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Moltkia petraea (Boraginaceae) in Greece

By

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With 4 Figures

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Summary

GEORGIOU O., DIMITRELLOS G. & GEORGIADIS Th. 2000. *Moltkia petraea* (*Boraginaceae*) in Greece. – Phyton (Horn, Austria) 40 (1): 57–69, 4 figures. – English with German summary.

The Balkan endemic *Moltkia petraea* (TRATT.) GRISEB. is a rare species in Greece, which has been found by the authors from only three localities in Epirus. Two of these localities are new records for the taxon, while the third is a rediscovery 100 years after its first report by HALÁCSY. A fourth locality near Thermopyles (Mt Iti) reported by BOISSIER has not yet been confirmed. The chromosome number 2n = 16, and the karyotype from Greek populations of *M. petraea* are presented for the first time. Ecological requirements of the species and phytosociological data from Greek biotopes are given and compared with corresponding data from the former Yugoslavia and Albania. Phytosociological relevées with *M. petraea* in Greece are also given for the first time; in Greece it is a part of chasmophytic communities with *Asperula chlorantha* (Onosmetalia frutescentis QUÉZEL)

Zusammenfassung

GEORGIOU O., DIMITRELLOS G. & GEORGIADIS Th. 2000. *Moltkia petraea* (*Boraginaceae*) in Griechenland. – Phyton (Horn, Austria) 40 (1): 57–69, 4 Abbildungen. – Englisch mit deutscher Zusammenfassung.

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Der Endemit der Balkan-Halbinsel *Moltkia petraea* (TRATT.) GRISEB. ist in Griechenland eine seltene Art, welche von den Autoren nur an drei Stellen gefunden worden ist. Zwei davon sind Neufunde, bei der dritten handelt es sich um einen Wiederfund 100 Jahre nach der Erstangabe durch HALÁCSY. Ein vierter, von BOISSIER genannter Fundort bei den Thermopylen (Mt Iti), konnte bisher nicht bestätigt werden. Die Chromosomenzahl beträgt 2n = 16 und wurde für die griechischen Populationen erstmals ermittelt. Ökologische Hinweise und pflanzensoziologische Daten von den griechischen Standorten werden mit solchen aus dem ehemaligen Jugoslawien und aus Albanien verglichen. Pflanzensoziologsche Aufnahmen von *M. petraea*-Beständen in Griechenland werden erstmals gebracht; hier findet sich *M. petraea* in Felsspalten-Gesellschaften mit *Asperula chlorantha* (Onosmetalia frutescentis QUÉZEL).

Indroduction

The genus *Moltkia* comprises of five species, all growing in the Eastern part of the Mediterranean region (GREUTER & al. 1984). Of these, *M. angustifolia* DC. (= *M. longiflora* WETTST. = *M. longifolia* RIEDL) occurs in Lebanon and probably Anatolia; *M. aurea* BOISS. is restricted to Anatolia; *M. coerulea* (WILLD.) LEHM. (= *Onosma coerulea* WILLD.) occurs in Anatolia, Lebanon and the Krimea; *M. suffruticosa* (L.) BRAND (= *Lithospermum suffruticosum* (L.) A. KERNER = *Pulmonaria suffruticosa* L.) is endemic to Italy, while *M. petraea* (= *Echium petraeum* TRATT.) is a Balkan endemic. According to "Flora Europaea" (TUTIN & al. 1972), the species *M. doerfleri* WETTST. is also referred as a Balkan endemic, however this taxon is now placed in the genus *Paramoltkia* GREUTER 1981.

Moltkia petraea is probably an ancient or even relict species (TURRILL 1929) which has a limited distribution in the western part of the Balkan Peninsula. This species is distributed mainly in former Yugoslavia and Albania and presents a disjunct and scattered distribution in Greece (Fig. 1). The distribution of *M. petraea* in former Yugoslavia extends along the Adriatic coast (Dalmatia), including some islands, and penetrates the Mediterranean and Submediterranean inland regions in Croatia, Bosnia, Erzegovine, Montenegro and FYROM, via gorges (DOMAC 1960, FUKAREK 1962, TRINAJSTIĆ 1964, EM 1967). The current presence of *M. petraea* in gorges is probably due to its preservation within these protected areas during the last Ice Age. A relatively precise distribution map of *M. petraea* in former Yugoslavia was given by TRINAJSTIĆ 1964. To the south, in Albania, *M. petraea* has been recorded from several localities concentrated mainly in the northern half of the country (MARKGRAF 1927, 1931, 1932, VANJGELI pers. com.). In Greece it is considered as a very rare taxon, recorded only from one locality in Epiros and a second in Sterea Hellas (Mt Iti), which marks the south-easternmost point of its distribution (HALÁCSY 1902).

Materials and Methods

This study is based on collections, field observations and sampling using the BRAUN-BLANQUET's method (1964). Data processing was carried out by using the multi-variate analysis techniques STATOS (ROUX 1994) and TWINSPAN (HILL 1979).

All plant specimens collected by the authors have been deposited in the Botanical Museum of the University of Patras (UPA). For the determination of the collected specimens TUTIN & al. 1968–1980, 1993 have been used. The nomenclature follows these publications and, where appropriate, GREUTER & al. 1984–1989.

The life-form categories follow the system of RAUNKIAER 1934. For the chorological types, PIGNATTI's classification (1982) was used.

The karyological study is based on potted seedlings, which were raised in the experimental garden of the Botanical Institute of Patras University. It is noteworthy that seed germination proved difficult but this problem was solved by scraping the seeds on sandpaper before sowing them. Seeds sowed in June, despite being placed in a refrigerator to remove dormancy, germinated the following December. Root tips of the seedlings were suitable for chromosome preparations three months after germination.

The root tip squash technique (ÖSTERGREN & HENEEN 1962) was used for the karyological investigation. Growing root tips were pre-treated for 2.5–3 hours in 2 mol 8-hydroxyquinoline solution. They were subsequently fixed in Carnoy solution (absolute ethanol: glacial acetic acid, 3:1), hydrolyzed in 1N HCl at 60° C for 12 minutes, and stained first with Feulgen reagent for 3–4 hours, and then with Orcein reagent for 18 hours. They were squashed in 45% acetic acid under a cover slip.

The nomenclature used for the centromeric position is in accordance with LEVAN & al. 1965, as modified by STEBBINS 1971. To minimize errors as much as possible, karyotype drawings were made with a camera lucida at a magnification of × 2500 according to BENTZER & al. 1971.

Results and Discussion

Geographical Distribution in Greece

BOISSIER 1879 reported *Moltkia petraea* from a locality in Sterea Hellas, based on a specimen collected by SPRUNER with the label "*Echium petraeum* TRATT. – In fissuris rupium montis Oeta versus Thermopylae" (G-BOIS!). Later, HALÁCSY 1902 reported this species as «rarissime» from only two localities [«Epirus: pr. Vonico ad Klissura distr. Philippiada (BALD.)» and «Mt Oeta pr. Thermopylas (SPRUN.)»]. The presence of this taxon near the village of Klissura along the River Louros, is confirmed here almost 100 years after HALÁCSY's report. Despite repeated efforts by the authors, *M. petraea* has not yet been found again from the region of Thermopyles. Quite probably, this population is now extinct, given the fact that this area is influenced strongly by human activities (including construction of a national road) and the ecological conditions that *M. petraea* prefers, may have changed. The other possibility could be an error of SPRUNER regarding the locality. However, the authors have discovered re-

cently two new localities for this species in the gorges of the rivers Acheron and Kalamas, in Epirus (Nomos Thesprotias) (Fig. 1).

Specimens seen:

1. Nomos THESPROTIAS: Gorge of the River Acheron (Stena Acheronta), 2 km to the east of the village Glyki, at the locality Skala Tzavelenas, alt. 100–200 m; on vertical calcareous cliffs; 39° 20′ N, 20° 38′ E. leg. GEORGIADIS, GEORGIOU & DIMITRELLOS 3113 (UPA), (new locality).
2. Nomos THESPROTIAS: Gorge of the River Kalamas (Stena Kalama), 1 km to the west of the village Pente Ekklisies, alt. 100–230 m; on vertical calcareous cliffs; 39° 36′ N, 20° 27′ E. leg. GEORGIADIS, GEORGIOU & DIMITRELLOS 3114 (UPA), (new locality).
3. Nomos PREVEZIS: 2 km to the south of the village Klissura, by the River Louros, alt 200–260 m; on vertical calcareous cliffs; 39° 21′ N, 20° 53′ E. leg. GEORGIADIS, GEORGIOU & DIMITRELLOS 3111 (UPA), (rediscovery after 100 years).
4. Nomos FTHIOTIDHOS: In fissuris rupium montis Oeta versus Thermopylae, leg. SPRUNER s.n. (G-BOIS!) (extinct?).

Karyology

The karyological study of the three Greek *M. petraea* populations revealed the diploid chromosome number 2n = 2x = 16. This number is given for the first time for Greek populations and is in accordance with the chromosome number found in plants from former Yugoslavia (ŠILIĆ 1984). The karyotype is also given for the first time and consists of 1 metacentric

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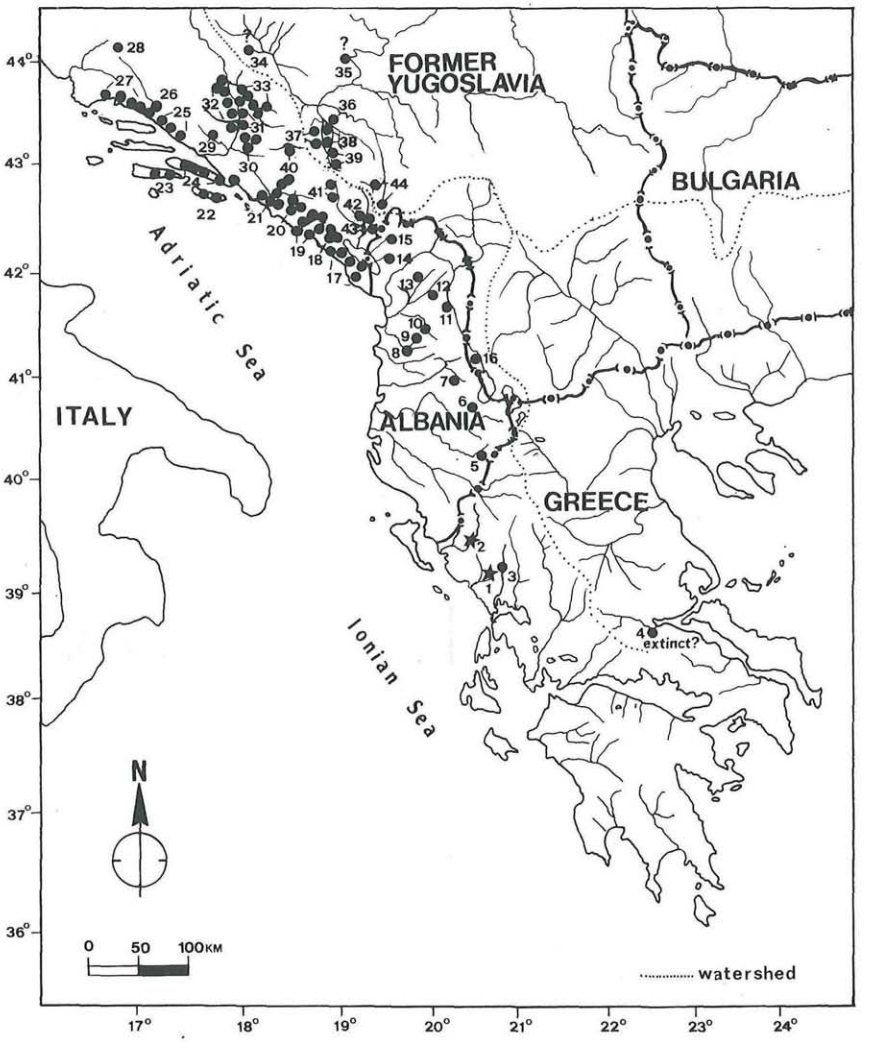
Fig. 1. Distribution of *Moltkia petraea* in the Balkan Peninsula: asteriscs represent new Greek localities [Greece: Acheron river (1), Kalamas river (2), Louros river - Klissura (3), Iti-Thermopyles (4); Albania: Erseka-Gryka e Drakovès -Osum river (5), Gur i Topit (6), Elbasan-Mali i Golisit -Shkumbia river (7), Mali i Dajtit -Erzen river (8), Krujë-Ishm river (9), E of Guribadhe (10), Fushé Lugie -W of Drin river (11), Rrèshen-Velë (12), Mali i Bjeshk (13), Shkodra-Maja e Arapit (14), District of Malesi e Madhe (15); Former Yugoslavia: Grni Drim river -N of Ochris lake (16), Mt Rumija -W of Shkodra lake (17), Mt Lovćen (18), Boka-Kotorska-bay (19), Mt Orjen (20), Trebisnica river (21), Isl. Mljet (22), Isl. Korčula (23), Peljesać (24), Mt Biokovo (25), Cetina river -E of Split (26), Trogir-Split (27), Dinara Planina -Knin (28), Trebižat river (29), W part of Mt Bjelašnica (30), Mostar -Neretva river (31), Mt Čvrsnica -W of Neretva river (32), Mt Prenj Plan -E of Neretva river (33), Mt Vranica -W of Fojnica ? (34), SE of Han Pijesak -W of Drina river ? (35), Mt Ljubišnja -E of Drina river (36), Mt Maglić (37), Mt Durmitor (38), Pive and Komarnica rivers (39), E part of Mt Bjelašnica (40) Montenegro-Nikšić (41), Moraća river (42), Cijevna and Male rivers (43), Tara river (44)]. 1–3 (UPA!), 4 (G.-BOIS!), 5–15 (MARKGRAF 1932, VANJGELI pers. com.), 16–43 (TRINAJSTIĆ 1964, STEVANOVIĆ pers. com.).



(m) chromosome pair, 4 submetacentric (sm) pairs, and 3 telocentric (st) pairs (Fig. 2).

Ecology and Synecology

Moltkia petraea is an important member of the chasmophytic vegetation. In the area of former Yugoslavia it appears to have wide ecological requirements, given that it grows throughout a wide altitudinal range, from a few metres above sea level (10 m) to high altitudes on the peaks of the Dinaric Alps (up to 2000 m) (see Table 1). This species belongs to the group of Illyro-Adriatic to Illyro-Mediterranean elements, which penetrates the hinterland of the Balkan peninsula via river gorges.

M. petraea is restricted to calcareous substrates and especially prefers warm, sunny places on vertical cliffs along rivers. The biotopes of all the Greek populations found by the authors reflect the above-mentioned requirements (see Table 1).

According to studies on the synecology of this species in former Yugoslavia, *M. petraea* participates in several chasmophytic communities. The syntaxonomy of these associations is discussed by different authors in a controversial way. There is no doubt about the position of all associations distributed in the former Yugoslavia and Albania in the order Potentilletalia caulescentis Br.-Bl. 1926 (calcareous rock fissure communities of the Alps, the Pyrenees and other calcareous mountain ranges in Europe). The large number of sometimes very locally distributed endemic species in southeastern Eupope is the reason for splitting the class into several orders beside Potentilletalia, that should be restricted to Alps and Pyrenees. While Horvat, Glavač & Ellenberg 1974 still include the Moltkietum

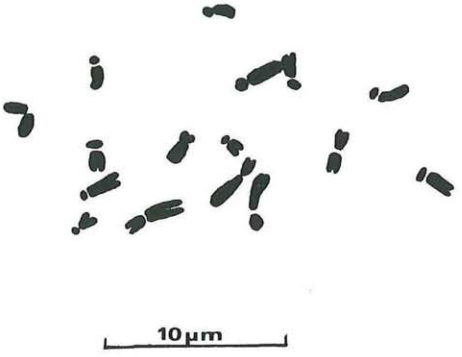


Fig. 2. Mitotic metaphase plate of *Moltkia petraea* with 2n = 16 (Population from Nom. Thesprotias, Gorge of the River Acheron).

Table 1. Characteristic biotopes of *Moltkia petraea* in Greece, Albania and former Yugoslavia

Locality	Altitude in m a. s. l.	Habitat (Substrate, inclination, vegetation)	Exposition
GREECE			
1. The gorge of the River Acheron (new locality)	100–200	Vertical calcareous cliffs by riverside – Sunny and shady places with chasmophytic vegetation of lower altitudes where penetrate phryganic and sclerophyllous elements (Table 3) (UPA!).	W, S, E
2. The gorge of the River Kalamas (Thiamis) (new locality)	100–230	Vertical calcareous cliffs by riverside – Sunny places with chasmophytic vegetation as above (UPA!).	NW
3. 2 km to the south of the village Klissura, by the River Louros	200–260	Vertical calcareous cliffs by riverside – Sunny places with chasmophytic vegetation as above (UPA!).	E, SE
4. Mt Iti, near Thermopyles (SPRUN.)		No available data. Population not found (extinct?) (G-Bois!).	
ALBANIA			
5. Top of Mali i Bjeshk NE of Tirana	900	Vertical calcareous cliffs with phryganic and chasmophytic vegetation (MARKGRAF 1932).	W
6. Mali i Dajtit, under the plateau	900	Vertical calcareous cliffs with phryganic and chasmophytic vegetation (MARKGRAF 1932).	W
7. To the east of the village Guribardhe on the road Tirana-Dibra	700	Vertical calcareous cliffs with phryganic and chasmophytic vegetation (MARKGRAF 1932).	S
FORMER YUGOSLAVIA			
8. Boka Kotorska bay	10	Steep calcareous maritime cliffs with chasmophilous species (STEVANOVIĆ pers. com.).	S, W, NW
9. Mt Rumija (Montenegro)	800–1200	Vertical calcareous cliffs with chasmophytic vegetation (LAKUŠIĆ 1968).	N, N, W
10. Gorges of the rivers Cijevne and Male (Montenegro)	150–190	Calcareous cliffs with steep inclination (70°–85°) by riversides with chasmophytic vegetation (STEVANOVIĆ & BULIĆ 1992).	N
11. Gorges of the rivers Pive and Komarnice (Montenegro)	570–1150	Vertical calcareous cliffs by riversides (rarely immobile screes) with chasmophytic vegetation. (BLEČIĆ 1958, LAKUŠIĆ 1968).	S, SE, N
12. Mt Lovćen (Montenegro)	100–1500	Calcareous cliffs with steep inclination (50°–90°, usually by riversides or by lake with chasmophilous species – Subalpine zone, in *Fagus* forest with forestal species (TOMIĆ-STANKOVIĆ 1970).	SE, E, W, S
13. South slopes of Mt Durmitor (Montenegro)	600–2000	Calcareous cliffs with steep inclination – In high altitudes beside *Pinus heldreichii* forest with other species of orophytic vegetation (TRINASTIĆ 1974).	N
14. Island Mljet (Croatia)	20–500	Vertical calcareous cliffs (in low altitudes by lake). Eu-mediterranean zone of vegetation (TRINAJSTIĆ 1974).	S, SW, SE
15. Island Korčula (Croatia)	250–400	Vertical calcareous cliffs (by waterfall). Eu-mediterranean zone of vegetation (TRINAJSTIĆ 1964).	–

petraeae BLEČIĆ 1958 in the Alliance Micromerion croaticae HORVAT 1931 within the Potentilletalia, LAKUŠIĆ 1968 created the new order Moltkeetalia petraeae and the Alliance Edraianthion, where the northern eumediterranean Campanulo-Moltkeetum petraeae HORVATIĆ 1963 and the oromediterranean adriatic Moltkietum petraeae as well as the Moltkeo-Galietum baldacii and the Geranio-Ramondaetum serbicae are summarized (Table 2).

None of the above associations have been found in Greece. The Greek populations of *M. petraea* grow in the Mediterranean vegetation zone and participate in chasmophytic communities of lower altitudes. These communities are classified in the Alliance Campanulion versicoloris QUÉZEL 1964, the Order Onosmetalia frutescentis QUÉZEL 1964 and the Class Asplenietea trichomanis BR.-BL. 1934. Phryganic and sclerophyllous elements from neighbouring vegetation often penetrate these chasmophytic communities (see Table 3).

In Greece, *M. petraea* seems to form particular communities accompanied by *Asperula chlorantha*. These communities are differentiated in the south by the participation of *Stachys decumbens, Ptilostemon chamaepeuce, Scabiosa epirota, Frangula rupestris* and *Cephalaria leucantha* in the River Acheron locality. *Scrophularia heterophylla* and *Ramonda serbica* participate in the locality by the River Kalamas, and *Silene ce-*

Table 2. Described syntaxa with *Moltkia petraeae* of the Balkan peninsula and their syntaxonomic position

Class: ASPLENIETEA-TRICHOMANIS Br.-Bl. 1934

Order: **Onosmetalia frutescentis** QUÉZEL 1964

Alliance: Campanulion versicoloris QUÉZEL 1964

Community: *Moltkia petraea* and *Asperula chlorantha* community (Ass. unpublished) [Eumed. regions of Greece: Gorges of Acheron river, Kalamas river and Louros river – Klissura].

Order: **Moltkeetalia petraeae** LAKUŠIĆ 1968

Alliance: Edraianthion LAKUŠIĆ 1968

Association: Moltkietum petraeae BLEČIĆ 1958 [Montenegro: Gorges Pive and Komarnica (BLEČIĆ 1958, LAKUŠIĆ 1968].

Association: Campanulo-Moltkeetum petraeae HORVATIĆ 1963 [Submed. part of C. and S. Adriatic coast of Croatia (STEVANOVIĆ pers. com., LAKUŠIĆ 1968); submed. and subalpine regions of Mt Lovćen – Montenegro (TOMIĆ-STANKOVIĆ 1970, LAKUŠIĆ 1968); eumed. zone on isl. Mljet, Croatia (TRINAJSTIĆ 1974, LAKUŠIĆ 1968); eumed. zone on isl. Korčula, Croatia (TRINAJSTIĆ 1964, LAKUŠIĆ 1968)].

Association: Moltkeo-Galietum baldaccii LAKUŠIĆ 1968 [Montenegro: Mt Rumija (LAKUŠIĆ 1968)].

Association: Geranio-Ramondaetum serbicae STEVANOVIĆ & BULIĆ 1992 [Montenegro: Gorges of the rivers Cijevne and Male (STEVANOVIĆ & BULIĆ 1992)].

Table 3. Communities with *Moltkia petraea* from localities along the rivers Acheron (A), Kalamas (K) and Louros (L)

Running number	123456	7891111 0123	111111 456789	
Releve number	326145	111 1 230891	1111211 6457089	
Releve locality	AAAAAA	KKKKKK	LLLLLLL	
Altitude (m × 10)	221211 007089	212122 351820	2222222 2603252	
Total cover (%)	632154 005550	242122 005550	2221211 5505555	
Inclination (degrees)	999999 000000	979889 050550	9799989 0500050	
Exposition	NNNNSS EE E	NNWWWW	SSSSESN W	
Surface (m^2 × 10)	588881 0	155511 0 0 00	6866858	
Geological substratum	cccccc	cccccc	ccccccc	
Character species of *Moltkia petraea – Asperula chlorantha* Ass.				C LF Chor
Moltkia petraea	211132	11+1+1	2211+1+	19 Ch/Balkan
Asperula chlorantha	++-+1+	121111	1111111	18 Ch/Balkan
Differential taxa				
D1				
Stachys decumbens	-1+111	------	-------	05 H/Balkan
Ptilostemom chamaepeuce	+1-+11	------	-------	05 Ch/Greek
Scabiosa epirota	--2-11	------	-------	03 Ch/Balkan
Frangula rupestris	+-----	------	-------	01 Np/Sub-Balk.
Cephalaria leucantha	---+--	------	-------	01 H/Europ.
D2				
Scrophularia heterophylla	------	++1+11	-------	06 H/Balkan
Ramonda serbica	------	-2----	-------	01 H/Balkan
D3				
Silene cephallenia subsp. epirotica	------	------	+111211	07 H/Balkan
Centaurea graeca	------	-----+	11++1--	06 H/Balkan
Teucrium halacsyanum	------	------	-111-+1	05 Ch/Greek

Ch. Campanulion versicoloris

Campanula versicolor	1+111-	1+1+21	1111111	18 H/NE.Med.
Athamantha macedonica	-1111-	11–+11	111-1-1	16 H/Sub-Balk.
Aurinia saxatilis subsp. orientalis	------	-+++11	-11+21+	11 Ch/E.Med.
Centranthus ruber	-----+	--1+++	11111–+	11 Ch/St.Med.
Ephedra fragilis	-++---	----2-	++++1++	10 Np/E.Med.
Pterocephalus perennis	------	-----+	-------	01 Ch/Greek
Umbilicus horizontalis	------	------	-+-----	01 G/St.Med.

Ch. Asplenietea trichomanis and Onosmetalia frutescentis

Ceterach officinarum	+--1-+	11-1+1	-11--1-	11 H/Paleotemp.
Asplenium trichomanes	++-+-+	+1--+-	-----+-	08 H/Cosmop.
Parietaria officinalis	--+---	-1-+---	+11+-+-	08 H/Eurasiat.
Sedum dasyphyllum	------	---111	-11-1--	06 Ch/Eu.Med.
Parietaria lusitanica	------	---++-	1-11---	05 T/St.Med.
Silene gigantea	------	-----+	+------	02 H/Balkan

Ch. Pistacio-Rhamnetalia

Teucrium flavum subsp. hellenicum	11-111	+-11++	1+-++-+	15 Ch/Balkan-An.
Coronilla emerus subsp. emeroides	1-1+1-	++----	++--+--	10 Np/Med.-Pont.
Pistacia terebinthus	++----	+-+-++	++-++--	10 P/Eu.Med.
Rhamnus alaternus	--+-++	---+-+	----+--	06 P/St.Med.
Phillyrea latifolia	1++-+-	+----+	-----+-	07 P/St.Med.
Anagyris foetida	++-+--	------	-----++	05 P/Med.
Fraxinus ornus	+---11	++-+--	-------	06 P/Eu.Med.
Prunus webbii	------	-----+	--++-+-	04 P/E.St.Med.
Olea europaea subsp. sylvestris	------	------	+++-+--	04 P/St.Med.
Smilax aspera	+---+-	------	-------	02 Np/Paleotemp.
Asparagus acutifolius	----++	------	-------	02 G/St.Med.
Euphorbia characias	------	--+---	------+	02 Np/St.Med.

Ch. Cisto-Micromerietea (-etalia)

Erica manipuliflora	31--+1-	---1-1	-------	06 Ch/E.Med.
Micromeria juliana	1-111-	---+-1	11---1-	09 Ch/St.Med.
Micromeria cremnophylla	+-++11	-1----	------1	07 Ch/Balkan
Phlomis fruticosa	----+-	---+-+	+----+-	05 Np/St.Med.
Osyris alba	---+--	-----+	-+-----	03 Np/Eu.Med.
Phagnalon graecum	---+--	------	++-----	03 Ch/NE.Med.
Cistus incanus subsp. creticus	+--+--	------	-------	02 Np/Med.
Salvia officinalis	------	-----+	-------	01 Ch/St.Med.

Additional taxa:
Selaginella denticulata (1:+, 6:+, 9:+, 13:+, 18:+); Leontodon crispus subsp. asper (5:+, 11:+); Festuca jeanpertii (1:+, 9:+); Brachypodium retusum (1:1, 6:1); Cymbalaria muralis (11:+, 14:+); Cephalaria ambrosioides (5:+, 14:1); Achillea holosericea (8:1, 11:+); Arenaria serpylifolia (1:+, 13:+); Galium verum (3:1, 5:+); Crepis frassii (7:+,

8:+); Lamium garganicum (8:+, 9:+); Crepis foetida (14:1, 17:+); Asphodeline lutea (14:+, 17:+); Psoralea bituminosa (14:+, 17:+); Isatis tinctoria (14:+, 16:+); Sedum cepaea (15:+, 17:+); Urginea maritima (11:+, 14:+); Arabis verna (11:+, 15:+); Erysimum cephalonicum (10:+, 12:+); Dryopteris filix-mas (9:+, 19:+); Silene italica (10:+, 11:+); Ferula communis (12:+, 19:+); Umbilicus chloranthus (10:+); Trachelium jacquinii (10:+); Lonicera implexa (1:+); Cotinus coggygria (1:+); Quercus ilex (1:+); Ruscus aculeatus (4:+); Solidago virgaurea (4:+); Laurus nobilis (10:+); Piptatherum coerulescens (14:+); Saxifraga tridactylites (14:+); Anthemis arvensis (13:+); Parietaria difussa (16:+); Stellaria media (11:+); Silene vulgaris (11:+); Piptatherum miliaceum (17:+), etc.

phallenia subsp. *epirotica, Centaurea graeca* and *Teucrium chalascyanum* in the locality by the River Louros (see Table 3). These communities should be described after finishing the complete investigation of a number of other Greek gorges where *M. petraea* populations could probably be found (e.g. Vikos gorge, Asopos gorge). Efforts should also be continued to rediscover the population near Thermopyles.

From the analysis of the life-form spectrum of the flora of the studied Greek *M. petraea* biotopes (Fig. 3), it is concluded that the Hemicryptophytes dominate the spectrum with 34%, the Therophytes follow with 22% and the Chamaephytes also participate with a high percentage (16%). These data agree with the Mediterranean character of the flora, as well as the Meso-Mediterranean bioclimatic character of the studied area.

The chorological spectrum (Fig. 4) shows that the Mediterranean group is represented by the highest percentage (47%), while the Balkan and Sub-Balkan groups participate in significant number (13% + 4% = 17%). This shows that a considerable part of the Balkan floristic element accompanied *M. petraea* on its geographical descent to Greece.

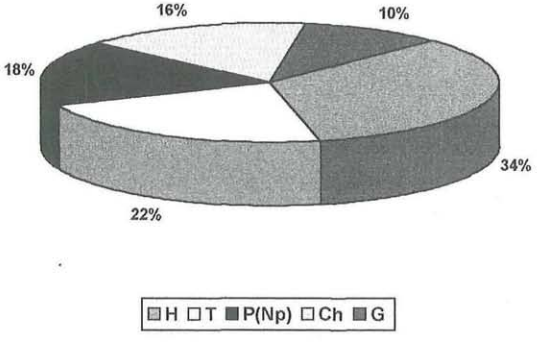


Fig. 3. Life form spectrum of the flora of the studied Greek biotopes of *Moltkia petraea*, using the 19 relevées given in Tab. 3.

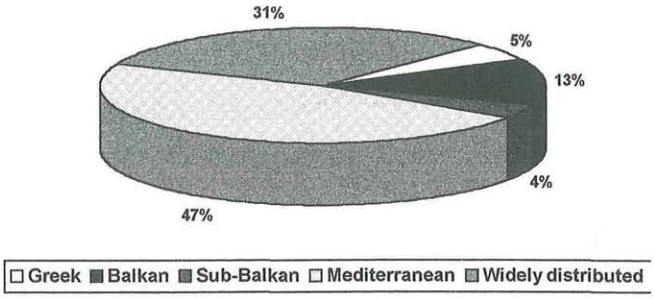


Fig. 4. Chorological spectrum of the flora of the studied Greek biotopes of *Moltkia petraea*, using the 19 relevées given in Tab. 3.

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