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Comparison of the vascular flora of the Mediterranean Peninsulas on the basis of distribution mapping

Abstract

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The overall distributions of the vascular plant floras of the Iberian, Apennine and Balkan Peninsulas are compared by using the data of 2023 indigenous species and subspecies from volumes 1-12 of *Atlas Florae Europaeae*. The floras of the peninsulas have clearly different overall distribution patterns. Some details of these patterns are discussed.

Introduction

Atlas Florae Europaeae (*AFE*) is a project for mapping the distribution of vascular plants in Europe. The principal aim of the project has been supplementing the taxonomic information of *Flora Europaea* by detailed distribution maps and additional taxonomic and floristical notes. The first volume appeared in 1972 and since then 3270 maps have been published in 12 volumes, completely covering the first volume of *Flora Europaea* (*Lycopodiaceae – Platanaceae*), which includes more than 20% of the European vascular plant flora. All the distribution maps published in *AFE* volumes 1 to 12 were made by hand. The construction of the *Atlas Florae Europaeae* database was started in 1992. The primary goal of the creation of the database was to make the distribution data available in digital format to be used in various studies and projects (e.g. Euro+Med PlantBase) and to further distribution analyses of the taxa (e.g. Humphries & al. 1997). An additional goal was to facilitate the editorial work of final maps from data provided by the Regional Collaborators (Lahti & Lampinen 1997). The chorological data are inserted into the map with squares of ca. 50 x 50 km, based on the Universal Transverse Mercator (UTM) projection and the Military Grid Reference System (MGRS). The special mapping symbols have been adopted to indicate the status of the taxa in each grid cell (see the home page of *Atlas Florae Europaeae*).

Methods

Using the *AFE* database we compared distributions of vascular plants of three

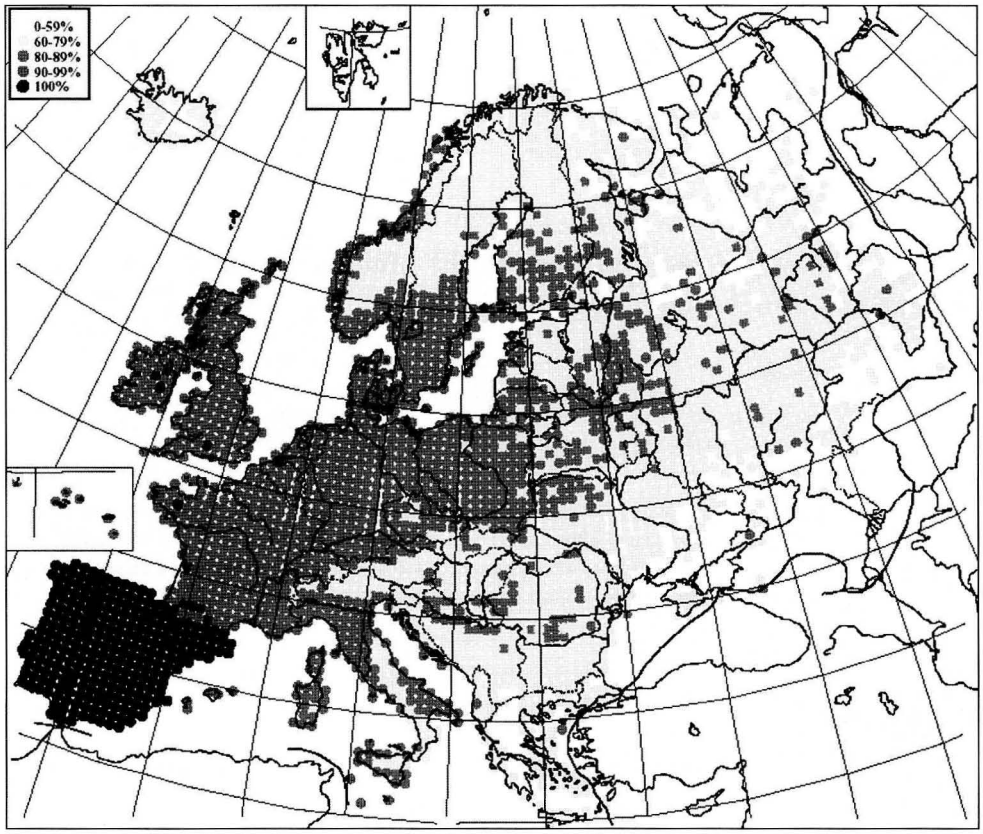

Fig. 1. The overall distribution in Europe of the flora of the Iberian Peninsula.

Mediterranean peninsulas: the Iberian Peninsula (Spain without the Balearic Islands and Portugal without the Azores), the Apennine Peninsula (Italy without Sardinia and Sicily) and the Balkan Peninsula (Albania, the former Yugoslavia, Greece without Crete, Bulgaria and Turkey-in-Europe, and also Romania). Altogether 2530 indigenous species and 931 infraspecific taxa were included, and they compose volumes 1–12 of *AFE*. The maps contain a total of 660936 grid cell records. In total 2023 species occur in the above-mentioned peninsulas. Introduced taxa and uncertain records were omitted from this study.

Next step was to score indigenous taxa of each peninsula. On the basis of these data, we produced a map, covering all species of each peninsula, and which displays their overall distribution in Europe. The number of taxa recorded in a grid cell often less depicts the real number of taxa than the botanical activity within the area. In order to get more comparable figures, we used proportional numbers of taxa instead of an absolute number by dividing the number of peninsula taxa by the total number of taxa recorded in a grid cell. Moreover, we omitted grid cells which had less than 10 indigenous species records (in Figs 1–3 visible as white gaps within the *AFE* area). A very low number of records (often of most widespread and common taxa) in a grid cell often distorts its floristic similarity with another

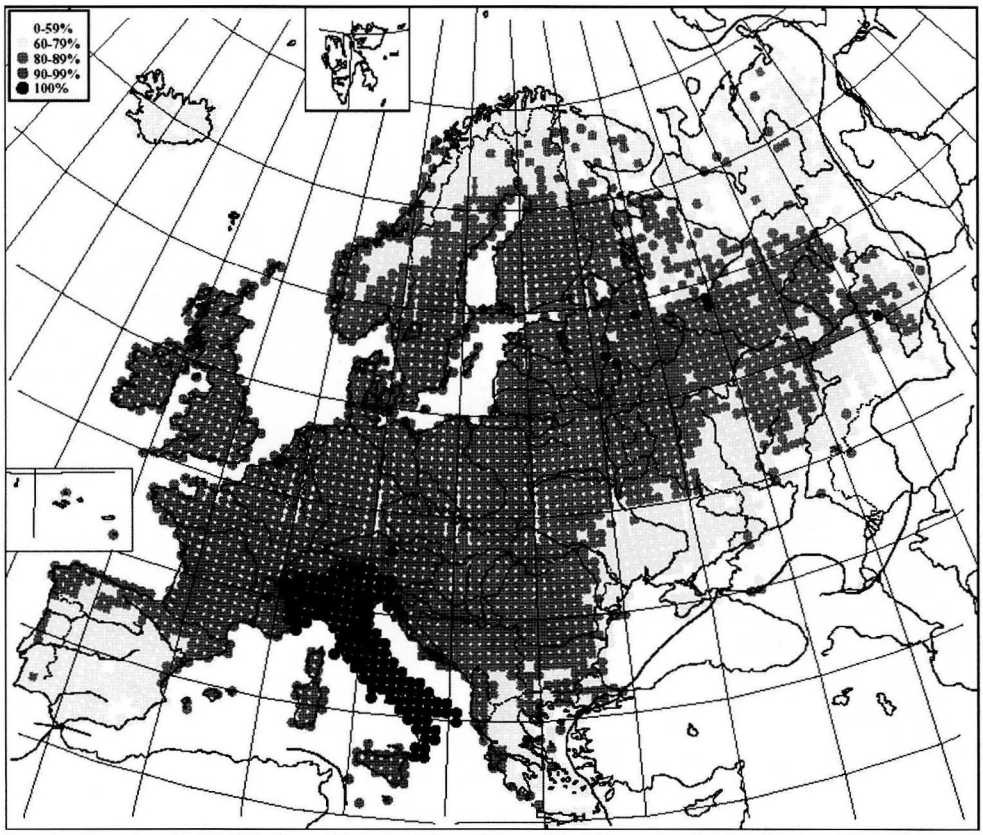

Fig. 2. The overall distribution in Europe of the flora of the Apennine Peninsula.

area.

The results of these calculations were used for the distribution maps (Figs 1–3) which was constructed with the aid of Dr. Alan Morton's DMAP for Windows software package (version 7.1). These calculations were done in order to compare the phytogeographical and the floristic affinities of the flora of each peninsula by utilizing the available *AFE* data.

Results and discussion

The overall distributions of the Peninsula floras show fairly different patterns. These in general correspond well with results obtained by other methods.

The vascular plant taxa of the Iberian Peninsula are common in West Europe up to the Danish and South Norwegian west coast (Fig. 1). The flora of the peninsula shows a strong affinity with the Atlantic Province and a weaker affinity with the Central European and Mediterranean Provinces. Some black grid cells in the western part of France and even in Great Britain and Ireland indicate very similar flora as to the Iberian Peninsula (cf. Dupont 2001). Iberian taxa seem to be less common in the Balkans than in the Apennine Peninsula. The

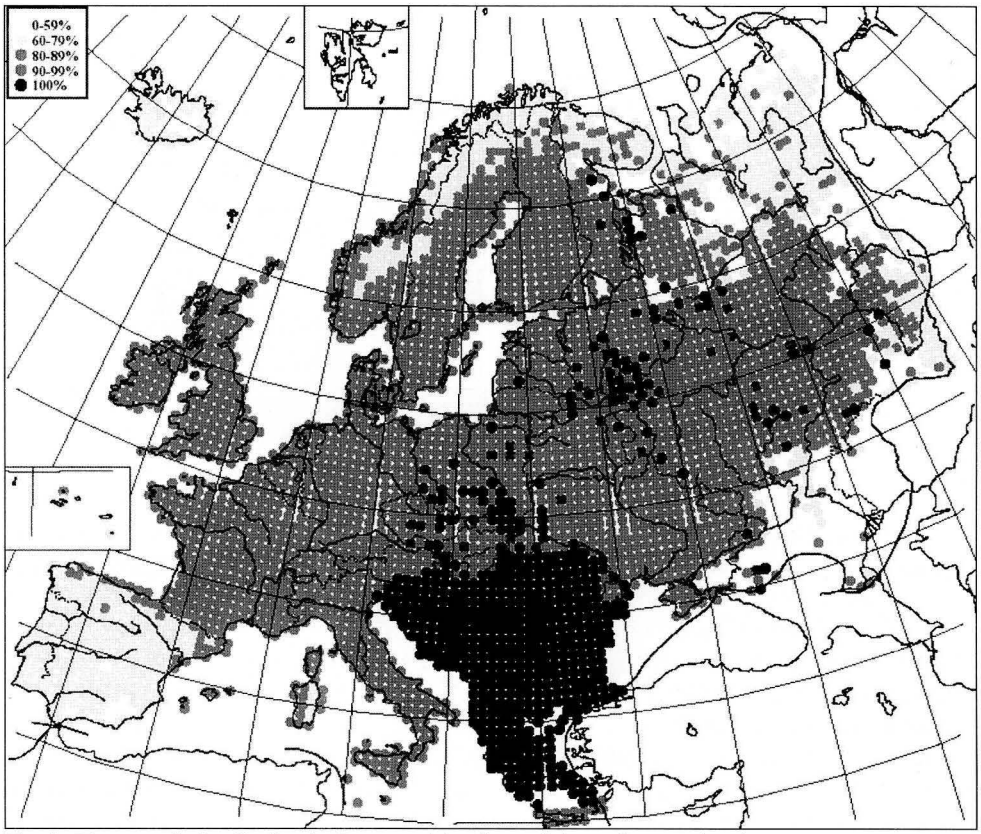

Fig. 3. The overall distribution in Europe of the flora of the Balkan Peninsula.

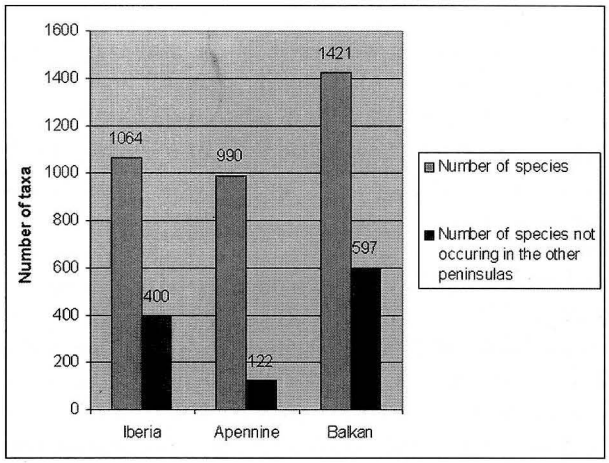

Fig. 4. The species diversity in three Mediterranean peninsulas, according to *Atlas Florae Europaeae* vols 1-12.

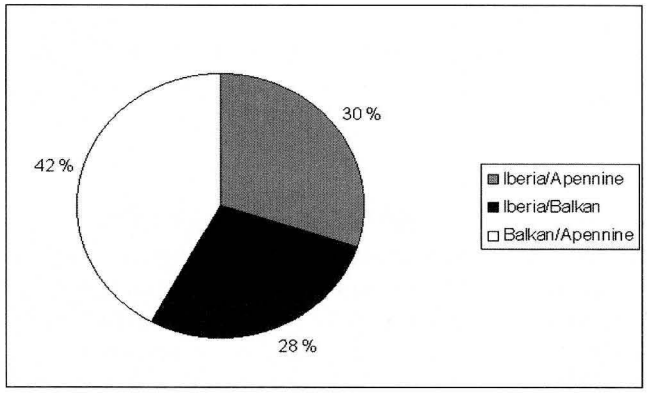

Fig. 5. Number of common species in three Mediterranean peninsulas, according to *Atlas Florae Europaeae* vols 1-12.

lower percentage of Iberian taxa in northern areas may indicate less diverse montane and alpine flora in the Iberian Peninsula than in the Apennine and Balkan Peninsulas (cf. Väre & al. 2003).

Plants of the Apennine Peninsula are dominating in the southwestern and southern Alps (Fig. 2), largely because of the common mountain flora of the Alps on both sides of the Italian border. Floristically Sicily and Corsica seem to be more closely related to the Apennine Peninsula than Sardinia. On the other hand, Sardinia has more similarities with the Iberian Peninsula. The Apennine Peninsula has a quite clear floristic affinity with the Central European Province and the Dinaric Alps, but a weaker affinity with the Atlantic Province. Even the floras in several boreal areas have much in common with the flora of the Apennine Peninsula. On the other hand, the Apennine plants are relatively poorly represented in the floras of central and southern Spain, Portugal and Greece, as they are in vast areas in eastern and northern Europe.

The list of Balkan plants contains 1421 species, and their distribution over Europe is extensive not only in the Central European and Boreal Provinces, but also in the Apennine Peninsula (Fig. 3). They are less common in the Iberian Peninsula as well as near the eastern border of Europe, although in the east they are not so clearly found as are Apennine and Iberian plants. Balkan taxa are very common for instance in the Tatra Mts and the Vladayskaya uplands east of the Baltic countries. Even in the northern and eastern parts of Russia there seems to be areas with a close affinity with the Balkan flora (e.g. the Volga uplands). The number of records per grid cell, however, is much lower there (especially in northern Russia, where it is usually less than 50) than for instance in Central Europe, which make the results less reliable.

Of the three South European peninsulas the Balkan Peninsula is the richest in vascular plant taxa, but it also covers the most extensive area (Fig. 4). It has also more of its "own taxa" (42%), i.e. taxa, which are not encountered in the other peninsulas. These "own taxa" include endemics, but most of them belong to more or less widespread taxa in other parts of Europe and non-European Mediterranean countries. The Iberian and Apennine Peninsulas are similar in species number (1064 and 990, respectively), but the Iberian

Peninsula has much more "own taxa" than the Apennine Peninsula (37,6% vs. 12,3%). Floristically the Balkan and the Apennine Peninsulas have a closer affinity than either the Balkan and the Iberian or the Iberian and the Apennine Peninsulas (Fig. 5).

Conclusions

Our results clearly indicate that the Iberian vascular plant flora differs more clearly from the floras of the Apennine and the Balkan Peninsulas in its overall total distribution and common taxa, whereas the Apennine and Iberian floras are more similar in these respects.

However, a low number of records in many grid cells, both in some parts of the peninsulas, e.g. Greece, and especially in the vast area of Eastern Europe, are indications of lower botanical activity. This makes our floristic comparisons more uncertain in those areas. Despite this unevenness the *AFE* database offers new possibilities to compare floristical patterns and to study phytogeographical affinities in various parts of Europe. For instance, even the results of this study indicate that comparisons of the big Mediterranean islands should be interesting. Moreover, the database allows analyses of distribution patterns of related genera and families, which may throw additional light on evolutionary processes.

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