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# The genus *Medicago* in Greece: 1. A review of species diversity, geographical distribution and ecological adaptation

**Abstract**

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Greece is one of the world's richest countries in Medicago taxa, counting 7 perennial and 27 annual species. This high diversity can at least partly be attributed to the geographical position of the country, which enabled its enrichment with different chorological elements. Furthermore, Greece is the outermost phytogeographical boundary of more than one third of the *Medicago* species present in its territory. The distribution of species varies considerably, from endemic taxa known to exist in only a few localities (*M. strasseri*) to species having their only European records in Greece (*M. heyniana, M. carica*) and also widespread species found in several areas of the Mediterranean. Between different regions, islands and islets an uneven distribution of *Medicago* species is found, attributed to populations' fluctuation or/and undercollection. Isoflors showed that the higher concentration of species forms a belt defined by Kerkira to east Thraki via Kriti. In the mainland, species concentration is dramatically reduced towards a northwards direction. The Greek *Medicago* species exhibit a considerable altitude range, from sea level up to ca. 2300 m and appear in various habitats, although they show a particular preference for limestone substrates, sand, sandy loam and loam soil textures. The preferences of certain *Medicago* species in Greece are restricted to very specific vegetation types, while others are found in a wide range of plant communities. Some annual species are adapted to Mediterranean fire conditions and others have developed a weedy behaviour. Species that are found in very few localities or grow in threatened environments may need protection.

*Key words*: Conservation, *Fabaceae*, Flora, *Leguminosae*.

## Introduction

The genus *Medicago* L. belongs to *Fabaceae* and includes a total number of 83 species, according to the last taxonomic study of the genus (Small & Jomphe 1989). The natural distribution of the genus covers broad regions of Eurasia and North Africa (Kouznetsoff 1926, Heyn 1963). The genus mostly includes herbaceous species with the exception of three shrubs. The biological cycles may be annual, biennial or perennial. According to Tutin (1968), Ivimey-Cook (1968), Heyn & Davis (1970), Huber-Morath (1970) and Greuter & al. (1989) *Medicago* comprises many species in Greece. A critical review on

species diversity, their geographical and altitudinal distribution and ecological preferences in Greece is still lacking, although a considerable part of information has been accumulated from the first botanical explorations and up the recent times. Treatments of *Medicago* taking into account species diversity, geography and ecology at country level are rather scarce (e.g. Ehrman & Cocks 1990 for Syria, Crespi & al. (2003) for north Portugal and Mehregan & al. 2003 for Iran). A worldwide ecogeographical analysis of the perennial *Medicago* was presented by Bennett & al. 2006.

Therefore, the aim of this study is to collect and evaluate information from published sources and herbarium collections, compile data and attempt an integrated approach on *Medicago* species found in Greece, which apart from species diversity, also includes spatial distribution and ecological requirements.

## Materials and methods

*Data compiling*

Information on most *Medicago* taxa has been collected during visits to the following Herbaria (abbreviations according to Holmgren & al. 1990): ACA, ATH, ATHU, B, BM, C, K, LD (including the electronic database: http://www.biomus.lu.se/indexBdate.html), MAIC, TAU, UPA, W, Natural History Museum of Kriti and the private collections of Z. Kypriotakis, Th. Chitos and the author. In total c. 3100 specimens have been seen. Mr. C. Pinatsis (Leonidas Pinatsis Herbarium) and Mr. R. Burton kindly offered written information from their private Herbaria. The Greek Gene Bank of the National Agricultural Research Foundation diffused to the author *Medicago* acquisitions. Prof. A. Strid provided the checklist of *Fabaceae* for Patmos Island extracted from the Flora Hellenica Database. Moreover, several thousands of reference sources were screened for information on *Medicago* species in Greece using the Flora Hellenica Bibliography (Strid 1996), as well as more recent publications. These sources were used in order to register in detail the following topics: locality, altitude, abiotic and biotic environmental factors and participation in plant associations. Lack of information on labels and sources was often noticed, a problem also mentioned by Bennett & al. (2006). In this context a major problem is the very rare information on population status, which could help in estimating the extinction risk of a species (IUCN 2001). The environmental factors were limited to Greece. Specimens with inadequate taxonomic features were not taken into consideration. The Australian database of South Australian Research and Development Institute (SARDI) has been reviewed for very rare species collected in Greece. The selected species were pot cultivated so that their identity could be confirmed. The botanical nomenclature follows MedChecklist (Greuter & al.1989) and the yet unpublished treatment for Flora Hellenica (P. Lassen, personal communication), which are almost alike the nomenclature adopted by Small & Jompe (1989). Since those references no new *Medicago* species to science has been described in Greece. Accepted names and synonyms were standardized using Rechinger (1943a), Heyn (1963) and Greuter & al. (1989) as important references. In general no subspecific taxa were accepted, the only exceptions being the two subspecies of *M. sativa*, where sufficient information was available. Furthermore, the comparison between an indigenous and a naturalized subspecies found in Greece would be of interest. The fol-

lowing references were used for data extraction, in alphabetical order (only authors not cited in other parts of this paper are presented here): Ade & Rechinger (1938), Anonymous 2000, Arianoutsou & al. (1986), Atchley (1938), Athanasiadis & Drossos (1990), Athanasiadis & Eleftheriadou (1995), Athanasiadis & Theodoropoulos (1990), Athanasiadis & al. (1993), Athanasiadis & al. (1996), Athanasiadis & al. (1998), Babalonas (1970, 1980, 1981, 1984, 1988, 1989), Babalonas & al. (1998), Baldacci (1894), Baltisberger (1991), Beauverd & Topali (1936), Béguinot & Andreucci (1925), Béguinot & Vaccari (1914), Bergmeier (1995, 1998b, 2002), Bergmeier & Matthäs (1995), Bergmeier & al. (1997), Biel (2005), Boissier (1872a, 1872b), Boissieu de (1896), Boratyńska & al. (1985), Boratyński & al. (1987), Boratyński & al. (1991), Boratyński & al. (1992), Bornmüller (1894, 1928), Bory de Saint-Vincent & Chaubard (1832), Brandes (1998), Browicz (1991, 1994, 1997, 1999a, 1999b), Browicz & Zieliński (1996), Brofas & Karetsos (1992), Brofas & al. (2001), Burton (1991), Böhling (1994), Candargy (1892,1899a), Čelakovský (1887), Chilton & Turland (1997, 2004), Christodoulakis (1994), Chitos (2005), Chochliouros & Georgiadis (1997), Ciferri (1943, 1944), Clarke (1810-1823), Constantinidis (1997, 2004), Constantinidis & al. (2004), Cousturier & Gandoger (1916), Covillot & al. (1997), Davis & al. (1988), Deffner (1922), Diapoulis (1940,1958), Dimalexis & al. (1999), Dimopoulos (1993), Drossos (1975, 1977, 1992), Drossos & Athanasiadis (1989), Economidou (1973), Eleftheriadou & Theodoropoulos (2003), Eleftheriadou & al. (1995), Ewing & Howieson (1987), Fielding & Turland (2005), Fiori (1924a, 1924b, 1939), Formánek (1891a, 1891b, 1896, 1897, 1899, 1900), Forsyth-Major & Barbey (1894a, 1896a, 1896b), Francis & Katznelson (1977), Francis & al. (1995), Gandoger (1915, 1916a, 1917, 1920a, 1920b), Ganiatsas (1936, 1938, 1940, 1955, 1963, 1971), Gelmi (1889), Georgiadis (1994), Georgiadis & al. (1990), Georgiadis & al. (1985), Georgou (1988), Gillespie (1989), Goulimis (1954, 1960), Gradstein & Smittenberg (1977), Greuter (1970, 1974), Greuter & Rechinger (1967), Griesbach (1843), Gutermann (1995), Habeck & Reif (1994), Halácsy (1892a, 1892b, 1894a, 1894b, 1901, 1906, 1908, 1910), Hansen (1982), Hansen & al. (1966), Hartvig & Strid (1995), Haussknecht (1894), Hayek (1928), Heiselmayer (1996), Heiselmayer & Siebenbrunner (1986), Heiselmayer & al. (1995), Heldreich (1880, 1883a, 1883b, 1898a, 1898b, 1898c, 1899a, 1899b), Hughes (1987), Hofmann (1968), Jahn & Schönfelder (1995), Jeanpert (1919), Karagiannakidou & Kokkini (1987), Karagiannakidou & Raus (1996), Karagiannakidou & al. (1995), Karagiannakidou & al. (2000), Karetsos (2001), Katsikopoulos (1936), Knapp (1964, 1965), Kokmotos (1999), Konstantinou (1992), Koumpli-Sovantzi (1991), Koumpli-Sovantzi & Vallianatou (1994), Koumpli-Sovantzi & Yannitsaros (1993), Koumpli-Sovantzi & al. (2000), Koutsopulos & Sarlis (2002), Krause & al. (1963), Krigas & Kokkini (2004, 2005), Krigas & al. (1999), Kull & Diamantopoulos (1998), Lavrentiades (1979), Maire (1921a,1921b), Maire & Petitmengin (1907, 1908), Malakates (1927, 1928b, 1933a, 1933b), Markgraf (1920), Maroulis & Artelari (2001), Maroulis & Georgiadis (2005), Meikle (1954), Nadji (1892), Nutt & al. (1996), Oberdorfer (1954a, 1954b), Ostermeyer (1887), Pampanini (1923, 1927), Panagopoulos & al. (2001), Panitsa & al. (2003), Pantis (1987), Papanastasis (1989), Papanikolaou (1985), Papanikolaou & Sarlis (1991), Papatsou (1975), Paraskeuopoulos (2006), Pavlides (1982, 1985), Phitos (1960), Phouphas (1968), Pieri (1814, 1824), Politis (1953), Preston & Strid (1986), Quézel (1964, 1967), Quézel & Contandriopoulos (1965a, 1965b), Quézel &

Katrabasa (1974), Ralf & al. (1995), Rauh (1949), Raulin (1869), Raus (1980, 1983, 1991, 1996b), Rechinger (1929, 1939, 1949, 1961), Rechinger & Rechinger-Moser (1951), Regel (1943, 1947, 1952,1953), Reif & Löblich-Ille (1999), Rikli & Rüber (1923), Ronniger (1941), Rothmaler (1944), Runemark & al. (1960), Samuelsson (1934), Sarika & al. (2005), Sarlis (1980, 1990, 1994a, 1994b), Schönfelder & Besl (1988), Schwarz (1981), Sibthorp & Smith (1813), Snogerup & Snogerup (1991, 1993), Snogerup & al. (1980), Snowball (1998), Spreitzenhofer (1877), Stamou & al. (2003), Stefanaki-Nikiforaki (1981, 1982, 2000a, 2000b, 2001), Stefani & al. (1891, 1895), Sterneck (1911), Stojanov (1928), Stojanov & Jordanov (1938), Stojanov & Kitanov (1944, 1946, 1950), Strid & Tzanoudakis (1998), Strid & Ugelvig (1986), Szijj (1983), Theocharopoulos & Georgiadis (1984), Theocharopoulos & al. (1998), Theodoropoulos (1991, 1996), Theodoropoulos & Eleftheriadou (2003), Theodoropoulos & Athanasiadis (1995), Tocl & Rohlena (1902), Tsiotsiou & Christodulakis (2004), Tuntas (1905), Turrill (1918, 1920, 1937), Weiss (1869), Yannitsaros (1969, 1998), Vallianatou & Yannitsaros (1993, 2000), Vandas (1905), Vierhapper (1914a), Vierhapper & Rechinger (1935), Vlachos & al. (2002), Voliotis (1967, 1976a, 1976b, 1977, 1981,1983, 1984), Zaffran (1976, 1990), Zaganiaris (1935b, 1938a, 1938b), Zerlentis (1959, 1965, 1968), Zotos & al. (2006).

*Presentation of geographical distribution*

There are at least, two different methods to choose from, when creating distribution maps of each taxonomic entity. The first method, represented by Pignatti (1982), uses a symbol to indicate the presence of any given taxon in a particular administrative region. The second one, represented by Strid & Tan (1997), locates any given taxon more precisely on a map, using coordinates. It was decided to use the first method for the following four reasons: a. Though information contained in old sources is often incomplete, nevertheless it can be valuable as it is not met in recent sources; b. The data colleted by herbaria and bibliography have a qualitative value and not a quantitative one. Quantitative presentation of data would request sampling procedures (e.g. Ehrman & Cocks 1990), which would eliminate bias. Such features are beyond the available information provided by the existing data; c. The same symbol of each administrative region can depict different altitudinal zones (Table 1); d. A sufficient amount of information is maintained by choosing the appropriate geographical unit for each taxon mapping. In our case, the units used refer to the prefectures (Nomos) and islands of Greece (Fig. 1), totaling up to 103 entities. The administrative boundaries of a few prefectures do comply with the physical ones. Thus, the mainland part of Nomos Evvias is incorporated in Nomos Viotias, Nomos Korinthias is limited to Peloponnisos only, and Nomos Argolidos also includes that part of Nomos Pireos situated in Peloponnisos. With regard to the islands, the largest of them were selected for full representation on the distribution maps; however, detailed reference is made to smaller islands or islets in Table 3 and the text, where necessary.

*Maps construction*

The data collected from various Herbaria, Gene Banks databases, personal communication and the references were summarized into tables, different for each species (all the tables are available by the author upon request). The data of each table were then transformed into distribution maps, where each species was indicated by its own symbol. This

Table 1. Symbols used for the representation of altitudinal zones.

| Altitudinal zone (m) | Symbols |
|---|---|
| 0-500 | |
| 501-1000 | |
| 1001-1500 | |
| 1501-2000 | |
| 2001-2500 | |
| Reference without altitude | |

Note: The above symbols could appear also in various combinations (e.g.  means that the altitudinal zone from 0 up to 1500 m is covered).

symbol was then modified in order to comprise five altitudinal zones (Table 1). In order to construct the isoflors map according to Maxted & al. (2000) the total number of species for each prefecture and island was calculated and then the appropriate lines were manually drawn (Fig. 17).

## Results and Discussion

### *A. Species distribution and habitats*

**1. *M. arborea*** L.

Linnaeus (1753) described *M. arborea* and indicated as provenance the Greek island of Rhodos and Neapoli (Napoli of Sicily).

This shrubby species grows in natural, undisturbed habitats but is more often found in anthropogenic localities, where the origin of the plants can be certainly attributed either to planting or to escaping. It can be found in macchie and garrigue (the term also includes phrygana, according to Th. Raus personal communication) vegetation types, sparse *Pinus halepensis* forest, in (sub)nitrophilous frutescent vegetation (Bergmeier & Dimopoulos 2003) and in olive groves. It has the potential of naturalization (Turland & al. 1993). Thus, some of the locations presented in Fig. 2 may either refer to planted material or individuals spread from planted stock. According to Fig. 2 and Table 3 *M. arborea* extends over the broadly defined Aegean region, particularly at low altitudes near the sea. Most probably, natural stands of *M. arborea* are confined to islets of the Aegean Sea (e.g. Greuter 1979, Malakates 1928a, Kamari 1988, Snogerup & al.1991), rocky places on larger islands like Kasos (Forsyth-Major & Barbey 1894b) or Saria (Raus 1996a) and at the rocky foothills of mountains in the mainland, as is the case of Mt Pateras (Constantinidis 1997). The species is not considered as native in Kriti but recently it has been found in two of the Dionysades island group, north-east of the Lassithi prefecture (Bergmeier & Dimopoulos 2003).

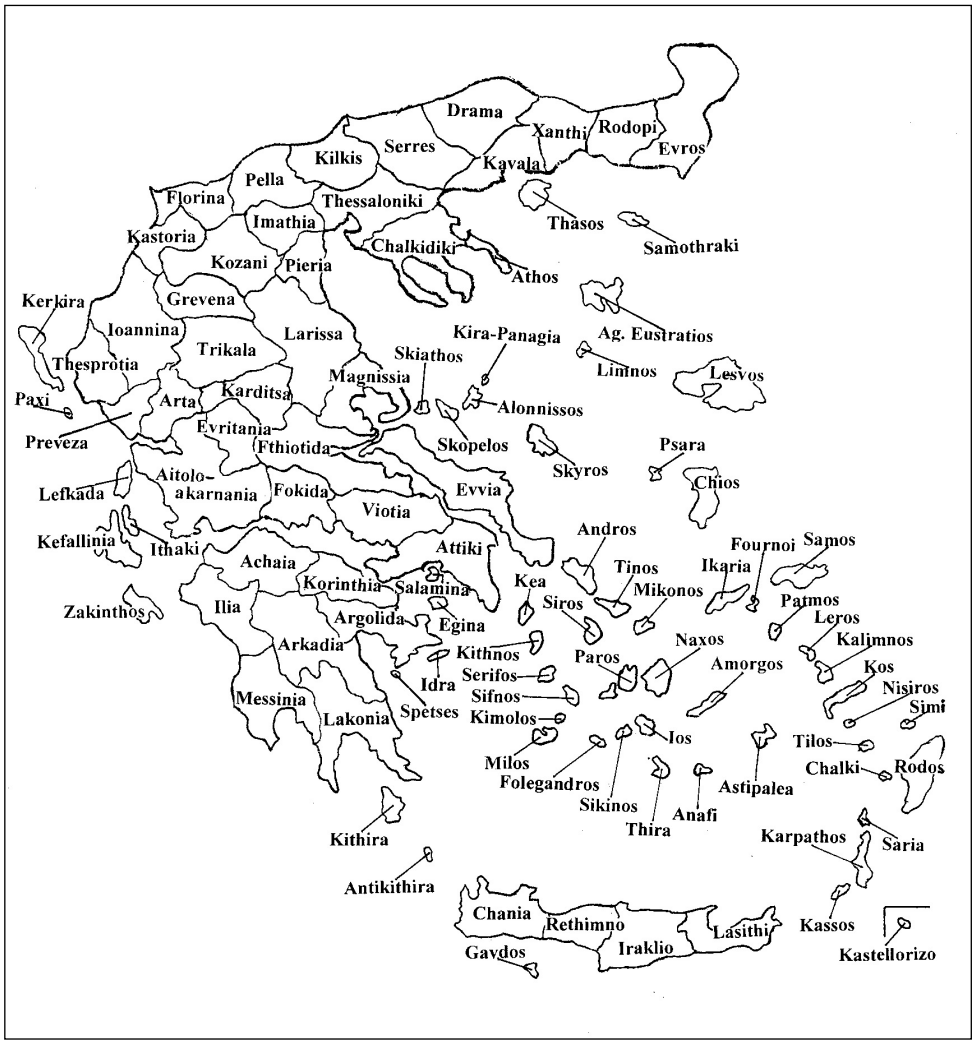


Fig. 1. Map of Greece with names of prefectures and islands which are floristically covered.

*M. arborea* is characterized as chasmophyte (Greuter 1979) and islet chasmophyte (Höner & Greuter 1991). This is substantiated by the fact that this species appears at steep limestone cliffs and seashore rocks. Grazing seems to be the driving force that restricts the species to cliffs and at the same time suppressing its expansion. The plants of *M. arborea* are highly preferred for consumption by small ruminants (Amato & al. 2004). Therefore, they only survive in isolated specific environments that offer long-term protection from either wild or domesticated ruminants for thousands of years. When grazing pressure ceases the plants may expand, if not limited by other unfavourable factors. Such an example is reported from the natural environment of Dionysades islands, where the plants spreaded

from cliffs to even grounds during the last 20 years (Bergmeier & Dimopoulos 2001, 2003). The same expansion has been observed in the Philopapos Hill semi-natural environment in Athens, where the plants colonize rocky places and increase in numbers. Obviously, the origin of this population should be attributed to planted material for decorative reasons. Consequently, *M. arborea* can be characterized as a facultative chasmophyte.

From a phytosociological point of view *M. arborea* forms the *Lavatera arborea-Medicago arborea* Ass. Bergmeier & Dimopoulos 2003, which appears both in the western and eastern Aegean islets (Bergmeier & Dimopoulos 2003).

**2. *M. strasseri*** Greuter, Matthäs & Risse

Sobrino & al. (2001) treat this taxon taxonomically as a subspecies. Nevertheless in this paper this taxon is maintained at species level (A. Strid, personal communication).

This is the only Greek endemic *Medicago* species, which is restricted to Kriti (Fig. 2), currently known from seven different localities in the area (Z. Kypriotakis, personal communication). Greuter & al. (1982) consider this species as a typical representative of the chasmophytic element of the island. It is localized on limestone cliffs of Kriti (Greuter 1986) with a high relative humidity, together with broad-leaved element of the island. It is localized on limestone cliffs of Kriti (Greuter 1986) with a high relative humidity, together with broad-leaved sclerophyllous species (Greuter & al. 1982). It is absolutely intolerant to grazing (ibid). It has been characterized as an obligatory chasmophyte or a true chasmophyte, which is both adapted and specialized to cliffs (Kypriotakis & Tzanoudakis 2001) in order to avoid grazing (Kypriotakis 1988). The last author also discovered this species on an islet NW of Heraklion, where neither cliffs nor any indication of grazing were observed (ibid., Kypriotakis & Tzanoudakis 2000). This may be reasonable, as some species can be adapted to chasmophytic environments without necessarily being specialized chasmophytes (Snogerup 1971). Therefore, its characterization as an obligatory chasmophyte should be re-examined and probably change into a facultative chasmophyte. Thus, *M. strasseri* behaves similarly to *M. arborea*, the way it is described above.

**3. *M. sativa*** L.

**3a. *M. sativa*** L. ssp. ***sativa***

This subspecies of Iranian origin was introduced in Greece during the Median Wars (Prosperi & al. 2001) and gained some importance in Greek agriculture (Bolton & al. 1972). During the Medieval ages the cultivation retreats in Europe (ibid.) and the same should have probably happened in Greece. Authors who reported on the cultivated plants of Greece do not referred to *M. sativa* ssp. *sativa* at all, or indicate it as very rarely cultivated (Fiedler 1840, Langkavel 1866, Hehn 1870). Several decades afterwards, Turrill (1929) did not include it in his list of plants cultivated in the Balkan Peninsula and Kriti. Heldreich (1862) mentioned that the cultivation of *M. sativa* ssp. *sativa* has just started in Greece. This is in accordance with a statement by Kontsiotou (2005) that *M. sativa* ssp. *sativa* was cultivated in Greece during 1860 in an area of about 9 hectares. At that time, Greece was restricted to the area south of Thessalia and Kriti was part of the Ottoman Empire. Heldreich (1877b) supports the restricted cultivation of *M. sativa* ssp. s*ativa* by stating that the taxon was still cultivated in small areas (gardens and beside roads) and not

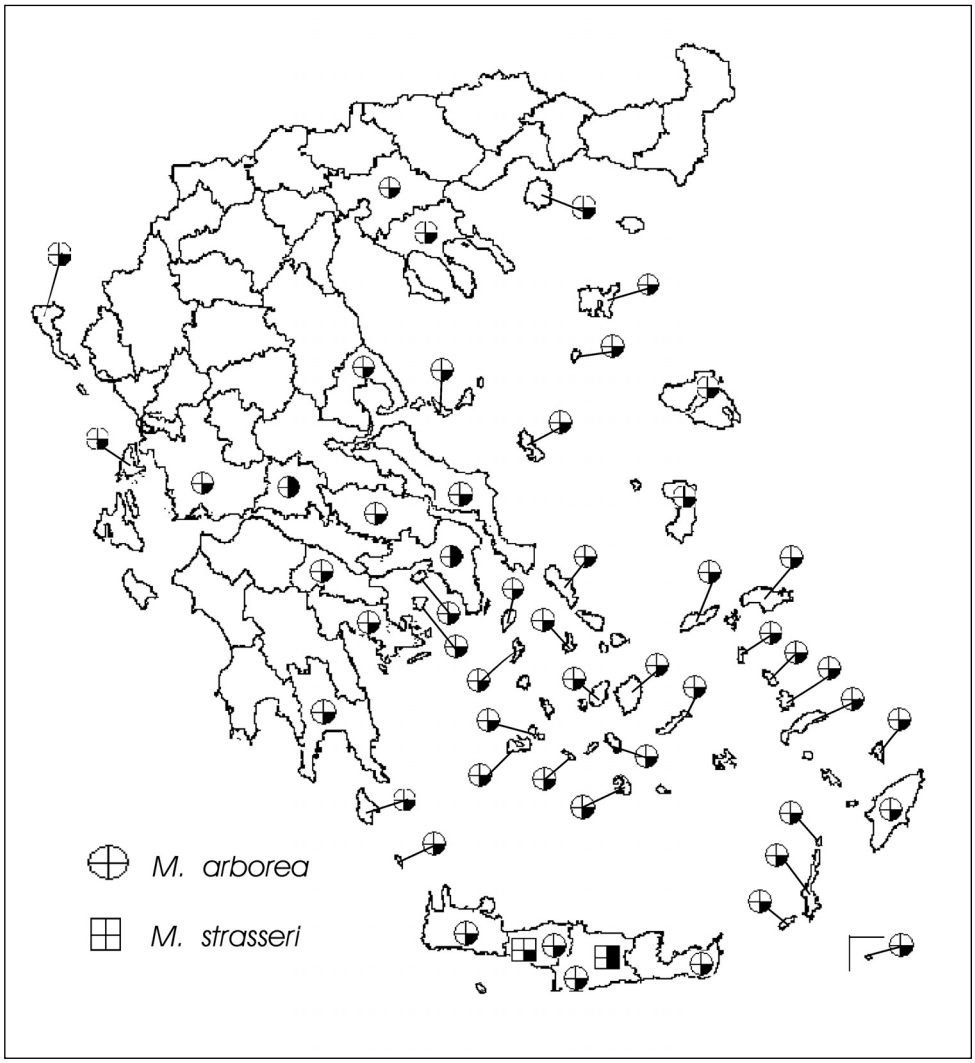


Fig. 2. Geographical and altitudinal distribution of *Medicago arborea* in Greece and total known distribution of *M. strasseri*.

in a large scale. He adds that most legumes (pulses) were cultivated for human consumption and the rest for animal feeding. It is therefore concluded that during the 19th century and possibly earlier centuries the feeding of domesticated animals was primarily based on natural resources and on fallow land. In 1930 about two thirds of the agricultural land was cultivated with cereals and the rest remains as fallow (Kontsiotou 2005). The introduction of innovations was slow due to many structural problems (e.g. lack or small ownership of land, cultivation of human food crops due to hunger, lack of machinery). Gradually, the

cultivation of *M. sativa* ssp. *sativa* was expanded up to 18.600 hectares just before the Second World War (ibid.).

*M. sativa* ssp. s*ativa* is a naturalized taxon in Greece (e.g. Greuter & al. 1983, Krigas & Kokkini 2004), escaping from cultivation probably during different periods after its original introduction. It is found in the Greek mainland and many islands, including some of the Kiklades (Fig. 3). It reaches an altitude of up to 1500 m (Ioannina prefecture, B!). It is adapted to different environments, including hydrobiotopes, grasslands, abandoned fields and waste places. In Kriti it can be found in wet places around estuaries (Greuter 1971). It is a good example of a taxon fully naturalized in Greece, in contrast to *M. sativa* ssp. *falcata,* which is native.

**3b. *M. sativa*** L. ssp. ***falcata*** (L.) Arcang.

This subspecies is widespread all over the country, being more common in the mainland and absent from the south Aegean and Ionian islands with the exception of Kerkira. It reaches the highest altitude of 1950 m (Fig. 3). In Kriti, this taxon is considered as being in the process of naturalization (Greuter & al.1989, Yannitsaros 1991). Barclay (1986), and Turland & al. (1993), who is reproducing Barclay (N. Turland, personal communication), indicate that this taxon is cultivated for fodder and possibly naturalized along field margins. However, no cultivation of *M. sativa* ssp. *falcata* is substantiated, either in Kriti or in Greece. For instance, Heldreich (1862) considered *M. sativa* ssp. *falcata* as a wild taxon and commented, in contrast, that *M. sativa* ssp. *sativa* is very seldom found in cultivation (in gardens and beside roads). Therefore, the probability of naturalization of *M. sativa* ssp. *falcata* in Kriti through cultivation should be considered as not realistic. Another hypothesis would be the naturalization of this taxon after an accidental introduction to Kriti. A first step to examine this hypothesis would be to review the existing collection data. The presence of *M. sativa* ssp. *falcata* in Kriti is reported in at least ten collection sites: Prefecture of Chania: 1. Chania (Heldreich 1877a, Gandoger 1916b, specimen in K!), Prefecture of Heraklion: 2. Heraklion (Heldreich 1877a, K!), 3. Gazi (Rechinger 1943b, BM!), 4. Faistos (Lakowitz 1929), 5. Prassa near Knossos, 6. Hersonissos east of Heraklion (Z. Kypriotakis, personal communication), 7. Near Arkalohori southeast Heraklion (Z. Kypriotakis with the presence of the author) and Prefecture of Lasithi: 8. Mesa Lasithaki (UPA!, collected 1982, altitude 850 m) and 9. Near Kristallenia Monastery in 1994 at an altitude of circa 900 m (N. Turland, personal communication) and W!. The above information indicates the presence of *M. sativa* ssp. *falcata* in various places separated by a long distance, for more than 100 years. One can argue, nevertheless, that all these localities are in the lowland and near cultivations. However, Egli (1993) reports the taxon from Mt. Psiloritis, at an altitude of 1200 m. These findings reduce the likelihood of naturalization through introduction.

Another hypothesis is that *M. sativa* ssp. *falcata* was introduced in Kriti introgressed in the cultivated *M. sativa* ssp. *sativa* and then regenerated through deintrogression. It is certain that the exchange of genetic material between the two subspecies is possible (Muller & al. 2003). Prosperi & al. (1996) observed the introgression between the two subspecies in Spain. However, Sinskaya (1940) states that ‘‘when *falcata* is crossed with *sativa*, the characters of the latter, i.e., of the cultivated type, are dominant. In this case extensive experiments have shown that all degrees of “impregnation”…are possible’’. Thus, the pos-

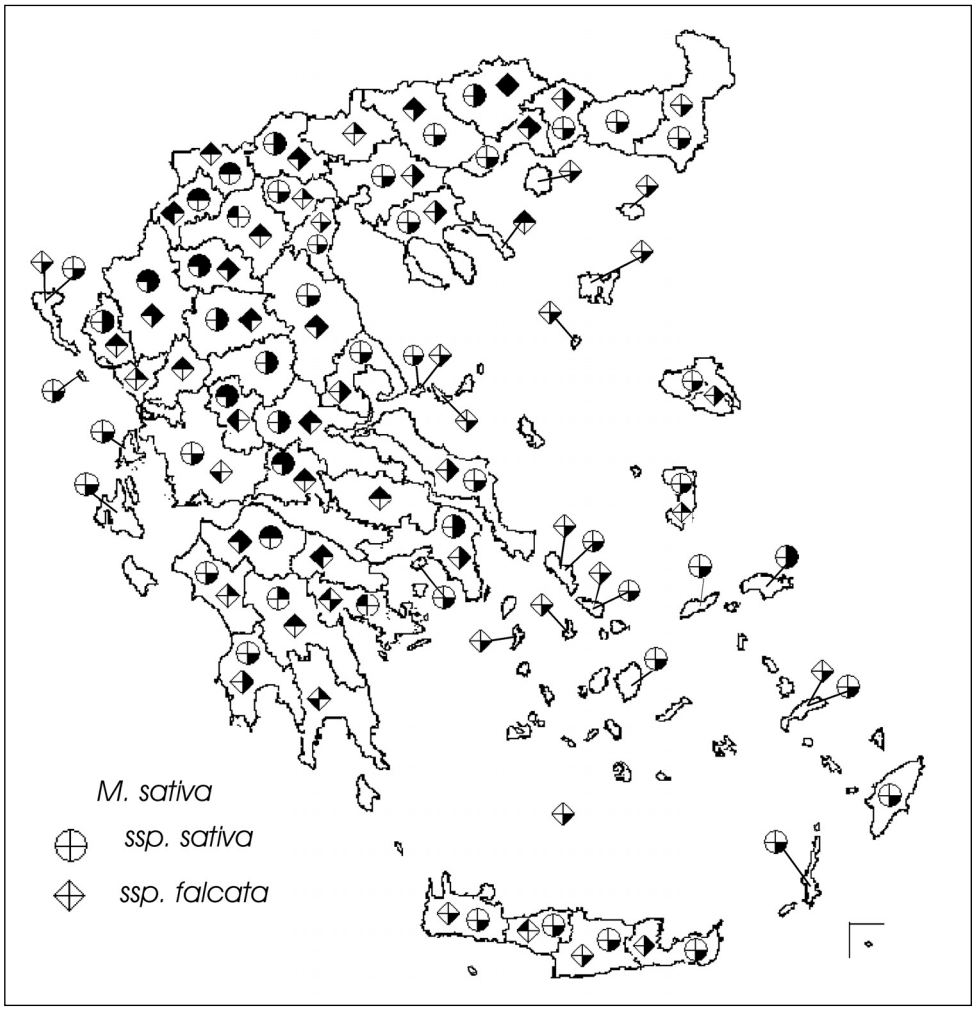


Fig. 3. Geographical and altitudinal distribution of *Medicago sativa* ssp. *sativa* and *M. sativa* ssp. *falcata* in Greece.

sibilities that after deintrogression "pure" plants of *M. sativa* ssp. *falcata* have been produced, which also remain "pure" in their following generations and at all the localities mentioned above should be considered as extremely low. On the other hand, the hybrid of *M. falcata* × *M. sativa* has not been reported from Kriti (Rechinger 1943b, Turland & al. 1993). The habitats, climate or latitude of Kriti pose no problem to the distribution of this subspecies on the island, as it has also been reported as native in Libanon and Morocco (Mouterde 1970, Greuter & al.1989). It is therefore concluded that the status of *M. sativa* ssp. *falcata* in Kriti should be considered indigenous rather, than naturalized. Future research could spread more light on this issue.

*M. sativa* ssp. *falcata* is adapted to various geological substrates (Table 4) and it is found in degraded *Quercus* forest, *Q. macrolepis* habitats (Candargy 1899b), *Pinus brutia* and *Abies* spp. forest, openings of *Fagus sylvatica* forest, *Juniperus oxycedrus* ssp. *oxycedrus* and *Juniperus foeditissima* stands, open shrub (*Quercus* spp., *Pyrus spinosa*), grasslands, road sides and fields (Bazos 2005), abandoned fields, as member of a weed flora and at ruderal places.

Where edaphic conditions are favourable (deep and compact soil) it can expand and cover up to the 25% of the land surface (Raus 1979). Together with *Ononis spinosa* and *M. sativa* ssp. *falcata* it creates a form of *Sarcopoterium spinosum* community in east Thessalia. These two taxa together may compete with *S. spinosum*, reducing it under 50% of surface cover (ibid. and Th. Raus, personal communication).

**4. *M. prostrata*** Jacq.

This species was first discovered in Greece in several localities of Mt Vourinos (Babalonas 1983) and later on Mts. Vermion (B!) and Falakron (UPA!). More recently it has been found in N Pindos (Tan & Vold 2006) and in two localities of Mt. Chasia (Trikala prefecture, UPA!), which currently form the southernmost border of the species distribution in Europe (Fig. 4). It is found at altitudes of 300 m and up to 2040 m (ibid.). It grows on serpentine and calcareous substrates, in rocky slopes with open shrub dominated by *Quercus pubescens* and *Buxus sempervirens* (Strid 1999), in *Pinus heldreichii* forest (Tan & Vold 2006) and in grasslands.

**5. *M. marina*** L.

*Medicago marina* is widespread in many coastal habitats of Greece (Fig. 4). It occurs in sandy beaches and dune systems, oligohaline lagoons (Lavrentiades 1971), hyperaline and fresh water hydrobiotopes, alluvial deposits and riparian sites. Several authors have studied the sand dune communities where *M. marina* grows (Babalonas 1979, Biondi 1989, Economidou 1969, 1975, 1981, Knapp 1965, Lavrentiades 1963, 1964, 1971, 1975a, 1976, Lavrentiades & Babalonas 1976, Gehu & al.1986, Géhu & al.1987, Christodoulakis & Georgiadis 1990, Drosos & al. 1996, Oberdorfer 1952, Voliotis & Drosos 1983, Pavlides 1976a, 1976b, Krause & al. 1963, Mayer 1995). Sýkora & al. (2001) reviewed the sand coast vegetation communities of Greece and stated that *M. marina* participates in pioneer communities of dunes. Based mainly on this review, the participation of *M. marina* in different phytosociological units is shown in Table 2.

**6. *M. carstiensis*** Wulf.

The only Greek locality of this rare species is apparently Mt Pageon (Fig. 4). To our knowledge, this is the southernmost limit of distribution in Europe. Northwards it is reported from areas of Albania, former Yugoslavia, Bulgaria, northeastern Italy and southeastern Austria (Small & Jomphe 1988). On Mt Pangeon, *M. carstiensis* occurs from 1050 m up to 1250 m in *Fagus* forests and grassland, on calcareous substrate. Its rhizomatous growth pattern (ibid.) and shade tolerance are very rare or unique features in the genus *Medicago* (Lesins & Lesins 1979). The locations of *M. carstiensis* in Greece are very few and the threats they may face need further investigation.

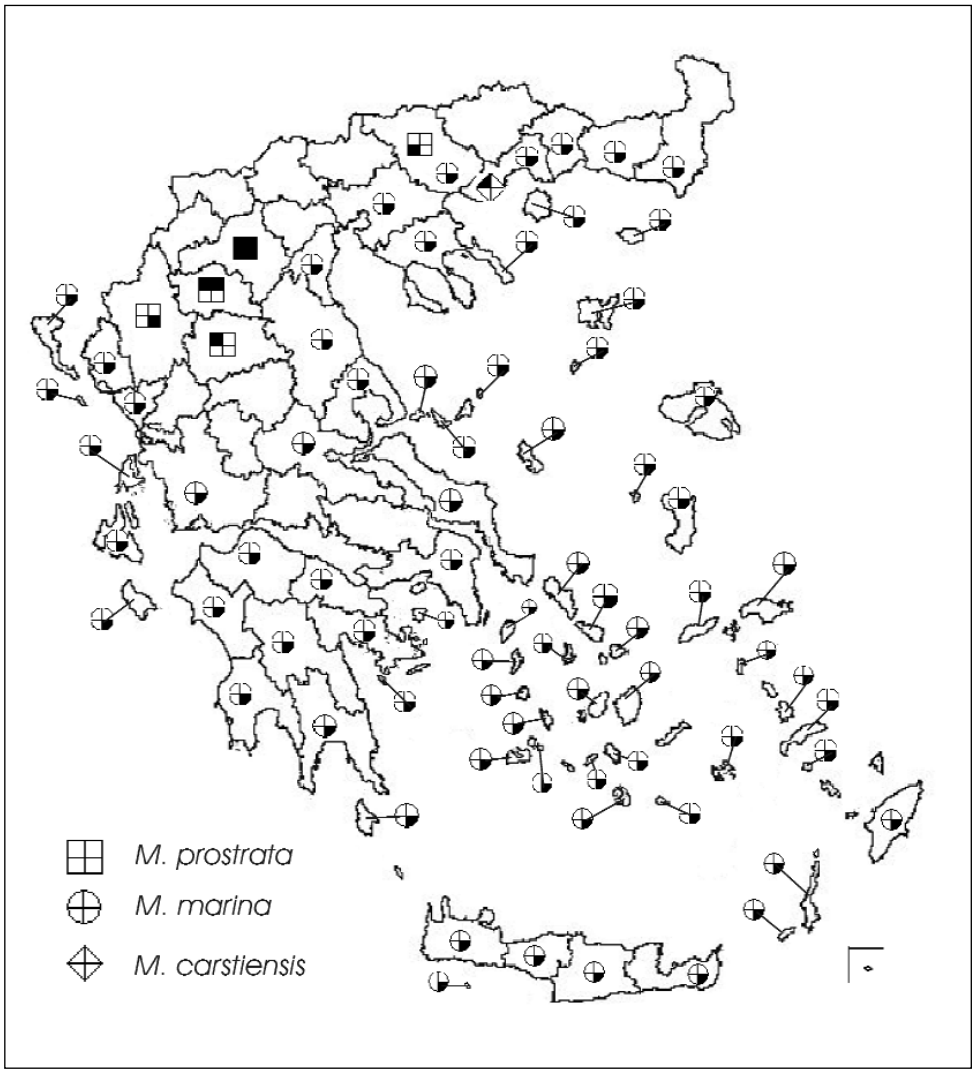


Fig. 4. Geographical and altitudinal distribution of *Medicago prostrata*, *M. marina* and *M. carstiensis* in Greece.

**7. *M. littoralis*** Loisel.

This species is widespread at lowland habitats of the mainland and on islands (Fig. 5). Occasionally, it can be found at altitudes higher than 500 m. It occurs mainly in coastal environments (fresh water hydrobiotopes, alluvial deposits, sub-littoral sandy places, dunes and gravelly or sandy seashores) but also on steep cliffs. It can further be found in garrigue, as a weed in olive groves and fruit orchards and in ruderal sites. *M. littoralis* participates in different phytosociological units (Table 2).

Table 2. The level of participation of *Medicago marina* and *M.littoralis* as constant species in different phytosociological units.

| Phytosociological unit | *M. marina* | *M.littoralis* | Reference |
|---|---|---|---|
| *Ammophiletalia* Ord. Br.-Bl. 1933 | | | |
| *Otanthus maritimus* Community | v | | Sýkora & al. 2001 |
| *Erygnium maritimum* Community | v | | Sýkora & al. 2001 |
| *Cypero mucronati-Agropyretum juncei* Ass. (Kühnholtz-Lordat 1923) Br.-Bl. 1933 | v | | Sýkora & al. 2001 |
| *centaureetosum spinasae* Subass. Géhu 1991 | v | v | Mayer 1995 |
| *Medicagini marinae- Ammophiletum australis* Ass. Br.-Bl. 1921 | v | | Sýkora & al. 2001 |
| *Limonio graeci-Triplachnetum nitentis* Ass. Mayer 1995 | v | v | Mayer 1995 |
| *Epherdo distachyae-Silenetum subconiae* Ass. Oberd. 1952 | v | | Sýkora & al. 2001 |
| *Coridothymo capitati-Centaureetum spinosae* Ass. Géhu 1991 | | v | Mayer 1995 |
| *Centaureo spinosae-Limonietum sinuati* Ass. Mayer 1995 | | v | Mayer 1995 |

**8. *M. truncatula*** Gaertn.

The distribution of *M. truncatula* is peripheral in Greece, mostly embracing coastal areas of the mainland up to 800 m of altitude, and the islands of the Ionian and the Aegean Sea. (Fig.6). It occurs in sandy fields and wet grasslands (Economidou 1969), wet meadows with *Juncus* spp. (Georgiadis & al. 1997), strongly overgrazed and degraded garrigue (Greuter 1976), garrigue with rocks and cliffs (Kamari & al. 1988), garrigue dominated by *Coridothymus capitatus*, open shrub (*Quercus* sp. and *Pyrus spinosa*), *Q. pubescens* stands (Matthäs 1988), *Q. coccifera-Phillyrea latifolia* forest (Kamari & al. 1988), coniferous forests, grasslands, fields and fallow fields, olive groves, as well as a weed in cereal crop (Turland & al. 2004) and waste places.

**9. *M. doliata*** Carmign.

The species is scattered in Greece (Fig. 6) currently known in four areas: 1. Western parts: Kerkira (Borkowsky 1994), Lefkada (B) and Etolo-akarnania (W), 2. Central parts: Magnisia (Raus 1979), Evvia (LD), Attiki (BM), 3. East Aegean Islands (Lesvos (B), Samos (Düll 2000), Ikaria (ibid.) and Rhodos (Rechinger1943a) and 4. Crete: Heraklion (B). It grows on colluvial loam, gravel beach, near coasts (Borkowsky 1994), in grasslands, roadsides and as a weed in open olive groves (Turland & al. 2004).

**10. *M. tubeculata*** Retz. (Willd.)

It is distributed peripherally in the mainland and also appears in most of the islands (Fig. 7), occasionally up to 600 m of altitude. It is found in sandy seashores and stony places, semi-natural and natural garrigue, macchie, *Q. pubescens* stands (Matthäs 1988), as a weed in olive groves and vineyards, in fallow fields, along field margins and road sides.

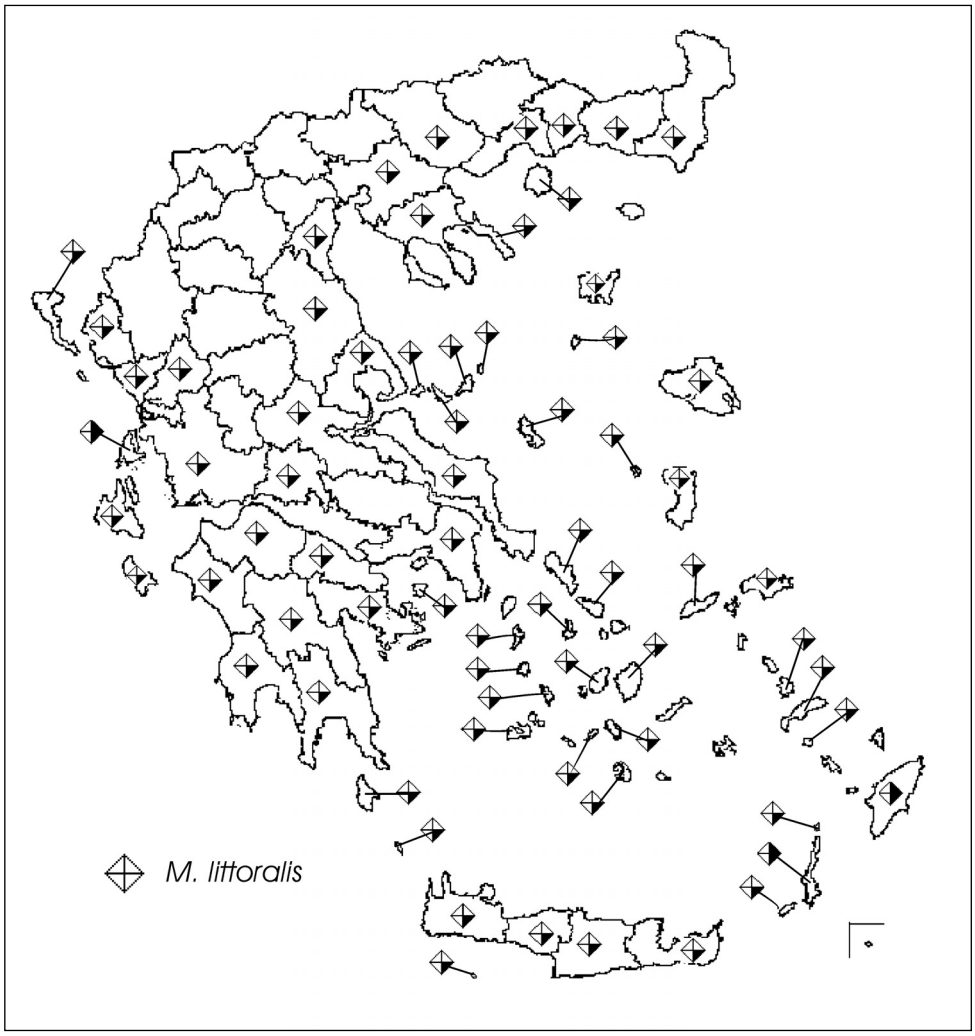


Fig. 5. Geographical and altitudinal distribution of *Medicago littoralis* in Greece.

**11. *M. rigidula*** (L.) All.

*Medicago rigidula* is widespread almost all over Greece, having a poor representation in Kiklades and being absent from Northern Sporades Islands. It reaches the altitude of 1800 m in Sterea Ellas (Fig. 7). It appears in riparian environments, garrigue with rocks and cliffs (Kamari & al. 1988), garrigue with *Sarcopoteriun spinosum*, open garrigue (*Quercus coccifera*, *Pyrus spinosa*), meadows in openings of *Q. coccifera* shrub (Strid 1999), macchie and clearings of macchie, *Caprinus orientalis* scrub, degraded *Quercus* forest, *Q. trojana* forests, *Q. pubescens* stands (Matthäs 1988), deciduous forests, *Juniperus oxycedrus* ssp. *oxycedrus and Juniperus foeditissima* stands, woodland of *J.*


Fig. 6. Geographical and altitudinal distribution of *Medicago truncatula* and *M. doliata* in Greece.

*foeditissima* and *Q. trojana* (Strid 1999), *Abies* stands, meadows and grasslands, as a weed in various crops (Zaganiaris 1939), as cereal crops (Turland & al. 2004), olive groves, edges of cereal fields (Strid 1999), fallow fields and waste places.

**12. *M. constricta*** Durieu

The distribution of this species mostly covers the eastern parts of Greece (Thraki, central Makedonia, Aegean islands) reaching westwards Messinia (UPA!) and Kefallinia Island (LD). The two latter areas constitute the westernmost border of the species distribution range in the Mediterranean (Fig. 8). In some Aegean islands and Kriti it appears at

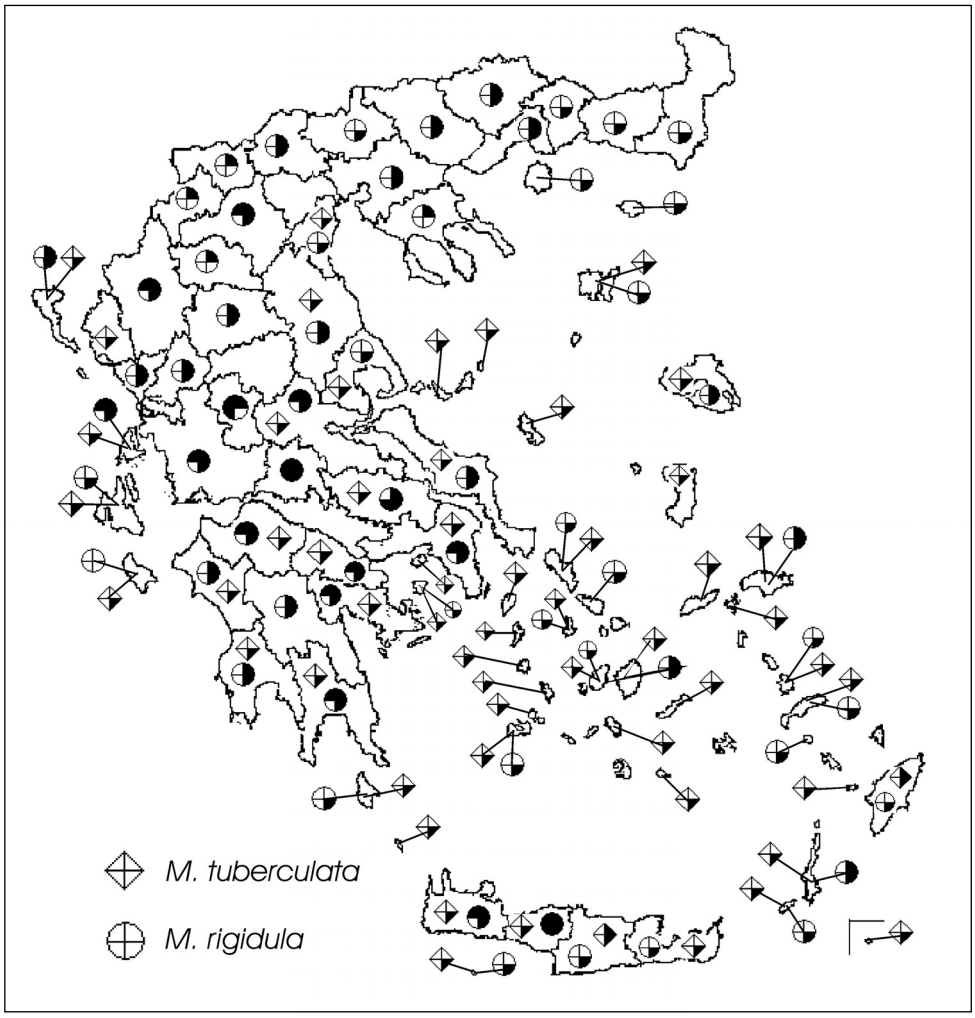


Fig. 7. Geographical and altitudinal distribution of *Medicago tuberculata* and *M. rigidula* in Greece.

altitudes of up to 650-800 m. It grows on rocky limestones, in sandy areas near the sea and also on saline soils. The biotic environments where *Medicago constricta* has been found in Greece include macchie, grazed garrigue dominated by *Quercus coccifera*, *Cistus* spp. or *Coridothymus capitatus,* areas with *Asphodelus* spp., dry meadows in openings of shrublands, deciduous *Quercus* woodland, *Pinus* forest, waste places and fields (Snogerup & al. 2001).

**13. *M. murex*** Willd.

*Medicago murex* is rather scattered in Greece, distributed in areas surrounded by the Aegean Sea (Athos Peninsula is the northernmost known locality in Greece) and also the

western parts of the country (Fig. 8), at altitudes from sea level up to 900 m. It is found in sandy shores, open places in *Phlomis* spp. garrigue, *Cupressus sempervirens* thickets, *Q. pubescens* stands (Matthäs 1988), grasslands, as a weed in cereal crops, olive groves and also in fallow fields (Turland & al. 2004).

**14. *M. rugosa*** Desr.

This species is common in south Greece (southwards of Sterea Ellas) and also in many Aegean Islands, while it becomes rare in the northern parts of the country. It reaches the altitude of up to 1000 m (Fig. 9). It is found in openings of garrigue, stands of *Q. coccifera* (Paraskeuopoulos (2006) or *Q. pubescens* (Matthäs 1988), fallow fields (Turland & al. 2004), and also participates in weed communities of cultivated fields (Turland & al. 1993), olive groves (Paraskeuopoulos (2006) and ruderal places.

An interesting case to be referred is a specimen collected by Candoger (1916) in Lassithi, Kriti and reported as *M. helix* Willd (= *M. italica*). Rechinger (1943a) accepted this reference without checking the specimen of Gandoger (W. Greuter, personal communication). An examination of images of Gandoger's collection (LY) by Th. Raus proved that the specimen from Kriti (Gandoger 1708!) is actually *M. rugosa* not *M. italica*.

**15. *M. scutellata*** (L.) Miller

*Medicago scutellata* is found in northern Greece (central Macedonia, Thraki and North Aegean Islands), the Ionian Islands, Sterea Ellas, the East Aegean Islands and Kriti –Karpathos. In the Kiklades it is recorded only on Paros, Siros and Milos (Fig. 9). Its highest altitude record is 600 m and 750 m above sea level for the mainland and Kriti respectively. The species recently rediscovered on the island of Lesvos by A. Vastaki, after its original report there by Candargy (1899a). Specimens were collected near Charamida village at the south-eastern parts of the island, in grazed olive orchards c. 300 m from the seashore. Generally, *M. scutellata* occurs in littoral sandy places, garrigue dominated by *Sarcopoterium spinosum*, grasslands, cultivated and fallow fields (Christodoulakis 1984, Turland & al. 2004) and as a weed in various crops (Zaganiaris 1939).

**16. *M. blancheana*** Boiss.

This is an Anatolian element, distributed mainly in the East Aegean Islands and also extending in eastern Kriti and east Macedonia (Fig. 9). The species is characterised as adventive in its latter locality (Lassen 1999). Nevertheless, it should not be ignored that *M. blacheana* also reported in the neighbouring region (Thraki) by Hayek (1927). It is found in alkaline and clay loam soils (data taken from SARDI) and in fields (Snogerup & al. 2001).

**17. *M. intertexta*** (L.) Miller

*Medicago intertexta* is present in a few localities of western Greece and only one in the eastern parts (Samos Island, C, personal communication by O. Ryding). Samos is an isolated locality and, to our knowledge, the easternmost limit of species' overall distribution (Fig. 10). *M. intertexta* is found near the sea but also at higher altitude on Kerkira Island (Unger 1862).

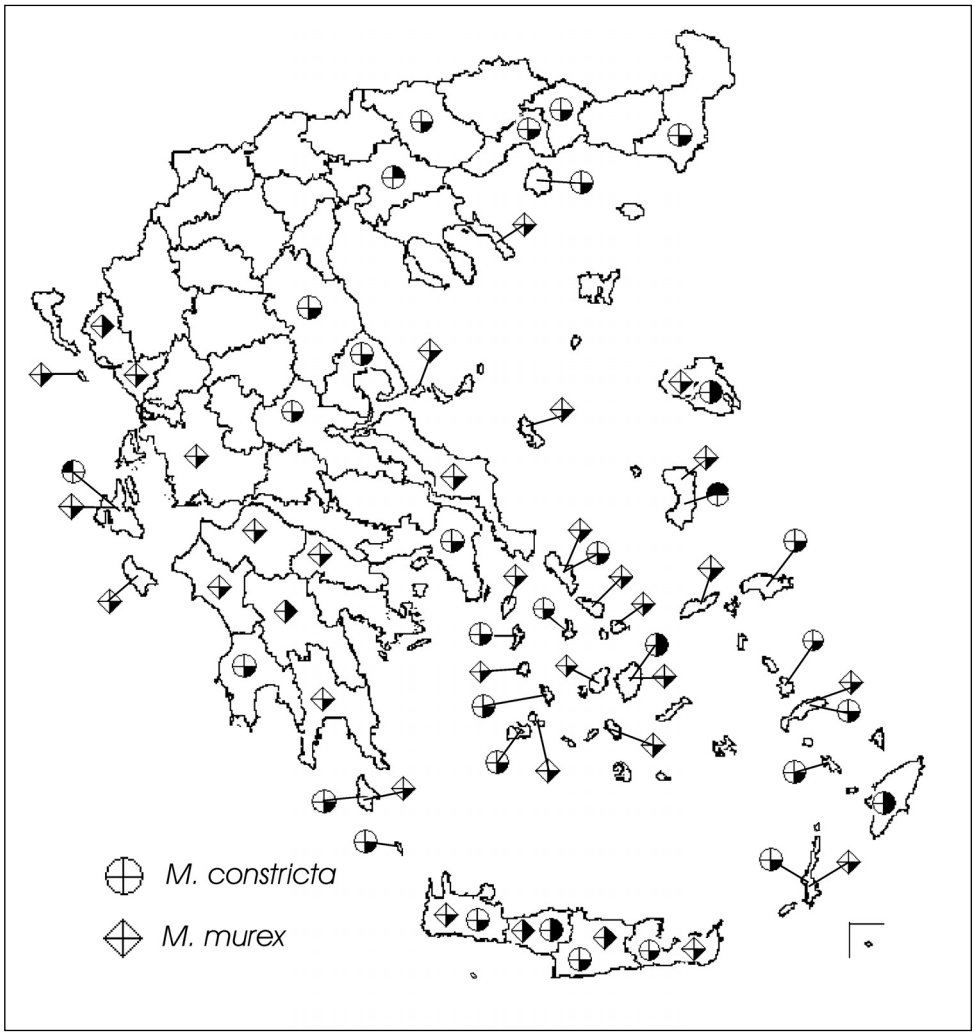


Fig. 8. Geographical and altitudinal distribution of *Medicago constricta* and *M. murex* in Greece.

**18. *M. ciliaris*** (L.) All.

The species has been reported in several localities and appears to be more widespread that the related *M. intertexta.* It is mainly found in western Greece, Peloponnisos, Kriti and some of the East Aegean Islands (Fig. 10). It grows in macchie, underneath *Q. pubescens* stands (Matthäs 1988), open grasslands (Turland & al. 1993), in abandoned terraced slopes, in olive grooves (Greuter & al. 1984), beside roads and fields. Greuter & al. (1984) made the hypothesis that the species in Kriti could have been introduced my man, accidentally or by purpose. The likelihood of an introduction by purpose is very low because no cultivation of annual *Medicago* species exists in Greece, according to author's investigations.

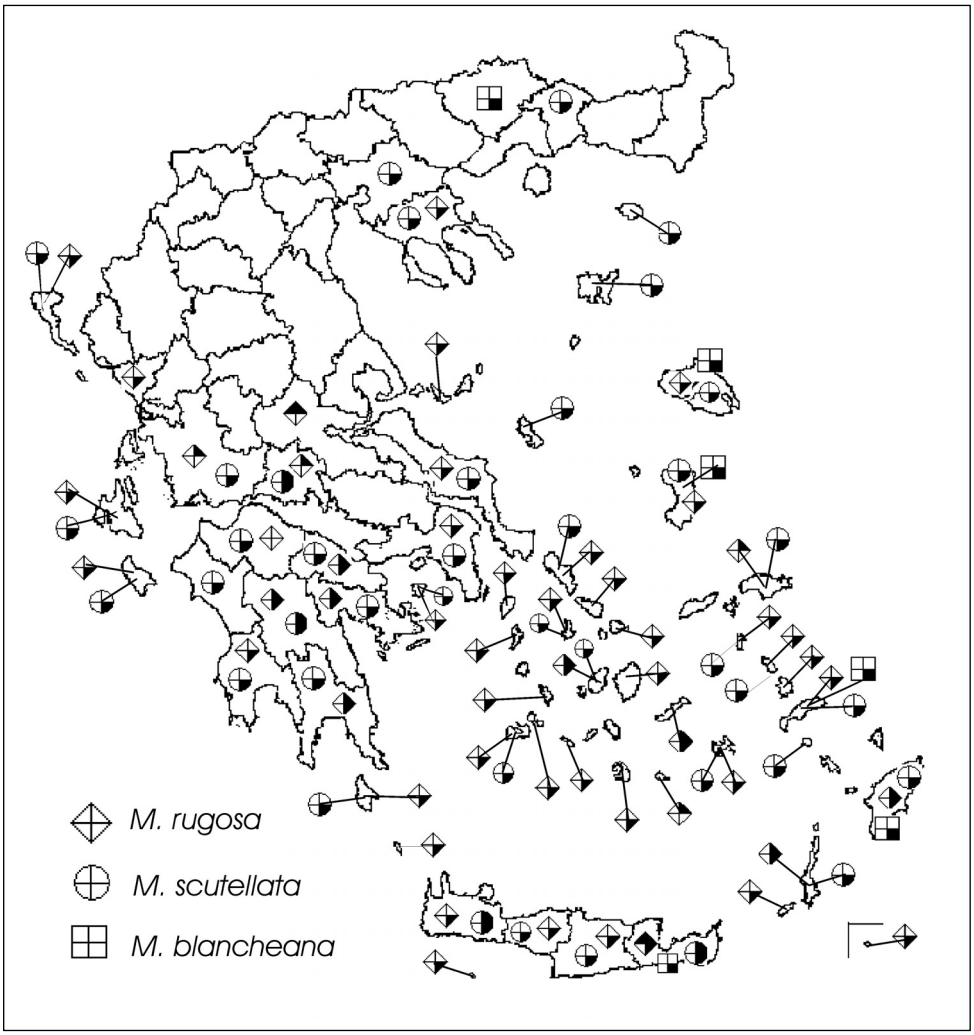


Fig. 9. Geographical and altitudinal distribution of *Medicago rugosa, M. scutellata* and *M. blancheana* in Greece.

Moreover, according to Street & al. (2001) no cultivar of this species exists, not even in Australia, which is pioneer in releasing *Medicago* cultivars (see also the Register of Australian Herbage Plant Cultivars at http://150.229.2.64/ahpc/home.htm and the Australian Plant Breeders Rights, http://www.ipaustralia.gov.au/pbr/). The fact that the species has been collected in five clearly separated, geographically and altitudinally, localities of Kriti (three mentioned by Greuter & al. 1984, a fourth at Festos region supported by a specimen at B! and reconfirmed c. 2 km north of Festos by Z. Kypriotakis in a personal communication, and a fifth found near Agios Thomas, Eparhia Kenourgiou, Irakliou Prefecture by the

author) minimizes the possibility of an accidental introduction. Furthermore, the scattered presence of *M. ciliaris* in Greece reduces the possibility of any accidental transfer in Kriti by escaping from introduced hay. On the other hand, the extent of this species distribution includes areas south of Kriti as Africa (Greuter & al. 1989). Therefore, Kriti should not be considered as out of the natural distribution range of the species.

**19. *M. muricoleptis*** Tineo

*Medicago muricoleptis* has a clear distribution to the west parts of Greece (Fig. 10). A very interesting finding is the discovery of the species in Kavala prefecture (J. M. Prosperi, personal communication), which forms a noteworthy expansion of the species' distribution to the east. *M. muricoleptis* has been found on sandy substrate, in olive groves, fallow fields and wasteland (P. Lassen, personal communication).

**20. *M. minima*** (L.) Bart.

This is a species widespread all over Greece, reaching the altitude of 1800 m. (Fig. 11). It shows good adaptation to overgrazing and high fire frequency (Pantis & Mardiris 1993). It succeeds in many rock substrates (Table 4) and in fresh-water hydrobiotopes, riparian environments, littoral places and carstic plains (Raus 1999). It is present in many different habitats: garrigue dominated by *Cistus* or *Sarcopoterium*, communities of *Thymus capitatus* with either *Ballota acetabulosa* or *Asphodelus ramosus* and communities dominated by *A. ramosus* (Pantis & Mardiris 1993), swampy areas with *Platanus*, in open shrub of *Quercus coccifera*, meadows in openings of evergreen shrub formations (Strid 1999), *Caprinus orientalis* shrub and mixed shrub dominated by *C. orientalis* and *Juniperus oxycedrus* (Strid 1999), open woodland dominated by *J. excelsa, J. oxycedrus* ssp. *oxycedrus* communities, open deciduous oak shrub (Strid 1999). It is also found in *J. foetidissima* and *Q. trojana* woodland, *Pinus nigra* (Strid 1999) or *Q. frainetto* (Sarlis 1988) formations, in openings of *P. sylvestris* (Eleutheriadou 1992), *Q. trojana, Q. pubescens* (Matthäs 1988), *Fagus sylvatica* or *Castanea sativa*, and *Abies cephalonica* (Sarlis 1988). It also appears as a weed in open olive groves, cereal fields (Lavrentiadis 1961, Turland & al. 2004) and mandarin orchards (Finkl 1962).

**21. *M. praecox*** DC.

The species is present in nearly all phytogeographical regions but appears to be scarcer than *M. minima* (Fig. 11). It reaches the altitude of up to 1000 m in the mainland and up to 1300 m in the island of Kriti. It has been reported in degraded, strongly overgrazed garrigue with a weedy cover (Greuter 1976), as a rare weed of extremely man-influenced habitats, in weed communities on trodden ground (Turland & al. 1993), in stream sides, along roadsides and in ruderal places.

**22. *M. coronata*** (L.) Bartal

*Medicago coronata* appears in most parts of Greece except some of the northern prefectures, at an altitude of up to 1000 m in the mainland and 1400 in Kriti (Fig. 12). It is found on a wide range of ground substrates (Table 4), close to the seashore, at sub-littoral and littoral places, on cliffs and rocky places. It is encountered in semi-natural shrub and garrigue communities (Greuter 1976, Kamari & al. 1988), strongly overgrazed garrigue

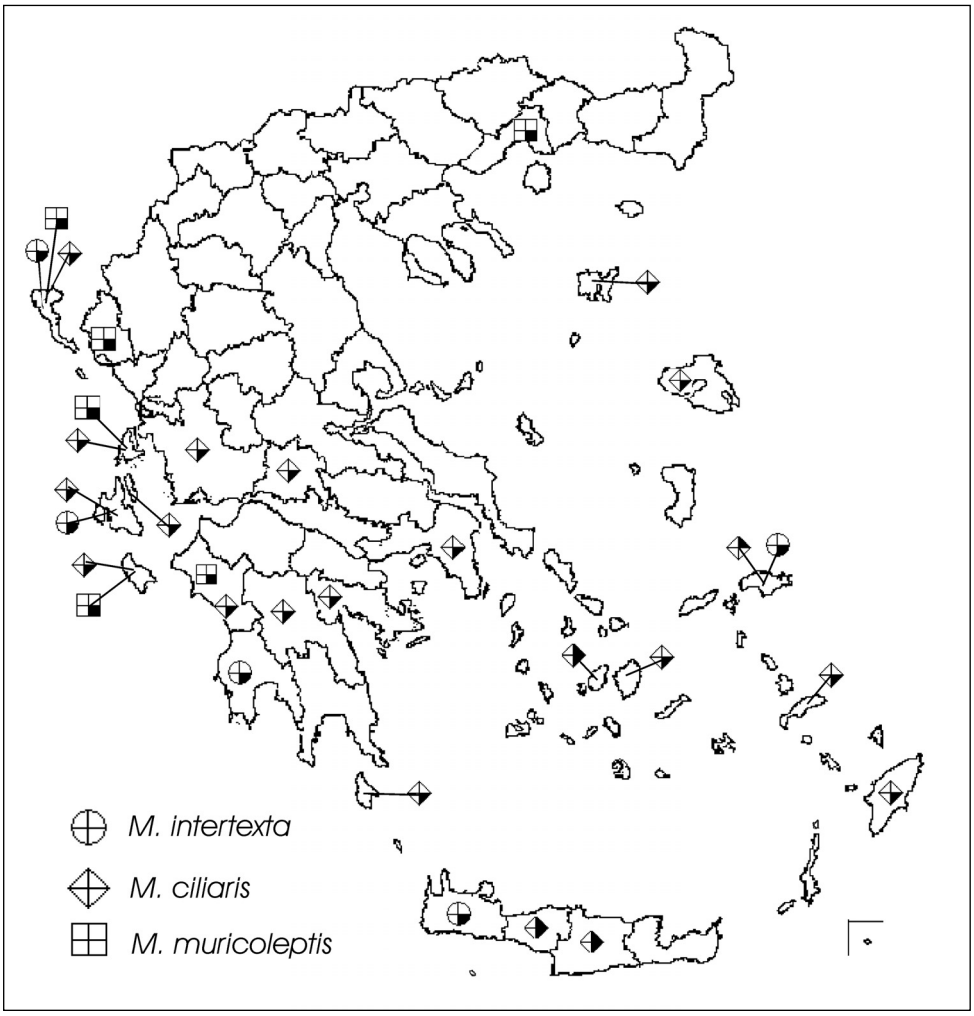


Fig. 10. Geographical and altitudinal distribution of *Medicago ciliarias, M. intertexta* and *M. muricoleptis* in Greece.

(Hartvig & Strid 1997), garrigue dominated by *Sarcopoterium*, open shrubland with *Quercus coccifera, Juniperus pheonicia* and *Pistacia lentiscus*, remnants of macchie, evergreen shrub dominated by *P. lentiscus* or/and *Euphorbia dendroides*, in *Q. pubescens* areas (Matthäs 1988), in grasslands, as a weed in cereal crops (Zaganiaris 1939), in non-irrigated olive groves (Turland & al. 2004) and fallow fields.

**23. *M. polymorpha*** L.

This species has the same distribution pattern as *M. coronata*, reaching the altitude of 1600 m (Fig. 12). It is present in various substrates, inhabiting soils of different texture

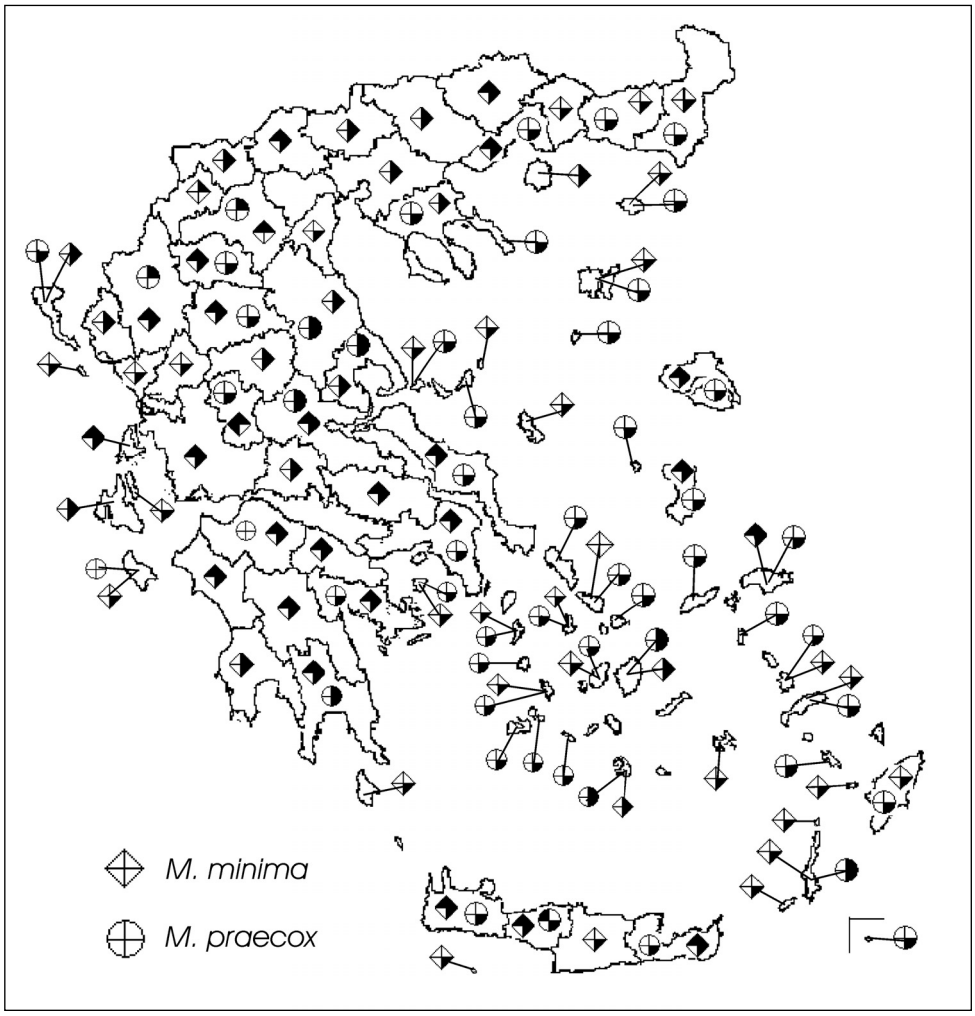


Fig. 11. Geographical and altitudinal distribution of *Medicago minima* and *M. praecox* in Greece.

(Tables 4 and 5) and is also found in riparian environments, streamsides, muddy places, hyperaline hydrobiotopes, fresh water hydrobiotopes, sand coast and dunes, salty places, halophilous lagoons (Wolf 1968/69) and wasteland. In Greece, *M. polymorpha* is found in natural and semi-natural garrigue, macchie with *Arbutus unedo*, margins of macchie (Turland & al. 1993), open shrub with *Quercus* ssp. and *Pyrus spinosa*, *Caprinus orientalis* scrub, evergreen scrub, *Q. pubescens* areas (Matthäs 1988), *Castanea sativa* or *Abies* forest, meadows and grasslands. It is also behaving as a weed of various crops (Zaganiaris 1939), and further found in olive groves, vineyards, citrus orchards (Protopapadakis 1985) and fallow fields (Turland & al. 2004). It is constant species of *Ephedra distachya – Silene subconica* Ass. Oberd. 1952 at the delta of Pinios river of Thessalia (Drosos & al.1996).

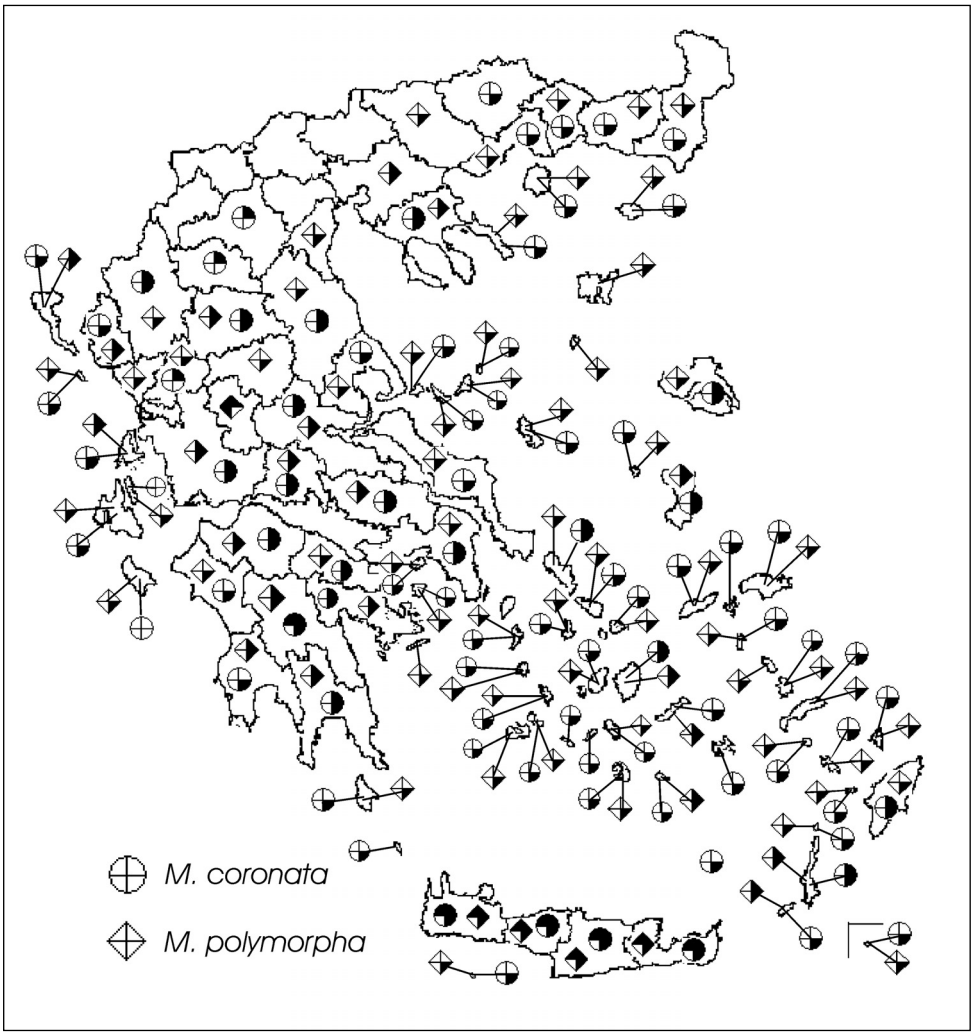


Fig. 12. Geographical and altitudinal distribution of *Medicago coronata* and *M. polymorpha* in Greece.

**24. *M. arabica*** (L.) Huds.

*Medicago arabica* covers most parts of the country with some gaps in north Greece and south Aegean (e.g. Kiklades, Karpathos Island), reaching the maximum altitude of 1300 m (Fig. 13). It occurs in wet and shady places, in riparian environments, swampy areas with *Platanus*, on cliffs and shrubland (Kamari & al. 1988), macchie, garrigue (Trigas & Iatrou 2000), meadows in openings of Q*uercus coccifera* shrub (Strid 1999) and *Caprinus orientalis* or *Q. coccifera-Phillyrea latifolia* shrub (Kamari & al. 1988). It is also found in clearings of various vegetation types: *Q. pubescens* (Matthäs 1988), *Pinus* ssp. and *Castanea sativa* forests, in wet grasslands, as a weed (Dimadou 1923) in cereals (Zaganiaris 1939,

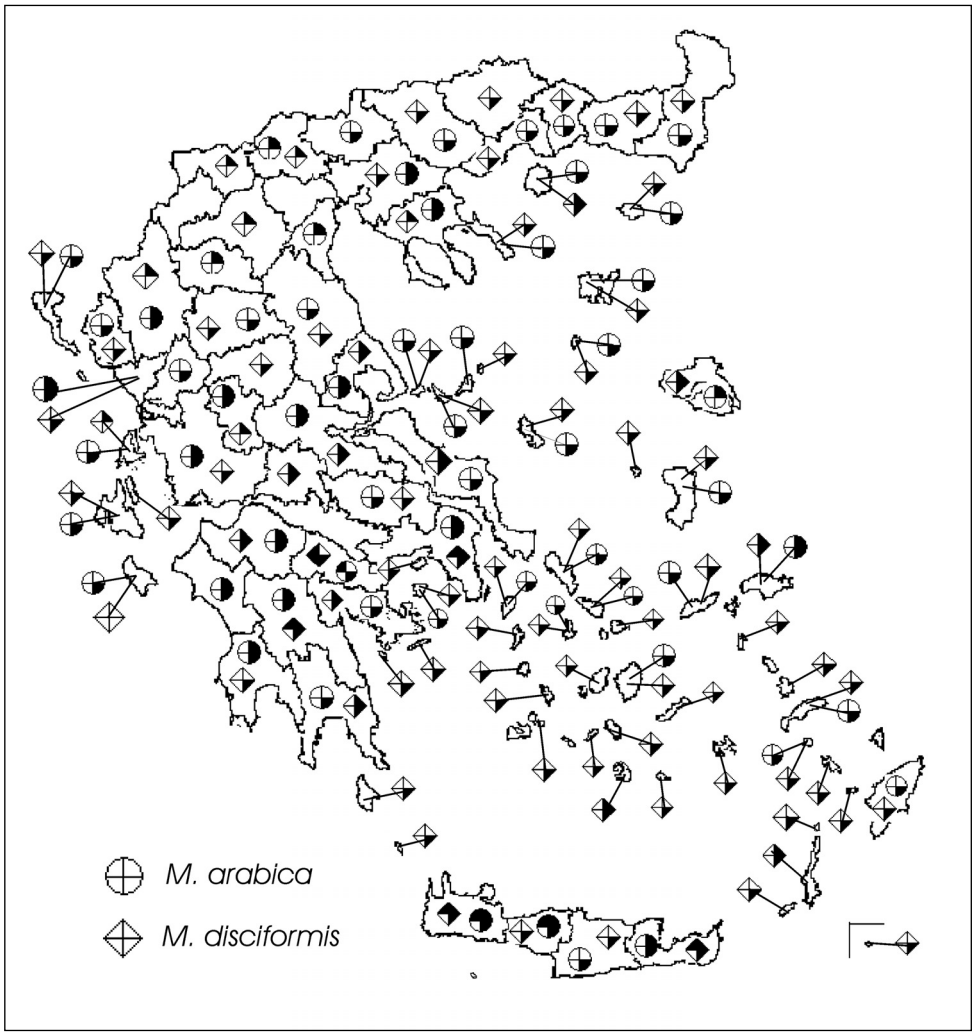


Fig. 13. Geographical and altitudinal distribution of *Medicago arabica* and *M. disciformis* in Greece.

Lavrentiadis 1961) and vegetables, in olive groves (Turland & al. 2004) and citrus orchards (Protopapadakis 1985).

**25. *M. disciformis*** DC

This is a species widespread all over the country, from the lowlands up to the altitude of 1500 m in Arkadia (Fig. 13). It has been reported in gravely beaches, ravines, littoral places, garrigue with rocks and cliffs (Kamari & al. 1988), semi-natural and strongly over-grazed garrigue with a weedy cover (Greuter 1976), garrigue dominated by *Cistus* or *Sarcopoterium*, open shrublands with *Quercus coccifera*, *Juniperus pheonicea*, *Pistacia*

*lentiscus*, remnants of macchie, mixed deciduous/evergreen scrub, woodland dominated by *Q. trojana* (Strid 1999), open and stony places of *Pinus* forest (*P. halepensis* and *P. brutia*), in grasslands, as a weed, in cereal crops (Zaganiaris 1939), olive groves (Turland & al. 1993), fallow fields and ruderal places.

**26. *M. lupulina*** L.

The geographical distribution of *Medicago lupulina* covers nearly all the country (Fig. 14) and its altitudinal range are from sea level up to 2300 m. It is reported in sand (Georgiadis & al. 1997), swampy areas with and without *Platanus* (Hartvig & Strid 1997), fresh water hydrobiotopes, dump wet meadows (Dimalexis & al. 1999), shady ravines, macchie vegetation (*Arbutus unedo, Pyrus spinosa*), garrigue, meadows in openings of *Quercus coccifera* shrub (Strid 1999), open deciduous woodland and shrub of *Caprinus orientalis*, *Acer monspessulanum*, *Fraxinus ornus* (Strid 1999), *Juniperus foeditissima* stands, in *Pteridium* spp. thickets or in forests of various densities where one of the following species is mostly dominated: *Abies cephalonica, A. borisii - regis, Fagus sylvatica* and *Pinus sylvestris* (Eleutheriadou 1992), *P. nigra, P. halepensis, J. oxycedrus, Q. coccifera, Q. pubescens* (Matthäs 1988), *Q. trojana*, *Castanea sativa.* It is further found in wet and dry grasslands (e.g. *Festuca, Daphne oleoides*), in fallow fields, as a weed in vineyards, olive and citrus orchards (Protopapadakis 1985) and in wasteland.

**27. *M. heyniana*** Greuter

Based on the data currently available, this species exhibits a south-eastern Aegean distribution pattern (Fig. 14), confined to several Greek islands and the Marmaris Peninsula of Turkey (Carlström 1987). Future research may, however, reveal other localities beyond those already known (Lassen, 1983). The species should be considered an east Mediterranean element (Th. Raus, personal communication). Till now, it has been found in cliffs, burnt pinewood, garrigue with *Phlomis* spp. or *Sarcopoterium spinosum* (Panitsa & Tzanoudakis 2000) and cultivated ground (Carlström 1987). It is the only Greek *Medicago* species legally protected by the Presidential Decree no. 67/1981, falling into the category of the non-endemic, rare and endangered species. Under this legislation its collection needs an official permission. It has been included in the Greek Red Data Book, where it is characterized as Vulnerable (Turland 1995). As overgrazing may constitute a threat for the species, it is proposed that its protection should include fencing (ibid.). The conservation status of its populations on Tilos Island is considered as good (Panitsa & Tzanoudakis 2000).

**28. *M. orbicularis*** (L.) Bartal

This species extends almost all over Greece, at altitudes from sea level up to 1800 m like in Evritania (Fig. 14). It is reported in fresh water hydrobiotopes, littoral sandy places, wet meadows with *Juncus* spp. (Georgiadis & al. 1997), semi-natural garrigue, strongly overgrazed garrigue, garrigue dominated by *Sarcopoterium spinosum* (Economidou 1969), meadows in openings of *Quercus coccifera* shrub (Strid 1999) or evergreen scrubs, *Juniperus foeditissima* stands, shrubland dominated by *Q. pubescens* and *Buxus sempervirens* (Strid 1999), macchie, in post-fire regeneration of *P. halepensis* forest (Sarlis 1976), in forests of *Q. trojana* and *Abies* spp., in *Q. coccifera-Phillyrea latifolia* stands (Kamari

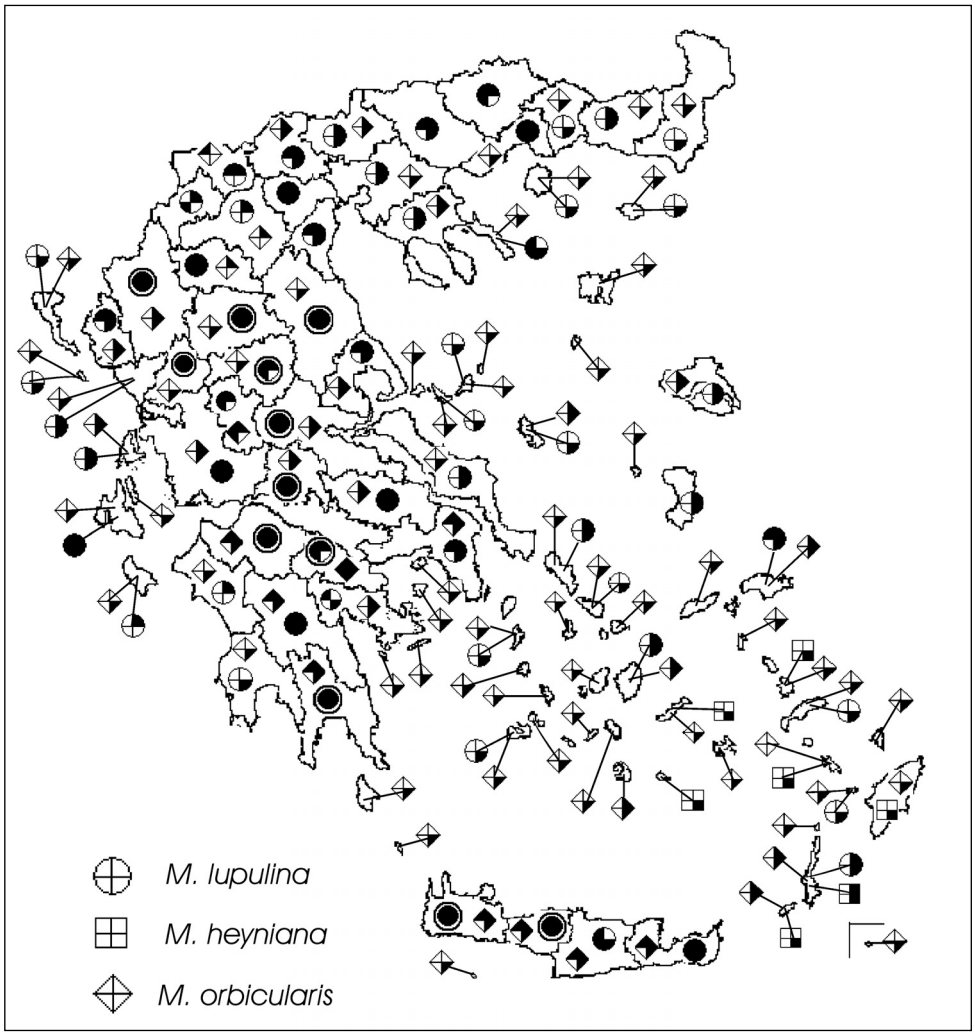


Fig. 14. Geographical and altitudinal distribution of *Medicago lupulina, M. heyniana* and *M. orbicularis* in Greece.

& al. 1988), in grasslands, abandoned and fallow fields (Paraskeuopoulos 2006), as a weed (Dimadou 1923) in grain fields (Lavrentiadis 1980) and other crops (Zaganiaris 1939), in open olive groves (Turland & al. 2004), at the edges of cereal fields (Strid 1999) and in wasteland (Carlström 1987).

**29. *M. phrygia*** (Boiss. & Bal.) Small

The only two Greek localities of this species are found on the islands of Samos and Ikaria. This is an Anatolian element, and the East Aegean Islands form the westernmost

known boundary in species distribution (Fig. 15). In Greece, it is found on marble and schist substrates, on sandy shores and in open dry-rocky places of grazed slopes with patches of evergreen shrubs and scree. Unger (1862) cited this species in Kefallinia (Ionian Islands), a locality that which would constitute a remarkable extension of its geographical distribution. Unfortunately, no voucher was found in GJO (K. Zernig, personal communication) where Unger's collection is housed. Since no other old or recent report or collection of this species are known from Kefallinia, Unger's report may be a misidentification.

**30. *M. fischeriana*** (Ser.) Trautv.

The only record of this species in Greece comes from Samos Island (Fig.15), where it has been found near the summit of Mt. Kerkis, at 1400 m (Burton 1999, R. Burton, personal communication). This species is further extended to Anatolia and Crimea (Greuter & al. 1989) and the Greek locality seems to be the westernmost boundary of its distribution range. *M. fischeriana* is not registered in the Flora Hellenica Database (P. Lassen, personal communication).

**31. *M. polyceratia*** Trautv. [incl. ***M. medicaginoides*** (Retz.) Small and ***M. orthoceras*** (Kar. & Kir.) Trautv.]

The taxonomic delimitation of *Medicago polyceratia*, as accepted here, is rather broad. *M. polyceratia* s.str. does not occur in Greece but two very closely related taxa, *M. medicaginoides* (Retz.) Small and *M. orthoceras* (Kar. & Kir.) Trautv., have rare occurrences in Greece. The three species need further investigations (Small & Jomphe 1989; P. Lassen, personal communication) that would probably clarify their taxonomic status.

**31a. *M. medicaginoides*** (Retz.) Small

*Medicago medicaginoides* is recorded in only three Greek localities. Two of them are found in Sterea Ellas, i.e. Mt. Timfristos (Dimitrellos & Christodoulakis 1995) and Mt. Iti where it was collected by Gustavson (P. Lassen, personal communication). The third locality is in northern Peloponnisos, on Mt. Klokos (LD). The species grows at the altitude of 1100 to 1800 m (Fig. 15). Its overall distribution includes former Yugoslavia, Bulgaria and Crimea (Greuter & al. 1989), and therefore the Mt. Klokos locality should be considered the southernmost boundary of species' distribution. Interestingly, *M. medicaginoides* has not been found in other parts of northern Greece and the disjunct Greek populations are not geographically connected with populations of other Balkan countries. The species appears on limestone, in *Juniperus foeditissima* stands, in *Abies* spp. forest and also in rocky pastures (Dimitrellos & Christodoulakis 1995).

**31b. *M. orthoceras*** (Kar. & Kir.) Trautv.

There is only one record of *Medicago orthoceras* known in Greece, based on a specimen kept in LD (!). The specimen has been found in the southern parts of Evros prefecture, close to the city of Alexandroupoli (Fig. 15). This place probably forms the westernmost boundary of this Anatolian element.

**32. *M. carica*** (Huber-Mor.) Small

This is an Anatolian element, which is found scattered, growing only on the islands of Kastellorizo and Strongili (Greuter 1979) at the south-easternmost part of Greece (Fig. 15).

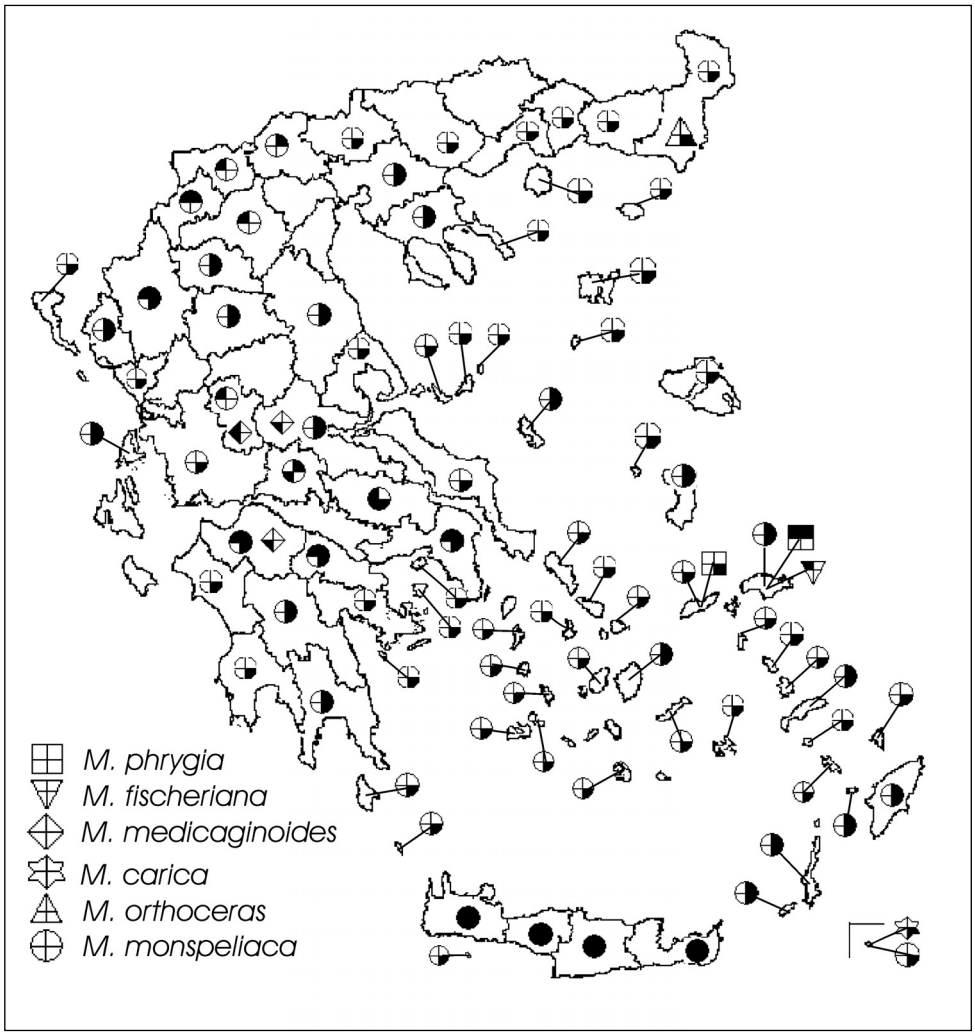


Fig. 15. Geographical and altitudinal distribution of *Medicago phrygia, M. fischeriana, M. medicaginoides, M. carica, M. orthoceras* and *M. monspeliaca* in Greece.

On these two islands *M. carica* has been found on calcareous ground, karstic rocks, stony and rocky slopes, semi-natural garrigue, in the more xeric types of garrigue, in low evergreen shrub and at ruderal places (ibid).

**33. *M. monspeliaca*** (L.) Trautv. (= *Trigonella monspeliaca* L.)

This is a rather common species, widespread in most part of Greece, but apparently absent in some prefectures of central and northern mainland. It reaches the altitude of 1700 m (Fig. 15), with most of the populations found at lower altitude. It has been reported in

ravines, land neighbouring salty soils, sandy or rocky seashores, cliffs (Kamari & al. 1988), degraded and strongly overgrazed garrigue with a weedy cover (Greuter 1976), semi-natural garrigue, burned garrigue, macchie, *C. orientalis* shrub, low evergreen scrub, open shrubland with *Quercus coccifera, Juniperus phoenicea* and *Pistacia lentiscus*, degraded *Quercus* spp. forest, *Q. pubescens* stands (Matthäs 1988), *Castanea sativa* or *Abies* spp. forests, grasslands, fallow fields, as a weed in cereal crop (Lavrentiadis 1961), open olive groves (Turland & al. 2004) and ruderal places. It participates in the *Trigonella monspeliaca-Sarcopoterium spinosum* Ass. Grabner & Heiselmayer 2000, which appears on erosion rills (Grabner & Heiselmayer 2000), in the island of Mikonos (Kiklades).

***B. General comments***

1. Evaluation of the data

The data presented in this manuscript originate from literature records and botanical collections. The conclusions, nevertheless, may be biased as certain areas of Greece (e.g. Kriti) are much better explored floristically than others. A richer collection of *Medicago* taxa and extended literature records that enable a more complete knowledge of their ecological preferences may exist in those parts of Greece which are floristically more thoroughly covered. Greuter & al. (1975) presented maps showing ill-explored and unexplored areas of Greece as well as the proportion of published floristic information. Nowadays, these insufficiently explored areas have been reduced, but there is still some lack of adequate floristic coverage in some Greek parts. For instance, Tan & Strid (1999) concluded that Mt Parnonas is less explored than the neighboring Mt Taigetos. Another problem is that the botanical information in certain cases is still based on old references (some of which may need verification) or remains very scarce. It is characteristic that there were found only two references on the presence of *M. murex* in Lakonia prefecture (Chaubard & Bory de Saint-Vincent 1838, Zaganiaris 1934) and that the only record of *M. scutellata* in Etoloakarnania comes from Garnweidner (1986). The potential of discovering additional *Medicago* taxa in certain areas, as the Greek Islands, is underlined by the results of Tsopra (2003), who found four new *Medicago* species in Milos.

Incorrect identification of specimens and published records that cannot be verified, together with mistakes in the use of plants' names and synonyms would be another source of bias. Species misidentification may be found also in Gene Banks databases as well as in some personal communications. For example, a Gene Bank database cited *M. teneorana* in Lesvos Island, which would be a new species for the area. The cultivation of seeds from the same accession proved that it was actually *M. praecox*. Another such example is *M. laciniata* in Naxos, which is cited by Gillespie (1989) and was not possible to be confirmed. In this report, special attention has been given to the critical examination of rare species in Greece. For these species in particular, visits to major Herbaria (see material and methods) and personal communications allowed a critical examination of specimens and a confirmation of their identity. Overall, part of some kind of misidentification could pass in the results. However, the presentation of the data on the maps in a qualitative basis per administrative region and the careful examination of the rare species are expected to noteworthy reduce such errors.

Although a large part of the available information has been used, there is certainly still a considerable proportion of unpublished information, or data kept in public or private Herbaria, or even personal collections, to which I do not have an access. It seems, therefore, that the floristic diversity and the distribution of *Medicago* in Greece are not fully explored and changes are expected in the future. The interpretation of the results should then be made after considering the issues mentioned above. Consequently, the present paper attempts to trace existing tendencies in *Medicago* diversity, indicates the expansion potentials of certain species and pays attention to particular factors responsible for species distributions rather than draws definite conclusions. For example, some *Medicago* collection sites, as those around Athens, have now been completely destroyed, and the old collections of Heldreich and Orphanides do not necessarily reflect the situation existing today.

## 2. *Medicago* species diversity and concentration in Greece

A comparison of Greece with other countries of approximately the same latitude and longitude revealed that it is the second richest country after Turkey, totaling 34 species (Fig. 16). Our quantitative data agree in many respects with the distribution maps provided by Kouznetsoff (1926) and Heyn (1963). In general, the highest species diversity within *Medicago* is concentrated in the Mediterranean basin, with the highest diversity of perennials found in Greece and of annuals in Turkey. This high level of diversity in Greece could be attributed to its phytogeographical position, with different elements originated from various phytochoria (e.g, Anatolian, Western Mediterranean) found in the regions of the country. This trend is also followed by other genera of Greek flora (Raus 1997, Strid & Tan 1997)

Within Greece, the concentration of species as expressed by the isoflors of Fig. 17 has the following characteristics: 1.The peripheral parts including Kerkira, Kriti and the East Aegean Islands appear to comprise the highest species concentration (20-24), apparently due to the connections with different phytogeographical regions (i.e. central Mediterranean and Anatolian). Furthermore, two regional endemics (*M. strasseri* and *M. heyniana* also found in Anatolia) are known in the area. 2. A second belt almost parallel to the peripheral one comprises a high species concentration (16-19). 3. A third region comprising the eastern mainland, Evvia and north-east Kiklades Islands has an even higher species concentration (17-21). 4. Kiklades Islands can be divided into two sub-regions, one belonging to the second belt and another to the southern and western one, with a lower (5-16) species concentration. It seems, therefore, that Kiklades do not have an even species concentration. Nevertheless, this picture may be the result of an ill exploration of certain islands or of floristic records still unpublished. As data accumulate this pattern may change. 5. In the mainland, there is a tendency of a reduction in species number towards the northern parts. This may be attributed to a gradual reduction of annual species and also inadequate exploration of some regions as the Thessalian and Makedonian lowlands. 6. Between isoflors with high species concentration there exist “islands” with a considerable lower species number (7-11), as in the Dodekanisos area. In this specific area some species, like *M. heyniana*, *M. murex*, *M. arabica*, are not met in each island. These differentiations, which include south Rodos, could be attributed to abiotic factors, human impact and the size of each island. 7. If we compare neighbouring areas, each with a high number of species, we find out that those species that are not present to both of

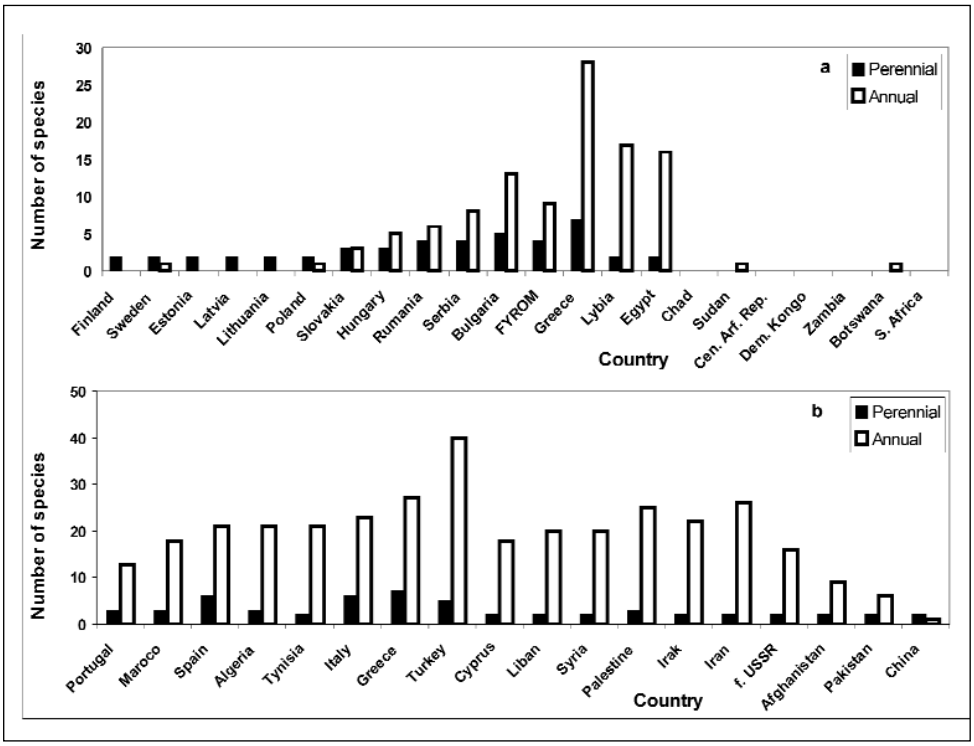


Fig.16. *Medicago* species diversity of countries of approximately the same longitude (a) and latitude (b) as Greece (based on Bertová (1988), Huber-Morath (1970), Ivimey-Cook (1968), Kožuharov (1965), Lock (1989), Lounamaa (1992), Micevski (2001), Natkevicaite-Ivanauskiene (1971), Pignatti (1982), Săvulescu (1957), Soó (1966), Tabaka (1987), Talavera (2000), Tutin (1968), Zohary (1987), Heyn & Davis (1970), Lock & Heald (1994), Greuter & al. (1989), Mirek & al. (2002), Varep & al. (1959).

them are rather few. These may be endemics or species reaching their distribution limits to a particular area. For instance *M. strasseri*, *M. heyniana* and *M. carica* are not common between Crete and Dodecanese.

In Fig. 17, the species concentration according to the isoflors is presented in macro-geographical scale. Any presentation in a micro-geographical scale needs detailed sampling of particular localities, in order to be representative of the existing reality. The use of the available data from the botanical collections may be responsible for biased results (e.g. a particular small population collected many times and the opposite, preference of highlands compared to the lowlands, ignorance of common species). Even in that case, however, the available information indicates that the concentration of species could depended on factors like the geographical location (e.g. the East Aegean Island include some species with an Anatolian origin), substrate (e.g. limestone seems to be the most favourable substrate), pH (all species can grow in alkaline soils), precipitation (perennial taxa are increased in areas

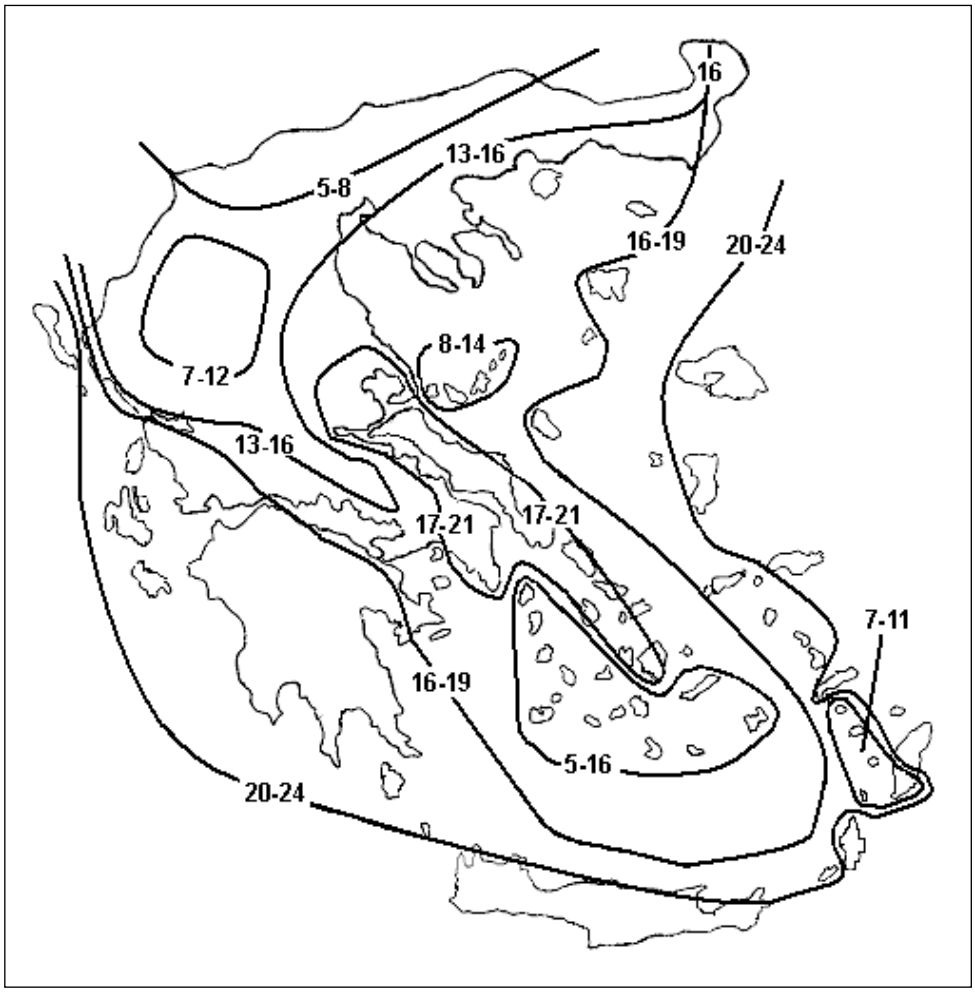


Fig. 17. Isoflor map for the genus *Medicago* in Greece. The numbers in each isoflor represent the number of species.

with a high precipitation), biotic factors (e.g. grazing, human activities), stage of phytosociological succession (e.g. vegetation changes that follow a fire) but also on the genetic plasticity of species population that permits to adapt and grow well under different conditions. Such factors are discussed in the following parts of this work.

3. Geographical and altitudinal distribution

The geographical distribution patterns of *Medicago* species in Greece could fall within the following categories:

a. Widespread species. i. Found all over the country without considerable gaps. The species are abundant, appearing in nearly all regions (e.g. *M. lupulina*, *M. arabica*). ii.

Found all over the country but scarce in some parts. The species may be absent (or apparently absent) in some particular areas (e.g. *M. doliata*).

b. Peripheral species reaching the marginal parts of Greece, e.g. *M. carstiensis, M. intertexta*, *M. muricoleptis*, *M. orthoceras*, *M. carica*, *M. phrygia*.

c. Species with a disjunct distribution: they are found in a few distinct localities, which are not directly connected with the main distribution of the species (*M. medicaginoides*).

d. Endemics: i. Local (*M. strasseri*), ii. South-east Aegean (*M. heyniana*).

These patterns describe the distribution of the species in a macro-geographical scale. In a micro-scale there is a tendency of an uneven distribution, as in the case of islands and islets (Table 3). *Medicago* species may be absent in many islets or only a very few species may be found in areas of limited surface. Their populations fluctuate over time and this may include absence of species in some years and their re-appearance (Snogerup & Snogerup 1987), with numbers of individuals obviously related to seed bank reserves in the soil, dormancy mechanisms and human interference. These phenomena may explain undercollection of *Medicago* species and also conflicting observations in some specific areas. For example, botanists report different *Medicago* species on Yioura and Dionysades Islands (Table 3). Another explanation, however, may be that the floras of neighboring islets are in some cases highly variable (Panitsa & Tzanoudakis 2001).

The altitudinal distribution varies considerably among species, independently of their biological cycle. There are species appearing in all altitudinal zones (e.g. *M. lupulina*, *M. sativa* spp. *falcata*, *M. rigidula*, *M. minima*); they extend from sea level up to 1800-2300 m. Some species (e.g. *M. monspeliaca*, *M. polymorpha*) are found up to 1300-1500 m, while others (e.g. *M. rugosa*, *M. constricta*, *M. murex*) do not exceed 800-1000 m. There are also species distributed at lower altitudes, up to 500-600 (e.g. *M. arborea*, *M. strasseri*), and species restricted to only one altitudinal zone (e.g. *M. marina*, *M. muricoleptis*).

4. Phytogeographical boundaries

Northeast Greece harbours the distribution boundaries of some species: *M. orthoceras* and *M. blancheana* have there their westernmost limits and *M. carstiensis* its southernmost limit (Fig. 18). These findings agree with the phytogeographical role of this area as described by Raus (1997). Six Anatolian elements have their westernmost boundaries in Greece, from Samos to Kefallinia. To the south, *M. strasseri* is known only from Kriti and the islet of Paximadi off the northern coast (Kypriotakis 1988, Z. Kypriotakis, personal communication), which thus forms the northernmost boundary of the species' distribution. In the mainland, *M. prostrata* has its southernmost limit at the area of Mt. Chasia, in northwestern Thessalia. The southermost distribution limit of *M. medicaginoides* is found in northern Peloponnisos, where the species forms at least one isolated population (LD). Both *M. intertexta* and *M. muricoleptis* have their easternmost boundary at western Greece but also appear in Samos Island and the Kavala area, respectively. It is expected that the three last species may be found in other localities too, particularly in areas that connect their known collection sites. Greece is therefore proved to be, in accordance to Turrill (1929), a meeting point of *Medicago* species also that have different origins. The *Medicago* taxa that have their distribution limit in Greece account for more than one third of the total species found in the country.

Table 3. *Medicago* species present in selected islands and islets.

| Island, islet or island group | Phyto-geographical region (see Fig. 18) | Number of island & islets[#] | *Medicago* species | | | | | | | | | | | | | | | | | | | | Total | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *arborea* | *sativa* ssp *sativa* | *marina* | *littoralis* | *truncatula* | *tuberculata* | *rigidula* | *murex* | *rugosa* | *scutellata* | *minima* | *praecox* | *coronata* | *polymorpha* | *arabica* | *disciformis* | *lupulina* | *constricta* | *orbicularis* | *monspeliaca* | | |
| Yioura | Wae | 1 | | | | | v | | | | | | | | v | | | v | | | | | 4 | Phitos 1967 |
| Yioura | WAe | 1 | v | | | | v | | v | | | | | | v | v | v | v | | | v | v | 9 | Kamari & al. 1988 |
| Kira Panagia | WAe | 1 | | | | v | v | v | | | | | v | | v | v | v | v | | | v | v | 10 | Phitos 1967, Snogerup & al. 1991 |
| Kira Panagia* | WAe | 4 | v | | | | | | | | | | | v | v | | v | | | | | v | 5 | Snogerup & al. 1991 |
| S. Evoikos | WAe | 36 | v | v | v | v | v | | | | | | v | | v | v | v | v | v | | v | | 12 | Sarlis 1981 |
| Skyros* | WAe | 3(6) | v | | | v | v | | | | | | | | | v | | v | | | | v | 6 | Snogerup & Snogerup 1987 |
| Psathura | WAe | 1 | | | | v | v | | | | | | | | | | | | | | | | 2 | Snogerup & al. 1980 |
| Skantzoura | WAe | 7(9) | v | | | | v | v | | | | | | v | v | | | v | | | v | v | 8 | Gustafsson & Snogerup 1974 |
| Psittalia | StE | 1 | | | v | v | v | | | | | | | | | | | v | | | | v | 5 | Vallianatou & al. 1994 |
| Saronic gulf (-Psittalia) | StE | 11(21) | | | | v | v | | | | | | | | v | v | | v | | | v | v | 7 | Vallianatou 2005 |
| Poros | Pe | 1 | | | v | | v | v | | | | | v | | v | v | | v | | | v | v | 9 | Friedrichsthal 1838, Zaganiaris 1935 & 1940 |
| Elaphonesos | Pe | 1 | | | v | | | | | | | | | | | | | | | | | | 1 | Yannitsaros 1971 |
| Kithira* | Pe | 1 | | | | | | | | | | | | | | | | | | | | v | 1 | Panitsa & al. 2004 |
| Antikithira* | Pe | 1(3) | | | | v | | | | | | | | | | | | | | | | | 1 | Tzanoudakis & al. 2006 |
| Andros* | Kik | 2(7) | | | | v | v | | | | | | | v | | v | | v | | | | | 5 | Malakates 1933b |
| Rinia | Kik | 1 | | | v | | | | | | | | | | | | | v | | | | | 2 | Heldreich 1901, LD |
| Yiaros | Kik | 1 | | | | v | v | | | v | v | | | | v | v | | v | | | v | | 7 | Tzanoudakis 1981 |
| Paros* | Kik | 4 | | | v | v | | v | | | v | | | | | v | | v | | | | v | 7 | Raus 1996 |
| Kimolos* | Kik | 3 | v | | | | | | | | | | | | | v | | | | | | | 2 | Malakates 1933 |
| Keros | Kik | 1 | | | | | | v | | v | | | | | v | | | | | | | | 3 | Rechinger 1943a |
| Heraklia | KiK | 1 | | | | | | | | | | | | | v | | v | v | | | | | 3 | Rechinger 1943a |
| Delos, Mikri Delos | KiK | 2 | | | v | v | | | | | | | | v | v | v | | v | | | v | v | 8 | Halácsy 1912, Vierhapper 1914b, LD |
| Antiparos | KiK | 1 | | | v | v | | v | | | v | | | | v | v | | v | | | | | 7 | Raus 1996 |

Table 3. (continued.)

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Paros* and Antiparos* | KiK | 6(18) | | | | v | v | | | | | | | v | | | v | | | | v | 5 | Raus 1996 |
| Thirasia | KiK | 1 | | | | v | | | | | | | | | | | | | | | v | 2 | Hansen 1971 |
| Karpathos* | KK | 7(15) | v | | | v | | | | | | | | v | v | | v | | | | v | 6 | Höner 1991 |
| Armathia, Kasos* | KK | 6 | v | | v | v | | | | v | | | | v | | | v | | | | v | 6 | Raus 1989 |
| Dionysaden | KK | 3 | | | | v | v | | | | | | v | v | | | | | | v | v | 5 | Candoger 1916, Christodoulakis & al. 1990 Rechinger 1943b, |
| Dionysaden | KK | 3 | v | | | | v | | | | | | v | v | | | | | | v | v | 6 | Bergmeier & Dimopoulos 2001 |
| Grabusa | KK | 2 | | | v | v | v | | | | | | | v | | | v | | | v | v | 7 | Rechinger 1943b, Christodoulakis & al. 1991 |
| Lesvos* | EAe | 3(4) | | | | | | v | | | | v | | | v | | | | | | | 3 | Bazos 2005, Panitsa 1997 |
| Gyali | EAe | 1 | | | v | v | | v | | | | | | | v | | | | | | | 4 | Brofas & al. 2001 |
| Chrisi, Koufonisi | EAe | 6 | | | v | v | v | | | | | v | | v | | | v | | | | v | 7 | Bergmeier & al.2001 |
| Fourni* | EAe | 2 | | | | | | | | | v | | | | | | v | | | | v | 2 | Christodoulakis & al. 1990 |
| Agathonisi, Pharmakonisi | EAe | 4(9) | | | | | v | v | | | | v | | v | v | | v | | | v | v | 9 | Panitsa & Tzanoudakis 1998 |
| Pserimos & Telendos | EAe | 2 | | | v | v | v | v | v | | | | | v | v | | | | v | v | v | 10 | Hansen 1980, Burton Herb. |
| Arki | EAe | 8(12) | | | | | v | | | | | v | | v | v | | | | | v | v | 6 | Panitsa 1997 |
| Oinouses | EAe | 3(6) | | | | | | v | | | | | v | v | | | v | | | v | v | 6 | Panitsa & al. 1994 |
| Samos* | EAe | 1(3) | | | | | | | | | | | | v | | | | | | | | 1 | Panitsa 1997 |
| Samiopoula | EAe | 1 | v | | | | | v | | | | | | v | v | | v | | | v | v | 7 | Christodoulakis 2000 |
| Lipsi | EAe | 5(25) | | | | v | v | v | | | | v | v | v | v | | | v | | v | v | 10 | Panitsa 1997 |
| Leros*-Kalolimnos-Imia | EAe | 3(14) | | | | | v | | | | | | | v | | | | | | | v | 3 | Panitsa 1997 |
| Othoni | IoI | 1 | | v | v | v | | | | | | v | | | | | | v | | v | | 6 | Borkowsky 1994, Georgiadis 1983 |
| Erikousa | IoI | 1 | | v | v | v | | | | | | | | | v | | | | | | | 4 | Borkowsky 1994, Georgiadis 1985 |
| Oxeia | IoI | 1 | | | | | | | | | | | | v | | | | | | v | | 2 | Christodoulakis & al. 1988 |
| Strofades | IoI | 1(2) | | | | v | v | v | | v | v | | v | | v | | | | | v | v | 9 | Halácsy 1899, Yannitsaros & al. 1995 |

* After the name it indicates the existence of offshore islets around a main island. Lack of the symbol indicates the island/islet itself.

# The number without or outside brackets indicates the islands/islets where *Medicago* species are recorded. The total number of islands/islets studied is shown in brackets.

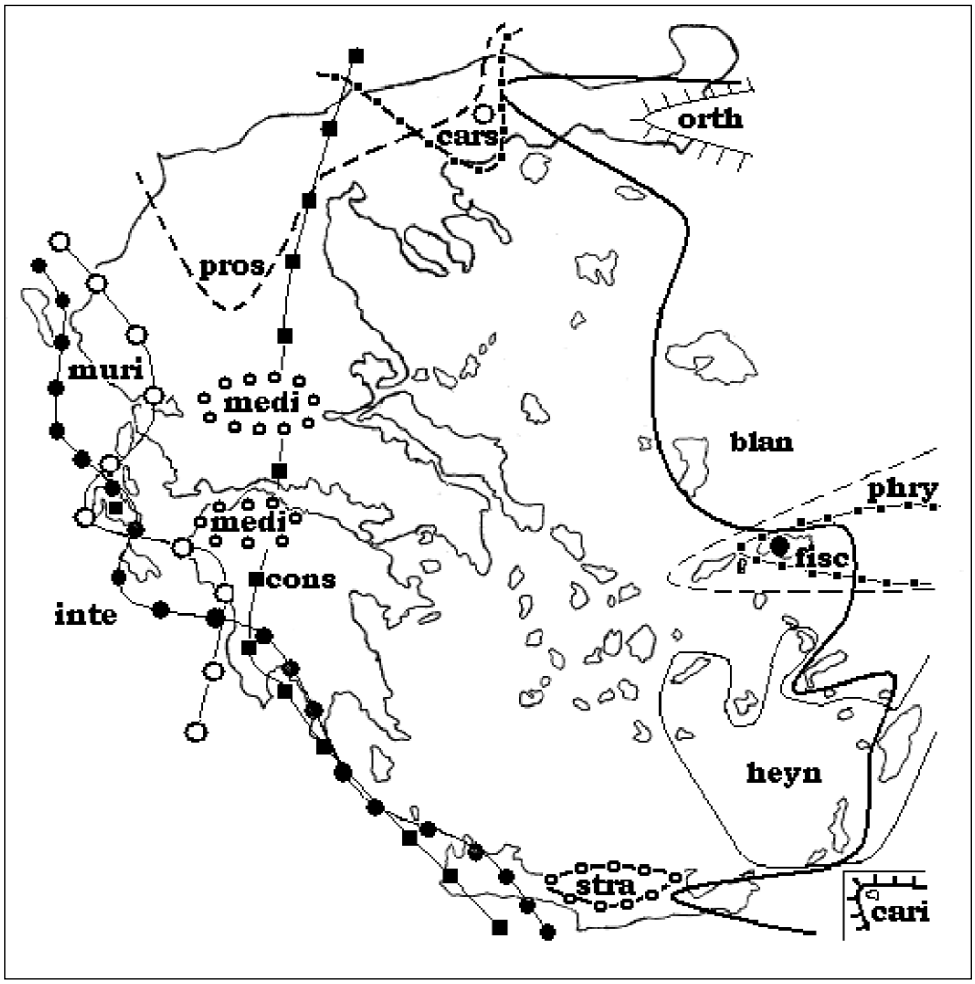


Fig. 18. Phytogeographical boundaries of *Medicago blancheana* (blan ———), *M. carica* (cari ⊔⊔⊔), *M. carstiensis* (cars -▪-▪-▪-), *M. constricta* (cons ▪—▪ and ▪), *M. heyniana* (heyn ———), *M. fischeriana* (fisc -▪-▪-), *M. intertexta* (inte ●—● and ●), *M. medicaginoides* (medi ▫ ▫ ▫), *M. muricoleptis* (muri ○—○ and ○), *M. orthoceras* (orth ⊔⊔⊔), *M. phrygia* (phry — — —), *M. prostrata* (pros ▬ ▬ ▬) and *M. strasseri* (stra -▫-▫-) in Greece.

5. Ecological adaptation

a. Abiotic environment:

The available data presented in this paper indicate that the Greek *Medicago* species exhibit a wide variation of adaptation to different geological substrates (Table 4). *M. polymorpha* and *M. orbicularis* are present in nearly all types of substrates. Most of the species are found on limestone, calcareous and schist substrates (Table 4). There are 9 species, annual and perennial, that are reported from serpentine substrates. With respect to soil tex-

ture, most species grow on sand, sandy loam and loam (Table 5). *M. polymorpha* is found on all soil types and *M. arabica* on nearly all types. As a rule, most species are growing on soils with an alkaline pH, even of high values, but there are also some that adapt well to moderate acidic pH (e.g. *M. disciformis, M. murex, M. truncatula*). The wider range of pH (from 5.5 up to 10) adaptation has been observed in *M. polymorpha*, *M. arabica* and *M. orbicularis*. Nevertheless, for several species the available data on their abiotic preferences should not be considered as complete. It is expected that a wider range of adaptation to abiotic factors should exist.

The available data do not provide exact information on the climatic conditions under which *Medicago* species grow in Greece. Nevertheless, by combining the climatic zones of Greece with the geographical and altitudinal distribution of the species some comments can be drawn. The species most tolerant to different climatic parameters appears to be *M. lupulina*, followed by *M. minima, M. orbicularis*, *M. arabica* and others (see Figures 2-15). In the opposite, there are species restricted to specific habitats as *M. carstiensis.* However, the majority of the species, being annuals, are mostly connected with xirothermic conditions (e.g. those preventing in the lowland of south Greece and the Kiklades).

A good number of species are adapted to Mediterranean fire conditions. They are participating in the post-fire vegetation regeneration of *Pinus* spp. forests. Such species are *M. arabica*, *M. orbicularis*, *M. littoralis, M. polymorpha, M. minima M. coronata*, *M. truncatula M. lupulina,* and *M. monspeliaca,* germinating even during the 4$^{th}$ year after the fire event (Papavasiliou 2001, Sarlis 1976, Kazanis & Arianoutsou 1994, Thanos & al. 1989).

b. Biotic environment

A brief summary of the biotic preferences of the Greek *Medicago* species is given here. More details can be found under each species.

Some species, as *M. marina*, are restricted to very specific vegetation types. Others, like *M. lupulina*, present a wide variation with respect to the phytocommunities where they are found. Interestingly, several *Medicago* species play an important role on phytosociological level.

Certain species are connected with human activities (Greuter 1976) and have developed a weedy behaviour (e.g. Lavrentiadis 1980, Turland & al. 2004). Usually they are not aggressive in their natural habitats. However, beyond their natural environment some species may exhibit an aggressive potential, as the case of *M. polymorpha* in Australia, which is spread in cleared and uncultivated land (Davidson & Davidson 1993). In Greek agroecosystems the *Medicago* species does not pose any serious problems in cultivations, despite their weedy behaviour (Giannopolitis 2004, C. Giannopolitis personal communication).

An interesting issue is the relationships between *Medicago* species and grazing animals. Most *Medicago* species seem to benefit from animals that facilitate their dispersal (Stebbins 1975, Thompson & al.1990) but, on the other hand, they are extensively used by the herbivores for feeding. There are not many studies that investigate the impact of grazing on *Medicago* species in Greece. One study in Kriti (Bergmeier 1998a, E. Bergmeier personal communication) showed that *M. coronata* and *M. monspeliaca* frequently appear in both grazed and non-grazed environments. The reproduction of *M. coronata* was somewhat, but not significantly, enhanced in non-grazed treatments, whereas the opposite was

Table 4. Parental geological substrate where *Medicago* species were observed. Based mainly on Snowball 1998, Francis & al. 1995, Hughes 1987, Gillespie 1989, Nut & al. 1996 and also Heldreich (1882), Greuter (1979), Strid (1999), Paraskeuopoulos (2006), Trigas & Iatrou (2000), Panitsa & al. (2003), ATH, B and LD.

| Species | Geological substrate | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Schist | Calcareous | Limestone | Alluvial | Sandstone | Dune | Granite | Basaltic | Volcanic | Serpentine | Flysch |
| *M. arborea* | v | | v | | | | | | v | | |
| *M. strasseri* | | | v | | | | | | | | |
| *M. sativa* | v | v | v | v | | | | | | v | V |
| *M. prostrata* | | v | | | | | | | | v | |
| *M. marina* | | | v | v | v | v | | | | | |
| *M. carstiensis* | | v | | | | | | | | | |
| *M. littoralis* | v | | v | v | | v | v | | v | | |
| *M. truncatula* | v | v | v | | | | v | | v | v | |
| *M. tuberculata* | v | v | v | v | | | v | | v | | |
| *M. rigidula* | | | v | | | v | | | | | v |
| *M. constricta* | | | v | | v | | | | | | |
| *M. murex* | v | v | v | | | v | v | v | | | |
| *M. rugosa* | v | v | v | v | | | v | | | | |
| *M. scutellata* | v | | v | | | | | v | v | | |
| *M. ciliaris* | | v | | | | | | | | | |
| *M. muricoleptis* | | | | | v | | | | | | |
| *M. minima* | v | v | v | v | | | | | | v | v |
| *M. praecox* | v | v | v | | | | v | | | | |
| *M. coronata* | v | v | v | | | | | | | | v |
| *M. polymorpha* | v | v | v | v | | v | v | v | v | v | v |
| *M. arabica* | v | v | v | | | | | v | | | v |
| *M. disciformis* | v | v | v | v | | | | v | v | v | v |
| *M. lupulina* | | v | v | v | | | | | v | v | v |
| *M. heyniana* | | v | v | | | | | | | | |
| *M. orbicularis* | v | v | v | v | | | v | v | v | v | |
| *M. phrygia* | v | | v | | | | | | | | |
| *M. medicaginoides* | | | v | | | | | | | | |
| *M. carica* | | v | | | | | | | | | |
| *M. monspeliaca* | v | v | v | | | | v | | | v | |

found in the case of *M. monspeliaca*. Bergmeier & Dimopoulos (2003) found that in grazed islets the number of species was in general higher compared to the ungrazed islets, but the reverse was true for species behaving as island specialists. The intensity of grazing also plays a role. Personal observations by the author in a grazed garrigue and a neighbouring protected and ungrazed area on Patmos Island indicated that the more closed canopy of the latter area reduced or eliminated the herbaceous species with a direct negative impact to the annual *Medicago* species. A study in Israel centred on the effects of grazing on annual legumes showed that six annual *Medicago* species had a significant positive response to grazing, to grazing of high and very high intensity (Noy-Meir & Kaplan 2002).

6. Species protection

Rare *Medicago* species in Greece as well as those that have in Greece limits of their geographical distribution may need particular attention and protection (e.g. *M. carstiensis*, *M. orthoceras, M. medicaginoides*). Human action (tourism, agriculture and animal husbandry, constructions) in islands can seriously affect or even extinct the littoral vegetation (Economidou 1995, Géhu & al. 1986, Spanou & al. 2006), directly influencing certain

Table 5. Soil texture where *Medicago* species were observed based on Snowball 1998, Ewing & Howieson 1987, Francis & al. 1995, Hughes 1987, Gillespie 1989, Nut & al. 1996 and B.

| | Soil texture | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Gravely or stony | Sand | Loamy sand | Sandy loam | Loam | Sandy clay loam | Clay loam | Sandy clay | Clay |
| Species | | | | | | | | | |
| *M. arborea* | v | | | v | v | | | | |
| *M. sativa* | | v | | | | v | v | | v |
| *M. marina* | | v | v | | | | | | |
| *M. littoralis* | v | v | | v | v | v | v | | v |
| *M. truncatula* | v | v | v | v | v | v | v | | v |
| *M. doliata* | | | | | v | | | | |
| *M. tuberculata* | v | | | v | v | | v | v | |
| *M. rigidula* | v | v | v | v | v | v | v | v | |
| *M. constricta* | | v | | v | v | v | | | |
| *M. murex* | v | v | v | v | v | v | v | v | |
| *M. rugosa* | v | v | | v | v | | | | |
| *M. scutellata* | | | v | v | v | | | | |
| *M. ciliaris* | | v | | | | | | | |
| *M. minima* | v | | v | v | v | v | v | | |
| *M. praecox* | | v | | v | v | v | | | |
| *M. coronata* | | v | | v | v | | v | | |
| *M. polymorpha* | v | v | v | v | v | v | v | v | v |
| *M. arabica* | v | v | v | v | v | v | v | v | v |
| *M. disciformis* | v | v | v | v | v | v | v | v | |
| *M. lupulina* | v | v | | | | | | | v |
| *M. heyniana* | | | | | | | | | v |
| *M. orbicularis* | v | v | v | v | v | v | v | | v |
| *M. monspeliaca* | v | v | | v | | | v | | v |

*Medicago* species. Düll (2000) estimated that *M. marina*, *M. littoralis* and *M. scutellata* are endangered in Samos and Ikaria Islands, due to tourism and building activities.

The *Medicago* species could be divided in two groups: a. Species widespread in the country not being under treat of extinction but eventually under treat of population impoverishment, b. Rare or regional endemic species in Greece appearing in few locations.

According to the data existing for the rare species we could initially subdivide the above-mentioned second group into three categories adopting only one of the criteria of IUCN (2001) used for the Red List. It is to be noted that the IUCN's methodology needs at least two criteria in order to be applicable. These categories are (the number in brackets indicating approximately the locations): a. Critically endangered: *M. fischeriana* (1) and *M. orthoceras* (1), b. Endangered: *M. carstiensis* (2), *M. phrygia* (2) and *M. carica* (3), c. Vulnerable: *M. strasseri* (7), *M. blancheana* (7), *M. intertexta* (5), *M. muricoleptis* (6)*, M. heyniana* (6), *M. medicaginoides* (5). It should be mentioned that some records are very old ones and not reconfirmed.

*Medicago* species' protection is achieved to a certain degree through the NATURA network based on the application of Directive 92/43 of the European Union. But more energetic policies are needed in order to achieve an effective protection: Such measures should include: a. Detailed studies on endemic (*M. strasseri* and *M. heyniana*) and rare species followed by monitoring and specific measures about any particular threats affecting their survivorship. b. I*n situ* conservation measures to be decided. c. Additionally collections in the different localities to be organized for *ex situ* conservation. d. Some *Medicago* genetic reserves to be established (may be comprising and other rare species), applicable in areas of high *Medicago* diversity (e.g. Evvia, Kerkira, Naxos, Chios, Crete) or areas with one rare species (e.g. Mountain Pagaion for *M. carstiensis*). e. The protection of species actually widespread including the safeguard of their genetic variation (Millar & Libby 1991), as well as of the specific plant communities in which the species participates.

## 7. Further research

There are at least two references considered doubtful and need further investigation. *M. laciniata* has been reported by Hansen (1980) on Kos Island. A search at C did not reveal any voucher (O. Ryding and A. Strid, personal communication). Bolòs & al. (1996) also cite a specimen from Kefallinia as *M.* cf. *italica*. Their report needs further clarification. Some other species, as *M. orthoceras*, are very poorly collected in Greece and need more surveys in the field (P. Lassen personal communication). The genetic variation and phytogeography of rare species will contribute to a better understanding of their population structure and origin. In some cases, as *M. intertexta*, clearly more information on environment details is needed. It is also expected that a more detailed floristic survey of particular Greek areas will enrich our knowledge on *Medicago* species. Indeed, the forthcoming 3rd volume of Flora Hellenica and other publications will offer new localities and additional information on the diversity patterns and geographical distribution of the genus in Greece.

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**References**

Ade, A. & Rechinger, K. H.1938: Samothrake. – Repert. Spec. Nov. Regni Veg. **100:** 106-146 + plates.

Amato, G., Stringi, L. & Giambalvo, D. 2004: Productivity and canopy modification of *Medicago arborea* as affected by defoliation management and genotype in a Mediterranean environment. – Grass & Forage Sci. **59:** 20-28.

Anonymous 2000: Environmental study for the programme of Milos' viper biotope. — Oikos-Management of Natural Environment Co. and Cyclades Development Company. – Athens.

Arianoutsou, M., Vlachos, Ch., Capetanyiannis, J., Kokkinakis, A., Kokkini, S., Letsios, V., Balaskas, G. & Hallmann, B. 1986: Delimitation programme of Ramsar Convention wetlands. Wetland: Lake Kerkini. – Athens (in Greek).

Atchley, S. C. 1938: Wild flowers of Attica. Illustrated with colour plates by W. O. Everett. – Oxford.

Athanasiadis, N. & Drossos, E.1990: Flora and vegetation of Mount Paiko. — Sci. Ann. Dept. Forest. Nat. Env. Univ. Thessaloniki **33/1:** 35-149 (in Greek).

— & Eleftheriadou, E. N. 1995: Flora of *Quercus trojana* Webb (*Quercus macedonica* DC.) forests of Kozani district. – Sci. Ann. Dept. Forest. Nat. Env. Univ. Thessaloniki **38/1:** 124-158 (in Greek).

— & Theodoropoulos, K.G. 1990: Contribution to the knowledge of the Mount Cholomon flora. – Sci. Ann. Dept. Forest. Nat. Env. Univ. Thessaloniki **33/2:** 167-211 (in Greek).

—, —, & Eleftheriadou E. N. 1993: Contribution to the knowledge of the Mount Krusia flora. – Sci. Ann. Dept. Forest. Nat. Env. Univ. Thessaloniki **36/2:** 255-290 (in Greek).

—, —, — & Drossos, E.1996: Forest plant communities of delta of Thessalian Pinios river (Thessalia, Hellas). – Sci. Ann. Dept. Forest. Nat. Env. Univ. Thessaloniki **39/2:** 880-902 (in Greek).

—, —, Gerasimidis, A., Eleftheriadou, E. N., Tsiripidis, I. & Korakis, G. 1998: Vegetation units of evergreen sclerophyllus zone of the Holly Mountain. — Thessaloniki (in Greek).

Babalonas, D.1979: Phytosociological study on the vegetation of Evros Delta (Ainision Delta). – Sci. Ann. Fac. Phys. Math. Aristotelian Univ. Thessaloniki **19:** 1-158 (in Greek).

— 1980: Vegetationseinheiten und Vegetationskartierung in dem Mündungsgebiet der Flusse Evros. – Feddes Repert. **91:** 615-627.

— 1981: Floristischer Katalog des Mündungsgebiets des Evros. – Candollea **36:** 251-269.

— 1983: Neue Fundorte für seltene Pflanzen in Nordgriechenland. – Ann. Musei Goulandris **6:** 17-25.

— 1984: Zur Kenntnis der Flora und Vegetation auf Serpentin-Standorten Nordgriechenlands I. Serpentinvegetation im Voras-Gebrige. – Feddes Repert. **95:** 687-697.
— 1988: Zur Kenntnis der Flora und Vegetation auf Serpentin-Standorten Nordgriechenlands II. Serpentinvegetation auf submontanen Stufen. – Bot. Jahrb. Syst. **110:** 145-156.
— 1989: Beitrag zur Flora des serpentinschen Vourinos-Gebriges (Nordgriechenland). – Willdenowia **18:** 387-398.
—, Constantinou, M. & Charalampidi, S. 1998: The flora of Holly Mountain. –Thessaloniki (in Greek).
Baldacci, A. 1894: Contributo alla conoscenza della flora Dalmata, Montenegrina, Albanese, Epirota e Greca. – Nuovo Giorn. Bot. Ital., n.s., **1:** 90-103.
Baltisberger, M. 1991: Cytological investigations of some Greek plants. – Fl. Medit. **1:** 157-173.
Barclay, C. 1986: Crete. Checklist of the vascular plants. – Englera **6:** xiii + 1-138.
Bazos, I. 2005: Study on the flora and the vegetation of Lesvos – Ph.D. thesis, Athens (in Greek).
Beauverd, G. & Topali, S. 1936: Excursions botaniques en Grèce (Pélion, Eubée et Péloponèse). – Bull. Soc. Bot. Genève, Sér. 2, **28:** 94-183.
Béguinot, A. & Andreucci, A. 1925: Piante della Macedonia (Reminiscenze di guerra). – Arch. Bot. (Forli) **1:** 205-216.
— & Vaccari, A. 1914: Contribuzione alla Flora di Rodi e di Stampalia. – Atti Reale Ist. Veneto Sci. Lett. Arti **72:** 309-330.
Bennett, S. J., Broughton, D. A. & Maxted, N. 2006: Ecogeographical Analysis of the Perennial *Medicago*. – CRC Salinity Buletin **1**: 1-62.
Bergmeier, E. 1995: Die Höhenstufung der Vegetation in Südwest-Kreta (Griechenland) entlang eines 2450 m-Transektes. — Phytocoenologia **25:** 317-361.
— 1998a: Combined effects of fire and grazing on phrygana vegetation - a case study in SW Crete (Greece). — Ecol. Medit. **23**[for 1977]**:** 1-10.
— 1998b: Flowering intensity of phrygana plants after fencing. – Isr. J. of Plant Sciences **46:** 41-46.
— 2002: Plant communities and habitat differentiation in the Mediterranean coniferous woodlands of Mt. Parnon (Greece). – Folia Geobotanica **37:** 309-331.
— & Dimopoulos, P. 2001: Changes and limits of floristic islands inventories - the Dionysades group (South Aegean, Greece) Re-visited. – Phyton (Horn) **41:** 227-293.
— & — 2003: The vegetation of the islets in the Aegean and the relation between the occurrence of the islet specialists, island size, and grazing. – Phytocoenologia **33:** 447-474.
— & Matthäs, U. 1995: Additions to the flora of W Crete. – Willdenowia **25:** 81-98.
—, Jahn, R. & Jagel, A.1997: Flora and vegetation of Gavdos (Greece), the southernmost European island. I. Vascular flora and chorological relations. – Candollea **52:** 305-358.
—, Kypriotakis, Z., Jahn, R., Böhling, N., Dimopoulos, P., Raus, Th. & Tzanoudakis, D. 2001: Flora and phytogeographical significance of the islands Chrisi, Koufonisi and nearby islets (S Aegean, Greece). – Willdenowia **31:** 329-356.
Bertová, L. (ed.) 1988: Flora Slovenska, **4**. – Bratislava
Biel, B. 2005: Contribution to the flora of the Aegean islands of Santorini and Anafi (Kiklades, Greece). – Willdenowia **35:** 87-96.
Biondi, E.1989: The vegetation of sedimentary low coasts in Corfu islands. – Colloq. Phytosoc. **19:** 401-427.
Boissier, E. 1872: Flora Orientalis, 2 (*Calyciflorae*). – Genevae et Basileae.
— 1888: Flora Orientalis. Supplementum. – Genevae et Basileae.
Boissieu, M. de 1896: Quelques notes sur la flore d' Orient. – Bull. Soc. Bot. France **43:** 83-291.
Bolòs, O. de, Masalles, R. M., Ninot, J. M. & Vigo, J. 1996: A survey on the vegetation of Cephalonia (Ionian island). – Phytocoenologia **26:** 81-123.

Bolton, J., Goplen, B. & Baenziger, H. 1972: World distribution and historical developments. – Pp.1-34 in: Hanson, C. H. (ed.) Alfalfa science and technology. Agronomy Monography **15.** – Madison.

Boratyńska, K., Boratyński, A., Browicz, K. & Dolatowski, J. 1985: Trees and shrubs of Rodhos – a monographic study. – Arbor. Kórnickie **30:** 127-199.

Boratyński, A., Browicz, K. & Zielińsky 1987: Woody flora of Chios. – Arbor. Kórnickie **32:** 37-92.

—, — & — 1991: Woody flora of Euboea. – Arbor. Kórnickie **33:** 13-74.

—, — & — 1992: Chorology of trees and shrubs in Greece. – Poznań.

Borkowsky, O. 1994: Übersicht der Flora von Korfu. – Braunschweig. Geobot. Arbeiten **3:** 1-202.

Bornmüller, J. 1894: Nachtrag zu ‘’Florula insulae Thasos’‘. – Österr. Bot. Z. **44:** 124-128.

— 1928: Ergebnis einer botanischen Reise nach Griechenland im Jahre 1926 (Zante, Cephalonia, Achaia, Phokis. Aetolien). – Repert. Spec. Nov. Regni Veg. **25:** 161-203.

Bory de Saint-Vincent, M. & Chaubard, M. 1832: Expédition scientifique de Morée. Tome III. - 2e partie. Botanique. – Paris.

Brandes, D. 1998: Vegetation der Straßenränder Korfus. – Braunschweiger Geob. Arb. **5:** 247-262.

Browicz, K. 1991: Trees and shrubs of Lemnos Is. (Greece). – Arbor. Kórnickie **36:** 5-25.

— 1994: Trees and shrubs of Kos Island. – Arbor. Kórnickie **39:** 31-55.

— 1997: Woody flora of Melos and Kimolos Island. – Arbor. Kórnickie **42:** 45-63.

— 1999a: Fifteen years of floristic and dendrological investigation in Greece. – Ann. Musei Goulandris **10:** 29-44.

— 1999b: Trees and shrubs of the island of Skyros (Northern Sporades, Greece). – Bot. Chron. **13:** 325-339.

— & Zielińsky, J. 1996: Trees and shrubs of Ikaria island (Greece). – Arbor. Kórnickie **41:**15-45.

Brofas, G. & Karetsos, G.1992: Contribution to the study of ecology of Schinias-Marathona. – Geotechnic Scientific Issue **3:** 32-41 (in Greek).

—, —, Panitsa, M., & Theocharopoulos M. 2001: The flora and vegetation of Gyali island, SE Aegean, Greece. – Willdenowia **31:** 51-70.

Burton, R. M. 1991: A check-list and evaluation of the flora of Nisyros (Dodecanese, Greece). – Willdenowia **20:** 15-38.

— 1999: Yet more new plants from the East Aegean island of Samos. – Ann. Mus. Goulandris **10:** 45-51.

Böhling, N. B. 1994: Studien zur landschaftsökologischen Raumgliederung auf der mediterranen Insel Naxos (Griechenland) unter besonderer Berücksichtigung von Zeigerpflanzen. – Diss. Bot. **230:** i-vii, 1-247.

Candargy, C. A. 1889: Flore de l’île de Lesvos. Plantes sauvages et cultivées. – Uster-Zürich.

— 1892: Flore de l’île de Lesvos. – Rev. Méd.-Pharm.Constantinople **5:** 58-59.

— 1899a: La végétation de l’île de Lesvos (Mytilène). – Ph.D. Thesis, Lille.

— 1899b: La végétation de l’île de Lesvos (Mytilène). – Rev. Gén. Bot. **11:** 268-280, 310-329.

Carlström, A. 1987: A survey of the flora and phytogeography of Rodhos, Simi, Tilos and the Marmaris peninsula (SE Greece, SW Turkey). – Ph.D. thesis, Lund.

Čelakovský, L.1887: Beitrag zur Kenntniss der Flora der Athos-Halbinsel. – Sitzungsber. Königl. Böhm. Ges. Wiss. Prag. Math.-Naturwiss. Cl. **1887:** 528-547.

Chaubard, M. & Bory de Saint-Vincent, M. 1838: Nouvelle flore du Péloponnèse et de Cyclades, entièrement revue, corrigée et augmentée par M. Chaubard, pour les Phanérogames et M. Bory de Saint-Vincent, pour les Cryptogames. – Paris/Strasbourg.

Chilton, L. & Turland, N. J. 1997: Flora of the Crete: A supplement. – Retford.

— & — 2004: Flora of the Crete: Supplement II, Additions 1997-2004 – Marengo Publications (http://www.marengowalks.com/fcs.html).

Chitos, Th. 2005: Plants of Tzoumerka Mountain. – Ioannina.

Chochliouros, S. & Georgiadis Th. 1997: Additions to the flora of Mount Vermion (N Central Greece). – Willdenowia **27:** 101-112.
Christodoulakis, D.1984: Neufunde für die Flora der Insel Samos (Griechenland) – Willdenowia **14:** 75-87.
— 1986: Die Flora und Vegetation der Insel Samos (Griechenland). – Ph.D. thesis, Patras (in Greek).
— 1996: The flora of Ikaria (Greece, E. Aegean Islands). – Phyton (Horn) **36:** 63-91.
— 2000: The flora of Samiopoula (E. Aegean Islands, Greece): a biological, chorological and ecological analysis. – Bot. Chron. **13:** 287-301.
— & Georgiadis, Th.1990: The vegetation of the island Samos, Greece. – Ann. Mus. Goulandris **8:** 45-80.
—, Economidou, E. & Georgiadis, Th. 1991: Geobotanische Studie der Grabusen-Inseln (Südägäis, Griechenland). – Bot. Helv. **101:** 53-67.
—, Artelari, R. Georgiadis, Th. & Tzanoudakis, D.2001: New records to the flora of Fourni (E. Aegean islands, Greece). – Bocconea **13:** 491-494.
—, Georgiadis, Th., Lösing, J. & Severin, I. 1988: Flora und Vegetation und ökologische Bedeutung der Insel Oxeia (Ionische Inseln, Griechenland). – Candollea **43:** 209-222.
—, —, Economidou, E., Iatrou, G. & Tzanoudakis, D. 1990: Flora und Vegetation der Dionysaden-Inseln (Südägäis, Griechenland). – Willdenowia **19:** 425-443.
Ciferri, R. 1943: Flora e vegetazione della isole italiane dell'Egeo. – Arch. Bot. (Forli) **19**, suppl.: i-viii.
— 1944: Flora e vegetazione della isole italiane dell'Egeo. – Atti Ist. Bot. Reale Univ. Reale Lab. Crittog. Pavia, Ser. **5 A:** 1-200.
Clarke, E. D. 1810-1823: Travels in various countries of Europe, Asia and Africa. – Part the second, London.
Constantinidis, Th. 1997: The flora and vegetation of Mounts Gerania, Pateras and Kitheron. – Ph. D. thesis, Athens.
— 2004. The Floristic Diversity of Serpentine in Greece 1. An inventory of the Aliki Area (Sterea Ellas, Cenrtal Greece). – Phyton (Horn) **44:** 45-67.
—, Chitos, Th. & Thanopoulos, R. 2004: A contribution to the study of the flora of West Evritania, with emphasis to pastures. – Pp. 149-158 in: Platis, P. & Papachristou, Th. (eds.) Proc. of the 3rd Panhellenic Rangeland Congres. Thessaloniki (in Greek).
Cousturier, P. & Gandoger, M. 1916: Herborisations en Crète (1913-1914). Première partie. – Bull. Soc. Bot. France **63:** 1-15.
Covillot J., Charlier P., Chautems A., Duperrex A., Guerne C. & Toni V. 1997: Excursion de notre société dans l'archipel de Santorin (Cyclades). – Sausserea **28:** 219-227.
Crespi, A.L., Guimarães, J., Bernardos, S., Fernandes, C. P., Castro, A., Pareira, A., Malfeito, T. & Amich, F. 2003: Contributión al conocimiento de la diversidad específica del género *Medicago* L. para el norte de Portugal. – Botanica Complutensis **27:** 105-117.
Davidson, B. R. & Davidson H. F. 1993: Legumes: The Australian experience. The botany, ecology and agriculture of indigenous and immigrant legumes. – New York.
Davis, P. H., Mill, R. R. & Tan, K. (eds.) 1988: Flora of Turkey and the East Aegean Islands, **10** (Supplement). – Edinburgh.
Deffner, M. 1922: The flora of Tsakonia. – Agricultural Library of Royal Agricultural Society **2**. – Athens (in Greek)
Diapoulis, Ch. 1940: The flora of the grasslands of west and central Macedonia. – Athens (in Greek).
— 1958: From the vegetation of Parnitha. – Vouno **1958:** 163-158 (in Greek).
Dimadou, D. 1923: Weeds of Thessalian fields. – Athens (in Greek).
Dimalexis, A., Pyrovetsi, M., & Babalonas, D.1999: Classification of wetland habitats at lakes Kerkini, Mikri and Megali Prespa. – Geotechnic Scientific Issues **10:** 4-16 (in Greek).

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

Dimopoulos, P. 1993: Floristic and phytosociological research of the Mount Killini - an ecological approach. – Ph.D. thesis, Patras (in Greek).

Drossos, E.1976: Beiträge zur Kenntnis der Pflanzenges. *Atropetum belladonnae* (Br.-Bl.1930) Tx. 1931 auf der Halbinsel Chalkidike. In Dafis, S. & Landolt, E. (eds.): Zur Vegetation und Flora von Griechenland, Band 2. – Veröff. Geobot. Inst. ETH Stiftung Rübel Zürich **56:** 72-86.

— 1977: Beitrag zur Kenntnis der Pflanzengesellschaft *Atropetum belladonnae* im griechischen Raum. – Ph.D. thesis, Thessaloniki (in Greek).

— 1992: A floristic study of Mytrikou lake and the lagoons of Nomos Rodhopi in W Thrace (N. Greece) – Willdenowia **22:** 97-117.

— & Athanasiadis, N.1989: Contribution to the research of the pastures of Mount Paiko flora and vegetation. – Sci. Ann. Dept. Forest. Nat. Env. Univ. Thessaloniki **32/1:** 277-320 (in Greek).

—, —, Theodoropoulos, K. G. & Eleftheriadou E. N.1996: Ammophilous, halophilous and hudrophilous plant communities of delta of Thessalian Pinios river (Thessaly, Hellas). – Sci. Ann. Dept. Forest. Nat. Env. Univ. Thessaloniki **39/1:** 328-365 (in Greek).

Düll, R. 2000: Preliminary list of vascular plants of Samos, Ikaria and Fourni (East Aegean islands Greece. – Bad Münstereifel.

Economidou, E. 1969: Geobotanic research of Skiathos island - phytogeography of north Sporades. – Ph.D. thesis, Athens (in Greek).

— 1973: Contribution a l' étude de la flore et phytogéographie de l'île de Skopelos. Phytogéographie des Sporades du Nord, II. – Biol. Gallo-Hellen. **5:**115-137.

— 1975: La végétation des îles de Skiathos et Skopelos (Sporades du Nord). In Dafis, S. & Landolt, E. (eds.): Zur Vegetation und Flora von Griechenland, Band 1. – Veröff. Geobot. Inst. ETH Stiftung Rübel Zürich **55:** 198-237.

— 1981: Le milieu terrestre de l' île de Limnos de ses reliques de forets. – Biol. & Écol. Médit. **8:** 129-138.

— 1995: L' appauvrissement de la flore et la végétation des îles grecques, conséquence des activités humaines. – Ecol. Medit. **21:** 299-304.

Egli, B. R. 1993: Ökologie der Dolinen im Gebrige Kretas (Griechenland). – Ph.D. Thesis, Zürich.

Ehrman, T. & Cocks, P. S. 1990: Ecogeography of annual legumes in Syria: Distribution patterns. – J. Appl. Ecol. **27:** 578-591.

Eleftheriadou, E. N.1992. Die Flora der kaltliebenden Laub- und Koniferenwälder und der hohen Extrawaldland von Elatia Dramas. – Ph.D. thesis, Thessaloniki (in Greek).

— & Theodoropoulos, K. G. 2003: Terrestrial flora in the coastal zone of Strymonikos and Ierissos gulfs. – Sci. Ann. Dept. Forest. Nat. Env. Univ. Thessaloniki **40/1:** 285-313 (in Greek).

—, Drossos, E., Athanasiadis N. & Theodoropoulos, K. G. 1995: Contribution to the flora of Pinios delta. – Sci. Ann. Dept. Forest. Nat. Env. Univ.Thessaloniki **38/1:** 206-231 (in Greek).

Ewing, M. A. & Howieson, J. G. 1987: A report on the collection of annual species of *Medicago* and associated *Rhizobium meliloti* from acidic regions of mainland Greece and the neighbouring islands of the Aegean Sea. – Perth.

Fiedler, K. G. 1840: Reise durch alle Theile des Königreichs Griechenland in Auftrag der Königl. Griechischen Regierung in der Jahren 1834 bis 1837, **1.** – Leipzig.

Fielding, J., Turland, N. & Mathew, B. 2005: Flowers of Crete. – Kew.

Finkl, A. 1962: Beiträge zur Kenntnis der Flora der Insel Rhodos. – Acta Albertina Ratisb. **24:** 101-120.

Fiori, A.1924: Contributo alla flore di Rodi e catalogo della piante vascolari finora note di quell'isola. – Ann. Reale Ist. Sup. For. Naz. **9:** 141-187.

— 1924: La flora dell'isola di Rodi. – Agric. Colon. Firenze **18:** 161-168.

— 1939: Piante raccolte nelle isole italiane dell' Egeo. Secondo contrbuto. – Nuovo Giorn. Bot. Ital., n.s., **42:** cxxxiii-cxxxviii.
Formánek, E.1891a: Beitrag zur Flora von Serbien, Macedonien und Thessalien. – Deutsche. Bot. Monatsschr. **9:** 88-101.
— 1891b: Beitrag zur Flora des Balkans, Bosporus und Kleinasiens. – Verh. Naturf. Vereins Brünn **29:** 113-158.
— 1896: Zweiter Beitrag zur Flora von Serbien, Macedonien und Thessalien. – Verh. Naturf. Vereins Brünn **34:** 255-365.
— 1897: Dritter Beitrag zur Flora von Thessalien. – Verh. Naturf. Vereins Brünn **35:** 134-215.
—1899: Fünfter Beitrag zur Flora von Macedonien. – Verh. Naturf. Vereins Brünn **37:** 124-220.
— 1900: Sechster Beitrag zur Flora von Macedonien. – Verh. Naturf. Vereins Brünn **38:** 165-240.
Forsyth-Major, C. J. & Barbey, W.1894a: Saria. Étude botanique. – Bull. Herb. Boissier **2:** 241-246.
— & — 1894b: Kasos. Étude botanique. – Bull. Herb. Boissier **2:** 329-341.
— & — 1896a: Kalymnos. Étude botanique. – Bull. Herb. Boissier **4:** 20-39.
— & — 1896b: Ikaria.Étude botanique. – Bull. Herb. Boissier **5:** 279-284.
Francis, C. M. & Katznelson, J. 1977: Observations on the distribution and ecology of subterranean clover, some other clovers, and medics in Greece and Crete. – Austral. Pl. Introd. Rev.**12:** 17-25.
—, Maxted, N., Kyriakakis, S. & Bennett, S. 1995: Crete: Observations on the ecogeography of grain, forage and pasture legumes. – Occ. Symp. **11** – Perth.
Friedrichsthal, E. 1838: Reise in den südlichen Theilen von Neu-Grichenland. Beiträge zur Charakteristik dieses Landes. – Leipzig.
Gandoger, M. 1915: Plantes nouvelles pour l'île de Crète. – Bull. Soc. Bot. France **62:** 151-157.
— 1916a: Troisième voyage botanique dans l'île de Crète (1917). – Bull. Soc. Bot. France **63:** 219-243.
— 1916b: Flora Cretica. – Paris.
— 1917: Quatrième voyage botanique en Crète (1917). – Bull. Soc. Bot. France **64:** 110-122.
— 1920a: Addenda et corrigenda ad floram Cretae. – Bull. Soc. Bot. France **67:** 181-185.
— 1920b: Florule de Syra (Grèce), d'après les récoltes faites par les frères Octave et Denis. – Bull. Soc. Bot. France **67:** 277-284.
Ganiatsas, K. 1936: Untersuchungen über die Vegetation auf den Salzböden bei Saloniki. – Ber. Deutsch. Bot. Ges. **54:** 430-444.
— 1938: Research on the flora of Chortiatis Mountain. – Sci. Ann. Fac. Phys. & Mathem. Aristotelian Univ. Thessaloniki **5:** 3-30 (in Greek).
— 1940: Contribution on the knowledge of the flora of mountain Tymphristos. – Sci. Ann. Fac. Phys. & Mathem. Aristotelian Univ. Thessaloniki **6:** 17-36 (in Greek).
— 1955: The flora of the mountainous grazinglands of Vermion (Phytosociological study). – Sci. Ann. Fac. Phys. & Mathem. Aristotelian Univ. Thessaloniki **7:** 115-145 (in Greek).
— 1963: The flora and vegetation of Holly mountain peninsula. – Thessaloniki (in Greek).
— 1971: Botanic research at Vikos' gorge. – Hepirotiki Estia **228-230:** 251-277 (in Greek).
Garnweider, E. 1986: Florenliste der Exkursion der Bayerischen Botanischen Gesellschaft 1983 nach Griechenland. – Ber. Bayer. Bot. Ges. **57:** 121-136.
— 1989: Florenliste der Exkursion der Bayerischen Botanischen Gesellschaft 1985 nach Kreta. – Ber. Bayer. Bot. Ges. **60:** 157-168.
— 1992: Florenliste der Exkursion der Bayerischen Botanischen Gesellschaft 1988 nach Rhodos. – Ber. Bayer. Bot. Ges. **63:** 155-174.
Géhu, J. M., Biondi, E., Gehu-Frank, J. & Arnold-Apostolides, N. 1986: Données synsystématiques et synchrorologiques sur la végétation du littoral sedimentarie de la Grèce continentale. – Doc. Phytosoc. n.s. **10:** 43-92.

—, Costa, M., Biondi, E., Frank, J. & Arnold, N.1987: Données sur la végétation du littorale de la Crète (Grèce). – Ecol. Medit. **13:** 93-105.
Gelmi, E. 1889: Contributzione alla flora dell'isola Corfù. – Nuovo Giorn. Bot. Ital. **21:** 446-454.
Georgiadis, Th.1983: Contributions à l' étude de la flore et de la végétation de l' île d' Othoni. – Candollea **38:** 503-539.
— 1985: Contributions à l' étude de la flore de l' île Erikousa (Grèce). – Willdenowia **15:** 203-210.
— (ed.) 1994: Ecological impacts from agricultural activities and management of three wetlands of W Greece (Kalamas-Acheron Delta-Kalodiki). – Patras (in Greek).
—, Dimopoulos, P. & Dimitrellos, G. 1997: The flora and vegetation of the Acheron Delta (W. Greece) aiming at the nature conservation. – Phyton (Horn) **37:** 31-60
—, Th., Economidou, E. & Christodoulakis, D. 1990: Flora and vegetation of the Strofilia coastal area (NW Peloponnesos - Greece). – Phyton (Horn) **30:** 15-36.
—, Iatrou, G. & Georgiou O.1985: Contribution à l' étude de la flore et de la végétation de l' île de Paxi, Grèce. – Willdenowia **15:** 567-602.
Georgiou, O.1988: The flora of Kerkira (Ionian Islands, Greece). A contribution.– Willdenowia **17:** 87-101.
Giannopolitis, C. N. 2004: Guide for identification of weed species in Greece, 2. –Georgia-Ktinotrofia **2004(8):** 1-171 (in Greek).
Gillespie, D. J. 1989: A report on the collection of annual legumes in southern Italy and some Greek islands. – Austral. Pl. Introd. Rev. **20:**1-15.
Goulimis, C. N. 1954: Flora of Mount Gamila. – Vouno (J. of the Hellenic Alpine Club) **1954:** 126-134 (in Greek).
— 1960: The Mount Vourinos and its flora. – Vouno (J. of the Hellenic Alpine Club) **1960:** 122-131 (in Greek).
Grabner, S. & Heiselmayer, P. 2000: Vegetation dynamics of phrygana in erosion rills on Myconos (Greece). – Acta Bot. Croat. **59:** 111-134.
Gradstein, S. R. & Smittenberg, J. H. 1977: The hydrophilous vegetation of western Crete. – Vegetatio **34:** 65-86.
Greuter, W. 1970: Contributio floristica austro-aegea 15. – Candollea **25:** 189-192.
— 1971: L'apport de l'homme à la flore spontanée de la Crète. – Boissiera **19:** 329-337.
— 1974: Floristic report on the Cretan area. – Mem. Soc. Brot. **24:** 131-171.
— 1976: The flora of Psara (E. Aegean Islands, Greece) – An annotated catalogue. – Candollea **31:** 191-242.
— 1979: The flora and phytogeography of Kastellorizo (Dhodhekanisos, Greece). – Willdenowia **8:**531-611.
— 1986: *Medicago citrina* (Font Quer) Greuter, comb. & stat. nov. – In Greuter, W. & Raus Th. (eds.) Med-Checklist notulae, 13. – Willdenowia **16:** 112.
— & Rechinger, K. H.1967: Flora der Insel Kythera gleichzeitig Beginn einer nomenklatorischen Überprüfung der griechischen Gefässpflanzenarten. – Boissiera **13:** 1-206.
—, Burdet, H. M. & Long, G. 1989: Med-Checklist, **4.** – Genève.
—, Matthäs, U. & Risse, H. 1982: Notes on Cardaegean plants. 3. *Medicago strasseri*, a new leguminous shrub from Kriti. – Willdenowia **12:** 201-206.
—, — & — 1984: Additions to the flora of Crete, 1973-1984 - II. – Willdenowia **14:** 269-297.
—, Phitos, D. & Runemark, H. 1975: Greece and the Greek islands. A report on the available floristic information and on current floristic and phytotaxonomic research. – Pp. 67-89 in: Guinochet, M., Guittonneau, G., Ozenda, P., Quézel, P. & Sauvage, P. (eds.): La flore du Basin Méditerranéen. – Paris.
—, Pleger, R. & Raus, Th.1983: The vascular flora of Karpathos island group (Dodecanesos, Greece). A preliminary checklist. – Willdenowia **13:** 43-78.

Griesbach, A. 1843: Spicilegium Florae Rumelicae et Bithynicae exhibens synopsin plantarum quas in aest. 1839 legit auctor A. Griesbach, **1.** –Brunsvigae.

Gustafsson, M. & Snogerup, S. 1974: Studies in the Aegean flora. XXI. The flora of the island of Skantzoura. – Bot. Notiser **127:** 364-372.

Gutermann, W. 1995: Catalogus abbreviatus plantarum vascularium ex Ioni insulis cognitarum. – Vindobonae.

Habeck, F. & Reif, A. 1994: Die Waldgesellschaften der montanen und subalpinen Stufe des Ostabfalls des Olymp, Griechenland. – Phytocoenologia **22:** 501-536.

Halácsy, E.v. 1892a: Beiträge zur Flora der Balkanhalbinsel. VIII. – Österr. Bot. Z. **42:** 368-375.

— 1892b: Beiträge zur Flora der Balkanhalbinsel. IX. Florula insulae Thasos. – Österr. Bot. Z. **42:** 412-420.

— 1894a: Botanische Ergebnisse einer im Auftrage der hohen Kaiserl. Akademie der Wissenschaften unternommenen Forschungreise in Griechenland. I. Beitrag zur Flora von Epirus. – Denkschr. Kaiserl. Akad. Wiss., Wien. Math. – Naturwiss. Kl. **61:** 217-268.

— 1894b: Botanische Ergebnisse einer im Auftrage der hohen Kaiserl. Akademie der Wissenschaften unternommenen Forschungreise in Griechenland. III. Beitrag zur Flora von Thessalien. – Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl. **61:** 467-486.

— 1897: Florula Sporadum. – Österr. Bot. Z. **47:** 60-62, 92-99.

— 1899: Florula Strophadum. – Österr. Bot. Z. **49:** 24-25.

— 1901: Conspectus Florae Graecae, **1.** – Lipsiae.

— 1906: Aufzählung der von Herrn Prof. Dr. L. Adamović im Jahre 1905 auf der Balkanhalbinsel gesammelten Pflanzen. – Österr. Bot. Z. **56:** 205-242, 277-283.

— 1908: Conspectus Florae Graecae. Supplementum. – Lipsiae.

— 1910: Aufzählung der von Dr. B. Tuntas auf der insel Scyros der nördlichen Sporaden im Juli 1908 gesammelten Arten. – Österr. Bot. Z. **60:** 114-118, 141-145.

— 1912: Supplementun secundum Concpectus Florae Graecae. – Magyar Bot. Lapok **11:** 114-202.

Hansen, A. 1971: Flora der Inselngruppe Santorin. – Candollea **26:** 109-163.

— 1980: Eine liste der Flora der Inseln Kos, Kalymnos, Pserimos, Telendos und Nachbar-Inselchen (Ostägäis, Griechenland). – Biol. Galo-Hellenica **9:** 3-105.

— 1982: Additions to and notes on the flora of Corfu and Vidos (Ionian Islands, Greece). – Bot. Chron. **2:** 18-29.

— Snogerup, S. & Rungby, S.V.1966: Beiträge zur Kenntnis der Flora der Inseln Rhodos. – Sitzungsberg. Österr. Akad. Wiss., Math.-Naturwiss. Kl. – Abt. 1, Biol. **175:** 363-381.

Hartvig P. & Strid, A. 1995: Flora and vegetation of the Peloponesse and Kithira. –Report from a student excursion from the Univrsity of Copenhagen May 14-28, 1995. – Copenhagen.

— & Strid, A. 1997: Flora and vegetation of North east Greece including Thasos and Samothraki. – Report from a student excursion from the Univrsity of Copenhagen May 17-31, 1997. – Copenhagen.

Haussknecht, C. 1894: Symbolae ad floram graecum. Aufzählung der im Sommer 1885 in Griechenland gesammelten Pflanzen [Fortsetzung]. – Mitth. Thüring. Bot. Vereins, N.F. **5:** 41-126.

Hayek, A.V. 1827: Prodromus Florae Peninsulae Balcanicae. – Repert. Spec. Nov. Regni Veg. **30:** 673-960.

— 1828: Ein Beitrag zur Kenntnis der Vegetation und der Flora des thessalischen Olymp. – Beih. Bot. Centralbl. **45 Abt. 2:** 220-328.

Hehn, V. 1870: Kulturpflanzen und Hausthiere in ihrem Übergang aus Asien nach Griechenland und Italien sowie in das übrige Europa. Historisch-Linguistische Skizzen. – Berlin.

Heiselmayer, P.1996: Menschlich Bedingte Vegetationveränderungen auf den Kykladen (Ägäis). – Arch. Für Nat.-Lands. **35:** 161-174.

— & Siebenbrunner, A. 1986: Vegetation und Brachenentwicklung auf Serifos (Kykladen). – Salzburg. Exkursionsber. **10:** 149-157.
—, Grabner, S. & Griehser, B. 1995: Vegetation und Vegetationsentwicklung der Phrygana in Mykonos and Tinos. – Salzburg. Geogr. Arbeit. **29:** 223-266.
Heldreich, Th.V. 1862: Die Nutzplanzen Griechenlands. – Athen.
— 1877a: Catalogus systematicus herbarii Theodorii G. Orphanidis nunc munificentia clarissimi Theodoro P. Rhodocankis. Fasciculus primus: *Leguminosae*. – Florentiae.
— 1877b: Die Pflanzen der attischen Ebene. – Pp. 471-597 in: Mommsen, A. (ed.): Griechische Jahreszeiten **5**, Schleswig.
— 1880: L' Attique au point de vue des charactères de sa vegétation. – Pp. 106-119 in Compete Rendu Congr. Int. Bot. Hortic. 1878.
— 1882: Flore de l' ile de Céphalonie ou catalogue des plantes... – Lausanne.
— 1883a: Bericht über die botanischen Ergebnisse einer Bereisung Thessaliens. – Sitzungsber. Königl. Preuss. Akade. Wiss. Berlin **6:**155-164.
— 1883b: About the botanical examination of Thessaly. – Parnassos **7:** 257-266 (in Greek).
— 1898a: Flore de l' ile d'Égine. – Bull. Herb. Boissier **6:** 221-238.
— 1898b: Flore de l' ile d'Égine. – Bull. Herb. Boissier **6:** 379-400.
— 1898c: The flora of Egina. – Year Book of Parnassus Society **2:** 265-321 (in Greek).
— 1899a: The flora of island Thera. – Year Book of Parnassus Society **3:** 259-291 (in Greek).
— 1899b: Die flora der Insel Thera. – Pp. 122-140 in F. Freiherr Hiller von Gaertringen: Die insel Thera, **1.** – Berlin.
— 1901: Contributions to the compilation of Cyclades' flora. Vegetation of Mykonos and the near-by islands Dilos and Rinia. – Year Book of Parnassus Society **5:** 239-255 (in Greek).
Heyn, C.C. 1963: The annual species of *Medicago*. – Scripta Hierosol. **12.** – Jerusalem.
— & Davis P. H. 1970: Medicago L. – Pp. 483-511 in: Davis P. H. (ed.): Flora of Turkey and the East Aegean Islands, **3.** – Edinburgh.
Hofmann, U. 1968: Untersuchungen an Flora und Vegetation der Ionischen Inseln Levkas. – Vierteljahrsschr. Naurf. Ges. Zürich **113:** 209-256.
Holmgren, P. K., Holmgren, N. H. & Barnett, L. C. 1990: Index Herbariorum. Part **I**: The Herbaria of the World. – New York.
Höner, D. 1991: Mehrjährige Beobachtungen kleiner Vegetationsflächen im Raume von Karpathos (Nomos Dhodhekanisou, Griechenland). Ein Beitrag zur Klärung des ''Kleininselphänomens''. – Diss. Bot. **173:** 1-185.
— & Greuter, W. 1998: Plant population dynamics and species turnover on small islands near Karpathos (South Aegean, Greece). – Vegetatio **77:** 129-137.
Hughes, S. 1987: Overseas travel report. Germplasm collection of the nothern Sporades region of Greece. – Adelaide.
Hubert-Morath A.1970: Trigonella L. – Pp. 452-482 in: Davis P. H. (ed.): Flora of Turkey and the East Aegean Islands, **3.** – Edinburgh.
IUCN, 2001: IUCN *Red List Categories and Criteria: Version 3.1.* IUCN Species Survival Commision. – IUCN, Gland, Switzerland and Cambridge, UK. ii + 30 p.p.
Ivimey-Cook R.B.1968: Trigonela L. Pp. 153-157 in Tutin, T. G., Heywood, V. H. Burges, N. A., Moore, D. M., Valentine, D. H., Walters, S. M. & Webb, D. A. (eds) Flora Europea, **2.** – Cambridge.
Jahn, R. & Schönfelder, P. 1995: Exkursionsflora für Kreta. – Stuttgart.
Jeanpert, E. 1919: Enumération des plantes de Macédoine. – Bull. Mus. Natl. Hist. Nat. **25:** 390-397.
Kamari, G., Phitos, D., Snogerup, B. & Snogerup, S.1988: Flora and vegetation of Yioura, N Sporades, Greece. – Willdenowia **17:** 59-85.

Karagiannakidou V. & Kokkini, S. 1987: The flora of Mount Menikion in the North East Greece. – Pyton (Horn) **27:** 267-283.

— & Raus Th. 1996: Vascular plants from Mount Chortiatis (Macedonia, Greece). – Willdenowia **25:** 487-559.

—, Konstantinou, M. & Papademetriou, K. 1995: Floristic and phytogoegraphical research on the upper montane and the subalpine grassland flora of East Macedonia, Greece. – Feddes Repert. **106:** 193-213.

—, —, Lavrentiadou, S. & Drossos, E. 2000: Structure analysis of the vegetation of Strymona river delta (NE Greece). – Pp. 185-190 in: Kamari, G., Psaras, G. Costantinidis, Th. (eds.) Proc.of the 8th Scientific Congress of Greek Botanical Society, Patras (in Greek).

Karetsos, G. 2001: Study on the ecology and vegetation of Mt Iti. – Ph.D. thesis, Patras (in Greek).

Katsikopoulos, I.1936: Contribution to the study of the flora of Samothraki Island. – Georgikon Deltion (Agricultural Bulletin of Greek Agricultural Society) **29:** 264-267.

Kazanis, D. & Arianoutsou, M. 1994: Contribution of legumes in the post-fire succession of Pinus halepensis forests in Attica, Greece. – Pp. 259-264 in Proc.of 5th Scientific Conference of Helenic Botanical Society. – Delphi.

Knapp, R. 1964: Vegetations-Untersuchungen im mittleren Griechenland und über Probleme der Entstehung anthropogener Pflanzengesellschaften. – Ber. Oberhess. Ges. Natur- Heilk., Giessen, N.F., Naturwiss. Abt. **33:** 373-393.

— 1965: Die Vegetation von Kefallinia, Griechenland. Geobotanische Untersuchung eines mediterranen Gebietes und einige ihrer Anwendungs-Möglichkeiten in Wirtshaft und Landesplanung. – Königstein.

Kokmotos E. 1999: Contribution to the flora and vegetation of Mount Elikonas. – M.Sci. thesis, Patras (in Greek).

Kontsiotou, H. 2005: The lucerne, cultivation and utilization. – Athens (in Greek).

Konstantinou, M. 1992: Phytosociological studies of the vegetation on metalliferous soils in Northern Greece. – Ph.D. thesis, Thessaloniki (in Greek).

Koumpli-Sovantzi L. 1991 Costal lagoon NW Peloponnisos (Greece). – Willdenowia **21:** 119-129.

— & Vallianatou, I. 1994: Floristic notes from aquatic stands of Central Greece (Sterea Hellas). – Candollea **49:** 195-207.

— & Yannitsaros A. 1993: A contiribution to the coastal flora of the Kikladhes (Greece). – Willdenowia **23:** 121-135.

—, — & Doxa, A. 2000: Flora survey of the Delphi archological site. – Pp. 230-233 in: Kamari, G., Psaras, G. Costantinidis, Th. (eds.) Proc.of the 8th Scientific Congress of Greek Botanical Society, Patras (in Greek).

Koutsopoulos, P. & Sarlis, G. 2002: Contribution to the study of the flora of Vouraikos gorge (Peloponnisos, Greece). – Fl. Medit. **12:** 299-314.

Kožuharov, S. I.1965: The species of genus Medicago L. (lucerne) in Bulgaria. – Izv. Bot. Inst. (Sofia) **15:** 119-188 (in Bulgarian).

Krause, W., Ludwig, W. & Seidel, F. 1963: Zur Kenntnis der Flora und Vegetation auf Serpentinstandorten des Balkans. 6. Vegetationsstudien in der Umgebung von Mantoudi (Euböa). – Bot. Jahr. Syst. **82:** 337-403.

Krigas, N. & Kokkini, S. 2004: A survey of the alien vascular flora of the urban and suburban area of Thessaloniki, N Greece. – Willdenowia **34:** 81-99.

— & — 2005: The indigenous vascular flora of the urban and suburban area of Thessaloniki (N Greece). –Bot. Chron. **18:** 29-85.

—, Lagiou, E., Handlidou, E. & Kokkini, S. 1999: The vascular flora of the Byzantine Walls of Thessaloniki (N Greece). – Willdenowia **29:** 77-94.

Kull, U. & Diamantopoulos, S. 1998: Kreta. Allgmeiner Exkursionsbericht Kumulative Pflanzenliste der Exkursionen 1974-1995 zugleich Führer zur botanisch-geologischen Exkursion der Gesellschaft für Naturkunde in Württemberg April 1988. – Arbeiten und Mitteilungen aus dem Biologischen Institut der Universität Stuttgart Nr. 28, Stuttgart.

Kypriotakis, Z. 1998: Contrubition to the study of the chasmophytic flora of Crete and to its utilization as a natural resource, to the direction of the ecotourism, the floriculture, the ethnobotany and the protection of the threatened plant species and their biotopes. – Ph.D. thesis, Patras (in Greek).

— & Tzanoudakis, D. 2000: Contrubition to the knowledge and the conservation of the Greek insular flora: The case of islet Dia (Cretan area, Greece). – Pp. 45, in: Özhatay, N. & al. (eds.) Abstacts of the 2nd Botanical Congress, Istanbul.

— & Tzanoudakis, D. 2001: Contrubition to the study of the Greek insular flora: The chasmophytic flora of Crete. – Bocconea **13:** 495-203.

Lakowitz, K. 1929: Verzeichnis der in Griechenland und auf der Insel Kreta während der Vereinsstudienfahrt im April 1928 gesammelten Pflanzen. – Ber. Versamml. Westpreuss. Bot.-Zool. Vereins Danzig **51:** 61-68.

Langkavel, B. 1866: Botanik der Spaeteren Griechen von dritten bis dreizehnten Jahrhunterte. – Berlin.

Lassen, P. 1983: *Medicago heyniana* Greuter. – In Greuter, W. & Raus Th. (eds.) Med-Checklist notulae, 7. – Willdenowia **13:** 98.

— 1999: *Medicago blancheana* Boiss. subsp. *blancheana*. – In Greuter, W. & Raus Th. (eds.) Med-Checklist notulae, 18. – Willdenowia **29:** 59.

Lavrentiades, G. 1961: Vegetational, phytogeographical and phytosociological research of the Cassandra peninsula. – Thessaloniki.

— 1963: On the vegetation of the Keramoti coasts. – Boll. Ist. Bot. Univ. Catania, ser. 3, **4:** 83-103.

— 1964: The ammophilous vegetation of the western Peloponnesos coasts. – Vegetatio **12:** 223-287.

— 1971: On the vegetation of sand dunes of Greek coasts. – Colloq. Phytosoc. **1:** 92-98.

— 1975a: On the vegetation of the Porto-Lagos coasts. – Pp. 365-379 in: Jordanof, D., Bondev, I., Kožuharov, S., Kuzmanov, B., Palamarev, E. & Velčev, V. (eds.) Problems of Ballkan flora and vegetation. – Sofia.

— 1975b: Substratum of some vegetation types in Greece. – Pp. 423-431 in: Dierschke, H. (ed.) Berichte der Internationalen Symposien der Internationalen Vereinigung fur Vegetationskunde. – Vaduz.

— 1976: On the vegetation of Patras area. In Dafis, S. & Landolt, E. (eds.): Zur Vegetation und Flora von Griechenland, **2.** – Veröff. Geobot. Inst. ETH Stiftung Rübel Zürich **56:** 59-71.

— 1979: Über die Unkrautgesellschaften in Feldern von Oräokastron, Reg. Bez. Saloniki. – Doc. Phytosoc. n.s. **4:** 571-584.

— 1980: On the grain-field weeds of the American Farm School of Thessaloniki. — Phytocoenologia **7:** 318-335.

— & Babalonas, D. 1976: Über die Vegetation der östlichen Kavala-küsten (Nordgriechenland). II. Sandige Küstentreifenvegetation. – Sci. Ann. Fac. Phys. Math. Aristotelian Univ. Thessaloniki **16:** 309-324.

Lesins, K. A. & Lesins, I.1979: Genus *Medicago* (*Leguminosae*). A taxogenetic study. The Hague.

Linnaeus, C. 1753: Species Plantarum, **2.** – London (A Facsmile of the first edition, 1959).

Lock, J. M. 1989: Legumes of Africa. A check list. – Kew.

— & Heald, J. 1994: Legumes of Indo-China. A check list. – Kew.

Lounamaa, N. 1992: The Finnish flora. – Forssa.

Maire, R. 1921a: Contribution à la étude de la végétation et de la flora de l' île de Skyros. – Bull. Soc. Bot. France **68:** 68-74.

— 1921b: Contribution à la étude de la flore Grècque. – Bull. Soc. Bot. France **68:** 370-380.
— & Petitmengin, M.1907: Etude des plantes vasculaires récoltées en Grèce (1904). In Maire, R.: Mateuriaux pour servir à la étude de la flore et de la géographie botanique de l' orient. Fasc. **2**. – Nancy.
— & — 1908: Etude des plantes vasculaires récoltées en Grèce (1906). In Maire, R.: Mateuriaux pour servir à la étude de la flore et de la géographie botanique de l' orient. Fasc.**4.** – Nancy.
Malakates, S. 1927: Die Flora von Kéa. — Repert. Spec. Nov. Regni Veg. **24:** 193-199.
— 1928a: Vegetation of Kimolos and its nearby islets. – Athens (in Greek).
— 1928b: Contributions to the compilation of Cyclades' flora. Vegetation of Serifos. – Athens (in Greek).
— 1933a: Contributions to the compilation of Cyclades' flora. Vegetation of Sifnos. – Athens (in Greek).
— 1933b: Die Flora von Andros. – Repert. Spec. Nov. Regni Veg. **33:** 81-101.
Margot, H. & Reuter, F.-G. 1839: Essai d'une flore de l'île de Zante. – Mém. Soc. Phys. Genève **8:** 250-314.
Markgraf, F. 1920: Botanische Kriegsbeobachtungen in Thrazien. – Verh. Bot. Vereins Prov. Brandenburg **62:** 8-15.
Maroulis, G. & Artelari R. 2001: New records for the flora of Mount Erimanthos (NW Peloponnisos, Greece). – Fl. Medit. **11:** 311-331.
— & Georgiadis, Th. 2005: The vegetation of supra-forest meadows and rock crevices of Mount Erimanthos (NW Peloponnisos, Greece). – Fitosociologia **42:** 33-56.
Matthäs, U. 1988: Die laubwerfenden Eichenwälder Kretas. – Diss. Bot. **119:** 1-172.
Maxted, N., Mabuza, P. & Kell, S. P. 2000: Ecogeographic techniques and conservation: A case study for the legume genus *Vigna* in Africa. – Pp. 63-91 in: Wild legumes (Vaughan, D.A ed.). MAFF, Japan.
Mayer, A. 1995: Comperative study of the coastal vegatation of Sardinia (Italy) and Crete (Greece) with respect to the effects of human influence. – München.
Mehregan, I., Moussavi, M. & Nasrabadi, N. 2003: The Genus *Medicago* in Iran: Biodiversity and variation centres. – Rostaniha **4:** 5-19.
Meikle, R. D. 1954: A survey of the flora of Chios. – Kew Bull. **1954:** 85-199.
Micevski, K. 2001: The flora of the Republic of Macedonia, **I.** – Skopje.
Millar & Libby 1991: Strategies for conserving clinal, ecotypic, and disjunt populaton diversity in widespread species. Pp. 149-170 in Falk, D. A. & Holsinger, K. E., Genetics and conservarion of rare plants. – New York, Oxford.
Mirek, Z., Piekoś-Mirkowa, H., Zajak, A. & Zajak, M. 2002: Flowering plants and pteridophytes of Poland. A checklist. – Kraków.
Mouterde, S. J. 1970: Nouvelle flore du Liban et de la Syrie, **2.** – Beyrouth.
Muller M. H., Prosperi, J. M., Santoni, S. & Ronfort, J. 2003: Inferences from mitochondrial DNA patterns on the domestication history of alfalafa (*Medicago sativa*). – Molec. Ecol. **12:** 2187-2199.
Nadji, A. U. R. 1892: Empire Ottoman géographie botanique. Faits nouveaux relatifs à la province de Salonique. – Salonique
Natkevicaite-Ivanauskiene, M. (ed.) 1971: Flora of Lithuanian S.S.R., **4.** – Vilnius.
Noy-Meir, I. & Kaplan, D. 2002: Species richness of annual legumes in relation to grazing in Mediterranean vegetation in northern Israel. – Israel J. Plant Sci. **50:** 95-109.
Nutt, B.J., Carr, S.J. & Samaras, S. 1996. Collection of forage, pasture and grain legumes and their associated rhizobia from selected Greek Islands. Occ. Publication **13**. – Perth.
Oberdorfer, E.1952: Bietrag zur Kenntnis der nordägäischen Küstenvegetation. – Vegetatio **3:** 329-349.

— 1954a: Über Unkrautgesellschaften der Balkanhabinsel. – Vegetatio **4:** 379-411.
— 1954b: Nordägäische Kraut- und Zwergstrauchfluren im Verleich mit den entsprechenden Vegetationseinheiten des westlichen Mittelmeergebietes. – Vegetatio **5-6:** 88-96.
Ostermeyer, F. 1887: Beitrag zur Flora der jonischen Inseln Corfu, Sta. Maura, Zanta und Cerigo. – Verh. K.K. Zool.-Bot. Ges. Wien **37:** 651-672.
Pampanini, R. 1923: L'esplorazione botanica dell'isola di Rodi dal 1761 al 1922. – L'Universo (Firenze) **4:** 955-971.
— 1927: Secondo contributo alla conoscenza della Flora dell'isola di Rodi. – Nuovo Giorn. Bot. Ital. n.s. **34:** 369-380.
Panagopoulos, T., Theodoropoulos, K. & Athanasiadis, N. 2001: Early vegetation succession on lignite mine spoils of Ptolemaida, Greece. – J. of Balkan Ecol. **4:** 68-79.
Panitsa, M. 1997: Contribution to the study of the flora and Vegetation of the East Aegean islets. – Ph.D. thesis, Patras (in Greek).
— & Tzanoudakis, D.1998: Contribution to the study of the Greek flora: Flora and vegetation of Agathonisi and Pharmakonisi (East Aegean area, Greece). – Willdenowia **28:** 95-116.
— & — 2000: Flora, vegetation and important habitiat types of Tilos island group (East Aegean): a management approach. – Pp. 342-351in: Kamari, G., Psaras, G. Costantinidis, Th. (eds.) Proc.of the 8th Scientific Congress of Greek Botanical Society, Patras (in Greek).
— & — 2001: A floristic investigation of the islet groups Arki and Lipsi (East Aegean area, Greece). – Folia Geobotanica **36:** 265-279.
—, Dimopoulos, P. Iatrou, G. & Tzanoudakis, D.1994: Contribution to the study of the Greek flora: Flora and vegetation of Enousses (Oinousses) islands (E. Aegean area). – Flora **189:** 69-78.
—, Snogerup, B., Snogerup, S. & Tzanoudakis, D. 2003: Floristic invastigation of Lemnos island (NE Aegean area, Greece). – Willdenowia **33:** 79-105.
—, Bazos, I., Dimopoulos, P., Zervou, S., Yannitsaros, A. & Tzanoudakis, D. 2004: Contribution to the study of the flora and vegetation of Kithira island group: Offshore islets of Kithira (S Aegean, Greece). – Willdenowia **34:** 101-115.
Pantis, J. D. 1987: Structure, dynamics and management of the Asphodel semi-deserts of Thessaly. – Ph.D. Thesis, Thessaloniki (in Greek).
— & Mardiris, Th. A. 1992: The effects of grazing and fire on degradation processes of mediterranean ecosystems. – Isr. J. Botany **41:** 233-242.
Papanastasis, V. 1989: The vegetation of Lake Kerkini. – Pp. 257-261 in: Gerakis, P. (ed.) Proc.of the Meeting for the protection and management of Greek wetlands, Thessaloniki (in Greek).
Papanicolaou, K. 1985: Contribution to the flora of Mount Pangaion (Pangeon), North East Greece. – Ann. Musei Goulandris **7:** 67-156.
Papanikolaou, G. & Sarlis, G. 1991: Phytosociological studies in the Tatoi district (Attica, Greece). – Vegetatio **93:** 81-90.
Papatsou, S.1975: The flora and vegetation of the island Nisyros and its offshore islets. – Patras: Ph.D. thesis, Univ. of Patras, (in Greek).
Papavassiliou, S. 2001: The role of legumes to the postfire regeneration of Mediterranean forest ecosystems. – Ph.D. Thesis. Athens (in Greek).
Paraskeuopoulos, E. 2006: Floristic diversity of Mt Artemisio. MSc. Thesis, Agricultural University of Athens, Athens (in Greek).
Pavlides, G. 1976a: On the flora and vegtation of the Sithonia peninsula of Chalkidiki. – Ph.D. thesis, Thessaloniki (in Greek).
— 1976b: Untersuchungen über die Vegetationsverhältnisse der Küste der Sithonie-Halbinsel. In Dafis, S. & Landolt, E. (eds.): Zur Vegetation und Flora von Griechenland, **2**. – Veröff. Geobot. Inst. ETH Stiftung Rübel Zürich **56:** 5-20.

— 1982: Geobotanical study of the mountainous range of Vertiskos. I. Flora and vegetation. – Thessaloniki (in Greek).
— 1985: Geobotanical study of the national park of lakes Prespa (NW Greece). Part A'. Ecology, flora, phytogeography, vegetation. – Thessaloniki (in Greek).
Phitos, D. 1960: Pflanzengeographische Untersuchung der zentale Euboea. – Ph.D. Thesis, Patras (in Greek).
— 1967: Florula Sporadum. – Phyton (Horn) **12:** 102-149.
Phouphas, Ch.1968: Contribution à l' étude de la flore de l' île "Spetsai". – Bull. Soc. Bot. Fr. **115:** 583-590.
Pieri, M. T. 1814: Della Corcirese flora, centurie prima, secunda, e terza, ossia steria di piante trecento, appartenenti al suolo dell' isola di Corfu. – Corcirae.
— 1824: Flora Corcirensis centuriae prima et secunda, sive enumeratio ducentarum plantarum quas in isnula Corcirae invenit. – Corcirae.
Pignatti, S. 1982: Flora d'Italia, **1.** – Bologna.
Politis, J. 1953: Contribution à l'étude de la flore de la Chalcidique. – Comp. Rend. Acad. Athènes 19: 1-97.
Preston, C. D. & Strid, A. 1986: Medicago L. Pp. 493-497 in Strid A. (ed.), Mountain flora of Greece, **1.** – Cambridge.
Prosperi, J. M., Angevain, M., Bonin, I., Chaulet, E., Génier, G., Jenczewski, E., Olivieri, I. & Ronfort, J. 1996: Genetic diversity, preservation and use of genetic resources of Mediterranean legumes: Alfalafa and Medics. – Pp. 71-89 in: Génier, G. & Prosperi, J.M.(eds), Genus *Medicago* in the Mediterranean region: Current situation and prospects in research. – Zaragoza.
—, Auricht, G., Génier, G. & Johnson, R. 2001: Medics (Medicago L.). – Pp. 99-114 in: Maxted, N. & Bennett, S .J. (eds), Plant Genetic Resources of Legumes in the Mediterranean. – Dordecht.
Protopapadakis, E. 1985: Changement de la flore adventive des vergers d' agrumes en Crète sous la pression du désherbage chimique. – Agronomie **5:** 833-840.
Quézel, P. 1964: Végétation des hautes montagnes de la Grèce méridionale. – Vegetatio **12:** 289-385.
— 1967: La végétation des hautes sommets du Pinde et de l' Olympe de Thessalie. – Vegetatio **14:** 127-228.
— & Contandriopoulos, J.1965a: Contribution à l' étude de la flore de hautes montagnes de Grèce. – Naturalia Monspel.Sér. Bot. **16:** 89-149.
— & — 1965b: Contribution à l' étude de la flore du Pinde central et septentrional et de l' Olympe de Thessalie. – Candollea **20:** 51-90.
— & Katrabasa, M.1974: Premiere aperçu sur la végétation du Chelmos (Peloponèse). – Biol. & Écol. Médit. **1:** 11-25.
Ralf, J., Schönfelder, P., Mayer, A. & Scheuerer, M. 1995: Exkursionsflora für Kreta. – Stuttgart.
Rauh, W. 1949: Klimatologie und Vegetationsverhältnisse der Athos-Halbinsel und der ost-ägäischen Inseln Lemnos, Evstratios, Mytiline und Chios. – Sitzungsber. Heidelberger. Akad. Wiss. Math.-Naturwiss. Kl. **1949:** 511-615.
Raulin, V. 1869: Libre IV: Botanique. – Pp. 691-974 in: Savy, F. (ed.): Description physique de l'île de Crète. – Paris.
Raus, Th.1979: Die Vegetation Ostthessaliens (Griechenland) II. Quercetea ilicis und Cisto-Micromerietea. – Bot. Jahrb. Syst. **101:** 17-82.
— 1980: Die Vegetation Ostthessaliens (Griechenland) III. Querco-Fagetea und azonale Gehölzgesellschaften. – Bot. Jahrb. Syst. **101:** 313-361.
— 1983: Wechselnasse Wiesen in Griechenland. – Tuexenia **3:** 259-270.
— 1989: Die Flora von Armathia und der Kleininseln um Kasos (Dodekanes, Griechenland). – Bot. Chron.**9:** 19-39.

— 1991: Die Flora (Farne und Blütenpflanzen) des Santorin-Archipels. – Pp. 109-124 in: Schmalfuss, H. (ed.): Santorin - Leben auf Schutt und Asche. Ein naturkundlicher Reiseführer. – Weikersheim.
— 1996a: Additions and admendments to the flora of Karpathos island group. – Bot. Chron.**12:** 21-53.
— 1996b: Flora von Paros und Antiparos (Kykladen, Griechenland). – Ann. Naturhist. Mus. Wien **98 B Suppl.:** 237-278.
— 1997: Zur Flora und Pflanzengeographie Nordost-Griechenlands – Befunde und Bewertungen. – Pp. 26-40 in: Lienau, C. & Mattes, H. (eds), Natur und Wirtschaft in Nordost-Griechenland. (=Berichte aus dem Arbeitsgebiet Entwicklungsforschung, **27**) – Muenster.
— 1999: Heinrich Kuhbier und die geobotanische Erforschung der Insel Korfu (Jonische inseln, Griechenland). – Abh. Naturwiss. Verein Bremen **44:** 397-416.
Rechinger, K. H.1939: Zur Flora von Ostmazedonien und Westthrazien. – Bot. Jahrb. Syst. **69:** 419-552.
— 1929: Beitrag zur Kenntnis der Flora der ägäischen Inseln und Ost-Griechenlands. – Ann. Naturhist. Mus. Wien **43:** 269-340.
— 1943a: Flora Aegaea. Flora der Inseln und Halbinseln des ägäischen Meeres. – Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. 105: 1-924.
— 1943b: Neue Beiträge zur Flora von Kreta. – Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. **105:** 1-184.
—1949: Flora Aegaeae supplementum (mit Beiträgen von B. L. Burtt und P. H. Davis). – Phyton (Horn) **1:** 194-228.
— 1961: Die Flora von Euboea. I Teil. – Bot. Jahrb. Syst. **80:** 294-382.
— & Rechinger-Moser, F. 1951: Phytogeographia Aegaea. – Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. **105:** 1-208.
Regel, C. V.1943: Florula montis Oeta in Grecia. – Feddes Repert. Spec. Nov. Regni Veg. **54:** 34-55.
— 1947: Zur Frage der Grenze zwischen dem Mittelmeergebiet und Mitteleuropa auf der Balknhalbinseln (Dritte Folge). – Ber. Geobot. Forschunginst. Rübel Zürich **1947:** 15-22.
— 1952: Flore du mont Oeta en Grèce. – Mém. Soc. Bot. France **33:** 122-143.
— 1953: Studien über die Florenelemente in Griechenland. Die Florenelemente des Oeta. – God. Biol. Inst. u Serajevu **5:** 339-348.
Reif, A. & Löblich-Ille, K. 1999: Sind die Rotbuchenwälder im Pieria-Gebrige (Nordgreichenland) höhenzonal oder extrazonal? Eine Studie zum Übergang zwischen temperaten und submediterranen Wäldern in Nordgreichenland. – Phytocoenologia **29:** 87-146.
Rikli, M. & Rüber, E. 1923: Über Flora und Vegetation von Creta und Griechenland. – Vierteljahrsschr. Naturf. Ges. Zürich **68:**103-227.
Ronniger, K. 1941: Flora der Insel Zante. – Verh. Zool.-Bot. Ges. Wien **88/89:** 13-108.
Rothmaler, W. 1944: Floristische Ergebnisse einer Reise nach dem Peloponness. – Bot. Jahrb. Syst. **73:** 418-452.
Runemark, H., Snogerup, S. & Nordenstam, B. 1960: Studies in the Aegean Flora. I. Floristic Notes. – Bot. Not.: **113:** 421-450.
Samuelsson, G. 1934: Symbolae ad floram graecum. – Ark. Bot. **26A:** 1-29.
Sarika, M., Dimopoulos, P. & Yannitsaros, A. 2005: Contribution to the knowledge of the wetland flora and vegetation of Amvrakikos Gulf, W Greece. – Willdenowia **35:** 69-85.
Sarlis, G. 1976: Succession of vegetation after fire-forest of halepo pine and some broadleaves. – Ph.D. thesis, Athens (in Greek).
— 1980: The flora of Mount Egaleo (Attika, Greece). – Phyton (Horn) **20:** 261-278.
— 1981: Contibution to the flora and vegetation of the islands and islets of southern Euboean gulf (Greece). – Athens (in Greek).
— 1988: Study of vegetation zones of Akarnanian Mountains (Pergandi, Boumistos). – Geotechnica **2:** 7-22 (in Greek).

— 1990: Riparian (meadow), marshy and aquatic flora and vegetation of Avilaria small-lake (Aetoloakarnania). – Agric. Res. **14:** 93-111 (in Greek).
— 1994a: Flora and vegetation of the island of Syra. – Letters of Syra **26-27:** 99-212 (in Greek).
— 1994b: Contribution to the study of the flora of Attica (Greece). – Lagascalia **17:** 229-256.
Săvulescu, T. 1957: Flora Republicae Popularis Romanicae, **5**. – Bucurest
Schönfelder, P. & Besl, H. 1988: Kreta. Exkursion für Fortgeschrittene, 16.-30. April 1988. – Regensburg.
Schwarz, U.1981: Vegetationskundliche Beobachtungen der Phrygana auf Syros. – Salzburg. Exkursionsber. **7:** 153-162.
Sibthorp, J. & Smith, J. E. 1813: Florae Graecae Prodromus, **2.** – Londini.
Sinskaya, E. M. 1940: Phylogenetic taxonomy as a basis for a genetic and breeding work-illustrated by Medicago. – Z. indukt. Abstamm.-u. Vererblehre **78:** 399-417.
Small, E. & Jomphe, M. 1989: A synopsis of the genus *Medicago* (*Leguminosae*). – Can. J. Bot. **67:** 3260-3294.
Snogerup, S. 1971: Evolutionary and plant geographical aspects of chasmophytic communities. – Pp. 157-190 in: Davis, P. H., Harper, P. C., & Hedge, I. C. (eds.) Plant life of South-West Asia. – Edinburgh.
— & Snogerup, B. 1987: Repeated floristical observations on islets in the Aegean. – Pl. Syst. Evol. **155:**143-164.
— & — 1991: Flora and vegetation of the island of Agios Eustratios, Greece. – Bot. Chron. **10:** 527-546.
— & — 1993: Additions to the flora of Samos, Greece. – Fl. Medit. **3:** 211-222.
—, Bothmer, R. V. & Gustafsson, M. 1980: Floristic report from the island of Psathura (Greece). – Bot. Notiser **133:** 145-148.
—, Snogerup, B., Phitos, D., Kamari, G. & Anagnostopoulos, A.1991: Flora and vegetation of Kira Panagia, N Sporades, Greece. – Bot. Cron **10:** 547-566.
—, —, Phitos, D. & Kamari, G. 2001: The flora of Chios island. – Bot. Cron **14:** 5-199.
Snowball, R. 1998: Germplasm exploration in the northern Aegean region. – CLIMA, Perth.
Sobrino, E., Hervella, A., Ceresuela, J. L., Barbado, A., Viviani, A., De Andrés F., Tenorio, J.L. 2001: Morfología y Taxonomía de la Sección *Dendrotelis* del género *Medicago* (*Fabaceae*). – Portugaliae Acta Biol. **19:** 225-237.
Soó, R.1966: Synopsis systematico-geobotanica florae vegetationisque Hungariae, **II**. – Budapest.
Spanou, S., Verroios, G., Dimitrellos, G., Tiniakou, A., & Georgiadis, T. 2006: Notes on flora and vegetation of the sand dunes of western Greece. – Willdenowia **36:** 235-246.
Spreitzenhofer, G.C. 1877: Beitrag zur Flora der jonischen Inseln: Corfu, Cephalonia und Ithaca. – Verh. K. K. Zool.-Bot. Ges. Wien **27:** 711-734.
Stamou, A., Theodoropoulos, K. & Eleftheriadou, E. 2003: Phytosociological research of *Platanus orientalis* L. and mixed *Fraxinus anguistifolia* Vahl. ssp. *oxycarpa* (Bieb. Ex Willd.) Franco & Rocha Afonso-*Ulmus minor* Miller azonal stands of the Kirea, Nilea, Voudoro rivers (N Euboea, Greece). – Geotech. Sci. Issue-Serie II-**14:** 54-68.
Stebbins, G. L. 1975: L'écologie comparative de quelques espèces de légumineuses de la flore Méditerranéene. – Pp. 361-368 in: Guinochet, M., Guittonneau, G., Ozenda, P., Quézel, P. & Sauvage, P. (eds.): La flore du Basin Méditerranéen. – Paris.
Stefanaki-Nikiforaki, M.1982: Contribution to the knowledge of the flora of Quercetalia ilicis zone of Messinia County. – Agric. Res. **6:** 443-454(in Greek).
— 1981: Contribution to the study of the flora of region of Fokis' prefecture. – Agric. Res. **5:** 213-236(in Greek).
— 2000a: Report and analysis of floristic elements collected in the country of Fokis. – Geotech. Scienttific Issue-Serie II-**11:** 184-200 (in Greek).

— 2000b: Native flora in olive-plantations in the island of Crete. – Agric. Res. **23:** 63-71 (in Greek).
— 2001: Qualitative and quantitative evaluation of the flora elements in vineyards in the island of Crete. – Geotechnic Scienttific Issue-Serie I-**12:** 66-72 (in Greek).
Stefani, C. De, Forsyth Major, C. J. & Barbey, W. 1891: Samos. Étude géologique, paléontologique et botanique. – Lausane.
—, — & — 1895: Karpathos. Étude géologique, paléontologique et botanique. – Lausane.
Sterneck, J. V. 1911: Botanische Reiseskizzen aus Griechenland. – Naturwiss. Z. Lotos **59:** 48-62.
Stojanov, N. 1928: Thracische und Macedonische Herbarmaterialien des verstorbenen Prof. Dr. Th. Nikoloff. – Spis. Bulg. Akade. Nauk. **26:** 49-209.
— & Jordanov, D. 1938: Botanische Studien auf dem thessalischen Olymp. I. Floristische Ergebnisse. – God. Sofijsk. Univ. Fiz.-Mat. Fak., 3 (Estestv. Istorija) **34:** 147-249.
— & Kitanov, B. 1944: Beitrag zur Kenntnis der Flora und der Vegetationsverhältnisse der Inseln Samothrake. – God. Sofijsk. Univ. Fiz.-Mat. Fak., **3** (Estestv. Istorija) **40:** 403-464 (in Bulgarian).
— & — 1946: Flora der Inseln Thasos. – God. Sofijsk. Univ. Fiz.-Mat. Fak., 3 (Estestv. Istorija) **42:** 89-196 (in Bulgarian).
— & — 1950 : Die Pflanzendecke der Inseln Thasos. – Izv. Bot. Inst. (Sofia) **1:** 214-358 (in Bulgarian).
Street, K. A., Robertson, L. D. & Maxted, N. 2001: Utilization of forages and pasture legume diversity. – Pp. 327-353 in: Maxted, N. & Bennett, S .J. (eds), Plant Genetic Resources of Legumes in the Mediterranean. – Dordecht.
Strid, A. 1996: Flora Hellenica Bibliography. Fragm. Flor.Geobot. Suppl. **4.** – Krakow.
— 1999: Flora and phytogeography of new NW Greece (Epirus and W. Macedonia). – Report from a student excursion from the Univrsity of Copenhagen 20 May - 2 June 1999. – Copenhagen.
— & Tan, Kit 1997: Flora Hellenica, **1.** – Königstein.
— & Tzanoudakis, D. 1998: Contribution to the study of the Greek insular flora: The flora and phytogeographical connection of Samothraki (N. Aegean). – Pp. 332-335 in Proc.of 7th Scientific Conference of Greek Botanical Society. – Alexandroupolis (in Greek).
— & Ugelvig, J.1986: Report for an excursion in mountainous north Greece. University of Copenhagen 3-16 June 1985. – Copenhagen (in Danish).
Sýkora, K. R., Babalonas, D. & Papastergiadou, E. S. 2003: Strandline and sand-dune vegetation of coasts of Greece and of some other Aegean countries. – Phytocoenologia **33:** 409-446.
Szijj, J. 1983: Ökologische Wertanalyse des Acheloos-Deltas (Westgriechenland). – Essen.
Tabaka, L. B. 1987: Flora and vegetation of Latvia S.S.R. – Riga.
Tan, Kit & Strid, A. 1999: Phytogeographical notes on the Parnonas range in the Peloponnese, southern Greece. – Preslia **71:** 361-367.
Tan, Kit & Vold, G. 2006: Reports 132-202. – Pp. 428-433 in: Vladimirov, V. & al. (eds.) New floristic records in the Balkans 3. – Phytol. Balcan. **12:** 428-433.
Talavera, S., Aedo, C., Castroviejo, S., Herrero, A., Romero Zacro C., Salgueiro, F. J. Velayos, M. (ed.) 2000: Flora Iberica, **7(2).** – Madrid.
Theocharopoulos, M. & Georgiadis, Th. 1984: Contribution à l'étude de la végétation de l'Attique orientale (NEA MAKRI) en Gréce. (Prise en compte des impacts urbains et touristiques). – Ecol. Medit. **10:** 133-157.
—, Dimitrellos, G., Assimakopoulos & Georgiadis, Th.1998: Recherche phytosociologique des communautés à Juniperus phoenicea et Euphorbia cendroides en Grèce: zone littolale et sub-littorale au nord du golphe de Corinthe (Strea Hellas-Grèce centrale). – Colloq. Phytosoc. **28:** 1197-1213.

Theodoropoulos, K. G. 1991. Bestimmung und Klassifizierung der pflanzensoziologischen Vegetationseinheiten im Universitaetswald Taxiarchis Chalkidiki. – Ph.D. thesis, Thessaloniki (in Greek).

— 1996: The vegatation of a small downy oak (*Quercus pubescens* Willd.) forest in the thessallian plain (C. Greece). – Pp. 89-98 in Proc. of the 6th Scientific Congres of Greek Botanical Society. – Paralimni (in Greek).

— & Eleftheriadou, E. N. 2003: The vegetation of pickly Juniper (*Juniperus oxycedrus* L. ssp. *oxycedrus*) shrublands of Mount Orvilos (E. Macedonia, Nomos Dramas, Greece). – Pp. 223-232 in: Platis, P. & Papachristou, Th. (eds.) Proc. of the 3rd Panhellenic Rangeland Congres. – Thessaloniki (in Greek).

—, Reif, A. & Athanasiadis, N. 1995: *Quercus dalechampii* forests in C. Macedonia, Greece). – Bot. Helv. **105:** 37-54.

Thanos, C. A., Marcou, S., Christodoulakis, D. & Yiannitsaros, A. 1989: Early post-fire regeneration in *Pinus brutia* forest ecosystems of Samos island (Greece). – Acta Oecologica/Oecol. Plant. **10:** 79-94.

Thomson, E. F., Rihawi, S., Cocks, P. S., Osman, A. E. & Russi, L. 1990: Recovery and germination rates of seeds of Mediterranean medics and clovers offered to sheep at a single meal or continuously. – J. Agric. Sci. (Cambridge) **114:** 295-299.

Tocl, C. & Rohlena, J. 1902: Additamenta in floram peninsulae Athoae. – Sitzungsber. Königl. Böhm. Ges. Wiss. Prag. Math.-Naturwiss. Cl. **1902:** 1-8.

Trigas, P. & Iatrou G. 2000: Additions to the flora Evvia (Greece). – Bot. Chron. **13:** 273-286.

Tsiotsiou, V. & Christodulakis, D. 2004: Contribution to the urban ecology of Greece: The flora of Mesolongi city. – Fl. Medit. **14:** 129-151.

Tsopra, A. 2003: Contribution to the study of the plant biodiversity of Milos Island. – M.Sc. thesis, Athens (in Greek).

Tuntas, B. 1905: The flora of Kithnos. – Geographical Bulletin **2-3:** 179-185.

Turland, N. J.1995: Medicago heyniana Greuter. – Pp. 360-361 in: Phitos, D., Strid, A., Snogerup, S. & Greuter, W. (eds.) The red data book of rare and threatened plants of Greece. – Athens.

—, Chilton, L. & Press, J. R.1993: Flora of the Cretan area. Annotated checklist & atlas. – London.

—, Phitos, D., Kamari, G. & Bareka, P. 2004: Weeds of traditional agiculture of Crete. – Willdenowia **34:** 381-406.

Turrill, W. B. 1918: Contributions to the flora of Macedonia: I. – Bull. Misc. Inform. **1918:** 249-341.

— 1920: Contributions to the flora of Macedonia: III. – Bull. Misc. Inform. **1920:** 177-196.

— 1929: The plant-life of the Balkan Peninsula. A phytogeographical study. – Oxford.

— 1937: A contribution to the botany of Athos peninsula. – Bull. Misc. Inform. **1937:** 197-273.

Tutin, T. G. 1968: Medicago L. Pp. 153-157 in Tutin, T. G., Heywood, V. H. Burges, N. A., Moore, D. M., Valentine, D. H., Walters, S. M. & Webb, D. A. (eds) Flora Europea, **2**. – Cambridge.

Tzanoudakis, D.1981: Contribution to the study of Cyclades Flora: The Flora of the island of Yiaros. – Bot. Chron. **1:** 124-136.

—, Panitsa, M., Trigas, P. & Iatrou, G. 2006: Floristic and phytosociological investigation of the island Antikythera and nearby islets (SW Aegean area, Greece). – Willdenowia **36:** 285-301.

Unger, F. 1862: Wissenchaftliche Ergebnisse einer Reise in Griechenland und den jonischen Inseln. – Wien.

Urumov, I. 1923: Contribution à la connaissance de la flore de la Thrace occidentale. – Spis. Bulg. Akad. Nauk. **28:** 1-107 (in Bulgarian).

Vallianatou, I. 2005: Geobotanic study of Salamis, Egina and other islands of the Saronic gulf (Hellas). – Ph.D. thesis, Athens (in Greek).

— & Yannitsaros, A. 1993: A contribution to the flora of the island of Aiyina (Saronic Gulf, Greece).

– Pp. 406-409 in Proc. 15th Conf. Hellen. Soc. Biol. Sci, Florina-Kastoria (in Greek).
— & Yannitsaros, A. 2000: A contribution to the vascular flora of the islands of the Saronic Gulf (Greece). – Bot. Chron. **13:** 302-323.
—, Koumpli-Sovantzi L. & Yannitsaros, A. 1994: Flora and vegetation of the island Psittalia (Saronic Gulf, Greece). – Candollea **49:** 209-224.
Vandas, C. 1905: Addimenta ad floram Maccedoniae et Thessaliae. – Magyar Bot. Lapok **4:** 262-268.
Varep, E.& al. (eds) 1959: Flora of Estonian S.S.R., **3.** – Tallinn.
Vierhapper, F. 1914a: Beiträge zur Kenntnis der Flora Kretas. – Österr. Bot. Z. **64:** 465-482.
— 1914b: Beiträge zur Kenntnis der Flora Grichenlands. – Verh. K.K. Zool.-Bot. Ges. Wien **64:** 239-270.
— & Rechinger, K. H. 1935: Bearbeitung der von Ignaz Dörfler im Jahre 1904 auf Kreta gesammelten Blüten- und Farnpflanzen. – Österr. Bot. Z. **64:** 123-157.
Vlachos, S., Christodulakis, D. & Kamari, G. 2002: The flora of Mount Boumistos (NW Sterea Ellas, Greece): Species list and chorological notes. – Fl. Medit. **12:** 413-438.
Voliotis, D. 1967: Untersuchungen über die Vegetation und die Flora des Cholomongebriges unter besonders Berücksichtigung der aromatischen, Heil- und Bienenzuchtplanzen. – Sci. Ann. Fac. Phys. & Mathem Aristotelian Univ. Thessaloniki **10:** 1-131 (in Greek).
— 1976a: Über die Vegetation und Flora des Lialias-Gebriges in Nordgriechenland. In Dafis, S. & Landolt, E. (eds.): Zur Vegetation und Flora von Griechenland, **2.** – Veröff. Geobot. Inst. ETH Stiftung Rübel Zürich **56:** 21-58.
— 1976b: Die Gehölzvegetation und die Vegetationszonierung des Gebirgszuges Tymphristos-Oeta-Parnassos (Griechenland). – Candollea **31:** 37-51.
— 1977: Flore et végétation de la région montagneuse de Lailia (Serres) Gréce. – Biol. Gallo-Hellen. **6,** suppl.**:** 1-90 (in Greek).
— 1981: Flora und Vegetation des Voras-Gebriges. – Sci. Ann. Fac. Phys.& Mathem Aristotelian Univ. Thessaloniki **19:** 189-278.
— 1983: Zur Flora des Tzena-Gebriges in Nord-Griechenland. – Acta Bot. Croat. **42:**157-172.
— 1984: Die Flora der Nestos-Schlucht in Griechenland. – Phyton (Horn) **24:** 153-164.
— & Drosos 1983: A study of an extensive biotope of the aromatic sea daffodil (*Pancratium maritimum*) near Aphytos, Kassandra Peninsula, northern Greece. – Bauhinia **7:** 229-242.
Weiss, E. 1869: Beiträge zur Flora von Grichenland und Creta. – Verh. K.K. Zool.-Bot. Ges. Wien **19:** 741-758.
Wolf, W. J. 1968/1969: The hallophilous vegetation of the lagoons of Mesolonghi, Geece. – Vegetatio **16:** 95-134.
Yannitsaros, A.1969: Contribution to the knowledge of the flora and vegetation of the island of Kithira. – Ph.D. thesis, Athens (in Greek).
— 1971: Notes on the flora of Elaphonesos island (Lakonia, Greece). – Biol. Gallo-Hellen. **3:** 149-162.
— 1991: Adventive flora of Crete: history, phytogeography, ecology and agricultural aspects. – Bot. Chron. **10:** 299-307.
— 1998: Additions to the flora of Kithira (Greece) I. – Willdenowia **28:** 77-94.
—, Vallianatou, I., Bazos, I. & Constantinidis, Th. 1995: Flora and vegetation of Strofades islands (Ionian sea, Greece). – Athens.Zaffran, J. 1976: Contributions à la Flore et à la Végétation de la Crète. I. Floristique. – Marseille.
— 1990: Contribution à la Flore et à la Végétation de Crète. – Marseille.
Zaganiaris, D. 1934: The flora of Mani. – Athens (in Greek).
— 1935a: The flora of Lavreotiki. – Georgikon Deltion (Agric. Bull. Greek Agric. Soc.) **28(7):** 256-264 (in Greek).
— 1935b: The flora of Poros.Study of taxonomic botany. – Athens (in Greek).

— 1938a: Herbarium macedonicum. Primule mille. – Sci. Ann. Fac. Phys.& Math. Aristotelian Univ. Thessaloniki **4:** 97-131.
— 1938b: Herbarium macedonicum. Tertium et quartum mille. – Sci. Ann. Fac. Phys.& Math. Aristotelian Univ. Thessaloniki **6:** 38-141.
— 1939: The weeds of Thessalonki district. – Thessaloniki (in Greek).
— 1940: La flore de Poros. – Actes Inst. Bot. Univ. Athènes **1:** 237-253.
Zerlentis, C. 1959: The plants of Lycabetus. – Bull. Agric. Bank **109:**19-28 (in Greek).
— 1965: Contribution to the flora of Imittos. – Athens (in Greek).
1968: Contribution to the study of the flora of Imittos. – Agic. Bull. (Ministry of Agriculture) **19:** 5-29 (in Greek).
Zohary, M. 1987: Flora Palaestina, **2.** – Jerusalem.
Zotos, A., Raus, Th. & Dimopoulos P. 2006: New floristic reports from the lakes Trichonis and Lysimachia (W Greece). – Willdenowia **36:** 731-739.

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