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Floristic composition and diversity of *Pinus pinea* forests in the south-western Anatolia region (Muğla - Turkey)

Abstract

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Pinus pinea L. (Stone pine) forests isn't widespread on the World. From the point of view of plant geography, study area is situated in the Mediterranean floristic region which is under the effective control of a semi-arid, and superior-lukewarm variants of Mediterranean climate. Annual rainfall quantity is very important for development *Pinus pinea*. The minimal rainfall must be at least 600 mm. In this study the floristic composition and diversity of *Pinus pinea* forests in the south-western Anatolia region of Turkey have been investigated. In the study area, 212 species belonging to 145 genera and 37 families were identified. Distribution rates of the species in terms of phytogeographic regions are as follows: 54 (25%) Mediterranean elements, 28 (13.20%) East Mediterranean elements, 6 (2.83%) Irano-Turanian and 4 (1.89%) Euro-Siberian elements, and 121 (57.08%) multi regional elements. The number of endemic is 11 and the rate of endemism is 5.1%.

Introduction

Pinus pinea L. (Stone pine) is an important species both economically and ecologically. There is an ongoing debate on the source of origin of stone pine. People cultivated stone pine, which is used as a nutrient source, in different regions around the world along the history. Stone pine requires spesific type parent rock for living. Since stone pine does not grow everywhere it is not widely distrubited around the world. Spread area of stone pine around the world indicates that it is a plant species belonging to the Mediterranean basin (Coode & Cullen 1965). Stone pine is not wide spreaded in Turkey, but it is found in Bergama-Kozak, Aydın-Koçarlı, Antalya-Side, around the Marmara sea, the coast of Gemlik gulf, Önsen and Hacıağalı villages in K. Maraş, Artvin and Trabzon in Black Sea region as Mediterranean enclave. According to Zohary (1973), stone pine in the Black Sea region is a Mediterranean relict. The total area of stone pine in Turkey is 30-35 thousand hectares. Moreover, due to the economic advantage and utility of stone pine, *its plantation hugely increases in Turkey*. In addition to this, in Italy, stone pine has been used for fixing sand-dunes in regions where the agricultural plants are grown. In order to prevent these plants from sea winds, stone pine has been widely used in Italy (Selçuk 1964).

Material and methods

The materials of this investigation were comprised 550 plant specimens collected (Muğla province) in the *Pinus pinea* forests during a study of vegetation between 2000 and 2001. The majority of the specimens were identified with the help of Flora of Turkey (Davis & al. 1965-1988). In cases of uncertainty, Flora Europaea (Tutin & al. 1964-1981) were used. The meteorological climatic data presented in Table 1a, 1b were obtained from Meteoroloji Isl. Gn. Mdl. (1995). Soil characteristics of the study area was taken from Turkish Forestry Research Institute (Akgül & Yılmaz 1991). The study area has a Mediterranean climate, the main characteristics of which are: dry summers and warm and rainy winters. In the research area, the annual mean temperature is 16.0 °C. The maximum mean temperature (M) is 33.9 °C in July and August. The minimum mean temperature (m) is 2.5 °C in January.

A brief description of the area

The study area is within the boundary of Muğla province in the Katrancı village of Yatağan, Çallı village of Milas and Kurucaova (Çamlıyurt) village of Kavaklıdere. The study area is in the western Anatolia region of Turkey. It is surrounded by the Geyik dam border to the west, Milas county border to the south-west, Yatagan county border to the south-east, and Kavaklıdere county border to the east. The area has a rough topography and ranges in altitude from 400 to 800 m (Fig. 1).

The plants are listed in the appendix. The sequence of families, genera and species in

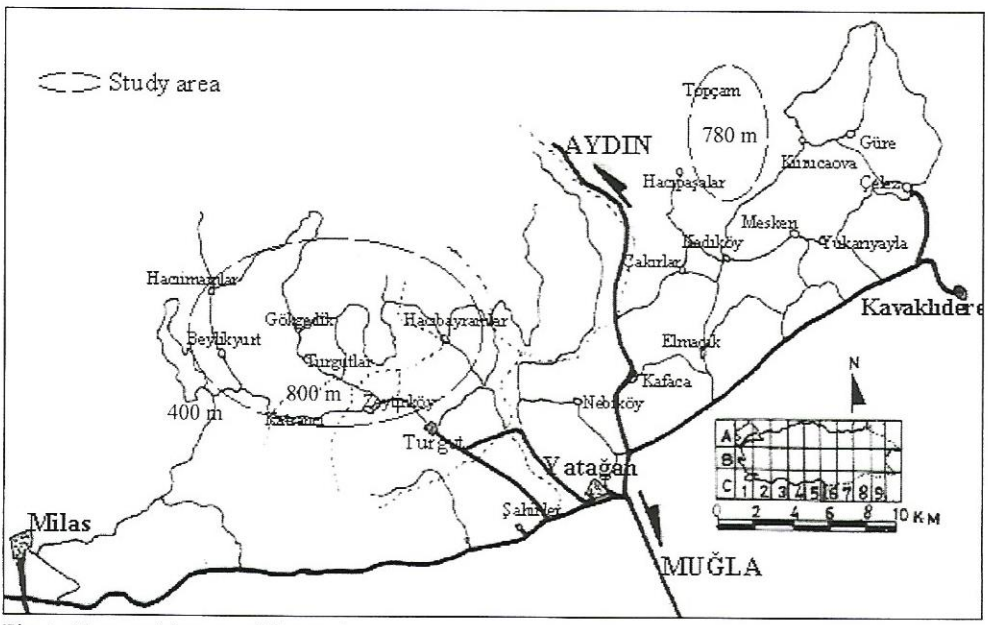

Fig. 1. Geographic map of the study area.

Table 1a. The avarage and extreme climatic values of Yatağan in the period from 1974 to 2001.

Meteorological elements	Observation periods (years)	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Mean
Mean temparature.(c°)	23	6.5	7.6	10.1	14.1	18.2	23.6	26.9	26.1	22.2	16.6	11.2	7.8	16.0
Max. mean temp. (c°)	23	11.2	12.5	15.9	20.4	26.1	30.7	33.9	33.9	30.6	24.1	17.4	12.6	22.4
Min. mean. temp. (c°)	23	2.5	3.3	4.8	7.9	11.4	15.3	18.4	17.7	14.1	10.0	6.2	3.8	9.6
Mean rainfall (mm)	37	130.0	91.8	65.8	37.6	35.2	19.3	8.6	4.4	11.3	44.0	77.9	131.0	656.9
Mean rel. humidity (%)	23	74.0	70.0	66.0	60.0	54.0	46.0	42.0	44.0	48.0	59.0	69.0	75.0	59.0

Table 1b. Seasonal distribution of rainfall.

Station	Observation period	Spring total (mm)	%	Summer total (mm)	%	Autumn total (mm)	%	Winter total (mm)	%	Yearly (mm)
Yatağan(Muğla)	37	138.6	21	32.3	5	133.2	20	352.8	54	656.9

the plant list is alphabetical. The plant specimens prepared for herbarium collection have been stored in the Department of Biology, Faculty of Science & Art, Muğla University.

The following abbreviations and symbols are used:

Euro-Sib. = Euro-Siberian element, Ir.-Tur. = Irano-Turanian element, Medit. = Mediterranean element, E. Medit.= East Mediterranean element, End. = Endemic, Ph = Phanerophyte, Ch = Chameophyte, H = Hemicrytophyte, G = Geophyte, T = Therophyte, P = Parasite, EN = Endangered, VU = Vulnerable, LR(cd) = Lower risk (conservation depentent), LR(nt) = Lower risk (near threatened), DD = Data deficient, • = New record for C1 grid square, ■ = New record for C2 grid square.

(1) = Katrancı village, 400-800 m, *Pinus pinea* forest

(2) = Kavaklıdere village 450-780 m, *Pinus pinea* forest

Vegetation of the area

The studied area lies in the Mediterranean region of the western Anatolia, and is dominated by Mediterranean elements. The presence of therophyte plants was abundant in the study area while dominant species was *Pinus pinea, s*hurbs such as *Cistus creticus* L., *Calicotome villosa* (Poiret) Link, *Pistacia terebinthus* subsp. *palaestina* (Boiss.) Engler, *Juniperus oxycedrus* L. subsp. *oxycedrus* are found. Stone pine forest forms unmixed community in the research area. However, *Pinus brutia* Ten. (but, it have been destroyed unconsciously by domestic people) have penetrated the floristic structure of the heterogeneous fields. Stone pine forest occurs on slopes with an inclination of 10-50% between 400-800 m. elevation in the study area.

Result and Discussion

Te floristic data relating to the a *Pinus pinea* forests in the Muğla province

Two hundred and twelve species belonging to 145 genera and 37 families were

Table 2. The floristic evaluation and species red list.

	Gymnospermae	Dicotyledones	Monocotyledones	Total
Family	2	31	4	37
Genera	2	112	31	145
Species	3	164	45	212
EN	-	3	-	3
VU	-	1	-	1
LR(cd)	-	2	1	3
LR(nt)	-	2	1	3
DD	-	1	-	1

identified in the study area. Thirty-eight plant samples which identified were collected first time from C_1 and C_2 square (Donner 1990). Of the species collected, 11 are endemic. Three of the 212 species are in *Gymnospermae* and the other 209 are in *Angiospermae*. Of these, 164 species belong to the class Dicotyledones, while the other 45 belong to Monocotyledones. (Table 2). The species of the study area, categorised according to phytogeographical regions, can be listed as follows: Mediterranean elements 53 (25%), East-Mediterranean elements 28 (13.20%), Irano-Turanian elements 6 (2.83%), Euro-Siberian elements 4 (1.89%) and the remaining 121 (57.08%) species are multi-regional (Table 3). This forests has a floristic structure which consists of trees, shrubs and herbs. The percentage of the total species recorded in the stands of floristic composition are as follows: 51.4% of the therophyte, 23.1% of the hemicryptophyte, 16.0% of the geophyte, 3.7% of the phanerophyte, 5.1% chameophyte, 0.7% of the parasite. *Radiola linoides* (*Linaceae*) species which is monotypic to Turkey were collected as new record from C_1 square in during this study. In the floristic composition of stone pine in our study field are dominant in the shrub level such as *Quercus coccifera*, *Cistus creticus* and *Lavandula stoechas* subsp. *stoechas*, in the herb level such as *Ornithopus compressus*, *Dianthus tripunctatus*, *Coronilla cretica*, *Tuberaria guttata*, *Trifolium repens* var. *repens* and *Plantago bellardii*. Stone pine forests in Muğla province occurs on the Lithic Xerochrept soils (FAO 1989) which are formed by granite bedrock. The soils of the stone pine forests in the study area are sandy and loamy in texture (SL), and have a slightly acidic character. Organic matter is mid-level (Akgül & Yılmaz 1991).

The six largest families according to number of species in this study (Table 4).

Almost everywhere *Poaceae, Fabaceae* and *Asteraceae* are among the first six families, according to their representative species number. The rate of endemism in the research area is very low (5.1%), when compare with endemism ratio in the total Flora of Turkey (33%). This figure may not seem to be high. But, when we the flora in Turkey is focused on, it is observed that 85% of the endemic species grow between 1000-2000 m. In this case, plains at lower altitudes are poor in terms of endemics. The status of each taxa is determined by

Table 3. Phytogeographic distribution of species and endemism.

	Gymnospermae	Dicotyledones	Monocotyledones	Total
Medit.	-	41	12	53
E.Medit.	1	19	8	28
Ir.-Tur.	-	3	3	6
Euro-Sib.	-	3	1	4
Multi regional	2	98	21	121
Endemic species	-	9	2	11

Table 4. The largest families.

Families	Number	%
Poaceae	2	12.26
Fabaceae	24	11.32
Asteraceae	21	9.90
Caryophyllaceae	15	7.07
Lamiaceae	12	5.66
Liliaceae	12	5.66

examining their distribution both in the our study area and in Turkey as a whole. The results are shown in Table 2. The populations of 3 taxa are at a endangered (see appendix), and if consevation measure are not taken, they will soon be extinct. The population dynamics of all these species should be investigated and continously monitored.

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Appendix - The plant list

ANACARDIACEAE

Pistacia terebinthus *L.* subsp. ***palaestina*** (Boiss.) Engl.
(2), Varol 3873, E. Medit., Ph.

APIACEAE (UMBELLIFERAE)

Berula erecta (Huds.) Coville
(1), Varol 3499, H.
Bunium microcarpum (Boiss.) Freyn subsp. ***microcarpum***
(2), Varol 3480b, E. Medit., T.
Daucus guttatus Sm.
(1)-(2), Varol 3448-3881, T.
Eryngium campestre L. var. ***virens*** Link
(1), Varol 3420, H.
Orlaya daucoides (L.) Greuter
(2), Varol 3877, Medit., H.
Peucedanum chryseum (Boiss. & Heldr.) Chamb.
(2), Varol 3513, End., H.
•***Scandix iberica*** M. Bieb.
(1), Varol 3284, T.
Thapsia garganica L.
(2), Varol 3475, Medit., H.
Torilis leptophylla (L.) Reichb.
(1), Varol 3367, T.
•***Torilis ucranica*** Spreng.
(1), Varol 3424, T.

ASTERACEAE (COMPOSITAE)

Andryala integrifolia L.
(1), Varol 3405, Medit., T.
Bellis perennis L.
(1), Varol 3302, Euro. Sib., H.

Calendula arvensis L.
(2), Varol 3618, T.
Centaurea solstitialis L. subsp. ***pyracantha*** (Boiss.)Wagenitz
(1), Varol 3508, End., Medit., T, LR(nt).
Chamaemelum mixtum (L.) All.
(1), Varol 3418, T.
Cnicus benedictus L. var. ***benedictus***
(1)-(2), Varol 3677-3723, H.
• ***Crepis foetida*** L. subsp. ***foetida***
(1), Varol 3408, T.
Crepis foetida L. subsp. ***rhoeadifolia*** (M.Bieb) ?elak.
(1), Varol 3282, T.
Crepis multiflora Sm.
(1), Varol 3392, Medit., T.
Filago eriocephala Guss.
(2), Varol 3409, Medit., T.
Hedypnois cretica (L.) Dum.Cours.
(1), Varol 3365, Medit., T.
Inula viscosa (L.) Aiton
(1), Varol 3541, Medit., C.
• ***Leontodon cichoraceus*** (Ten.) Sanguin.
(1), Varol 3355, Medit., G.
• ***Logfia arvensis*** (L.) Holub
(1)-(2), Varol 3338-3455, T.
Pulicaria dysenterica (L.) Cass.
(2), Varol 3546, C.
Scariola viminea (L.) F.W.Schmidt.
(1), Varol 3357, G.
Scolymus hispanicus L.
(1), Varol 3311, Medit., H.
Senecio vulgaris L.
(2), Varol 3588, T.
Steptorhamphus tuberosus (Jacq.) Grossh.
(2), Varol 3880, G.
• ***Taraxacum aznavourii*** Soest
(1), Varol 3281, H, DD.
• ***Trogopogon buphthalmoides*** (DC.) Boiss. var. ***buphthalmoides***
(1), Varol 3347, H.

BERBERIDACEAE

• ***Leontice leontopetalum*** L. subsp. ***leontopetalum***
(1), Varol 3267b, H.

BORAGINACEAE

■ ***Alkanna areolata*** Boiss. var. ***areolata***
(2), Varol 3509, End., Medit., H.
Alkanna orientalis (L.) Boiss.var. ***orientalis***
(1), Varol 3275, Ir.-Tur., H.
Alkanna tinctoria (L.) Tausch subsp. ***tinctoria***

(1)-(2), Varol 3627-3657, H.
Heliotropium lasiocarpum Fisch. & C.A.Mey
(1), Varol 3500, Ir.-Tur., T.
Myosotis cadmaea Boiss.
(1), Varol 3309, E. Medit., T.
Myosotis ramosissima Rochel ex H.Schult. subsp. ***ramosissima***
(1)-(2), Varol 3308-3471, T.

BRASSICACEAE (CRUCIFERAE)

Alyssum fulvescens Sibth. & Sm. var. ***fulvescens***
(1), Varol 3293, E. Medit., T.
Arabis verna (L.) DC.
(1), Varol 3276a, Medit., T.
Arabidopsis thaliana (L.) Heynh.
(1), Varol 3274, T.
Cardamine hirsuta L.
(1), Varol 3389, T.
Erophila verna (L.) Chevall. subsp. ***macrocarpa*** (Boiss. & Heldr.) Walters
(1), Varol 3667, T.
•***Erophila verna*** (L.) Chevall. subsp. ***verna***
(1), Varol 3276b, T.
Sisymbrium officinale (L.) Scop.
(2), Varol 3462, H.
Teesdalia coronopifolia (Berg.) Thell.
(1), Varol 3298, T.

CAMPANULACEAE

Campanula lyrata Lam. subsp. ***lyrata***
(1), Varol 3422, End., H.
Legousia pentagonia (L.) Thell.
(1), Varol 3736, E. Medit., T.
Legousia speculum - veneris (L.) Chaix
(1)-(2), Varol 3346-3482, Medit., T.

CARYOPHYLLACEAE

•***Arenaria pamphylica*** Boiss. & Heldr. subsp. ***alpestris***
(1), Varol 3679b, End., E. Medit., T, LR(nt)
Arenaria rhodia Boiss. subsp. ***rhodia*** var. ***rhodia***
(1), Varol 3599, E. Medit., T, EN.
Arenaria serpyllifolia L.
(1), Varol 3385, T.
Cerastium glomeratum Thuill.
(1), Varol 3301, T.
Cerastium illyricum Ard. subsp. ***comatum*** (Desv.) P.D.Sell & Whitehead
(1)-(2), Varol 3439, 3457, Medit., T.
Dianthus tripunctatus Sibth. & Sm.
(1), Varol 3332, Medit., T.
Holesteum umbellatum L. var. ***umbellatum***
(1), Varol 3426, T.

Moenchia mantica (L.) Bartlott subsp. ***caerula*** (Boiss.) A.R.Clapham
(1), Varol 3292, T.
Polycarpon tetraphyllum (L.) L.
(1), Varol 3502, T.
Silene gallica L.
(1)-(2), Varol 3849-3882, H.
Silene squamigera Boiss. subsp. ***squamigera***
(2), Varol 3517, Medit., H.
Silene subconica Friv.
(1)-(2), Varol 3319-3449, H.
Spergularia marina (L.) Gris
(2), Varol 3622, H.
Spergularia media (L.) C.Presl
(1), Varol 3652, H.
Velezia hispida Boiss.
(1), Varol 3416, End., H.

CISTACEAE

Cistus creticus L.
(1)-(2), Varol 3947, Ph.
Cistus laurifolius L.
(2), Varol 3948, Ph.
Helianthemum aegyptiacum (L.) R.B.Mill.
(2), Varol 3465, T.
• ***Tuberaria guttata*** (L.) Fourr.
(1), Varol 3333, T.

CRASSULACEAE

Umbilicus rupestris (Salisb.) Dandy
(1), Varol 3359, G.
Sedum pallidum M.Bieb. var. ***pallidum***
(1), Varol 3412, T.

CUPRESSACEAE

Juniperus oxycedrus L. subsp. ***oxycedrus***
(1), Varol 3353, Ph.

CUSCUTACEAE

• ***Cuscuta campestris*** Yunck.
(1), Varol 3378, P.

EUPHORBIACEAE

Euphorbia peplis L. var. ***peplis***
(1), Varol 3398, T.
Euphorbia rigida M.Bieb.
(2), Varol 3476, Medit., H.
Euphorbia taurinensis All.
(1), Varol 3269, T.

FABACEAE

Biserrula pelecinus L.
(2), Varol 3715, Medit., T.
Calicotome villosa (Poir.) Link
(2), Varol 3490, Medit., C.
Coronilla cretica L.
(1)-(2), Varol 3320-3730, Medit., T.
■ ***Lathyrus sativus*** L.
(1)-(2), Varol 3336-3747, T.
● ***Lotus macrotrichus*** Boiss.
(1)-(2), Varol 3328-3472, End., E. Medit., T.
Onobrychis caput-galli (L.) Lam.
(2), Varol 3706, Medit., H.
Ornithopus compressus L.
(1)-(2), Varol 3287-3711, Medit., T.
Trifolium arvense L. var. ***arvense***
(1)-(2), Varol 3305-3493, T.
Trifolium campestre Schreb.
(1)-(2), Varol 3344-3729, T.
Trifolium cherleri L.
(1)-(2), Varol 3337, Medit., T.
● ***Trifolium glanduliferum*** Boiss. var. ***nervulosum*** (Boiss & Heldr.) Zoh.
(1), Varol 3444, E. Medit., T.
Trifolium glomeratum L.
(1), Varol 3665, H.
Trifolium leucanthum M.Bieb.
(2), Varol 3450, T.
Trifolium lucanicum Gasp.
(1), Varol 3858, Medit., T.
● ***Trifolium phleoides*** Pourr. ex. Willd.
(1), Varol 3446, Medit., T.
● ***Trifolium repens*** L. var. ***repens***
(1)-(2), Varol 3292-3741, T.
Trifolium stellatum L. var. ***stellatum***
(1)-(2), Varol 3268-3735, T.
Trifolium tomentosum L.
(1)-(2), Varol 3732-3856, T.
Trifolium uniflorum L.
(2), Varol 3742b, Medit., T.
Vicia articulata Hornem.
(1), Varol 3286, T.
Vicia grandiflora Scop. var. ***dissecta*** Boiss.
(1), Varol 3277a, T.
Vicia grandiflora Scop. var. ***grandiflora***
(1), Varol 3277b, E. Medit., T.
Vicia lathyroides L.
(1)-(2), Varol 3290-3621, T.
■ ***Vicia villosa*** Roth subsp. ***villosa***
(1)-(2), Varol 3417-3486, H.

GENTIANACEAE

Centaurium maritimum (L.) Fritsch
(1), Varol 3443, Medit., T.

GERANIACEAE

Erodium botrys (Cav.) Bertol.
(1), Varol 3603, Medit., H.
■ ***Erodium cicutarium*** (L.) L' Hér. subsp. ***bipinnatum*** (Cav.) Tourlet
(1)-(2), Varol 3585-3602, T.
Erodium cicutarium (L.) L' Hér. subsp. ***cicutarium***
(1), Varol 3368, T.
● ***Erodium laciniatum*** (Cav.) Willd. subsp. ***laciniatum***
(1), Varol 3300, T.
Geranium lucidum L.
(1), Varol 3280a, T.
Geranium molle L. subsp. ***molle***
(1), Varol 3280c, T.
Geranium purpureum Vill.
(1), Varol 3280b, T.
● ***Geranium sanguineum*** L.
(1), Varol 3503, Euro. Sib., H.
HYPERICACEAE
Hypericum atomarium Boiss.
(2), Varol 3514, E. Medit., H.

ILLECEBRACEAE

Herniaria incana Lam.
(2), Varol 3474, C.
Paronychia argentea Lam. var. ***argentea***
(2), Varol 3528, Medit., H.
■ ***Paronychia echinulata*** Chater
(1)-(2), Varol 3828, T.

IRIDACEAE

Crocus chrysanthus (Herb.) Herb.
(1), Varol 3565, E. Medit., G.
● ***Romulea columnea*** Seb. & Mauri subsp. ***columnea***
(1), Varol 3391, G.

LAMIACEAE (LABIATAE)

Ajuga orientalis L.
(1), Varol 3673, H.
Lamium amplexicaule L.
(1)-(2), Varol 3267-3623, T.
Lavandula stoechas L. subsp. ***stoechas***
(1), Varol 3313, Medit., C.
Mentha pulegium L.
(1)-(2), Varol 3519-3540, H.

Micromeria myrtifolia Boiss. & Hohen.
(2), Varol 3494, E Medit., C.
Micromeria nervosa (Desf.) Benth.
(2), Varol 3520, Medit., C.
Origanum onites L.
(2), Varol 3468, E. Medit., H.
•***Prunella orientalis*** Bornm.
(1), Varol 3438, H.
Salvia tomentosa R.B.Miller
(2), Varol 3872, C.
Sideritis lanata L.
(1)-(2), Varol 3339-3466, E. Medit., T.
Teucrium chamaedrys L. subsp. ***cahamedrys***
(1), Varol 3521, H.
Ziziphora tenuior L.
(1)-(2), Varol 3342-3522, Ir. -Tur., T.

LILIACEAE

■ ***Allium flavum*** L. subsp. ***flavum*** var. ***flavum***
(1)-(2), Varol 3383-3516, E. Medit., G.
■ ***Allium pilosum*** Sm.
(2), Varol 3488, E. Medit., G.
•***Colchicum lingulatum*** Boiss. & Spruner ex Boiss.
(1), Varol 3536, E. Medit., G.
Fritillaria bithynica Baker
(1)-(2), Varol 3613-3927, End., E. Medit., G., LR(cd)
Gagea peduncularis (J. & C.Presl) Pascher
(1), Varol 3563, Medit., G.
Muscari comosum (L.) R.B.Mill.
(1)-(2), Varol 3375-3478, G.
•***Ornithogalum alpigenum*** Stapf
(1)-(2), Varol 3371-3461, End., E. Medit., G., Lr(nt)
Ornithogalum armeniacum Baker
(1), Varol 3307, E. Medit., G.
Ornithogalum nutans L.
(1), Varol 3306, G.
Ornithogalum sphaerocarpum Kerner
(1), Varol 3370, G.
Scilla autumnalis L.
(1)-(2), Varol 3545-3549, Medit., G.
Scilla bifolia L.
(1), Varol 3564, Medit., G.

LINACEAE

Linum bienne R.B.Mill.
(1), Varol 3857, Medit., T.
•***Radiola linoides*** Roth
(1), Varol 3812, T.

MALVACEAE

Alcea remotiflora (Boiss. & Heldr.) Alef
(2), Varol 3512, H.

ORABANCHACEAE

Orabanche minor Sm.
(1), Varol 3883, P.

ORCHIDACEAE

Neotinea maculata (Desf.) Stearn
(1), Varol 3656, Medit., G.
Orchis coriophora L.
(1), Varol 3413, G.
Orchis collina Banks & Sol.
(1), Varol 3304, Medit., G.
Orchis morio L. subsp. ***picta*** (Loisel.) K.Richter
(1), Varol 3680, Medit., G.
Spiranthes spiralis (L.) Chevall.
(1), Varol 3538, Medit., G.

PINACEAE

Pinus brutia Ten.
(1)-(2), Varol 3945, E. Medit., Ph.
Pinus pinea L.
(1)-(2), Varol 3946, Ph.

PLANTAGINACEAE

Plantago bellardii All.
(1), Varol 3299, H.
Plantago lanceolata L.
(1), Varol 3505, H.

POACEAE

Aegilops triuncialis L. subsp. ***triuncialis***
(1), Varol 3401, T.
Aegilops umbellulata Zhuk. subsp. ***umbellulata***
(1), Varol 3340, Ir. Tur., T.
•***Alopecurus utriculatus*** Sol. subsp. ***utriculatus***
(1), Varol 3324, Ir.-Tur., T.
Avena barbata Pott ex Link subsp. ***barbata***
(1)-(2), Varol 3459-3843, Medit., H.
Briza maxima L.
(1), Varol 3799, H.
Briza minor L.
(1), Varol 3787, T.
Bromus squarrosus L.
(1), Varol 3364, T.
Bromus sterilis L.

(1), Varol 3381, H.
Bromus tectorum L.
(1), Varol 3406- 3453, T.
Chrysopogon gryllus (L.) Trin.
(2), Varol 3483, H.
Cynodon dactylon (L.) Pers. var. ***villosus*** Regel
(2), Varol 3529, G.
Cynosurus echinatus L.
(1)-(2), Varol 3339-3470, Medit., T.
• ***Dactylis glomerata*** L. subsp. ***glomerata***
(1), Varol 3330, G.
■ ***Eremopoa capillaris*** R.Mill
(1), Varol 3345, T.
Gaudinia fragilis (L.) P.Beauv.
(1), Varol 3407, Av. Sib., T.
Hordeum murinum L. subsp. ***leporinum*** (Link) Arc. var. ***leporinum***
(1)-(2), Varol 3273-3463, H.
Lagurus ovatus L.
(1)-(2), Varol 3430-3473, Medit., T.
Lolium rigidum Gaudin var. ***rigudum***
(1)-(2), Varol 3351-3469, T.
Lolium temulentum L. var. ***temulentum***
(1), Varol 3348, T.
Melica minuta L.
(1), Varol 3498, Medit., H.
■ ***Milium pedicellare*** (Bornm.) Roshev. ex Melderis
(2), Varol 3489, Ir.- Tur., H.
Poa bulbosa L.
(1), Varol 3325, G.
Poa diversifolia (Boiss.& Bal.) Hack. ex Boiss.
(2), Varol 3526, E. Medit., T.
Poa nemoralis L.
(2), Varol 3885, T.
Stipa bromoides (L.) Dörfl.
(2), Varol 3525, Medit., H.
Vulpia myuros (L.) C.C.Gmel.
(1)-(2), Varol 3400-3452, T.

POLYGONACEAE

Rumex acetosella L.
(1)-(2), Varol 3414-3485, T.
Rumex bucephalophorus L.
(1), Varol 3285, Medit., T.
Rumex conglomeratus Murr
(1), Varol 3507, H.
• ***Rumex crispus*** L.
(1), Varol 3506, H.

PRIMULACEAE

Anagallis arvensis L. var. ***caerulea*** (L.) Gouan
(2), Varol 3718, T.
Anagallis foemina R.B.Mill.
(1), Varol 3415, Medit., T.
•***Cyclamen mirabile*** Hildebr.
(1)-(2), Varol 3539-3543, End., G, EN.
Lysimachia linum-stellatum L.
(1), Varol 3836, T.

RANUNCULACEAE

Nigella arvensis L. var. ***glauca*** Boiss.
(2), Varol 3511, T.
Ranunculus constantinopolitanus (DC.) d'Urv.
(1)-(2), Varol 3682-3716, G.
Ranunculus isthmicus Boiss. subsp. ***stepporum*** P.H.Davis
(2), Varol 3624, G.
Ranunculus rumelicus Griseb.
(1), Varol 3272, Medit., G.
Ranuncuus sprunerianus Boiss.
(1), Varol 3661, E.Medit., G.

RHAMNACEAE

Rhamnus oleoides L. subsp. ***graecus*** (Boiss. & Reut.) Holmb.
(1), Varol 3949, E. Medit., Ph.

RUBIACEAE

Crucianella imbricata Boiss.
(1)-(2), Varol 3270-3484, Medit., T.
Galium floribundum Sm. subsp. ***floribundum***
(1), Varol 3862, T.
Galium murale (L.) All.
(1), Varol 3349, Medit., T.
Galium spurium subsp. ***spurium***
(2), Varol 3480, Euro. Sib., T.
Sherardia arvensis L.
(1), Varol 3397, Medit., T.

SAXIFRAGACEAE

Saxifraga cymbalaria L. var. ***huetiana*** (Boiss.) Engl. & Irmsch.
(1)-(2), Varol 3619-3660, T.
•***Saxifraga graeca*** Boiss. & Heldr.
(1), Varol 3649b, T., VU
Saxifraga hederacea L. var. ***hederacea***
(1), Varol 3360, T.

SCROPHULARIACEAE

Linaria pelisseriana (L.) R.B.Mill.
(1)-(2), Varol 3421-3733, Medit., T.
Misopates orontium (L.) Raf.

(2), Varol 3467, T.
Parentucellia latifolia (L.) Caruel subsp. ***latifolia***
(1), Varol 3671, Medit., T.
Scrophularia pinardii Boiss.
(1), Varol 3295, E. Medit., H.
Verbascum luciliae (Boiss.) Kuntze
(2), Varol 3544, C, EN.
• ***Verbascum napifolium*** Boiss.
(1)-(2), Varol 3403-3495, End., E. Medit., C, LR(cd)
Veronica cymbalaria M.Bodard
(1), Varol 3649b, T.
Veronica donii Römmp
(1), Varol 3294, End., E. Medit., T, LR(cd)

VALERIANACEAE

Valeriana officinalis L.
(1)-(2), Varol 3694-3738, G.
Valerianella muricata (Stev.) Baxter
(1), Varol 3297, T.
Valerianella coronata (L.) DC.
(2), Varol 3713, T.

VERBENACEAE

Vitex agnus-castus L.
(2), Varol 3531, Medit., Ph.