

**Distribution of the western European endemic
Centaurium scilloides (L. f.) Samp. (Gentianaceae),
Perennial Centaury**

T. C. G. RICH

*Department of Biodiversity and Systematic Biology, National Museums & Galleries of Wales,
Cardiff CF10 3NP*

S. B. & A. E. EVANS

Glan-y-mor, Dinas Cross, Newport, Pembrokeshire SA42 0UQ

S. MAGNANON & F. HOPKINS

Conservatoire Botanique National de Brest, 52 Allée du Bot, F-29200 Brest, France

F. B. CALDAS

*Departamento de Botânica, Faculdade de Ciências, Universidade do Porto, Rua do Campo
Alegre, 1191, 4150-181 Porto, Portugal*

and

K. V. PRYOR & M. D. LLEDÓ

National Botanic Garden of Wales, Llanarthne, Carmarthenshire SA32 8HG

ABSTRACT

Centaurium scilloides (L. f.) Samp. is a western European endemic occurring in the Azores, northern Portugal, northern Spain, N.W. France, S.W. England and S.W. Wales. It occurs on coastal cliffs, sands, heaths and pastures, and inland in grassland, heaths and scrub. It usually occurs on nutrient-poor, acidic, dry to moist, sandy, stony or rocky soils. It has a long flowering period during the summer, and flowers later with increasing latitude and altitude. It appears to be declining in all areas except northern Spain and the Azores.

KEYWORDS: Altitude, Azores, Latitude, rare species.

INTRODUCTION

Centaurium scilloides (L. f.) Samp. is a western European endemic with a restricted world distribution in the Azores and the Atlantic coasts of Portugal, Spain, France and Britain. In France it is a Red List and legally protected species (Danton & Baffray 1995); it has declined significantly in Brittany, especially inland (Magnanon 2005, in press). In Britain it is now confined to one site, and is regarded as I.U.C.N. category 'Vulnerable' (Evans 1999). Although comprehensive survey data are not available, it appears to be declining in all areas except northern Spain and the Azores.

As part of a collaborative project into conservation of some rare Welsh plants, we have been researching the distribution, conservation biology, genetic variation and ecology of *C. scilloides*. Its world distribution has never been mapped before, and the objective of this paper is to present the first distribution map of this species.

Palhinha (1966) split *Centaurium scilloides* into two subspecies, making the new combination

C. scilloides subsp. *massonii* (Sweet) Palhinha for plants from the Azores. However, the basionym *Erythraea massonii* Sweet is based on plants described (in abbreviated form) by Sweet (1830) as being yellow-flowered, herbaceous perennials which needed growing in a frame as they were not quite hardy. As *C. scilloides* has white (rarely pink) flowers on the Azores and not yellow flowers, it is unclear to what taxon the name *C. scilloides* subsp. *massonii* (Sweet) Palhinha actually refers. In general, Azores plants differ from mainland plants in having white flowers and narrower leaflets, but white-flowered plants have been recorded in Galicia, Spain, and pale pink-flowered plants have been recorded in Cantabria, Spain and Normandy, France. Also leaflet shape is quite variable in some parts of Spain and Portugal. The Azores plants may not merit recognition as a separate taxon and Melderis (1972) did not separate them in *Flora Europaea* (see also Wilmott 1918, 1920; Druce 1919, Stapf 1926 for discussion).

METHODS

Distribution information was abstracted from the literature, U.K. Biological Records Centre, B.S.B.I. Threatened Plants Database, Conservatoire Botanique National de Brest, field work in the period 1997–2004, and from specimens at the following herbaria: **BM, BORD, BRISTM, CGE, CHE, E, FCO, HDD, K, LISFA, MA, NMW, OXF, P, PO, RNG, TBY, TCD** and **TRU** (herbaria abbreviations following Holmgren *et al.* 1990 and Kent & Allen 1984). Information about its habitats and the dates of flowering were also compiled from these sources.

RESULTS

DISTRIBUTION AND HABITATS

Approximately 118 localities were traced; they are summarised in Table 1 and native records mapped in Figure 1. Full details of sources are held by T. Rich and are available on request.

It occurs on all the Azores Islands, where it is scattered to rare (Sjögren 1984; Schäfer 2002, 2003). It grows in moist, moderately exposed places, mostly in relict, open, grassy *Laurus* forests, but also on open coastal rocks, cliffs, ravines and steep, grassy slopes. The altitudinal range is from near sea level to 1000 m, but it is most usually found between 400–700 m altitude. It occurs on a range of substrates from volcanic rock debris to *Sphagnum* hillocks.

In northern Portugal it is probably not uncommon, but no full inventory of sites has yet been carried out. On the coast, it grows on sand dunes, sandy pastures, Atlantic mesophyllous hay meadows and road verges. It is also found in the lower foothills and the upland granite mountain ranges of northern Portugal (such as the Serra de Peneda) in open scrub, grassy places and banks, up to 1000 m altitude or more.

It is reasonably frequent and widespread in north-west Spain. In Galicia, it occurs mainly around the coast in open, sandy ground and pastures, on cliffs and in damp, acidic, sandy places. Inland, it occurs in moist meadows, stream sides, acid pastures and rarely in open *Pinus pinaster* Aiton woodland. In Asturias to the east, it occurs on dunes, sandy coastal pastures and slopes and *Erica* heath, especially near the sea, and rarely inland. At an isolated site near Santander, Cantabria it occurs on gentle, east-facing flushed coastal slopes with *Schoenus nigricans* L. and *Asparagus prostratus* Dumort. The altitudinal range appears more limited in Spain than in Portugal or the Azores.

In northern Brittany, France there are two extant sites known on Côtes d'Armor and 11 in Finistère (Magnanon 2005, in press). Historically it has been known from about 32 sites in total. It mostly occurs inland scattered on road verges, on damp heath, in open *Ulex* or *Pteridium* scrub and open woodland, to 300 m altitude. The soils are generally acidic, dry, stony and nutrient-poor, and are derived from a range of substrates. The vegetation types are *Agrostio setacei-Ericetum cinereae* and *Ulici europaei-Ericetum cinereae*. It also occurs occasionally on the north coast, on rocky and sandy slopes in *Ulici humilis-Ericetum cinereae* and in *Ulici maritimi-Ericetum cinereae* vegetation. In N.W. Normandy (Manche), it is still very locally frequent on cliff-top grasslands, old dunes and edges of coastal paths and pastures, and on the edges of *Ulex* and

TABLE 1. SUMMARY OF LOCALITIES OF *CENTAURIUM SCILLOIDES*, ALL DATE CLASSES.

AZORES

Corvo. Faial. Flores. Graciosa. Pico. Santa Maria. São Jorge. São Miguel. Terceira.

PORTUGAL

Minho: Afife. Arredores de Melgaço, São Gregório. Guimarães. Leça de Palmeira. Matosinhos. Montedor. Paredes de Coura. Ponte de Lima. Porto (Oporto). Póvoa de Lanhoso, Serra do Merouço. Ponte de Bacca Lindoso. Serra da Peneda. Serra do Gerês. Serra do Soajo, Peneda. Terras do Bouro. Vila Praia de Âncora.

SPAIN

Galicia, A Coruña: A Coruña. Camariñas, Cabo Villano. Carnota, O Pindo. Cee, Playa de Gures. El Burgo. La Sinolla. Neda. Península de Finisterre. Playa de Baldayo, Carballo. Punta Candelaria. Punta da Estaca, Beres. Rial. Santiago de Compostela. Vimianzo. Xubia. Zas, Coto do Muiño.
Lugo: Portocello. Ribadeo, Punta del Faro.
Pontevedra: Baiona. Cangas de Morrazo. Mougas. San Martiño, Illas Cíes.
Asturias: Bobia. Boal, Peña de la Mesa. Busto. Castropol. Cudillero. La Caridad. Playa de Cartavío. La Magdalena. Luarca. Navia. Porcía, El Franco. Punta de la Cruz. Figueras. Tapia de Casariego.
Cantabria: Liencres. Playa de la Virgen del Mar, Santander.

FRANCE

Finistère: Berrien. Brennilis. Brest. Guimaëc. Huelgoat. La Roche Maurice. Lanhouarneau. Lannéanou. Le Cloître-Saint-Thégonnec. Locquénolé. Locquirec. Loqueffret. Morlaix. Plonévez-Porzay. Ploudiry. Plouegat Moysan. Plouezoch. Plougasnou. Plougonven. Plouigneau. Ploujean. Saint Herbot. Scrignac.
Côtes d'Armor: Gurunhuel. Lohuec. Loguivy-Plougras. Louargat. Merléac. Saint Briec.
Manche: Auderville. Barfleur. Beaumont Hague. Biville. Cherbourg. Diguilleville. Eculleville. Gréville. Herqueville. Jobourg. Landinez. Omonville-La-Petite. Omonville-La-Rogue. Saint Germain-des-Vaux. Urville-Nacqueville. Vauville.

ENGLAND

Cornwall: Porthgarra. Sandymouth Bay.

WALES

Pembrokeshire: Newport.

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England: Bramshott Common, Hampshire. Cooden and Bexhill, Sussex.
Southborough, Kent.
Ireland: Killarney, Kerry.

Pteridium scrub, and there are about eight extant sites with loss of another five.

In Cornwall, S.W. England, it was recorded on a scrubby cliff top at Porthgarra, St Levan between 1952–1967 and on low, sandy ground in 1956 at Sandymouth Bay; both sites have been searched repeatedly and it is extinct (Margetts & David 1981; French *et al.* 1999).

In Pembrokeshire, Wales, it is locally plentiful on dry, freely-drained sea cliffs, coastal *Erica* and *Ulex* heath, dunes and adjacent pastures over three kilometres of coast near Newport, where it was first discovered in 1918 (Wilmott 1918; Evans 1999). The rocks are mainly slates and shales.

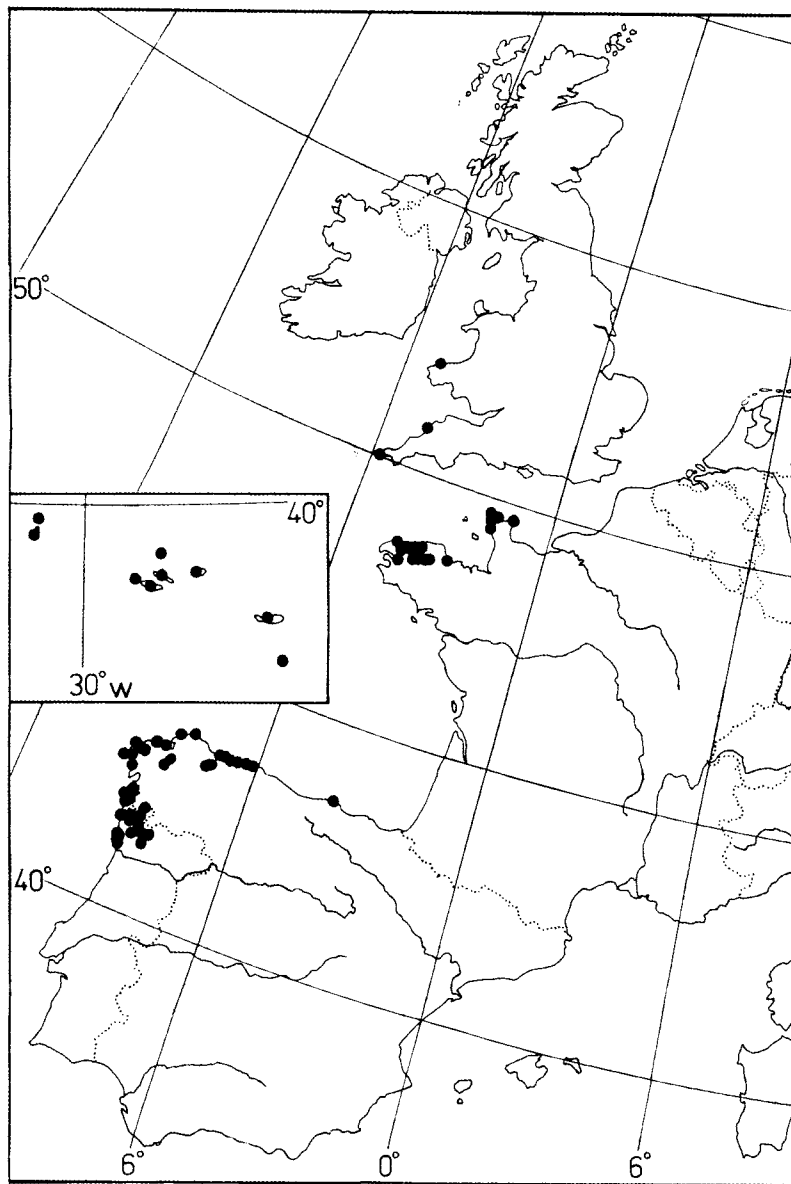


FIGURE 1. Natural distribution of *Centaurium scilloides*. inset Azores.

INTRODUCED SITES

Centaurium scilloides has been in cultivation in Britain since being introduced possibly from the Azores by W. Aiton in 1777, but the original cultivation does not seem to have survived. Pink-flowered plants were introduced from another unknown source(s) through the horticultural trade in 1881 (Stapf 1926). Colonies established in gardens and adjacent banks and verges have been reported from Cooden and Bexhill, East Sussex and Southborough, Kent (Philp 1983; FitzGerald 1987) and Bramshott Common, Hampshire (A. R. G. Mundell, pers. comm. 2003). Bowen (1968) reported it from a lawn at Killarney, Ireland.

VARIATION IN FLOWERING TIME

Excluding duplicates, there were 132 specimens with a full collection date (i.e. day and month), 32 specimens with month only, and c. 55 with year only or undated. It is assumed that the herbarium specimens were collected randomly with respect to flowering time.

The herbarium specimens indicate that overall *C. scilloides* has been collected flowering from April through to October. Within most sites flowering occurs over a period of about three months with a main peak and then lower numbers of flowers continuing as weather conditions allow (e.g. Evans 1999).

When all records with precise dates are correlated against latitude, there is a pronounced cline in flowering time from southern to northern latitudes, as might be expected, with northern plants flowering later (Figure 2; $n = 131$, $r = 0.398$, $p < 0.001$). When only native coastal records from Portugal, Spain, France, England and Wales are included to minimise the confounding effects of climate varying with both increasing altitude and latitude, the relationship is stronger ($n = 86$, $r = 0.625$, $p < 0.001$).

Similarly, flowering dates of coastal and inland specimens from the same latitudes can be compared to separate the effects of increasing altitude. In Portugal where there is a strong altitudinal gradient from the coast to the mountain ranges inland (which reach 1469 m), there is a significant increase (two-tailed t-test, $p < 0.001$) in mean flowering date from 10 June ($n = 13$) for coastal collections to 21 July ($n = 8$) for inland collections, indicating flowering occurs later at higher altitudes. In Brittany, mean flowering dates of coastal specimens (19 July, $n = 32$) are not significantly different from those of inland specimens (24 July, $n = 9$); possible explanations include the smaller altitudinal range and the location of some inland sites at relatively low altitudes (two-tailed t-test, $p > 0.4$).

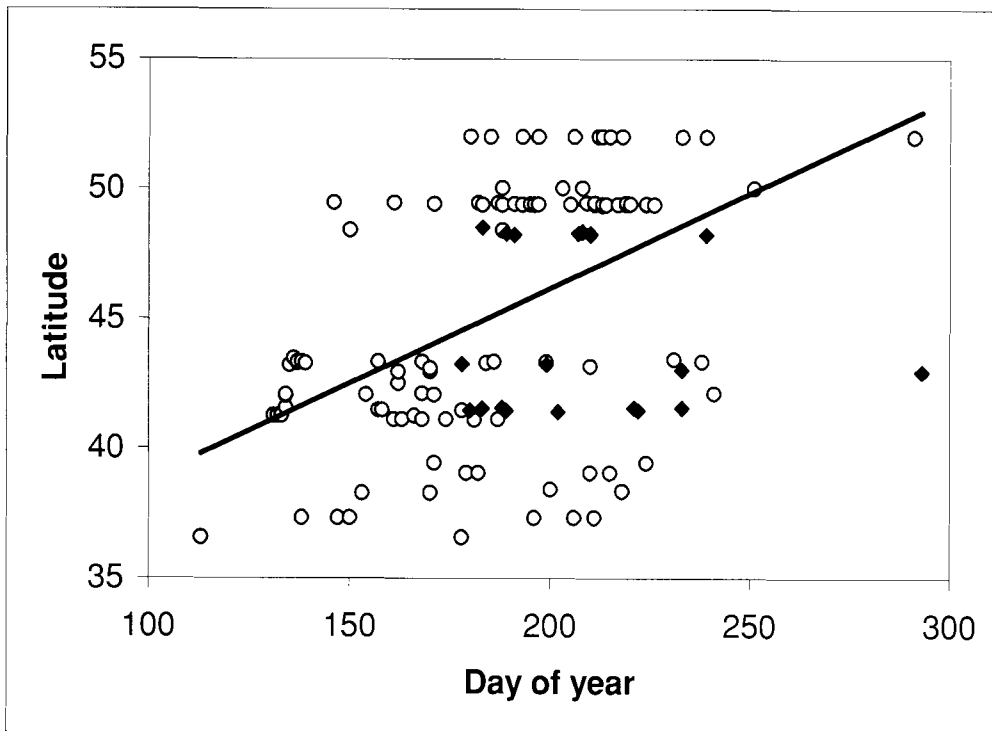


FIGURE 2. Variation in flowering date of herbarium specimens of *Centaurea scilloides* with latitude. 10 April (day 100) to 27 October (day 300). ○ Coastal populations. ◆ Inland populations. Introduced localities not included. A best-fit line is also shown.

DISCUSSION

The distribution of *C. scilloides* (Fig. 1) shows several interesting features. Although this Oceanic species is predominantly coastal, it also occurs inland in the N.W. Iberian Peninsula and Brittany, sometimes to quite high altitudes in the former. This contrasts with the distribution of two other western European endemics with generally similar distribution patterns but which are otherwise exclusively coastal: *Rumex rupestris* Le Gall which occurs in N.W. Spain, N.W. France, S.W. England and Wales (Jalas & Suominen 1994), and *Asparagus prostratus* Dumort. which occurs from N.W. Spain to N.W. Germany, England, Wales and Ireland (Kay *et al.* 2001). Although clearly tolerant of salt spray, *C. scilloides* is presumably either less sensitive to climatic factors such as frost or is a better competitor in the absence of significant soil salinity than these two species.

The distribution may be partly related to climate. The regions where *C. scilloides* grows are characterised by mild winters (January mean temperature of 5–15°C) and temperate summers (mean July temperature of 15–25°C) and an annual rainfall of between 800 and 1600 mm. There is a reasonable correlation between the winter isotherms and the distribution pattern, but not with summer isotherms. Winter temperatures may be important because it is evergreen, and shoots start elongating in the autumn and grow through the warmer parts of the winter, eventually to flower in early summer.

Its habitats can be characterised as being relatively short, open grassland or heathland vegetation on the coast or inland, and more rarely in scrub or open woodland. The soils appear to be generally acidic, nutrient-poor and damp to dry but not permanently wet, and they are generally rocky, stony or sandy. There is also a noticeable change in habitat from moist sites in the Iberian Peninsula to dry sites in Wales.

The distribution has a series of disjunct populations, some with large clusters of records (e.g. N. W. Iberian Peninsula and N.W. France), and others where it is scattered or rare (Cantabria, England, Wales). This pattern could be relict from a more continuous distribution earlier in this interglacial but is more likely to be indicative of re-colonisation from a few glacial refugia, as once established in an area it seems to grow well and colonise a range of habitats. The pattern may thus result from dispersal from the well-established populations in areas with suitable habitats to the smaller, more recently colonised sites. This pattern of expansion of range is now being fragmented through loss of populations due to man-induced changes of habitats (e.g. losses in Cornwall and Brittany).

Its seeds are tiny (c. 0.3–0.4 mm), subglobose and have a deep reticulate surface pattern. Beyond being shaken out of the sides of the capsules after they split, the seeds have no obvious dispersal mechanism. Gentianaceae seeds in general are usually dispersed by the wind, rarely by water or animals (Bouman *et al.* 2002). *Centaurium scilloides* seeds float readily in water by surface tension and are difficult to wet, which could allow dispersal by the sea provided they are tolerant of salt water. Schäfer (2003) regards the seeds as both wind- and water-dispersed.

Genetic analysis may clarify the re-colonisation history after the last glaciation, as has been shown for the northward spread of *Cakile maritima* Scop., *Carex arenaria* L. and *Eryngium maritimum* L. along the coast (Clausing *et al.* 2000, Jonsson & Prentice 2000). It may also clarify the relationship between the Azores and mainland European plants; the fact that, within the predominately pink-flowered genus *Centaurium* occasional albino forms occur sporadically in many species, suggests that the Azores plants are derived from mainland populations and not *vice versa*.

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