Lost and found in the Greek flora

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Mediterranean-type ecosystems

The five mediterranean-type areas in the world – the Mediterranean basin, California, central Chile, the south-western Cape of South Africa and south-western Australia – are well-known hotspots of plant species diversity and endemism. In very general terms they are characterised by a climate with hot dry summers and cool wet winters – the climate of olives groves, vineyards and citrus orchards. Most of the areas are mountainous with a great diversity of local climate, bedrock and soil. The native vegetation is generally dominated by evergreen, hard-leaved shrubs and feature a number of bulbous and tuberous plants. The northern hemisphere areas and the Mediterranean basin in particular have a high percentage of annuals, often associated with disturbed or manmade habitats. The floras are old *in situ*, and extensive speciation has taken place, resulting in a large number of local and regional endemics some of which can be classified as threatened or vulnerable.

In South-west Asia and the Eastern Mediterranean area transformation of the natural landscape through agriculture and domestication of animals such as cattle, sheep and goats started at least 8,000 years ago. Great civilizations like the Minoan one in Crete developed some 4,000 years ago and by that time agriculture and animal husbandry was already well established. The long and gradual process up to the present day has had profound influences on the natural flora and vegetation, resulting in a complex small-scale mosaic of natural, semi-natural and manmade habitats. In the other four areas of the world with mediterranean-type climate and vegetation the history of human influence is radically different. The aborigines of Western Australia and the native peoples of the south-western Cape walked with light steps on earth, leaving few traces. Agriculture and domestic animals were introduced with European colonization which in the case of Western Australia was as late as 1828. Almost from one year to the other huge areas were cleared for agriculture, mainly cultivation of wheat, and domestic animals, mainly cattle and sheep, were introduced.

Differences between the five areas

In southern Greece, e.g. in the Peloponnese and the Aegean islands, agriculture was old already in classical times. Ancient thrashing floors and disused terraces are frequently found in the hills; some of them may have been used continuously for thousands of years, the surrounding hillslopes being deforested and turned into garigue. A picture from the wheat belt of Western Australia is radically different. Huge areas of flat, sandy ground have been cleared for mechanised agriculture and the few eucalypts still standing are rather an exception.

Although the mediterranean-type areas of the world have some general features in common, there are distinct differences in the patterns of plant species diversity. Species numbers are high to very high in all five regions. Areas with a mediterranean-type climate in the countries bordering the Mediterranean Sea may have a total of 20,000 species of vascular plants, although precise figures are difficult to establish since published Floras and checklists are generally based on politically defined geographical units such as countries or provinces. Greece – a medium-sized country with a land area of some 132,000 km^2 – is home to about 5,800 native species of vascular plants, but many of these are referable to Central European or other phytogeographical elements. In the Cape floral kingdom, an area of only some 90,000 km^2, the figure is even higher, maybe 8,000 native species, making it one of the true botanical hotspots in the world. The mediterranean south-western corner of Australia is somewhere in between, with perhaps 7,000 native species. All mediterranean areas have a high percentage of species with small distribution areas – local or regional endemics.

As mentioned, the history of human impact through agriculture is radically different in the five areas, and this is presumably the decisive factor underlying differences in the weed flora and generally in the percentage of annual species. In lowland areas in countries such as Greece, Italy and Spain, annual species often make up c. 50 per cent of the flora. It is perfectly possible that many of these Mediterranean annuals, which are mostly associated with disturbed habitats, were originally introduced from areas of steppe and semi-desert in South-West Asia, but if so, this happened long before there are any records of it. It is a striking feature of the weed flora of the other four areas in the world with a mediterranean-type climate, that most species have been introduced from the Mediterranean basin. This is very typically so for Western Australia where agriculture has the shortest history. There are few native annuals in the flora of south-western Australia. Further inland, in the semi-desert outback, there are indeed annual members of Asteraceae, Goodeniaceae and many other families but they stood little chance in the competition with aggressive invaders from the Mediterranean basin whose genotypes had been adapted to manmade landscapes through thousands of years of selection. In many temperate areas of the southern hemisphere and particularly on oceanic islands the weed flora has a distinctly European character. A striking example is New Zealand where European weeds have taken over completely even in mountainous area with moderate disturbance mainly by sheep grazing. *Echium vulgare*, for instance – a European species not regarded as a troublesome weed in its native land – covers huge areas in the hill country in the northern part of the South Island.

There are few examples of overseas weeds in the flora of the Mediterranean basin, but a few may be mentioned. *Oxalis pes-caprae*, a species introduced from South Africa, is abundant in southern Greece, painting the olive groves yellow in early spring. Having been around for a couple of centuries and spreading aggressively by means of vegetative propagules it has presumably reached its climatically determined distribution area, being common in the lowland south (even on small islands) but lacking in the north and in the mountains. *Solanum eleagnifolium*, a South American species introduced as late as c. 1940, is spreading aggressively along roads and even invading cultivated fields and semi-natural vegetation.

As a result of wholesale destruction of natural habitats a fairly large number of species in areas such as the Cape Flats east of Cape Town and the wheat belt of SW Australia have gone extinct or survive in tiny, fragmented and threatened populations. As we shall see, the situation is rather different in Greece with few known extinctions and relatively few seriously threatened species.

Botanical exploration of Greece

Modern botanical exploration of Greece, if by that we mean the time after Linnaeus, started with the Oxford professor John Sibthorp who in 1786-87 collected the material for the magnificent *Flora Graeca* which appeared after his death in 10 folio volumes featuring nearly 1,000 hand-coloured copper engravings. The mid-19th century was the golden age of botanical exploration in Greece. Two of the leading figures were Theodor von Heldreich and Thoodoros Orphanides. Heldreich, a botanist of German origin, arrived in Greece as a young man in 1843 and stayed until his death in 1902, exploring throughout the country and collecting some 700 new species. His Greek contemporary Orphanides travelled in many remote mountain areas and made several spectacular discoveries. By the turn of the century, Halácsy's *Conspectus Flora Graeca* appeared in three volumes, summarizing floristic knowledge for the country up to that time.

Plotting the number of new taxa and new combinations per decade from the time of Linnaeus to the present we can observe some conspicuous peaks and valleys (Table 1). An all-time low occurred just after the Second World War, but interestingly there is a new surge in floristic and taxonomic activity from c. 1965. Extrapolating data we find that 12-15 new species and subspecies per year have been described over the last 30-40 years – a high figure for a European country. Most of them are local endemics or species in previously neglected groups. One of the leading collectors of the mid-20th century was Karl Heinz Rechinger, later coordinator of the great *Flora Iranica* project.

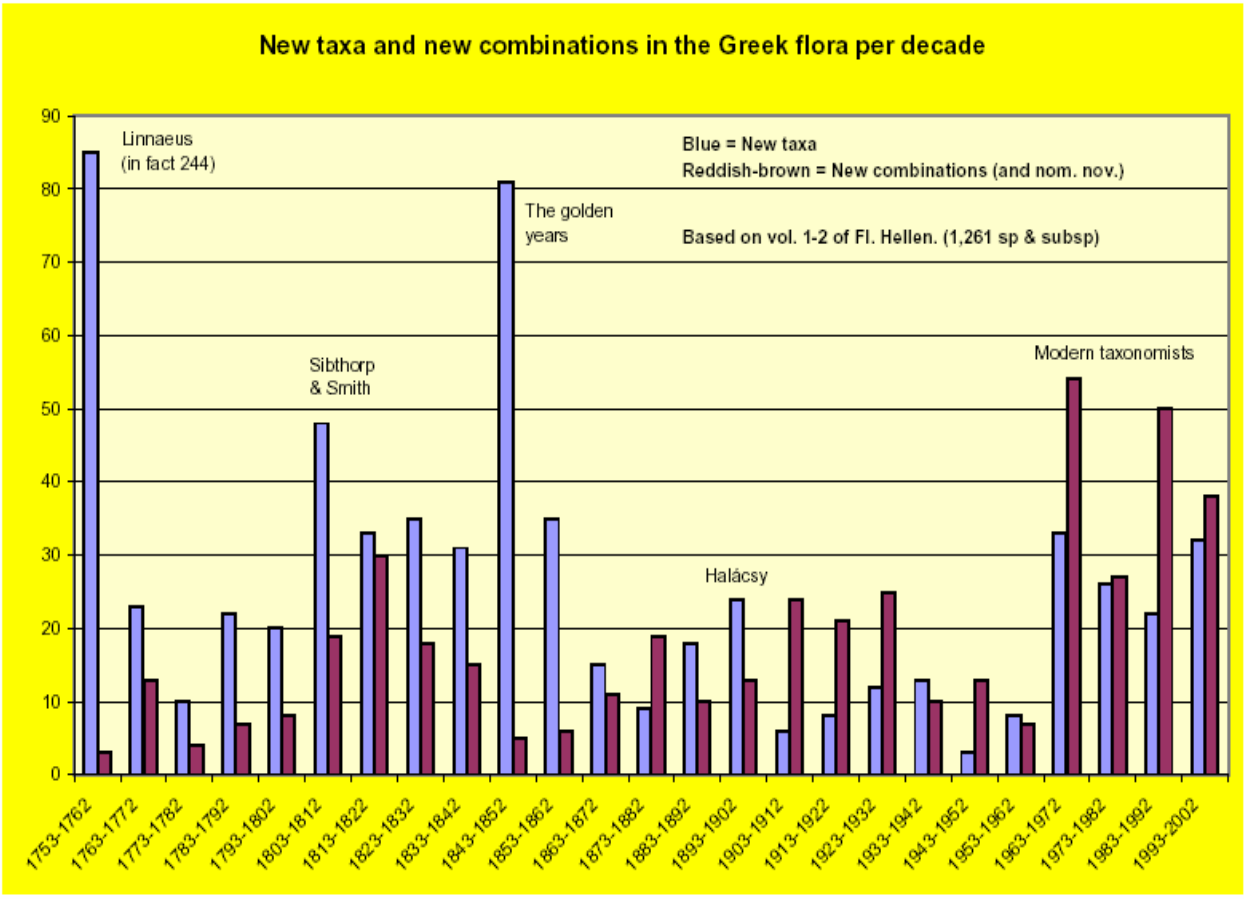

Table 1. Number of new taxa and new combinations in the Greek flora from Linnaeus to the present.

Intensive floristic exploration has taken place in Greece over the past 40-50 years, particularly in the mountains and islands. A database established in connection with the *Flora Hellenica* project now comprises 684.000 records, all with detailed data including geographical coordinates, on the collection or observation of a plant species somewhere in Greece. In the *Mountain Flora of Greece*, which was published in two volumes in 1986 and 1991, we had six or seven species which had not been observed for 100 years or more and were listed as presumably extinct. I am happy to report that all have now been rediscovered, and so have a number of supposedly lost lowland species.

Species lost and found

The following are a few case histories of species believed to be extinct but recently rediscovered:

(1) *Astragalus idaeus*, a low, grey-leaved and yellow-flowered perennial, was collected in Crete by Heldreich in 1846. Although hundreds of botanists have visited Crete it was not rediscovered until 2002, presumably in the original locality – a remote mountainside – where the total population comprises a few hundred individuals.

(2) *Centaurea musarum* ("knapweed of the muses") was found by Orphanides in 1854 on Mt Parnassos above the archaeological site of Delphi, where it was rediscovered in 1995. It is a distinct and taxonomically isolated species apparently confined to a single limestone rock with a total of perhaps 200 individuals. This species as well as the previous were rediscovered by the intrepid Greek field botanist Dionysios Vassiliades.

(3) *Bongardia chrysogonum*, an herbaceous tuberous member of the Berberidaceae, grows in steppic areas and ploughed fields in C and SW Asia. In 1987 the present author discovered it in a small field in the northern Peloponnese, far from its nearest localities in eastern Turkey. The only previous Greek record dated back to 1822 and is dubious, probably resulting from confusion with the superficially similar *Leontice leontopetalum*.

Figure 1. Fritillaria sibthorpiana*, a lost and rediscovered species 219 years between the pictures. Left* Fritillaria sibthorpiana*.* Flora Graeca *tab. 330 (1823). Illustration by Ferdinand Bauer based on a specimen collected by Sibthorp 30.3. 1787 at Porto Cavaleri [near Akyar Burnu], SW Anatolia. Right:* Fritillaria sibthorpiana*. Rediscovered after 185 years by Runemark & Wendelbo in same area (C2 Mugla: Pass SW of Bozburun). Cultivated in Göteborg Botanical Garden, phot. 23.4. 2006.*

(4) In 1787 John Sibthorp and the artist Ferdinand Bauer were travelling by ship from Constantinople to Cyprus. In south-west Anatolia opposite the Greek island of Rodhos they landed at a place known as Porto Cavaleri, and on March 30 they collected a *Fritillaria* which was drawn by Bauer and later described as *Fritillaria sibthorpiana*. It is a distinct species which was never found again until 1972 when two Scandinavian botanists, Hans Runemark and Per Wendelbo, travelled in the area. At or very near locus

classicus they rediscovered the enigmatic *Fritillaria sibthorpiana* which is still cultivated in our garden (Fig. 1).

Conclusions

We may conclude that few if any of the rare and local species of natural and semi-natural habitats in the mountains have gone extinct in the last 100-150 years. Some may be threatened simply by being very rare and occurring in small populations – such as examples 1 and 2 above – but human impact is limited and fairly constant. Shepherds are grazing their flocks of sheep and goats just as they did 100 years ago, but the plants can cope unless there are major disturbances such as mining or construction of large skiing resorts. Local endemics are not necessarily threatened. The famous *Jankaea heldreichii*, for instance, one of the few European members of the Gesneriaceae, is confined to Mount Olympus but is found in large quantity on inaccessible limestone rocks. No amount of collecting or other conceivable disturbances could threaten the survival of this local endemic – which was listed in one IUCN publication as a prime example of a rare and critically endangered species.

There are indeed a few species in Greece which are presumably gone for ever. A fairly typical example is *Astragalus graecus*, a yellow-flowered perennial 40-50 cm tall, once common as a weed in cereal fields in Attica. It was frequently collected and every major European herbarium has several sheets of it. It was last seen in 1947. Scientific collecting was certainly not the reason for its decline, but changing agricultural practices, particularly deep ploughing, as well as the spread of metropolitan Athens.

Weeds of agriculture, especially perennial ones, are often declining and threatened. A spectacular example is the red tulip *Tulipa undulatifolia* which was common in wheat fields of Attica and the Peloponnese, but has now disappeared except in a few places where it is deliberately protected by local farmers managing selected fields by old-fashioned methods. It flowers around Greek National Day (March 25) and is then picked in large quantity for decorating churches and homes.

A number of species adapted to other lowland habitats such as sandy beaches, salines and freshwater swamps are also in jeopardy. They include some local endemics such as *Consolida arenaria* and *Verbascum syriacum* from sandy beaches on the island of Rodhos, an area subject to much development of tourist facilities. Even if most of the species of such habitats are fairly widespread they are often similarly threatened throughout their range.

Redlisting taxa for individual countries or provinces, although politically correct, is of little scientific value. Every species, even the most common and widespread, will be rare somewhere on the far side of an invisible line in the terrain. Consequently, all the world's redlists taken together will comprise most of the world's flora. Interest should focus on species, not countries or other politically defined entities. Conservational measures should be based on intimate knowledge of the species in the field throughout their range of distribution, not on mechanically compiled lists. The term *endemic* should be abandoned and replaced by *range-restricted*, for instance defined as species with less than 500 km distance between the furthest points of occurrence – regardless whether the distribution area is confined to one country or cuts across national borders.