This is an impressive total for a peninsula only 5 x 1 km and makes the flora an important one to conserve. A number of factors have probably promoted this richness, reflecting some of the factors that have enriched the regional flora generally.

a) Geographical situation; where Europe and Africa meet.

One of the most southerly points on the European mainland, Gibraltar clearly has affinities with adjacent

Morocco. The adjacent parts of Andalucia, as noted above include some of the most floristically diverse plant communities in Europe. The mountainous nature of the Straits region has allowed the migration of varied floral elements from outside the region. In the Sierra Nevada, Purple Saxifrage (*Saxifraga oppositifolia*) has its most southerly stuation in Europe. In the lowland zone the sunny south-facing aspect of the Iberian coastline has favoured the survival of thermophilous African elements in the flora, for example the asclepiad *Caralluma europea* and the conifer *Tetraclinis articulata*. The relatively large proportion of autumn-flowering bulbs in the flora probably reflects the more arid climate of the region generally. Elsewhere in Europe, only Crete and the southern Aegean islands have as fine a suite of autumn-flowering bulbs. At the same time, the strong Atlantic influence, with high winter rainfall, allows the survival of relict pockets of plants such as the subtropical ferns mentioned above, growing with other relict plants such as Rhododendron (*Rhododendron ponticum* subsp. *baeticum*) and Mouse Arum (*Arisarum proboscoideum*).

b) *Physical geography: isolation and dissected topography.*

Gibraltar is effectively an isolated island ecosystem, within which broken ground has created a varied range of habitats. The considerable height of the Rock, rising to 426m, is itself an important factor, creating a range of microclimates. In the Mediterranean, even small mountains are effectively isolated amongst the arid lowlands. The more gently sloping western side of the ridge supports tall maquis and woodland. In cleared areas and more broken, rocky ground there is garigue and pseudosteppe. The eastern side is dominated by cliff communities and remnants of a considerable area of blown sand piled against the cliffs. This more acid substrate has fragments of the sun rose (*Cistus*)



Figure 3. Sustainable use of plants in the Mediterranean region. In Crete, as in Andalusia and elsewhere, local people gather native plants for food and other uses.

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heath and scrub so characteristic of the littoral of southern Spain and Portugal, with *Calbidus* and *C. salviifolius*. Windmill flats and Europa Point have a more open, steppic vegetation.

c) *Geology: limestone.*

The peninsula is primarily made up of Jurassic limestone, which contrasts with the mostly acid rocks of the mountains inland. The cliff topography of the eastern and northern sides of the rock derives from the physical nature of the faulted limestone.

In general limestones carry a larger flora than acid substrates and in the case of Gibraltar the Rock has a similar geology to that of the Rif Mountains across the Strait in Morocco. The majority of the great floristic sites of the Mediterranean are on limestone: Mt Olympos, the gorges of Crete, the coastal ranges of Croatia, the Madonie Mountain of Sicily, the Sierras of Grazalema and Cazorla, to name but a few. That is not to say that acid regions are floristically poor, nor have they no endemics: Corsica and Sardinia have an astonishing suite of endemics.

c) *Equable climate.*

The Mediterranean climate and southerly latitude and aspect of Gibraltar is tempered by its coastal position and the cloud induced by the Levanter wind. Similar cloud cover is a feature, for example, of some of the isolated mountains of Sicily, several of which carry interesting floras, such Rocca de Busambra.

d) *History of human disturbance.*

Not only have the inhabitants, representing successive waves of invasion from outside the Rock, brought in new plants, but they have disturbed, modified and amplified habitats. Not all of the human impact has been beneficial though, for the vegetation has suffered greatly. It is not clear how much woodland there was on the Rock prior to the Moorish invasion of 711. Certainly there is evidence that the peninsula was cultivated and grazed during the Spanish occupations of 1309-33 and 1462-1704. The greatest damage was done by British garrisons in the days of the 'Redcoat' wars with France especially during the siege of 1779-82. Not only did the garrison need wood for fuel, but grazing animals for food. At the same time, particular areas were cleared for purely military reasons. The British soldiery does seem to have removed the last Carob trees, although the more weedy Olive has survived well. More recently, with a population rising to 29.000, large areas of vegetation have been cleared to make firebreaks and water catchment areas.

The removal of the last grazing animals during the present century has allowed the development of High Maquis, 4-5 m tall, on the western slopes of the Rock. This formation presumably flourishes on the shaly substrate here rather than on the more arid limestone of the higher slopes. A feature of this community is fully grown individuals of Fan-palm (*Chamaerops humilis*), usually seen in southern Spain as grazed-down shrubs. One would normally have to go to a Mediterranean botanic garden, for example that at Pisa in Tuscany, to see these trees exhibit their potential. The fruits are eaten and presumably dispersed by the Rock's famous apes (Stocken 1969), so here is another human interaction with the flora, since the apes were apparently introduced from Morocco.

Any area with so long a history of invasions, garrisons and trade is bound to have an interesting historical flora, with relics of the plants used by successive generations. In a site such as Gibraltar, the broken topography has also allowed remarkable pockets of native or semi-natural flora to remain. I am reminded of work that we carried out in Dublin during

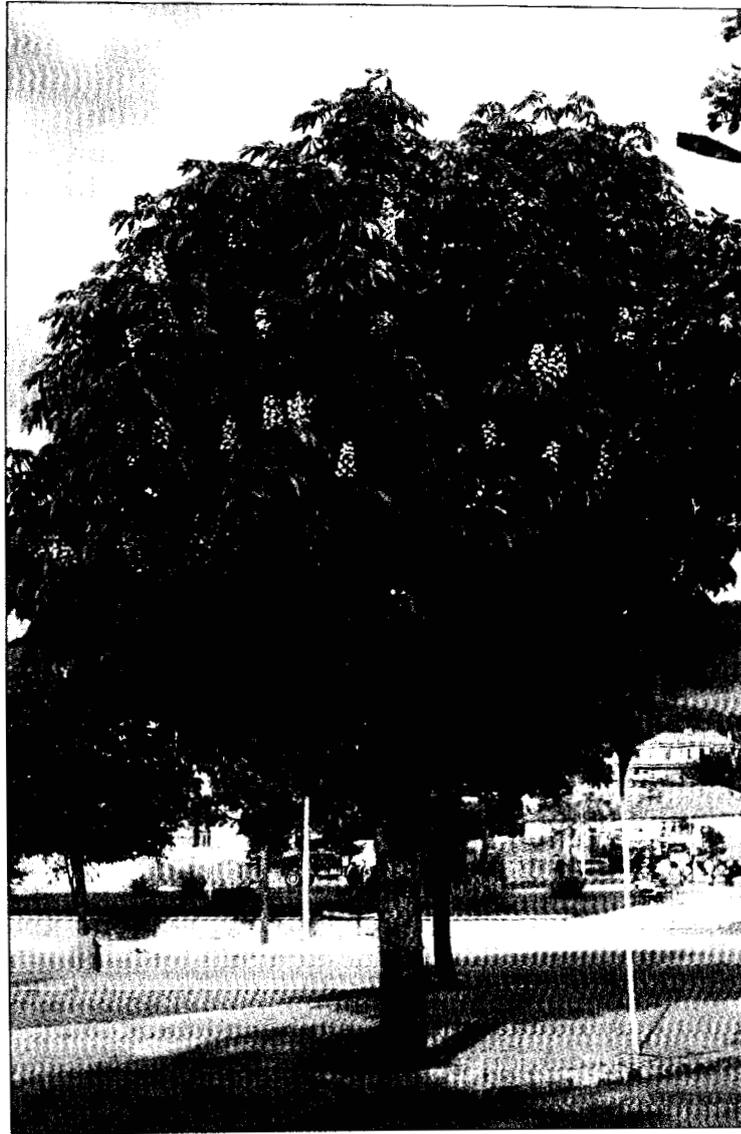


Figure 4. Conservation of Europe's endemic flora. In the Albanian town of Gjirokastir, Horse Chestnut (*Aesculus hippocastanum*), a rare Balkan endemic, is planted as a street tree.

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the early 1980s, cataloguing the varied flora of the streets, waysides, canal-banks and odd woodland and grassland fragments of that historic city (Wyse Jackson & Sheehy-Skeffington 1984). We gathered a large total of species and we must have struck a chord with Dubliners, for the book was on the Irish 'best-sellers' list for several weeks!

Gibraltar's special flora.

Several plant taxa are restricted to Gibraltar or to the adjacent littoral of the Campo de Gibraltar. These are discussed briefly below. The plants of rocky ground are probably under no immediate threat but they need to be monitored, whereas those of more sandy communities by the sea are threatened by coastal development.

Cerastium gibraltarium (*C. boissieri* Gren. var. *gibraltarium* (Boiss.) Gren.)

This mouse-ear chickweed is a glandular perennial, 10-25 cm tall, with clusters of showy white flowers. The new second edition of *Flora Europaea* 1 keeps the species distinct from the closely related *C. boissieranum* Greuter & Burdet (*C. boissieri* Gren. var. *boissieri*), but Valdés *et al.* (1987), *Flora Ibérica* and *Atlas Florae Europaeae* subsume it within the variable *C. boissieranum*. The plants from Gibraltar are, however, apparently closer to those from North Africa. This is the sort of taxonomic problem that will be resolved by the current cooperation between colleagues in Andalucía and Morocco.

It is remarkable how much vital evidence about the European flora requires the study of material from N.W. Africa. Only in recent years have European botanists realised that the common White Champion of Europe, the widespread arable weed long known as *Silene alba*, is identical to the plant that grows in Morocco (*S. latifolia* Poiret). Both subsp. *latifolia* and subsp. *alba* (Miller) Greuter & Burdet occur in southern Spain.

Silene tomentosa Otth (*S. gibraltaria* Boiss.)

This is a distinct species, thought to be endemic, and has been included in the account that I wrote with Arthur O'haer and Dr. Max Walters in the second edition of *Flora Europaea* 1. It belongs to a variable group of perennial, subshrubby species, mostly on coastal cliffs and rocks in the western Mediterranean. It is a handsome plant by all accounts, with violet flowers. Dr. Daniel Jeanmonod, who revised this group of perennial species, was unfortunately unable to see it during the course of his extensive study. It was last seen in 1985 (Cortés & Linares 1993) which is hopeful in itself, for it would surprise me if a plant of inaccessible rocks had disappeared completely. I remain optimistic, having seen so many putatively extinct plants refound at a national and local level in recent years. Good field botanists are needed to scan the known stations. This simple technique has worked wonders in Britain and Ireland over the last five years. Several members of this group are rare and elusive. One species, *S. rothmaleri* P. Silva, from Cabo de S. Vicente in S.W. Portugal, is known just from the type collection and another, *S. hicesiae* Brullo & Signorello was described only in 1985 from cliffs in the Isole Eolia and one station near Palermo in Sicily.

Iberis gibraltaria L.

This handsome, glabrous, subshrubby, lilac-flowered crucifer is probably the best-known of Gibraltar's special plants. It is mostly a plant of the Rif, but has its single European station on Gibraltar, where it is locally frequent on

pathsides and the higher rocks. It is grown in gardens in Britain, but is more important as a parent of garden hybrids. It flourishes in our Norfolk garden and establishes from cuttings or seeds, although it is not as hardy or compact as some garden cultivars of the genus. The plant is under no immediate threat on the Rock, but it is clearly attractive enough to be a temptation to visitors to pick where it grows near paths.

Saxifraga globulifera Desf. var. *gibraltarica* Ser.

This saxifrage, forming loose white-flowered cushions on steep, limestone rocks, occurs also in a small area around Ronda, although it is fairly widespread in N.W. Africa, where it is extremely variable. The plants from Gibraltar are distinct enough to be recognised at varietal rank. They tend to have 3-lobed rather than 5-lobed leaves and more elongate and more shortly stalked axillary buds.

Ononis natrix L. subsp. *ramosissima* (Desf.) Batt.

Gibraltar and the adjacent coastal fringe of Andalucía are the only European stations for this North African plant. The plant is subglabrous to glandular-puberulent, which distinguishes it from the very viscid, glandular-pubescent subsp. *natrix*; it has shorter calyx-teeth and somewhat smaller flowers. The plants on Gibraltar, var. *ramosissima*, are distinct morphologically, on the basis of minute characters of the hairs, from the commoner variant, ironically called var. *gibraltarica* (Boiss.) Rouy (*O. gibraltarica* Boiss.). The subspecies is threatened by coastal development, like many endemics of Mediterranean coasts.

Limonium emarginatum (Willd.) O. Kuntze

This tall and rather handsome sea-lavender is an uncommon endemic of the Straits of Gibraltar region and is perhaps restricted to Gibraltar within the European part of its distribution. Here it is locally common on coastal cliffs and rocks.

Thymus willdenowii Boiss. (*T. hitrus* Willd.)

This decumbent species of thyme occurs in N.W. Africa, but Gibraltar and the Campo de Gibraltar are its only European stations. It is plant of rocky ground so perhaps little threatened at present.

Other plants are of interest and importance as variants of more widespread species. A purple-flowered variant of that lovely flower of wintertime, Virgin's Bower (*Clematis cirrhosa*), was alluded to by Stocken (1969): gardeners in England would go wild over such a plant if it could be propagated. *Romulea clusiana* (Lange) Nyman, the exquisite sand-crocus still widespread in open grassy places on Europa Flats, may be but a variety of the widespread *R. bulbocodium* (L.) Sebastiani & Mauri according to *Flora Europaea*, but it is a very distinct one, most characteristic of the Andalusian littoral. It is as worthy of conservation as any of the other endemics of the region; certainly its sandy, coastal habitat is under grave threat in Spain.

Further recording in Gibraltar is bound to reveal more species and intraspecific variants to be present. These all need to be catalogued. For instance, during an all-too-brief visit here in March 1990, I recorded Early Meadow-grass (*Poa*

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infirmus) by paths on ground that remains damp during the winter months. This had not been reported in recent literature on the flora (Linares 1983, 1990). A widespread Mediterranean species, it was overlooked in Greece until about fifteen years ago (M. Damanakis, pers. comm.) and has only been reported at all widely in well-explored S.W. Britain (outside its known stations in Scilly and West Cornwall) during the late 1980s.

Another plant that interested me on my visit was Friar's Cowl (*Arisarum vulgare*), that curious winter-flowering aroid, which was different to the plant I know well from Crete and elsewhere. The material that I saw was at the end of its flowering season, but the plants on the Rock clearly belong to subsp. *simorrhinum* (Durieu) Maire & Weller, the N. African subspecies. This can be distinguished from subsp. *vulgare* by the shorter scapes and the globular rather than cylindrical or subclavate apex to the spadix. Valdes *et al.* (1987) note that all Andalusian plants of this species belong to what they regard as a distinct species, *A. simorrhinum* Durieu. Note that *Flora Europaea*, as ever, is more cautious about separating the two taxa at specific rank.

An established alien species on Gibraltar is of particular interest to me, one of several South African species of Aizoaceae, popularly known as 'mesems', established on coasts of western and southern Europe. Hottentot-fig (*Carpobrotus edulis*) is familiar to me from both the Mediterranean region and from the coasts of Cornwall and Ireland. There are two variants on the Rock, one with yellow (var. *edulis*), the other with purplish-crimson (var. *rubescens* Druce) flowers. Hottentot-fig or 'Fig' has been grown in Cornwall for over 100 years, and was probably originally introduced via the celebrated Abbey Gardens on Tresco in the Isles of Scilly. The purple-flowered plant, especially, features much on postcards and has entered popular culture under the name Sally-my-Handsome. Var. *rubescens* was described by the English botanist G.C. Druce from plants growing on the Cornish coast rather than from its native home in South Africa.

This plant is frequently confused with the similar, purple-flowered *C. acaniciformis*. However, although I have examined many living plants of Hottentot-fig in the Mediterranean region and the British Isles, I have never recorded this other species (Akeroyd & Preston 1990). It is probably cultivated, but the familiar naturalised plant is *C. edulis* var. *rubescens*. A third variant, var. *crysophthalmus* Preston & Sell, with purple petals that are yellow at the base, has been described recently (Sell & Preston). This has been misnamed as *C. acaniciformis* in Britain.

There is thus scope for much more floristic exploration of Gibraltar and the adjacent mainland, leading to taxonomic and other research. If I may be permitted a geographical digression, I have in recent years been recording with others the flora of the numerous islands of Roaringwater Bay in West Cork in S.W. Ireland (Cape Clear Island, like Gibraltar a famous passage-route for birds, lies at the westernmost edge of this bay). Not only have we discovered a total of over 550 species, a large figure in a country with a flora of less than 1,000 species overall, but one had not previously been reported from Ireland and 30 of them are amongst that nation's rarest plants. This flora includes not only relict species of pockets of semi-natural vegetation, but scarce weeds of cultivation and a wealth of plants introduced in earlier times for human use; there are numerous intraspecific variants several rare or unrecorded in Ireland. I am sure that Gibraltar, with its fascinating geography and history, can yield plenty of treasures still.

Conservation and the role of Gibraltar's Botanic Garden.

Finally, let us think about the conservation of Gibraltar's flora. The nations of Europe have devoted extensive resources to the conservation of plants and their habitats, with each European nation establishing National Parks and

Protected Areas. These cover a range of habitats, notably the most threatened wetland communities and species-rich mountainous areas (Polunin & Walters 1985). The need for them is great, as the Threatened Plants Database maintained by the World Conservation Monitoring Centre (WCMC), Cambridge, have listed 23 species of flowering plants that have become extinct in the wild in Europe. It is possible that some of these will be rediscovered, since there are many more that survive in very low numbers or remote or scattered localities. At the moment *Silene tomentosa* should perhaps be on this list, if only to draw attention to its plight.

The WCMC have also listed more than 2,200 European species as 'Endangered', 'Vulnerable', 'Rare' or 'Indeterminate', assessed on the basis of the categories of threat drawn up by the International Union for the Conservation of Nature. At both regional and local level there have of course been numerous extinctions. We in Britain have lost a number of plants during this century especially wetland species such as Summer Ladies-tresses (*Spiranthes aestivalis*) and other plants on the edge of their range such as the seashore plant Cottonweed (*Otanthus maritimus*). One should also remember intraspecific variants, many of which are threatened, although we just do not have data in most cases.

Let me put in a good word for the role of the Gibraltar Botanic Garden, having recently taken part in a conference in Geneva on botanic gardens (Akeroyd 1993). Pressure on Europe's flora is today so great that it may not always be possible to protect our most precious wild plants *in situ*, or to prevent their numbers in the wild from being drastically reduced. Botanic gardens are ideally suited to act in support of Nature Reserves or Protected Landscapes; Gibraltar is part of a trend to site new botanic gardens close to or in intimate association with conserved native vegetation, in this case the Upper Rock Nature Reserve. Nor are garden collections today restricted to traditional living exhibits that are vulnerable to genetic impoverishment, hybridisation or episodes of neglect. Gardens have moved into a new era as a result of technological advances in computerised record-keeping, the maintenance of living seeds and pollen, and micropropagation and cryopreservation of living material. All this is vital, for the plants in botanic garden cultivation may one day be required by the geneticist or horticulturist for plant breeding.

The botanic garden is a natural centre for the study of threatened species, via its collections, field and laboratory studies of biology and taxonomy, and an assessment of genetic variation, knowledge of which is essential if any reintroduction or restoration programme in the wild is envisaged. A garden can provide the infrastructure, techniques and plant material for restoration of plant species and communities into the wild and subsequent after-care and management. The Botanic Garden in Gibraltar has advantage of being situated in such close proximity to the flora. Botanic gardens also have a role in the implementation of CITES and other practical and legal measures for the protection of wild plants. They are in a position to promote measures to ensure that threatened plants will survive both in the wild and in cultivation, and be exploited where appropriate in a positive and sustainable manner. By propagating and distributing material of threatened plants, they can ensure their survival in cultivation. After all, Europe's private gardens represent an astonishing reservoir of genetic variation.

The establishment of the Gibraltar Botanic Gardens is an ideal opportunity to establish an integrated, far-reaching *in situ* and *ex situ* conservation strategy for the flora of the Rock and the Campo de Gibraltar, providing a model for similar ecosystems elsewhere in the Mediterranean region. Education and publicity will promote public awareness of the flora generally, but especially local, regional or internationally important species or intraspecific taxa. Biodiversity represents our most vital and precious resource, and we must each of us do what we can, especially at a committed local level, to protect our flora and ensure that it is passed on to future generations. Some good steps have been taken in Gibraltar, with

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guides to the flowers and wildlife and now the establishment of a Botanic Garden on the solid foundation of the famous Alameda Gardens. I wish John Cortés and his colleagues the best of luck in their endeavours.

Acknowledgements.

I am grateful to Dr. John Cortés for his kind invitation to present a paper at this meeting and for demonstrating to me so many of the plants of Gibraltar in the field. I must also thank Betty Mollesworth Allen, who has introduced me to many of the special plants of the Campo de Gibraltar.

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