G. Dimitrellos & D. Christodoulakis

The phytogeographical distribution patterns of the flora of Mt Timfristos (N.W. Sterea Ellas, Greece)

Abstract

Dimitrellos, G. & Christodoulakis, D.: The phytogeographical distribution patterns of the flora of Mt Timfristos (N.W. Sterea Ellas, Greece). — Fl. Medit. 9: 215-229. 1999. — ISSN 1120-4052.

An analysis of the distribution patterns and endemism of the vascular flora of Mt Timfristos is presented here. 17 new floristic records are given, bringing the total number of the vascular taxa found on Timfristos up to 1156. The distribution of 22% of the taxa surveyed is limited to Italy, the Balkan Peninsula and Anatolia, or to a smaller area. From the study of those species, and in particular of biregional endemics, it appears that Timfristos exhibits a strong floristic affinity with both southern Pindos and Peloponnisos, and that the affinity with these two areas is of equal significance; this supports the view that Timfristos occupies an intermediate phytogeographical position between northern and southern mainland Greece. The floristic links with Anatolia originate primarily through N.E. Greece (Thraki), and secondarily via the southern Aegean island arc. However, the influence of Anatolian species on the composition of the present flora of Timfristos is evidently of less significance than that from Balkan species.

Introduction

Timfristos is a mountain range in southern Greece (Sterea Ellas) with a N.W. to S.E. orientation (Fig. 1) and forms a natural border between northern and southern Greece, as well as between western and eastern Sterea Ellas. Being an interesting area from a botanical point of view, its phytogeography has been discussed in earlier studies (Phitos 1960, Strid 1993). However, previous conclusions were not based on the phytogeographical analysis of its whole flora, as this was until recently incompletely known. The present study attempts to analyse the distribution patterns and endemism of the flora of Timfristos, since the registration of its flora has already been completed by the authors as far as possible (Dimitrellos & Christodoulakis 1995).

Materials and methods

This study is based on the survey of 1156 wild vascular plant taxa (species & subspecies), 1139 of which have been dealt with in Dimitrellos & Christodoulakis (1995), while the remaining 17 are reported here for the first time.

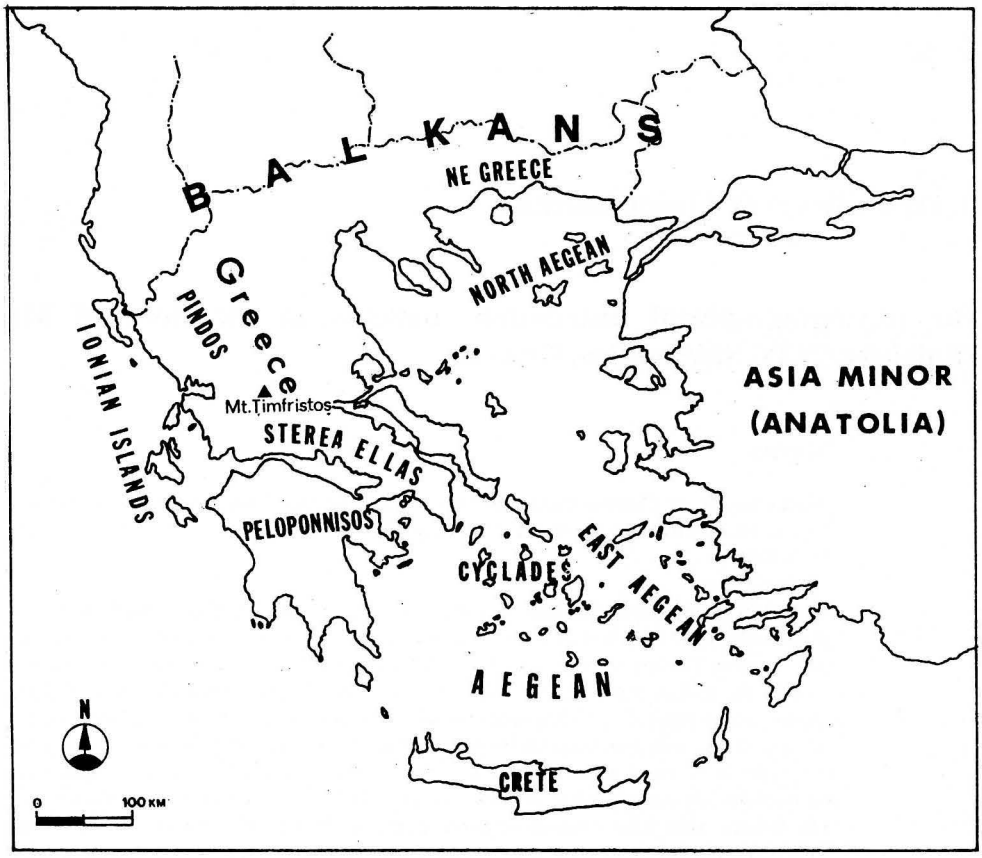

Fig. 1. Position of Mount Timfristos (arrowed) in relation to adjacent regions.

The nomenclature is consistent with *Med-Checklist* (Greuter & al. 1984-1989), *Flora Hellenica* (Strid & Tan 1997), *Mountain Flora of Greece* (Strid 1986, Strid & Tan 1991) and *Flora Europaea* (Tutin & al. 1964-1980). The classification by Pignatti (1982), in combination with that by Davis (1965) were used for the chorological types.

This study deals with the phytogeographical affinities of Mt Timfristos, taking into account especially taxa with a relatively limited distribution, i.e. Italy, the Balkan Peninsula and Anatolia, which will be referred to as Italian-Balkan-Anatolian endemics hereafter. For the purpose of the comparative chorological observations in mainland Greece and the Aegean, the phytogeographical subdivisions by Strid (1986) and Rechinger (1943) were followed, respectively. In addition, due to the lack of detailed floristic studies for many Greek mountains, and because the basic reference source of comparative data is the Mountain Flora of Greece (Strid 1986, Strid & Tan 1991), only the taxa of high altitudes were considered in the phytogeographical discussion.

The following abbreviations are used for mountains, countries and phytogeographical regions:

Al = Albania
Bu = Bulgaria
Ch. = Chelidona

EC = East Central
El. = Elikonas
Ju = Yugoslavia
Kal. = Kaliakouda
NC = North Central
NE = North East
Npi = Northern Pindos
Ox. = Oxia
Pan. = Panetoliko
Parn. = Parnassos
Pel = Peloponnisos
Ps. = Parnis
Spi = Southern Pindos
Timfr. = Timfristos
Vard. = Vardousia

Results

General distribution pattern of the flora of Timfristos

The native flora of Timfristos consists of 1156 vascular taxa in total. 1139 of these have already been published by Dimitrellos & Christodoulakis (1995), and the following 17 are new records: *Angelica sylvestris, Eleocharis palustris, Hedypnois cretica, Juncus articulatus, Lens ervoides, Potentilla recta, Rumex acetosella* subsp. *multifidus, R. tuberosus* subsp. *horizontalis, Salix fragilis, Scleranthus verticillatus, Trifolium dalmaticum, T. heldreichianum, T. nigrescens, T. patens, Velezia rigida, Vicia cassubica* and *V. laeta.*

The 1156 taxa surveyed here were classified into 22 main chorological groups according to their general distribution (Table 1).

The Italian-Balkan-Anatolian endemic group includes mainly the narrowly distributed taxa of the examined chorological spectrum, and represents 22% (255 taxa) of the total flora. Hence, phytogeographically this constitutes the most interesting group and is discussed in a separate section below.

The Mediterranean elements are dominant in the flora of Timfristos, and include 390 taxa in total (33.7%). Of these, the Eurymediterranean element is the richest in taxa with 173 representatives (15%).

The proportion of Eurasiatic elements seems remarkably high (23.5%), while the remaining elements of the chorological spectrum are represented at a much lower proportion.

Endemism

The endemic taxa of the area fall into one of the eight categories in Fig. 2 on the basis of their overall distribution range.

According to the available data, only two taxa, *Centaurea princeps* and *Thymus rechingeri* subsp. *macrocalyx*, are considered endemic to Mt Timfristos.

Table 1. Chorological spectrum of the flora of Timfristos.

Chorological group	Number of taxa	%
Italian - Balkan - Anatolian endemics	255	22.0
Mediterranean taxa		
Stenomediterranean	59	5.1
Eurymediterranean	173	15.0
W. Mediterranean	2	0.2
E. Mediterranean	94	8.1
Mediterranean - Montane	35	3.0
W. Mediterranean - Montane	1	0.1
E. Mediterranean - Montane	26	2.2
Eurasiatic		
Paleotemperate	62	5.4
Eurasiatic s. str.	57	4.9
European	66	5.7
European - S. Siberian	40	3.5
European - Caucasian	46	4.0
Orophilous S. European	34	2.9
Boreal		
Circumboreal	35	3.0
Eurosiberian	20	1.8
Arctic - Alpine	6	0.5
Mediterranean - Turanian	34	2.9
Mediterranean - Atlantic	16	1.4
Irano - Anatolian	1	0.1
Pan-, Sub-, Paleo-, Paleosub-tropical	10	0.9
Sub- and Cosmopolitan	84	7.3
Total	1156	100

Until present, 60 Greek mainland endemics are known from Timfristos (Table 2), 5 of which are restricted to Sterea Ellas, namely *Aubrieta gracilis, Carum heldreichii, Genista millii, Hypericum elongatum* subsp. *tymphresteum* and *Poa trichophylla*. Furthermore, 23 taxa occur on mainland Greece, as well as on the Aegean and Ionian islands, and are therefore characterized as Greek endemics (Table 3). Of these, *Petrorhagia fasciculata* has not been taken into consideration in the phytogeographic discussion because it grows at low altitudes.

The Balkan-Greek mainland endemics (Fig. 2) are dominant on Timfristos (86 taxa, 33.7%). Of these, 42 taxa have a distribution that is restricted to Sterea Ellas and to the north of it (Table 4), while the remaining 44 also extend their distribution to the south of Sterea Ellas and reach Peloponnisos (Table 5). Of the first group, *Scorzonera doriae* has not been taken into consideration because it grows at low altitudes. In addition, 33 Balkan taxa have a distribution within Greece on both the mainland and the islands, and are therefore characterized as Balkan-Greek endemics (Table 6).

The Balkan-Italian group is relatively poorly represented (22 taxa, 8.6%) (Fig. 2).

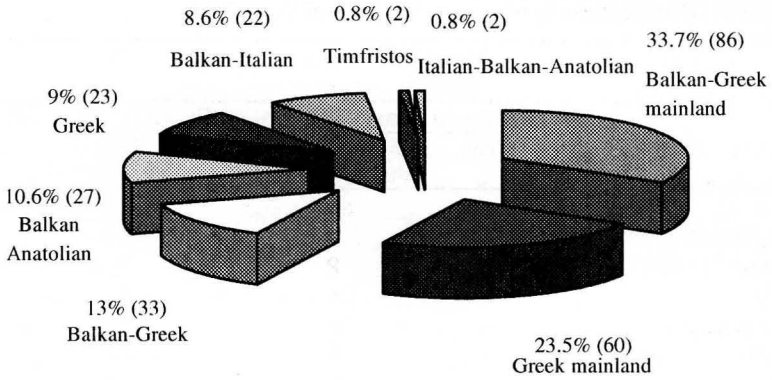

Fig. 2. Chorological spectrum of the endemic component. The numbers in brackets indicate the number of taxa.

The Balkan-Anatolian endemic group is also small, and is represented by 27 taxa. Of these, 7 taxa, viz. *Asperula nitida, Ballota acetabulosa, Centaurea pichleri, Colchicum boissieri, Festuca polita, Galium incanum* subsp. *incanum* and *Teucrium flavum* subsp. *hellenicum,* limit their westward distribution to mainland Greece, while the remaining also occur in other Balkan countries.

Finally, only two species, *Prunus webbii* and *Saponaria calabrica*, are endemic to Italy, the Balkans and Anatolia.

Discussion and conclusions

As mentioned earlier, there are 5 taxa on Timfristos which are considered mountain endemic to Sterea Ellas (Table 7). In addition, of the 60 Greek mainland endemics, 43 taxa occur on Timfristos, as well as on other mountains of Sterea Ellas (Table 8). These data lead to the conclusion that Timfristos shares particularly close phytogeographical links with the remaining mountains of Sterea Ellas, and these links seem to be particularly narrow between Timfristos and Giona, as both these mountains have 4 endemics of Sterea Ellas (Table 7) and a total of 34 Greek mainland endemics (Table 8) in common. The strength of the phytogeographical affinity between Timfristos and the other mountains of Sterea Ellas decreases in the following order: Giona, Vardousia, Parnassos, Iti, Oxia, Kaliakouda, Panetoliko, Chelidona, Elikonas, Parnis (Tables 7, 8).

Timfristos and southern Pindos have a total of 30 Greek mainland endemics in common, 8 of which are considered biregional endemics, viz. *Achillea pindicola* subsp. *pindicola, Asperula pinifolia, Cirsium heldreichii, Minuartia stellata* var. *epirota, Satureja horvatii* subsp. *macrophylla, Sedum apoleipon, Seseli parnassicum* and *Taraxacum gionense* (Table 2).

Likewise 9 taxa, namely *Asperula boissieri, Campanula radicosa, Dianthus tymphresteus, Draba lacaitae, Edraianthus parnassicus, Inula verbascifolia* subsp. *parnassica, Ornithogalum fibriatum* subsp. *gracilipes, Taraxacum delphicum* and *Veronica erinoides* are biregional endemic to Timfristos and Peloponnisos, while these two regions have a total of 30 Greek mainland endemics in common (Table 2).

Table 2. Greek mainland endemics in the flora of Timfristos.

Taxon	Mainland Greece							
	Sterea Ellas		Pel	SPi	NPi	NC	NE	EC
	Timfr.	Other Mts						
1. *Achillea pindicola* subsp. *pindicola*	+	+		+				
2. *Aethionema saxatile* subsp. *graecum*	+	+	+				+	
3. *Allium achaium*	+	+	+	+	+			
4. *Anthemis spruneri*	+	+	+					+
5. *Armeria undulata*	+		+			+		
6. *Asperula boissieri*	+	+	+					
7. *A. oetaea*	+	+	+	+				
8. *A. pinifolia*	+	+		+				
9. *Aubrieta gracilis*	+	+						
10. *Aurinia gionae*	+	+		+	+			
11. *Campanula albanica* subsp. *sancta*	+	+	+	+	+	+	+	
12. *C. radicosa*	+	+	+					
13. *Cardamine raphanifolia* subsp. *barbareoides*	+			+	+			
14. *Carum heldreichii*	+	+						
15. *Centaurea affinis* subsp. *pallidior*	+	+		+		+		
16. *Cephalaria tenuiloba*	+					+		
17. *Cerastium brachypetalum* subsp. *pindigenum*	+			+	+	+		+
18. *Cirsium heldreichii*	+	+		+				
19. *C. mairei*	+	+				+		
20. *Colchicum graecum*	+	+	+	+	+			
21. *Dianthus corymbosus*	+					+	+	+
22. *D. tymphresteus*	+	+	+					
23. *Draba lacaitae*	+	+	+					
24. *Edraianthus parnassicus*	+	+	+					
25. *Erysimum pusillum*	+		+			+		
26. *Galium absurdum*	+	+			+	+		
27. *Genista millii*	+	+						
28. *Hieracium epirense*	+	+	+	+	+	+		
29. *H. leithneri*	+	+	+	+				
30. *Hypericum elongatum* subsp. *tymphresteum*	+	+						
31. *H. vesiculosum*	+		+			+		
32. *Inula verbascifolia* subsp. *parnassica*	+	+	+					
33. *Lamium garganicum* subsp. *pictum*	+	+	+	+	+			
34. *Marticaria rosella*	+		+					
35. *Marrubium velutinum*	+	+	+	+	+			
36. *Minuartia eurytanica var. eurytanica*	+	+		+	+			
37. *M. stellata var. epirota*	+	+		+				

Table 3. (continued).

Taxon	Mainland Greece		Aegean				Ionian
	Timfristos	Other regions	W	S	E	N	Islands
7. *Dianthus biflorus*	+	+	+				
8. *Digitalis laevigata* subsp. *graeca*	+	+					+
9. *Erysimum cephalonicum*	+	+					+
10. *E. graecum*	+	+	+	+			
11. *Euphorbia deflexa*	+	+	+	+		+	
12. *Fritillaria mutabilis*	+	+					+
13. *F. thessala* subsp. *thessala*	+	+					+
14. *Galium citraceum*	+	+	+	+			+
15. *Helictotrichon convolutum* subsp. *heldreichii*	+	+					+
16. *Heliotropium halacsyi*	+			+			+
17. *Leontodon graecus*	+	+	+		+	+	+
18. *Melilotus graecus*	+	+		+			+
19. *Petrorhagia fasciculata**	*	*		*			*
20. *Thlaspi bulbosum*	+	+**	+		+		
21. *Trinia frigita*	+	+					+
22. *Veronica thymifolia*	+	+		+			
23. *Viola phitosiana*	+.	+	+				
Total	22	21	10	7	4	3	14

*lowland taxon not included in the phytogeographical discussion.
**only in Sterea Ellas.

Table 4. Balkan-Greek mainland endemics in the flora of Timfristos with Sterea Ellas as their southern distribution limit.

Taxon	Balkan					
	Mainland Greece			Al	Ju	Bu
	Sterea Ellas		Remaining regions except Peloponnisos			
	Timfr.	Other Mts				
1. *Acantholimon graecum*	+	+		+		
2. *Aesculus hippocastanum*	+	+	+	+	+	+
3. *Alchemilla heterotricha*	+		+		+	
4. *Alkanna pindicola*	+	+	+	+	+	
5. *Anthyllis vulneraria* subsp. *pindicola*	+	+	+		+	
6. *Asperula aristata* subsp. *condensata*	+	+	+		+	+
7. *A. purpurea* subsp. *apiculata*	+	+	+		+	+

Table 4. (continued).

8. *Astracantha thracica* subsp. *parnassi*	+	+	+		+	
9. *Aubrieta scardica*	+	+	+	+	+	
10. *Bromus riparius* subsp. *macedonicus*	+		+		+	
11. *Centaurea graeca*	+	+	+	+	+	
12. *Corydalis cava* subsp. *blanda*	+				+	
13. *Crepis viscidula* subsp. *geracioides*	+		+	+	+	
14. *Crocus veluchensis*	+	+	+	+	+	+
15. *Draba lasiocarpa* subsp. *dolichostyla*	+	+		+		
16. *Erodium guicciardii*	+		+	+	+	
17. *Galium degenii*	+		+	+	+	
18. *G. hellenicum*	+	+	+		+	+
19. *G. oreophilum*	+	+	+	+	+	
20. *Geranium aristatum*	+		+	+	+	
21. *Geocaryum pindicolum*	+	+	+	+		
22. *Hieracium bracteolatum*	+	+			+	
23. *Linum tauricum* subsp. *albanicum*	+	+	+		+	
24. *Lonicera formanekiana*	+		+	+	+	
25. *Malcolmia orsiniana* subsp. *angulifolia*	+	+	+	+		+
26. *Minuartia attica* subsp. *attica* var. *ramosissima*	+	+	+	+	+	
27. *M. baldaccii*	+		+	+	+	
28. *Nepeta spruneri*	+	+	+	+		
29. *Paronychia macedonica*	+	+	+		+	
30. *Peucedanum oligophyllum*	+	+	+	+	+	
31. *Plantago reniformis*	+			+	+	
32. *Poa macedonica*	+	+				+
33. *Satureja cremnophila*	+	+	+	+		
34. *Scorsonera doriae**	*		*	*	*	
35. *Sesleria wettsteinii*	+	+	+	+	+	
36. *Sideritis raeseri* subsp. *raeseri*	+	+	+	+	+	
37. *Silene fabarioides*	+	+	+	+		+
38. *Stachys scardica*	+		+	+	+	+
39. *Thlaspi microphyllum*	+	+	+	+	+	
40. *Thymus boissieri*	+		+	+	+	
41. *Trifolium medium* subsp. *balcanicum*	+	+	+		+	+
42. *Verbascum graecum*	+	+			+	
Total	41	29	34	27	33	10

*lowland taxon not included in the phytogeographical discussion.

This data demonstrates on the one hand the strong floristic affinity of Timfristos with both southern Pindos and Peloponnisos, and on the other one that this affinity with the latter two areas is more or less of equal strength.

Table 5. Balkan-Greek mainland endemics in the flora of Timfristos with Peloponnisos as their southern distribution limit.

Taxon	Balkan						
	Mainland Greece				Al	Ju	Bu
	Sterea	Ellas	Pel	Remaining regions			
	Timfr.	Other mts					
1. *Acer heldreichii*	+	+	+	+	+	+	+
2. *Achillea holosericea*	+	+	+	+	+	+	
3. *Allium phthioticum*	+	+	+	+	+		
4. *Anthemis arvensis* subsp. *cyllenea*	+	+	+	+	+		
5. *Anthyllis vulneraria* subsp. *bulgarica*	+	+	+	+	+	+	+
6. *Astracantha rumelica*	+	+	+	+	+	+	
7. *Bromus cappadocicus* subsp. *lacmonicus*	+	+	+	+			+
8. *Bupleurum flavicans*	+	+	+	+	+	+	
9. *Campanula spatulata* subsp. *spruneriana*	+	+	+	+	+	+	+
10. *Carlina frigida*	+	+	+	+	+	+	
11. *Carum graecum* subsp. *graecum*	+	+	+	+	+	+	
12. *Centaurea zuccariniana*	+		+	+	+		
13. *Crataegus heldreichii*	+	+	+		+		
14. *Dianthus cruenthus*	+	+	+	+	+	+	+
15. *D. integer* subsp. *minutiflorus*	+	+	+	+	+	+	
16. *D. pinifolius* subsp. *lilacinus*	+	+	+	+	+		
17. *D. stenopetalus*	+	+	+	+	+	+	+
18. *Euphorbia heldreichii*	+	+	+	+	+		
19. *Galium laconicum*	+	+	+	+		+	+
20. *Helictotrichon aetolicum*	+	+	+	+		+	
21. *Herniaria parnassica* subsp. *parnassica*	+	+	+	+	+		
22. *Hieracium parnassi*	+	+	+	+	+	+	+
23. *Lilium chalcedonicum*	+	+	+	+	+		
24. *Linum elegans*	+	+	+	+	+	+	+
25. *Malcolmia graeca* subsp. *bicolor*	+	+	+	+	+		
26. *Minuartia stellata* var. *stellata*	+	+	+	+	+		
27. *Myosotis alpestris* subsp. *suaveolens*	+	+	+	+	+	+	+
28. *Onobrychis montana* subsp. *scardica*	+	+	+	+	+	+	+
29. *Pedicularis graeca*	+	+	+	+	+		
30. *Poa thessala*	+	+	+	+	+	+	

Table 5. (continued).

Taxon	Balkan						
	Mainland Greece				Al	Ju	Bu
	Sterea	Ellas	Pel	Remaining regions			
	Timfr.	Other mts					
31. *Scabiosa taygeta*	+	+	+	+		+	
32. *Senecio macedonicus*	+	+	+	+	+	+	
33. *S. thapsoides*	+	+	+	+	+	+	
34. Silene parnassica subsp. *parnassica*	+	+	+	+	+		
35. *S. radicosa*	+	+	+	+	+	+	+
36. *Staehellina uniflosculosa*	+		+	+	+	+	
37. *Taraxacum gracilens*	+	+	+			+	
38. *T. pindicola*	+	+	+	+		+	+
39. *Thymus teucrioides*	+	+	+	+	+		
40. *Trifolium pignantii*	+	+	+	+	+	+	+
41. *Trisetum flavescens* subsp. *tenue*	+	+	+	+	+		
42. *Verbascum guicciardii*	+	+	+		+		
43. *Vincetoxicum hirundinaria* subsp. *nivale*	+	+	+	+	+	+	+
44. *Viola aetolica*	+	+	+	+	+	+	
Total	44	42	44	41	38	28	15

Table 6. Balkan - Greek endemics in the flora of Timfristos.

1. *Abies borisii-regis*
2. *Arabis bryoides*
3. *Aristolochia elongata*
4. *Asperula chlorantha*
5. *Bupleurum glumaceum*
6. *Campanula spatulata* subsp. *spatulata*
7. *Carum rupestre*
8. *Centaurea spruneri*
9. *Centranthus ruber* subsp. *sibthorpii*
10. *Cephalaria ambrosioides*
11. *Cerastium banaticum* subsp. *speciosum*
12. *C. decalvans*
13. *Dianthus gracilis* subsp. *gracilis*
14. *Drypis spinosa* subsp. *spinosa*
15. *Galium intricatum*
16. *Hieracium cymosum* subsp. *heldreichianum*
17. *Linaria peloponnesiaca*
18. *Malabaila aurea*
19. *M. involucrata*
20. *Petrorhagia illyrica* subsp. *illyrica*
21. *Rhamnus saxatilis* subsp. *prunifolia*
22. *Saxifraga chrysospleniifolia*
23. *Scabiosa tenuis*
24. *Scutellaria rupestris* subsp. *adenotricha*
25. *Scrophularia laciniata*
26. *Silene caesia*
27. *S. graeca*
28. *S. waldsteinii*
29. *Stachys plumosa*
30. *Trifolium dalmaticum*
31. *T. velenovskyi*
32. *Valantia aprica*
33. *Verbascum undulatum*

Table 7. Sterea Ellas endemics in the flora of Timfristos.

Taxon	Mountains of Sterea Ellas						
	Timfr.	Giona	Vard.	Parn.	Iti	Ox.	Kal.
1. *Aubrieta gracilis*	+	+	+		+	+	+
2. *Carum heldreichii*	+	+	+	+			
3. *Genista millii*	+				+	+	
4. *Hypericum elongatum* subsp. *tymphresteum*	+	+					
5. *Poa trichophylla*	+	+	+	+			
Total	5	4	3	2	2	2	1

Table 8. Greek mainland endemics common between Timfristos and other high mountains of Sterea Ellas.

Taxon	Timfr.	Giona	Vard.	Parn.	Iti	Kal.	Pan.	Ch.	Ox.	El.	Ps.
1. *Achillea pindicola* subsp. *pindicola*	+	+	+			+		+			
2. *Aethionema saxatile* subsp. *graecum*	+									+	+
3. *Allium achaium*	+	+	+		+						
4. *Anthemis spruneri*	+	+	+	+							
5. *Asperula boissieri*	+	+		+							
6. *A. oetaea*	+	+	+		+				+		
7. *A. pinifolia*	+		+			+		+			
8. *Aurinia gionae*	+	+	+			+					
9. *Campanula albanica* subsp. *sancta*	+	+	+				+	+			
10. *C. radicosa*	+	+		+			+				
11. *Cardamine raphanifolia* subsp. *barbareoides*	+	+									
12. *Centaurea affinis* subsp. *pallidior*	+	+	+	+	+	+					
13. *Cirsium heldreichii*	+	+		+							
14. *C. mairei*	+	+	+		+						
15. *Colchicum graecum*	+	+	+		+	+	+	+			
16. *Dianthus tymphresteus*	+	+	+		+						
17. *Draba lacaitae*	+	+	+	+	+	+					
18. *Edraianthus parnassicus*	+	+	+	+	+	+		+	+		
19. *Galium absurdum*	+	+					+				
20. *Hieracium epirense*	+			+		+		+			
21. *H. leithneri*	+	+	+	+		+		+	+		
22. *Inula verbascifolia* subsp. *parnassica*	+	+		+							
23. *Lamium garganicum* subsp. *pictum*	+	+	+	+					+		
24. *Marrubium velutinum*	+	+	+	+	+	+		+	+	+	
25. *Minuartia eurytanica* var. *eurytanica*	+	+	+		+		+	+			

Table 8. (continued).

Taxon	Timfr.	Giona	Vard.	Parn.	Iti	Kal.	Pan.	Ch.	Ox.	El.	Ps.
26. *M. stellata* var. *epirota*	+	+	+								
27. *Ornithogalum fimbriatum* subsp. *gracilipes*	+								+		
28. *Plantago atrata* subsp. *graeca*	+	+	+	+		+	+		+		
29. *Rhinanthus pubescens*	+	+	+	+							
30. *Satureja horvatii* subsp. *macrophylla*	+		+			+	+	+			
31. *Scorzonera purpurea* subsp. *peristerica*	+			+							
32. *Sedum apoleipon*	+	+	+	+	+		+	+			
33. *Seseli parnassicum*	+	+		+							
34. *Sesleria vaginalis*	+	+	+	+			+	+			
35. *Taraxacum fibratum*	+								+		
36. *T. gionense*	+	+			+	+	+	+	+		
37. *T. molybdocephalum*	+			+			+		+		
38. *T. protervum*	+	+					+				
39. *Trifolium parnassi*	+	+	+	+	+	+	+	+	+		
40. *Verbascum epixanthinum*	+	+	+	+	+				+		
41. *Veronica chamaedrys* subsp. *chamaedryoides*	+		+	+	+		+		+	+	
42. *V. erinoides*	+	+	+	+							
43. *Viola graeca*	+	+	+	+	+	+					
Total	43	34	28	24	16	15	14	14	13	3	1

This means that Timfristos occupies a rather intermediate phytogeographical position between north and south mainland Greece.

Timfristos shares further 19 Greek mainland endemics with northern Pindos, 21 with the North Central, 4 with the North East and 4 with the East Central region of mainland Greece (Table 2).

The above data indicate that the floristic links between Timfristos and other regions of mainland Greece decrease in the following order: Sterea Ellas, southern Pindos = Peloponnisos, North Central, northern Pindos, North East = East Central Greece (Table 2).

41 Balkan-Greek mainland endemics have their southernmost distribution range on Timfristos and the remaining mountains of Sterea Ellas. Of these, 31 have their northernmost boundary in Albania and Yugoslavia (Table 4). Almost all Balkan taxa that extend their distribution range to Italy (Balkan-Italian endemics) are also found in Albania and/or Yugoslavia. This observation, in combination with the sequence of decreasing floristic links between Timfristos and the regions of Greece mentioned above, indicates the migratory route followed by northern floristic elements represented in the flora of Timfristos. This route coincides with the NNW-SSE orientation of the Pindos mountain range (see also Strid 1986, 1993, Dimopoulos & Georgiadis 1992).

The phytogeographical links between Timfristos and the Aegean islands are considered to be closer with the islands of the western and southern Aegean and this is supported by

the common occurrence of 10 and 7 Greek endemics respectively (Table 3). The island of Evvia with its high mountains contributes much to this relationship, while the role of the other smaller islands of the western Aegean is of lesser significance. The Greek endemics of Timfristos which are common with the islands of the eastern and northern Aegean decrease to 4 and 3 respectively, indicating weak relationships.

A group of Balkan-Anatolian taxa are absent from the Aegean islands, or sometimes appear on some marginal islands, but not on the islands of the southern and central Aegean at the same time. However, they always appear in the N.E. area of mainland Greece and/or European Turkey, viz. *Anthemis tinctoria* subsp. *parnassica, Carduus tmoleus, Geranium macrostylum, Knautia orientalis, Lysimachia atropurpurea, Ranunculus sartorianus, Taraxacum scaturiginosum, Thlaspi ochroleucum, Trifolium heldreichianum* and *Vincetoxicum speciosum.*

Moreover, of the Anatolian taxa which have their westernmost distribution limit in mainland Greece, *Centaurea pichleri* and *Galium incanum* subsp. *incanum* show more or less the same chorological behaviour as the above taxa, and only *Festuca polita* seems to reach Timfristos via the islands of the S. Aegean. This indicates that the floristic links of Timfristos with Anatolia arise mainly through N.E. Greece (Thraki), while the migration of anatolian elements via the South Aegean island arc seems to be very limited. The distribution of *Arenaria filicaulis* subsp. *graeca* is rather typical, as it represents the two migratory routes linking the flora of Timfristos with that of Anatolia mentioned above.

The analysis of the distribution of species presented here shows that the influence of Balkan species on the composition of the present flora of Timfristos is apparently of greater importance than that of species from other areas. Plant migration from Anatolia to Timfristos appears to be only of secondary importance.

Acknowledgments

We are grateful to Dr. M. A. Callimassia for her linguistic corrections to this manuscript.

References

Davis, P. H. (ed.) 1965: Flora of Turkey and the East Aegean Islands, **1.** — Edinburgh.

Dimitrellos, G. & Christodoulakis, D. 1995: The flora of Mount Timfristos (N. W. Sterea Ellas, Greece). — Fl. Medit. **5:** 9-51.

Dimopoulos, P. & Georgiadis, T. 1992: Floristic and Phytogeographical analysis of Mount Killini (NE Peloponnisos, Greece). — Phyton (Horn, Austria) **32(2):** 283-305.

Greuter, W., Burdet, H. M. & Long, G. 1984-1989: Med-Checklist, **1, 3, 4.** — Genève.

Phitos, D. 1960: Phytogeographical observations on the mountain range Timfristos-Oxia. — Das. Chron. **25:** 1099-1105 (in Greek).

Pignatti, S. (ed.) 1982: Flora d'Italia, **1.** — Bologna.

Rechinger, K. H. 1943: Flora Aegea. Flora der Inseln und Halbinseln des aegaeischen Meeres. — Denkschr. Akad. Wiss. Wien, math.-naturwiss. Kl. **105(1).**

Strid, A. (ed.) 1986: Mountain Flora of Greece, **1.** — Cambridge.

— 1993: Phytogeographical aspects of the Greek mountain flora. — Fragm. Flor. Geobot. Suppl. **2(2):** 411-433.

— & Kit Tan (ed.) 1991: Mountain Flora of Greece, **2.** — Edinburgh.

— & — (ed.) 1997: Flora Hellenica, **1.** — Koenigstein.

Tutin, T. G. & al. (ed.) 1964-1980: Flora Europaea, **1-5**. — Cambridge.

Address of the authors:
Dipl. For. G. Dimitrellos & Assoc. Prof. Dr. D. Christodoulakis, Botanical Institute, University of Patras, GR-265 00 Patras, Greece.