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The boreal and central European element in the forest flora of Greece

Abstract

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The southernmost occurrences in Greece of selected vascular plant species associated with woodlands of beech, fir and spruce in C. and N. Europe are discussed. Preliminary maps of the Greek distribution are given for *Aegopodium podagraria, Allium ursinum, Corallorhiza trifida, Galium odoratum, Lamium galeobdolon, Luzula luzuloides, L. sylvatica, Milium effusum, Orthilia secunda, Paris quadrifolia, Prenanthes purpurea,* and *Salvia glutinosa.*

Introduction

The land surface of continental Greece is far from being isolated from adjacent parts of S.E. Europe by effective, W.-E. orientated geomorphological barriers. Mountains, lowlands and N.-S. running stream valleys allow free exchange and migration of organisms from and to non-mediterranean areas in the north. The dinaric-pindic high mountain system, in particular, forms an uninterrupted connection between the southern part of the Balkan peninsula and C. Europe, which was an important factor during the period of postglacial restoration of European forest vegetation (Hammen 1965, Messerli 1967, Bottema 1974, Horvat & al. 1974, Athanasiadis 1975, Pott 1992). The mediterranean-type climate, however, actually limits regional southward distribution in N. and C. Greece for many plants which are widespread in C., W. and N. Europe but not adapted to pronounced summer aridity.

Montane *Fagus-Abies-Picea* woodlands and various types of wetland habitats are those favourable niches in Greece where summer draught is sufficiently compensated by micro- and mesoclimatic effects and where most of the "northern" elements of the Greek flora are therefore concentrated. This applies first of all to arctic-alpine plant species from above the timberline in Greece, which have been treated recently by Strid (1986) and Strid & Tan (1991) and are not under consideration here. In what follows, the occurrence in Greece of selected forest plants of a boreo-montane and subatlantic-submediterranean chorotype is discussed, and comments are offered on their presently known

southern distribution limits on the Balkan Peninsula. Some of these species are rare in Greece and should be included in a Red Data list of the country.

Material and methods

The Greek distribution, and especially the southern boundaries, of selected woodland species have been critically compiled from the floristic literature, and preliminary dot maps have been drawn. A few of the author's unpublished collections were added (herbarium material in B). The following publications were used as sources of floristic data: Ade & Rechinger 1938; Akeroyd & Preston 1981; Aldén 1976; Barbero & Quézel 1976; Beauverd & Topali 1937; Bergmeier 1988, 1990a-b; Boratyński & al. 1990; Bornmüller 1928; Dafis 1966; Drossos 1977; Economidou 1969; Eleftheriadou 1992; Franzén 1980; Gamisans & Hébrard 1980; Ganiatsas 1938, 1955; Georgiou 1988; Goulimis 1956, 1960a-b; Greuter 1977; Gustavsson 1978a-b; Halácsy 1900-1904, 1908, 1912; Hansen 1982; Hartvig 1978; Haussknecht 1893-1899; Karagiannakidou & Kokkini 1988; Kitanov 1943; Knapp 1965; Maire & Petitmengin 1908; Markgraf-Dannenberg 1976; Mattfeld 1927; Papanicolaou 1985; Pavlidis 1976, 1982, 1985; Phitos 1962; Phitos & Damboldt 1985; Quézel 1967, 1969; Quézel & Contandriopoulos 1965a-b, 1968; Raus 1979a-b, 1980, 1983; Rechinger 1936, 1939, 1943, 1949, 1961; Regel 1943; Rothmaler 1944; Stefanov 1921; Stojanov & Jordanov 1938; Stojanov & Kitanov 1944, 1950; Strid 1976, 1978, 1980, 1986; Strid & Franzén 1982, 1984; Strid & Papanicolaou 1981; Strid & Tan 1991; Turrill 1938; Vandas 1909; Voliotis 1967, 1976, 1979, 1981a-c, 1982a-b, 1983a-b, 1984, 1988, 1990; Zaganiaris 1938-1940; Zahariadi 1973; and Zoller & al. 1977. Highly improbable records or localities (given, e.g., by Smith 1806-1816, Zaganiaris l.c., and others) have been excluded for mapping purposes. Information concerning the total range of the species discussed is taken from Meusel & al. (1965, 1978), Meusel & Jäger (1992), Jalas & Suominen (1973-1991), and Hultén & Fries (1986).

Chorotypes allied to *Fagus sylvatica*

The beech (*Fagus sylvatica* L.) has a mainly C. European distribution range with a strong subatlantic-submediterranean tendency and a sharp limit towards the continental and boreal parts of Europe (Meusel & al. 1965: 121, Jalas & Suominen 1976: 66). The Greek woodlands made up predominantly of beech have been exactly mapped by Moulopoulos (1965). In Greece, *Fagus sylvatica* occupies moisture-exposed, predominantly siliceous mountain habitats where a negative water balance is restricted to a period of not more than 1-2 months (around August) and the annual precipitation is considerable (see climate diagram in Bergmeier 1990b: 31). The southernmost beech localities in Greece are found on Mt Oxia in S. Pindhos and on Mt Pilion in E. Thessaly.

In C. Europe, *Fagus* communities form two principal ecological wings, a first one on soils rich in nutrients with a central community-type called Asperulo-Fagetum, and a second one on acid soils poor in nutrients, with the Luzulo-Fagetum as the relevant central phytocoenological unit (Ellenberg 1988, Oberdorfer 1992). How do the syntaxo-

nomically name-giving herbs, *Galium odoratum* (L.) Scop. (= *Asperula odorata* L.) and *Luzula luzuloides* (Lam.) Dandy & Wilm., chorologically behave in Greece, along the south-eastern distribution limit of European beech woodlands?

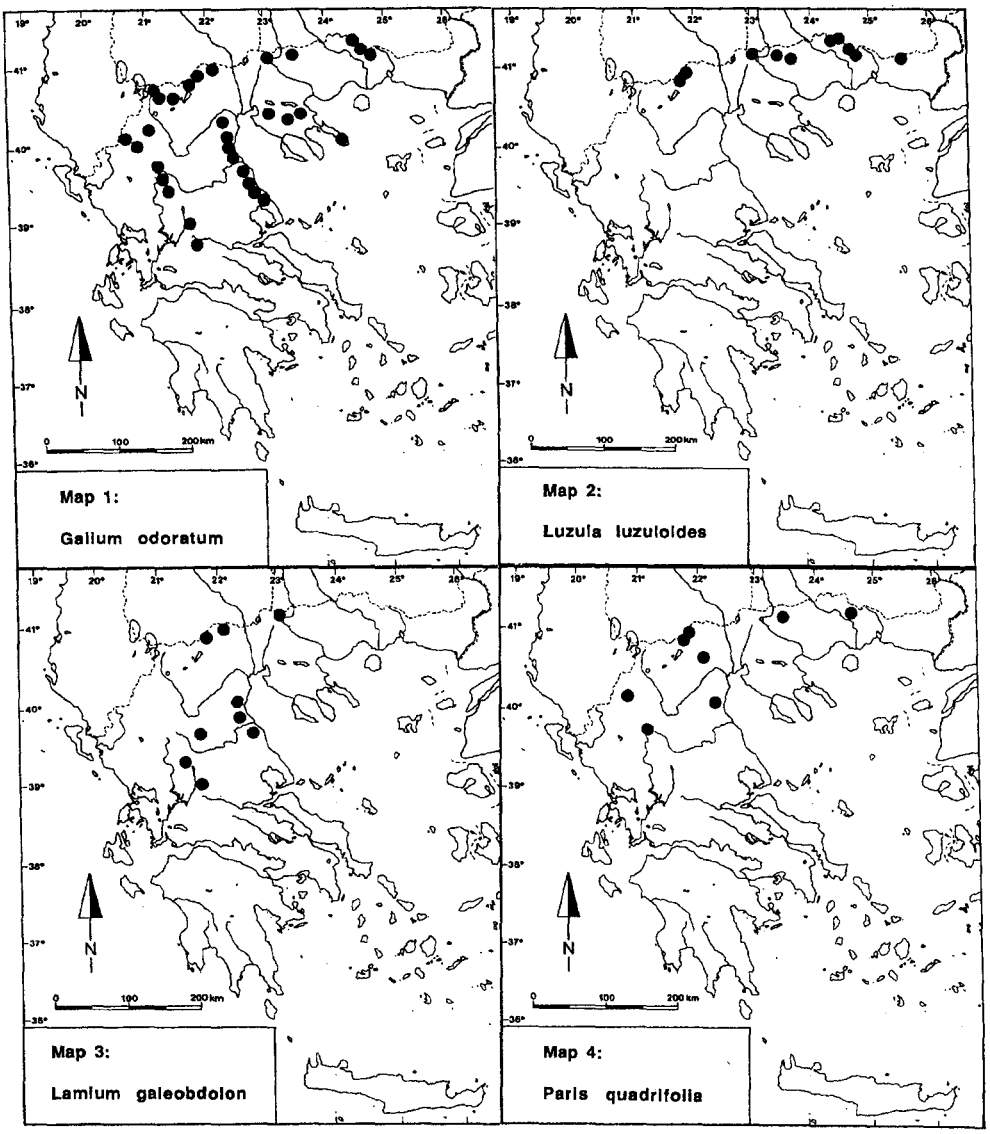

Fig. 1. The known Greek distribution of *Galium odoratum* (Map 1), *Luzula luzuloides* (Map 2), *Lamium galeobdolon* (Map 3), and *Paris quadrifolia* L. (Map 4).

Galium odoratum exhibits, in Europe, a temperate total range with a strong oceanic-submediterranean tendency (similar to *Fagus*). Beyond this it occurs somewhere in the C. Asian mountains and in temperate E. Asia (Meusel & Jäger 1992: 423, Hultén & Fries 1986: 759). In Greece it is, chorologically speaking, a faithful *Fagus* follower, going south to Mt Oxia and to Mt Pilion (see Map 1), but occasionally it settles also in other types of deciduous woodland or even in *Abies cephalonica* or *Pinus nigra* stands at 800-2000 m of altitude, on calcareous as well as non-calcareous substrates, mostly along streams or in moist places within the forests.

On the contrary, *Luzula luzuloides*, with an "exact" C. European primary distribution (Meusel & al. 1965: 87, Hultén & Fries 1986: 83) and a phytocoenologically diagnostic value for species-poor, non-calcareous *Fagus-Abies* communities (Oberdorfer 1990), does not follow *Fagus* down to C. Greece but stops at the northern border of the country (see Map 2), growing there in open forests and on meadows, often around the actual timberline between 1700 m and 2000 m. Both subspecies (*L. luzuloides* subsp. *cuprina* (Asch. & Graebn.) Chrtek & Křísa, and subsp. *luzuloides*), as well as intermediate forms, are reported from northernmost Greece (Strid & Franzén 1982: 23).

A typical C. European species, and at the same time a character species of Fagetalia communities in Europe, is *Lamium galeobdolon* (L.) L., in Greece represented by the tetraploid *L. galeobdolon* subsp. *montanum* (Pers.) Hayek and ecologically indicating fresh soils with good nutrient conditions. The distribution map of Meusel & al. (1978: 376) shows a single dot for Greece, going back to Haussknecht (1893-1899) who detected the species as new to the Greek flora in S. Pindhos, just at its southernmost locality in S.E. Europe. In the following century, botanists added about ten more Greek localities in N. Pindhos, Antichassia Mts, the Ossa-Olimbos area and the northern border areas (see Map 3), always correlated with moist beech woods and occasionally ascending to about 1900 m of altitude. The species seems to be rare in Greece, restricted to more or less undisturbed woodland areas.

The next pair of examples relates to C. European forest plants with a boreal-atlantic instead of a submediterran-subatlantic distribution in Europe. *Paris quadrifolia* L. occupies a large area from Scotland and Norway to the Siberian taiga, indicating seeping water in the soil of moist, nutrient-rich deciduous as well as conifer forests (thence representing a Fagetalia species with a phytocoenologically rather weak diagnostic value). It is certainly rare in Greece where it occurs in damp, deciduous forests and shady, humus-rich places, often by streams, generally at 900 m to 1600 m of altitude, occasionally to 1900 m as on Mt Falakron in Greek Makedonia (Strid & Tan 1991: 716). The southernmost localities on the Balkan Peninsula are the Katara pass in C. Pindhos and Mt Olympus in the Voras-Pilion chain (see Map 4). *Milium effusum* L., a circumpolar species with additional disjunct occurrences in E. North America and boreal-pacific E. Asia (Meusel & al. 1965: 56), has the same boreo-atlantic tendency in its general range in Europe, where it is a character species of Fagetalia communities in fresh, nutrient-rich but usually non-calcareous habitats. Its southern boundary on the Balkan peninsula runs a little further south than that of *Paris*, namely in the Pertouli area of C. Pindhos and in *Fagus* forests of the moist Aegean side of Mt Ossa in E.C. Greece (Map 5). Another tall forest grass, *Hordelymus europaeus* (L.) Jessen, shows a Greek distribution quite similar to that of *Milium effusum* (south to Pertouli and Ossa), even with more or less the same

ecological requirements, whereas its total range is more strictly C. European (without a boreal-oceanic extension, see Meusel & al. 1965: 44).

Hepatica nobilis Schreb. is a striking example of a genuine C. European distribution range, in that it is completely absent from the atlantic, boreal and pontic-pannonic parts of the continent and is lacking in the mediterranean lowlands (see map in Walter &

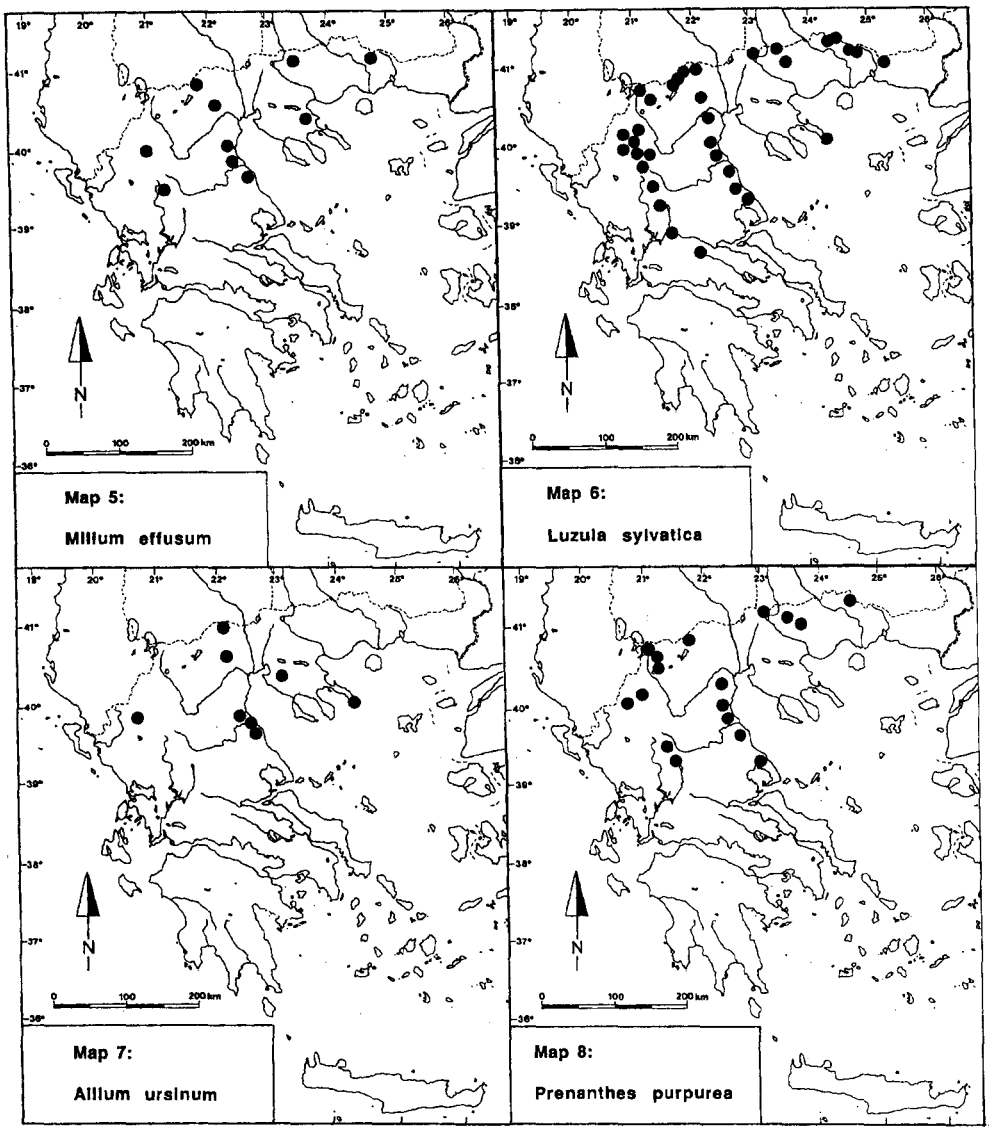

Fig. 2. The known Greek distribution of *Milium effusum* L. (Map 5), *Luzula sylvatica* (Map 6), *Allium ursinum* (Map 7), and *Prenanthes purpurea* (Map 8).

Straka 1970: 298). North of the Alps it grows gregariously in nutrient-rich forest stands on calcareous substrate, and the same is true for the sole recorded locality in Greece, a Cephalanthero-Fagion woodland over limestone on Mt Athos (Zoller & al. 1977: tab. 4). The species is neither given for Greece by Tutin & al. (1993: 264) nor by Greuter & al. (1989: 411).

A few C. European forest herbs exhibits a distinct atlantic tendency in their general distribution. *Allium ursinum* L. and *Luzula sylvatica* (Huds.) Gaudin belong to this group, and their total ranges are nearly identical (Meusel & al. 1965: 87, 93). The occurrence in Greece of the latter species exactly coincides with the *Fagus* range, southwards to Mt Athos, Mt Pilion and Mt Oxia, with, however, the southernmost locality on Mt Iti, i.e. beyond the regional southern *Fagus* limit (see Map 6). In C. Europe, *L. sylvatica* is typical for damp, acid forests of beech, fir and spruce, with a high atmospheric moisture. At its southern boundary in Greece it can similarly be found in moist mountain forests, on heaths, meadows and rock ledges on non-calcareous substrates between 1200 m and 2300 m of altitude.

In contrast, *Allium ursinum* becomes very rare at its southern boundary in Greece. The Greek populations belong to *A. ursinum* subsp. *ucrainicum* Kleopow & Oxner (Stearn 1978: 147). The species is extremely moisture-demanding and indicates great fertility of the soil. At its southernmost localities on the Balkan Peninsula, at the foot of Mt Ossa in E. Thessaly (see Map 7), it does not at all grow in beech woods (which are too dry) but in wet riverine forests of the Pinios delta as well as in damp ravines up to c. 500 m altitude where it is associated with, e.g., *Aesculus hippocastanum* L. (Raus 1980: 350-352). This is thus a case of a C. European forest plant which, at its southern distribution limit, does not ascend into the high mountains, as most of the other Fagetalia species do.

Chorotypes allied to *Abies alba*

White fir (*Abies alba* Mill.) is of a definite European-montane chorotype, extending from hercynic C. Europe and mountain areas and the Alps to adjacent mountain systems of S Europe from the Pyrenees in the west to the Carpathians in the east (Meusel & al. 1965: 20, Jalas & Suominen 1973: 10). In Greece, *A. alba* reaches the northernmost part of the country, morphologically merging further south with the mediterranean Greek fir (*A. cephalonica* Loud.; for details see Mattfeld 1930 and Farjon 1990: 19, 23). Numerous species from the herb layer of C. European montane woodlands share the chorotype of *A. alba*, e.g. *Prenanthes purpurea* L. (for total range, see Meusel & Jäger 1992: 540) which indicates nutrient-rich, chiefly acid soils in a humid mountain climate. The species maintains its ecological requirements on the southern Balkan Peninsula, where it becomes very scattered and has its southernmost populations in C. Pindhos and on Mt Pilion in E. Thessaly (see Map 8).

Salvia glutinosa L. has a similar general distribution (Meusel & al. 1978: 381) and autecology as *Prenanthes* (at least in Greece), but stops in E. C. Greece at the Timbi valley and does not reach Mts Ossa and Pilion (Map 9). This gap in the Pelagonian massif (i.e. the Voras-Pilion mountain chain) is caused by the Pinios river on its way to the

Aegean Sea, which seems to act as a local "barrier" that bundles the regional southern distribution limits of several C. European forest plants (e.g. *Anemone nemorosa* L., *Convallaria majalis* L., *Actaea spicata* L., and *Festuca gigantea* (L.) Vill.).

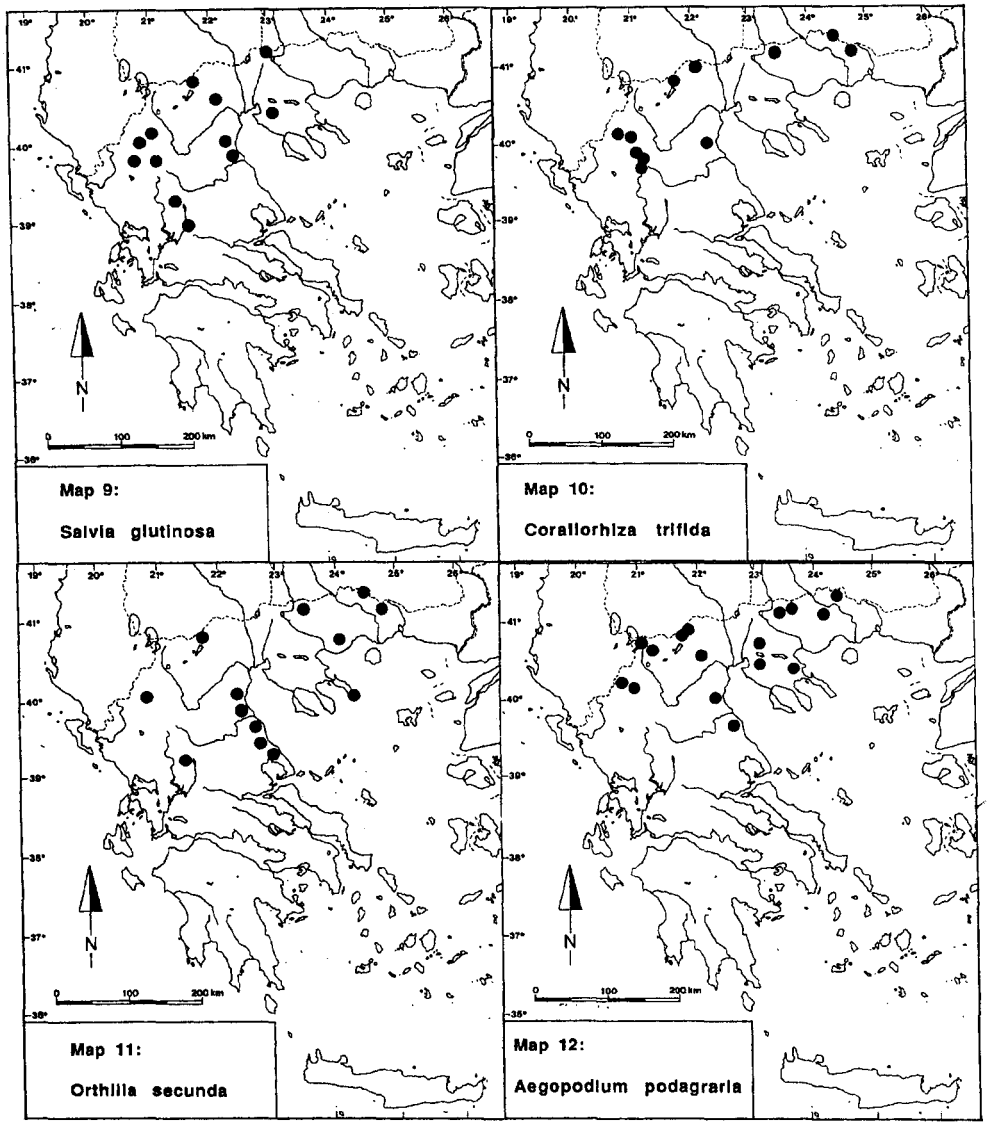

Fig.3. The known Greek distribution of *Salvia glutinosa* (Map 9), *Corallorhiza trifida* (Map 10), *Orthilia secunda* (Map 11), and *Aegopodium podagraria* (Map 12).

Chorotypes allied to *Picea abies*

The boreal element in the forest flora of Greece is exemplified by species which have the same general distribution range as Norway spruce (*Picea abies* (L.) Karsten; see Meusel & al. 1965: 20, Jalas & Suominen 1973: 13). Except for extra-zonal occurrences in fens and moors, these species are absent from the nemoral zone of C. Europe but otherwise widespread north of the temperate zone as well as in the upper montane and subalpine belts of the Alps and adjacent high mountain systems. *Picea abies* reaches the Greek territory in the C. Rhodopi area where, surprisingly, a portion of the southernmost spruce population of Europe is preserved in a "virgin" forest stand, now strongly protected by law (for phytocoenological details, see Volpers 1989).

Some boreal species seem to be restricted to this *Picea* area in Greece. The small orchid *Listera cordata* (L.) R. Br. is worth mentioning, which has been found in a few places in spruce stands in the Elatia and Zagradenia areas (nomos Drama) near the Bulgarian border (first published by Bader & Raus in Greuter & Raus 1986: 115). These are obviously the southernmost localities of the species in Europe, and *L. cordata*, certainly a very rare plant in Greece and ecologically depending on undisturbed habitats, should be included in the Red Data list of the country.

Other boreal forest species are more widespread in Greece, being associated with high mountain *Fagus* or *Pinus* forests, e.g. *Corallorhiza trifida* Chatel., again a small forest orchid. It is of diagnostic value with respect to Vaccinio-Piceetalia communities (Oberdorfer 1990, 1992) and shows a circumboreal distribution (Meusel & al. 1965: 112). It has been reported from mossy, damp mountain forests in Greece, south as far as the Katara pass and Mt Olympus (Map 10), which likewise are the southernmost occurrences of the species in Europe.

Orthilia secunda (L.) House is a circumboreal forest species of acid soils, associated with beech, fir and spruce. At its southern boundary on the Balkan Peninsula it is not at all rare or endangered but is locally gregarious in acid *Fagus* forests. It is a regionally characteristic species of the Orthilio-Fagetum (Barbero & Quézel 1976: 64, Bergmeier 1990 a: 283) and occurs predominantly in woodland, especially in E. C. Greece from Mt Olympus to Mt Pilion, but also on moors and heaths, ascending to ca. 2000 m of altitude in the mountains of Greece (see Map 11).

Vaccinium myrtillus L. has a very similar distribution in Greece, reaching south as far as C. Pindhos, Mt Pilion and Mt Athos (see map in Boratyński & al. 1990: 200, where the southernmost populations in E. C. Greece are omitted). Like *Lamium galeobdolon* (see above), *V. myrtillus* was first reported in Greece, by chance, from its southernmost European locality (on Mt Pilion, in 1935, see Beauverd & Topali 1937: 108). The general range of the species includes the whole of subarctic Europe (Meusel & al. 1978: 330). In Greece it occurs abundantly in subalpine grassland and heath up to 2200 m, on the high mountains along the northern border of the country, but at its very distribution limit, in the south, it descends into the forest belt and becomes a pure woodland species in acid *Fagus* forests, at 1200-1440 m of altitude, on the humid Aegean side of Mt Ossa and Mt Pilion (Raus 1980).

Riverine forest plants

In the eu-mediterranean lowlands of continental Greece, flood plains along rivers, streams and big lakes provide the only suitable habitats for extremely water-demanding C. European forest plants. Such species may be rare and endangered in Greece, since agriculture with its water-consuming irrigation cultures strongly "competes" with natural vegetation in such areas. As an example *Euphorbia palustris* L. may be mentioned, which has its natural occurrences in C. Europe in riverbank forests and swamps along the Rhine, Danube, Elbe etc., with a subcontinental centre of distribution in E. Europe (Hultén & Fries 1986: 641). For Greece there is only one known locality (Rechinger 1939: 444), located in a swampy area S. of Drama where agriculture now heavily endangers the remnants of natural wet forest communities.

Another example of this C. European species group is *Peucedanum palustre* (L.) Moench, which in Greece is restricted to the swamps of Lake Prespa where it was only recently detected by Pavlidis (1985: 38, 260). The Prespa area, under protection as a national park, seems to be the southernmost locality of *P. palustre* in the whole of Europe, judging from the total range given by Hultén & Fries (1986: 713). This species, as well as *Euphorbia palustris* (if still extant), should certainly be included in a Greek Red Data list (see Raus 1991 for further examples).

Aegopodium podagraria L., likewise primarily a plant of flood plain habitats, is not perhaps that kind of species on which plant hunters are keen in C. Europe, where gardeners loathe it as a noxious weed. In Europe (see Meusel & al 1978: 312) it is distributed southwards as far as 40°N in C. Italy and on the Balkan Peninsula, where it really is worth collecting, because it grows in fairly natural habitats at the southern boundary of its range. In Greece it occurs chiefly in damp places in forests. The southernmost known populations (see Map 12) grow in remnants of flood plain forests in association with, e.g., *Thalictrum lucidum* L. and *Leucojum aestivum* L. (Raus 1980: 535). Species like *A. podagraria,* however, are strongly under-collected in Greece, and present knowledge of its southern distribution limits in continental Greece may prove inexact as field work in the forest belt of the country progresses.

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