The vascular flora of the Byzantine Walls of Thessaloniki (N Greece)

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Abstract

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An inventory of 263 taxa of vascular plants growing spontaneously on and around the Byzantine Walls of the city of Thessaloniki is presented, based on own collections and studies of the sites. The flora of the Walls is analysed with respect to the local distribution of the taxa as well as to the chorological and life form spectra. The results are discussed in comparison to other European and Mediterranean wall floras.

Introduction

Thessaloniki was founded by Cassander (the brother-in-law of Alexander the Great) in 316 or 315 BC. From the beginning and throughout its history, the city was a strategic port and a centre of political and commercial importance. Fortification walls were built right after its foundation and reconstructed several times, mainly during the Byzantine period (thus called today Byzantine Walls). The city was confined by the Walls until 1873, when a first major demolition took place, followed by a second in 1902 (Gounaris 1982, Velenis 1998). Nowadays, the Walls lie in the centre of the city (Fig. 1) and only half of their original length has remained. Because of their age, the construction of the masonry and the low human impact, the Walls, unlike modern buildings of the city, are covered by a well developed vegetation.

Walls, the most distinct man-made constructions, are an extreme environment for plant life in many respects, such as the availability of room for settlement, the hardness and alkalinity of the substratum, the scarcity of soil and humus, the inclination, the increased temperature and reduced humidity (Segal 1969). The flora of this peculiar habitat, suitable for only a limited number of taxa, is the subject of an increasing number of publications (e.g., Brandes 1987, 1988, 1992, 1996, Darlington 1981, Guggenheim 1992, Hruska 1987, Karschon & Weinstein 1985, Lisci & Pacini 1993, Lötschert 1984, Segal 1969, Weinstein & Karschon 1977, Werner & al. 1989, Woodell 1979, Woodell & Rossiter 1959). The present work, part of a wider research project on the urban and suburban flora of the city of Thessaloniki, presents a floristic inventory of the Byzantine Walls of Thessaloniki.

Fig. 1. The centre of Thessaloniki showing the location of the Byzantine Walls. The letters a-e indicate the different collection sites (scale 1: 20 800).

Investigated area

The Walls of Thessaloniki form a trapezium, with parallel east and west sides (Fig. 1). About 4 km of the Walls are extant today, with gaps where they have been demolished, mainly in their SW

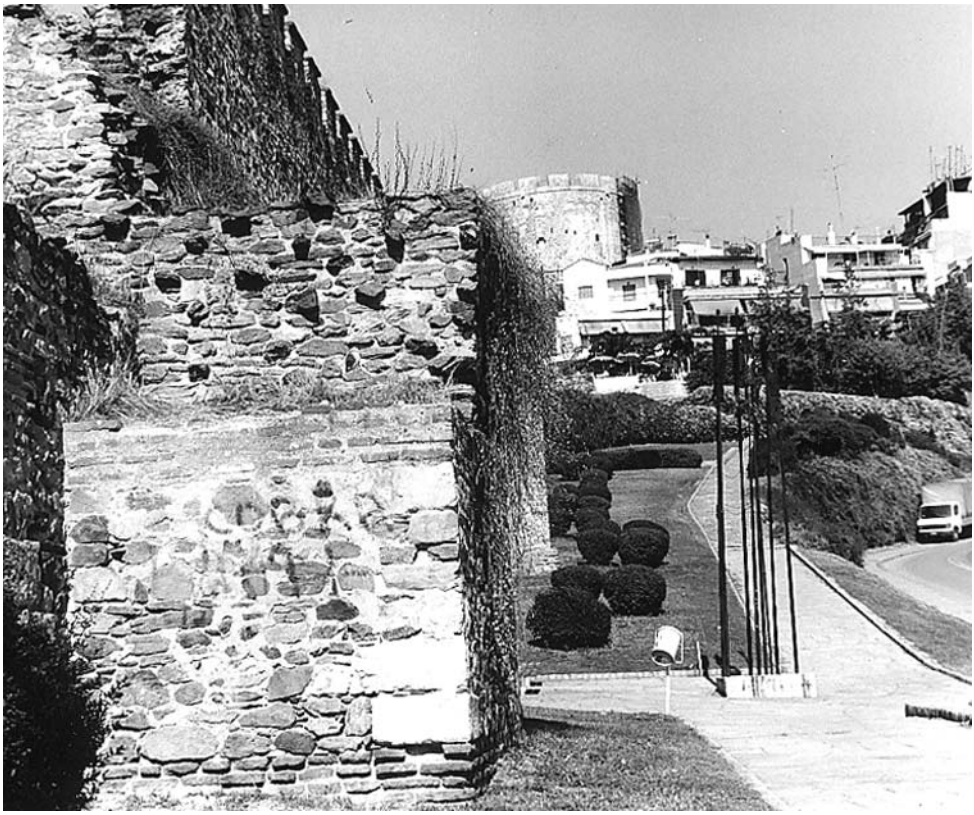

Fig. 2. The E part of the Byzantine Walls of Thessaloniki with *Capparis spinosa* subsp. *spinosa* growing on the side of the wall.

part. The greater intact part stands above Ag. Dimitriou Street. The height reaches up to 12 m, and the width ranges between 1.0 and 2.8 m. The style of the masonry varies according to the periods at which the different restorations were carried out. The greater part of the Walls, dating from the early Christian and the Byzantine periods, is constructed either of blocks of greenschist with interposed brick bands or of bricks decorated with rubble (Gounaris 1982). Mortar is mainly composed of lime and silicic materials in proportion of 1: 0.5-1: 2 (Papayanni pers. comm.). The Walls are surrounded by narrow open areas, up to 17 m from each side, which are either planted with a few species of ornamental trees and shrubs or are covered with spontaneous vegetation (Fig. 1-2).

According to Kotini-Zambaka (1983), the city of Thessaloniki belongs to the northern climatic zone of Greece, which is transitional between the Continental-Mediterranean and the Real Mediterranean climate. The Meteorological Station of Thessaloniki (40°03'N, 22°58'E) gives a mean annual temperature of 15.8 °C and a mean annual precipitation of 451.7 mm. The annual course of the mean monthly precipitation and temperature is shown in Fig. 3.

Material and methods

Only plants spontaneously growing in the studied area are included in the floristic catalogue. Families, genera and species are arranged alphabetically within the major units of classification, viz. *Gymnospermae, Dicotyledoneae* and *Monocotyledoneae*.

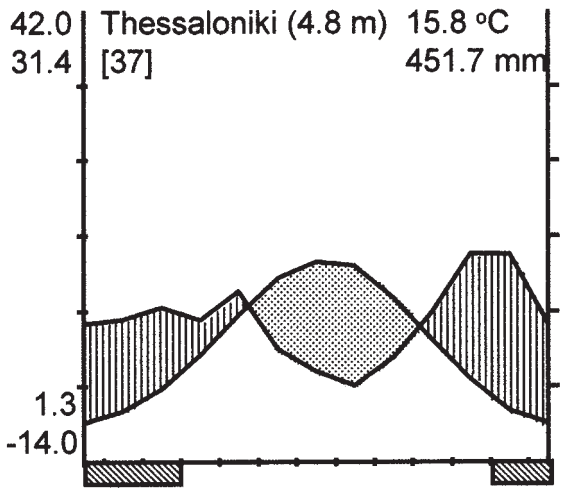

Fig. 3. Ombrothermic diagram of the meteorological station of Thessaloniki (after Walter & Lieth 1960).

The collection sites, shown in Fig. 1, are given for each taxon with the following abbreviations:

a: E part of the Walls and their surrounding area, which extends up to 4 m from each side.
b: N part and the surrounding area up to 13 m; this part of the Walls is called Eptapyrgion (Yedi Kule during the Ottoman period) because of its seven (= epta) towers (= pyrgoi).
c: W part, from Agiou Dimitriou Street northwards and the surrounding area up to 9 m.
d: W part, from Agiou Dimitriou Street southwards and the surrounding area up to 3 m.
e: SW part, including Top-Hané Tower (the fortress of Vardar), near the port of Thessaloniki, and its surrounding area up to 16.5 m.

The location of each taxon in each collection site is coded by numbers:

1: Top and sides of the Walls
2: Surrounding area

The collectors, collection numbers and collecting dates are abbreviated and summarised as follows:

E. Lagiou (= *L*): *101:* 10.2.1995; *102:* 5.5.1995; *103:* 9.5.1995; *105-217:* 4.7.1995; *218:* 9.7.1995; *219-259:* 4.8.1995; *260-277:* 5.8.1995; *278:* 9.8.1995; *280-299:* 3.9.1995; *303-354:* 9.9.1995; *355-388:* 8.10.1995; *389-397:* 9.10.1995; *398-408:* 3.11.1995; *452-512:* 2.12.1995; *514-525:* 3.1.1996; *527-561:* 10.2.1996; *562-617:* 9.3.1996; *619-610:* 10.3.1996; *638-719:* 7.4.1996; *720-731:* 23.4.1996; *733-762:* 2.5.1996; *766-862:* 5.5.1996; *864-883:* 20.5.1996; *884:* 21.5.1996; *885-889:* 23.5.1996; *890-981:* 3.6.1996; *983-985:* 4.7.1996; *986:* 9.7.1996; *988:* 27.7.1996; *989-1004:* 21.8.1996; *1005:* 2.9.1996; *1007:* 24.10.1996.

E. Lagiou & N. Krigas (= *L & K*): *409-413:* 5.11.1995; *417-447:* 9.11.1995.

N. Krigas (= *K*): *1826-1827:* 6.6.1996; *1839-1843:* 7.6.1996; *1856-1861:* 8.6.1996; *2352:* 21.6.1996; *2940-2942:* 3.10.1996; *2976-2987:* 13.11.1996; *3368-3406:* 23.5.1997; *3744-3792:* 23.6.1997; *4288-4335:* 20.7.1997.

N. Krigas & E. Hanlidou (= *K & H*): *3407-3442:* 22.5.1997.

E. Hanlidou & S. Kokkini (= *H & Ko*): *5271-5297:* 20.4.1997.

E. Hanlidou (= *H*): *5298-5326:* 1.5.1997; *5460-5484:* 1.7.1997.

obs. = observed but not collected.

Fig. 4. *Ailanthus altissima* grows abundantly on the Byzantine Walls of Thessaloniki.

Specimens are deposited in the Herbarium of the Institute of Systematic Botany and Phytogeography of the University of Thessaloniki (TAU).

Unless otherwise stated, taxonomy and nomenclature follows Flora Hellenica (Strid & Tan 1997) for the taxa therein included and Flora Europaea (Tutin & al. 1968-93). Information concerning the distribution and life form of the taxa is taken from the above literature and additionally from Pignatti (1982) and Davis (1965-85).

Results and discussion

Local distribution of the taxa

A total of 263 taxa were collected. Among them, 46 taxa were recorded only on the Walls, 109 both on the Walls and in their surrounding area, whereas 108 were found only in the latter area. Mostly because of the preservation works, only a few pure stands of *Capparis spinosa* (Fig. 2), *Ficus carica, Hyoscyamus albus, Mercurialis annua, Parietaria judaica* and *Ailanthus altissima* (Fig. 4) grow on the Walls' vertical sides, while the plateau of the top has a dense plant cover.

The most widespread taxa on the Walls of Thessaloniki and in their surroundings are: *Parietaria judaica, Bromus madritensis, Mercurialis annua, Capparis spinosa, Calendula arvensis, Diplotaxis tenuifolia, Verbascum undulatum, Convolvulus arvensis, Sisymbrium orientale, S. irio, Euphorbia prostrata, Setaria viridis, Malva sylvestris, Ficus carica, Urtica pilulifera, Salsola kali, Chenopodium murale, Tragopogon porrifolius* and *Papaver rhoeas.* In addition, a number of urbanophilous taxa, frequently encountered in urban areas (Brandes 1988, Kunick 1982, Wittig & al. 1985) and also found all over the city of Thessaloniki, are widespread on the Walls and their surroundings, viz. *Amaranthus retroflexus, Ballota nigra, Capsella bursa-pastoris, Chenopodium album, Conyza bonariensis, Galium aparine, Hordeum murinum, Lactuca serriola, Senecio vulgaris, Sonchus asper, S. oleraceus, Stellaria media, Tribulus terrestris,* etc.

Several of the taxa found on the Walls and not in their surroundings, such as *Allium paniculatum, Carlina corymbosa, Micromeria juliana, Muscari comosum, Potentilla laciniosa, Salsola kali, Scilla autumnalis, Thymus sibthorpii, Trifolium uniflorum and Trigonella monspeliaca, a*re very rare or not found in other parts of Thessaloniki (unpubl. data). Moreover, among the taxa found only on the Walls, there are inhabitants of rocky or stony places, the most similar 'natural' habitats, e.g. *Allium guttatum, Ephedra foeminea, Koeleria cristata, Lactuca viminea, Saxifraga tridactylites, Sedum album, S. sediforme, S. urvillei* and *Silene flavescens*. The frequent occurrence of 'rock plants' is a common feature of wall floras (Darlington 1981, Hruska 1987, Segal 1969, Woodell 1979). About the origin of the exclusively wall-dwelling taxa in the studied area, two assumptions appear plausible: (i) they are relics of an older vegetation covering the area in the past (both the Walls' age and the low human impact on their top support this assumption), or (ii) they invaded more recently from distant areas around Thessaloniki and established, finding a suitable and relatively undisturbed habitat.

The flora is not homogeneous throughout the area studied: only 26 taxa were found in all five collection sites. The majority of the taxa (207) was recorded in the northern part of the Walls (Eptapyrgio (site b), Fig. 1). Among them, 82 were located only there, e.g. *Achillea pannonica, Asphodelus fistulosus, Berteroa orbiculata, Carlina corymbosa, Centaurea diffusa, Herniaria incana, Holosteum umbellatum, Hypecoum pseudograndiflorum, Polycarpon tetraphyllum, Reseda lutea, Scolymus hispanicus, Silene exaltata, Thymus sibthorpii* and *Verbascum leucophyllum*. Eptapyrgio lies in the city perimeter and its floristic richness should be attributed to its vicinity to a large recreational pineforest (Seih-Sou, Fig. 1), which extents almost up to Mt Chortiatis, an area with a high variety of plant taxa (Karagiannakidou & Raus 1996).

Life form and chorological spectra

Therophytes are the most abundant life form both on the Walls and in their surrounding area (more than 50% of their flora), followed by hemicryptophytes (Tab. 1). The percentage of

Tab. 1. Life form spectra of the flora of the Byzantine Walls of Thessaloniki and their surrounding area.

Life form (%)	The Walls	Surrounding area	Total area
Therophytes	52.9	50.2	47.5
Hemicryptophytes	25.8	33.2	33.0
Chamaephytes	6.5	1.4	3.8
Geophytes	3.9	5.5	5.7
Nanophanerophytes	1.3	–	0.8
Phanerophytes	9.7	9.7	9.1

Tab. 2. Chorological spectra of the flora of the Byzantine Walls of Thessaloniki and their surrounding area.

Chorological elements (%)	The Walls	Surrounding area	Total area
(Sub-)Balkan	3.3	3.7	4.6
Mediterranean	36.2	27.0	30.1
European / European-Caucasic	4.0	3.3	3.5
Eurasiatic / Paleotemperate	27.0	26.5	25.0
(Sub-)Cosmopolitan / Circumboreal	15.1	19.5	17.7
Cultivation escapes	7.9	7.4	7.7
Xenophytes	6.6	12.6	10.8

chamaephytes is higher on the Walls than in the surrounding area, whereas that of hemicryptophytes and geophytes is lower (Tab. 1). The phanerophytes are well represented in the studied area (c. 9% of the total flora). However, among the different species of trees and shrubs, only *Ailanthus altissima* (Fig. 4), *Ficus carica* and *Robinia pseudacacia* have a widespread occurrence. Our results support previous findings for the predominant occurrence of therophytes in the Mediterranean wall floras. Towards N Europe, instead of therophytes, hemicryptophytes prevail (Hruska 1987, Karschon & Weinstein 1985, Segal 1969, Weinstein & Karschon 1977, Woodell & Rossiter 1959).

Of the total of 263 taxa found in the studied area 21 are escapes from cultivation. These are mostly ornamentals grown in the area of Thessaloniki such as *Campsis radicans, Hedera helix, Ipomoea indica, Koerleuteria paniculata, Nerium oleander, Parthenocissus inserta* and *Vitis vinifera*. Further 28 taxa are xenophytes, which are successfully established, as is frequently observed in urban areas (Rebele 1994). The majority of them has an American (e.g. *Amaranthus spp., Aster squamatus, Chenopodium multifidum, Conyza albida, C. bonariensis, Datura stramonium, Euphorbia prostrata, Opuntia ficus-indica, Oxalis corymbosa, Paspalum paspalodes, Robinia pseudoacacia, Solanum elaeagnifolium* and *Sporobolus indicus*) or Asiatic origin (e.g. *Ailanthus altissima, Broussonetia papyrifera* and *Fallopia aubertii*). The escapes from cultivation are almost equally represented on the Walls and in their surroundings, whereas the xenophytes are much better represented in the surroundings (Tab. 2). The most abundantly growing xenophyte on the Walls, frequently damaging them, is *Ailanthus altissima*. Photographic evidence from the beginning of this century suggests that it has been introduced in Thessaloniki and planted for ornament at least since that period (Fig. 5).

With respect to the different chorological groups, the Mediterranean taxa prevail both on the Walls and in their surroundings, followed by the widespread Eurasiatic/Paleotemperate and (sub-)Cosmopolitan/Circumboreal taxa (Tab. 2). A relatively higher percentage of Mediterranean taxa and a lower percentage of Cosmopolitan/Circumboreal taxa were recorded on the Walls. The

Fig. 5. The NE side of the Walls in 1913, when *Ailanthus altissima* was planted for ornament. – Photograph by Fred Boissonnas, courtesy of the Folklife and Ethnological Museum of Macedonia, Thessaloniki.

(sub-)Balkan element is represented only by 12 taxa, 5 of them occurring on the Walls, i.e. *Sedum urvillei, Thymus sibthorpii, Verbascum leucophyllum, V. undulatum* and *Silene flavescens* subsp. *thessalonica.* The last taxon, originally described as *S. thessalonica* Boiss. & Heldr. because of the proximity of its locus classicus to the city ("In rupibus montis Korthiati pr. Thessalonicam alt. 1500' leg. Heldreich), is mainly found in NE Greece and extends to F.Y.R. Makedonija and Bulgaria just beyond the Greek borders (Greuter 1997).

Comparison with other wall floras

A comparison between the flora of the Byzantine Walls of Thessaloniki and other European and Mediterranean wall floras (Bergmeier 1990, Brandes 1987, 1992, 1995, 1996, Guggenheim 1992, Hruska 1987, Karschon & Weinstein 1985, Lisci & Pacini 1993, Lötschert 1984, Segal 1969, Weinstein & Karschon 1977, Werner & al. 1989, Woodel & Rossiter 1959) reveals both similarities and differences. The similarities are exemplified by the presence of typical wall-dwelling taxa, which are found

(i) all over Europe and often in the Mediterranean area, such as *Antirrhinum majus, Diplotaxis tenuifolia, Convolvulus arvensis, Parietaria judaica, Sonchus asper, S. oleraceus, Sedum album* and *Saxifraga tridactylites.*

(ii) mainly in the Mediterranean area, such as *Bromus madritensis, Calendula arvensis, Capparis spinosa, Chrysanthemum coronarium, Conyza bonariensis, Ephedra foeminea, Ficus carica, Hyoscyamus albus, Lactuca viminea, Malva parviflora, Mercurialis annua, Sisymbrium irio, Sonchus tenerrimus, Veronica cymbalaria* and *Urtica pilulifera.*

The main differences concern

(i) the absence of pteridophytes, which are frequently found in other wall floras of Europe (e.g. *Asplenium ruta-muraria*) and the Mediterranean area (e.g. *Anogramma leptophylla*) or in both of them (e.g. *Ceterach officinarum*),

(ii) the restricted occurrence of some typical wall-dwellers both in Europe and the Mediterranean area, such as *Cymbalaria muralis* and *Erysimum cheiri,* and

(iii) the dominant occurrence, not recorded elsewhere, of a number of taxa, such as the Balkan *Verbascum undulatum* and the Mediterranean *Allium guttatum, Asphodelus fistulosus, Clypeola jonthlaspi, Peganum harmala, Salsola kali* and *Sisymbrium orientale*. However, it should be noted that only a few E Mediterranean walls have been studied. Further information may reveal that these taxa have a wider occurrence in the wall floras of the Mediterranean area.

Floristic catalogue

GYMNOSPERMAE

Ephedraceae

Ephedra foeminea Forssk. – *L 480*: a1, *L 552*: b1, *L 198*: c1.

DICOTYLEDONEAE

Amaranthaceae

Amaranthus albus L. – *K 4315*: b2, *L & K 409*: d2.
A. blitoides S. Watson – *L 355*: d2.
A. deflexus L. – *L 914* : a2, *K 3784*: b2, *L 263*: c2, *L 224*: d2, *H 5469*: e2.
A. hybridus L. – *L 383*: c1, *K 2980*: d2.
A. muricatus (Moq.) Hieron. – *L 264*: c2, *K 4296*: b2. – This naturalised xenophyte is known to occur in Greece only on the two Central Aegean islands of Siros and Tinos (Raus 1997).
A. retroflexus L. – *L 465*: a1, *L 306*: b1, *L 139*: b2, *L & K 430*: c1, *L 265*: c2, *L 356*: d2.
A. viridis L. – *L 466*: a2, *K 4295*: b2, *L 384*: c2.

Apocynaceae

Nerium oleander L. – *K 3385*: b1.

Araliaceae

Hedera helix L. – b2, e1, e2 (obs.).

Bignoniaceae

Campsis radicans Seem. – *K 4301*: b2, *H 5322*: e2; e1, b1 (obs.).

Boraginaceae
Alkanna tinctoria L. – *L 652*: a1, *L 182*: c1.
Asperugo procumbens L. – *L 690*: b2.
Buglossoides arvensis (L.) I. M. Johnst. subsp. *arvensis* – *L 692*: b1, *L 691*: b2
Echium italicum L. – b2 (obs.).
Heliotropium europaeum L. – *K 1827*: a2, *K 3781*: b2, *L 330*: c1, *L 105*: d1, *L 106*: d2.
H. suaveolens M. Bieb. subsp. *suaveolens* – *L 307*: b1.
Myosotis ramosissima Rochel subsp. *ramosissima* – *L 653*: a1.

Cactaceae
Opuntia ficus-indica (L.) Mill. – *L 107*: d1.

Capparaceae
Capparis spinosa L. subsp. *spinosa* – *L 304*: a1, *L 143*: b1, *L 186*: c1, *L 108*: d1; e1 (obs.).

Caprifoliaceae
Lonicera etrusca Santi – b2, e1, e2 (obs.).

Caryophyllaceae
Arenaria serpyllifolia L. – *L 798*: b1, *K & H* 3425: b2, *L 755*: c2, *L 767*: d1, *L 109*: d2, *H & Ko 5287*: e1.
Cerastium glomeratum Thuill. – *L 668*: a1.
Herniaria cinerea DC. – *K 4322*: b1, *H & Ko 5288*: e1.
H. hirsuta L. – *K* 3777: b2.
H. incana Lam. – *L 698*: b1.
Holosteum umbellatum L. – *L 699*: b1.
Polycarpon tetraphyllum (L.) L. – *K 4289*: b1.
Silene exaltata Friv. – *K 3775*: b2.
S. flavescens subsp. *thessalonica* (Boiss. & Heldr.) Nyman – *K 839*: a1, *K & H 3411*: b1, *L 187*: c1.
Stellaria media (L.) Vill. – *L 620*: b1, *L 527*: d2; e2 (obs.).
S. pallida (Dumort.) Piré – *L 593*: a1, *L 594*: a2, *L 500*: b1, *L 501*: b2, *L 450*: d2.

Chenopodiaceae
Atriplex rosea L. – *L 365*: b1, *L* 390: b2.
A. tatarica L. – *L 309*: b1, *L 366*: b2.
Chenopodium album L. – *L 471*: a2, *L 367*: b1, *L 145*: b2, *L 266*: c2, *L 221*: d2.
Ch. ambrosioides L. – *K 4314*: b1, *K 2983*: d2.
Ch. multifidum L. – *K 3773*: b2, *H 5478*: e2.
Ch. murale L. – *L 472*: a2, *L 261*: b1, *L 502*: b2, *L 334*: c2, *L 110*: d2.
Ch. opulifolium W. D. J. Koch & Ziz – *L 103*: b1, *L 391*: b2, *L 111*: d1, *L 231*: d2.
Ch. vulvaria L. – a2, b2, d2 (obs.).
Salsola kali L. – *L 473*: a1, *L 544*: b1, *L 146*: b2, *L 398*: c1, *K 2979*: d1, *L 1005*: d2.

Compositae
Achillea pannonica Scheele – *K 1856*: b2.
Anthemis altissima L. – *L 919*: al.
A. arvensis subsp. *incrassata* (Loisel.) Nyman – *L 669*: a1, *L 670*: a2, *L 188*: c1.
Artemisia campestris L. subsp. *campestris* – *K 3369*: b1, b2 (obs.).
Aster squamatus (Spreng.) Hieron. – *L 520*: a1, *K 2978*: a2, *L 514*: d1, *L 528*: d2.
Bellis perennis L. – *H & Ko 5281*: e2.
Calendula arvensis L. – *L 595*: a1, *L 596*: a2, *K 3374*: b1, *K & H 3432*: b2, *L 529*: d1, *L 530*: d2, e1, e2 (obs.).
C. officinalis L. – *K & H 3435*: b2.
Carduus macrocephalus Desf. subsp. *macrocephalus* – *K & H 3424*: b1, *H 5301*: e1.
C. cf. *nutans* L. – *L 953*: b2, *L 770*: d1.

C. pycnocephalus subsp. *albidus* (M. Bieb.) Kazmi – *K & H 3407*: b1, *L 802*: b2, *L 864*: d1, *H 5312*: e2.
C. thoermeri Weinm. – *K 4309*: b1.
Carlina corymbosa L. subsp. *corymbosa* – *K 4292*: b1.
Centaurea diffusa Lam. – *K 3762*: b2.
Chamomilla recutita (L.) Rauschert – *L 982*: a1, *K 3382*: b1, *K & H 3412*: b2, *L 865*: d1, *L 768*: d2.
Chondrilla juncea L. – *L 112*: d1, *H 5483*: e1; d2, e2 (obs.).
Chrysanthemum coronarium L. – *L 866*: d1, *L 720*: d2.
Cichorium intybus L. – *L 218*: c2, *H 5479*: e2.
Conyza albida Spreng. – *K 3787*: b2, *L 335*: c2, *L 515*: d2.
C. bonariensis (L.) Cronq. – *L 474*: a2, *L 311*: b1, *K 4312*: b2, *L 189*: c2, *L 531*: d2, *H 5304*: e1, *H 5474*: e2.
Crepis foetida subsp. *rhoeadifolia* (M. Bieb.) Čelak. – *L 671*: a1, *L 921*: a2, *K 4308*: b2, *L 190*: c1, *L 455*: d1, *L 735*: d2, *H & Ko 5293*: e1.
C. setosa Hall. fil. – *L 867*: d1.
C. versicaria subsp. *haenseleri* (Boiss. ex DC.) P. C. Sell – *H 5313*: e2.
Lactuca serriola L. – *L 149*: b2, *L 234*: d1, *H 5480*: e1.
L. viminea (L.) J. & C. Presl subsp. *viminea* – *L 336*: c1, *L 235*: d1; a1 (obs.).
Matricaria perforata Mérat – *L 150*: b2, *L 721*: d2, *H & Ko 5275*: e2.
Scolymus hispanicus L. – b2 (obs.).
Senecio vulgaris L. – *L 597*: a1, *L 598*: a2, *L 548*: b1, *L 563*: b2, *L 560*: c2, *L 532*: d1, *L 533*: d2; e1, e2 (obs.).
Silybum marianum (L.) Gaertn. – *H 5299*: e1.
Sonchus asper (L.) Hill subsp. *asper* – *L 922*: a2, *K 4319*: b2, *L 191*: c1, *L 192*: c2, *L 116*: d1.
S. asper subsp. *glaucescens* (Jordan) Ball – *L 986*: a1, *L 312*: b1, *K & H 3426*: b2, *L 278*: c1, *L 193*: c2, *L 236*: d1.
S. oleraceus L. – *L 152*: b1, *L 151*: b2, *L 237*: d1, *K 2986*: d2, *H 5476*: e2.
S. tenerrimus L. – *L 808*: b1, *L 738*: d1, *H & Ko 5296*: e1.
Taraxacum aleppicum Dahlst. – *L 475*: a1, *L 476*: a2, *L 313*: b1, *L 624*: b2.
T. erythrospermum aggr. – *L 809*: b1, *L 504*: b2, *L 642*: d2.
T. hellenicum Dahlst. – *L 810*: b1, *L 643*: d1.
Tragopogon porrifolius subsp. *australis* (Jordan) Nyman – *L 672*: a1, *L 811*: b1, *L 812*: b2, *L 773*: d1, *H 5305*: e1.
Urospermum picroides (L.) F. W. Schmidt – *K 3387*: b1, *L 774*: d1, *L 739*: d2.

Convolvulaceae
*Convolvulus althaeoide*s subsp. *tenuissimus* (Sibth. & Sm.) Stace – *L 599*: a2, *L 549*: b2, *L 194*: c2, *H 5471*: e2.
C. arvensis L. – *L 478*: a2, *L 314*: b2, *L 195*: c2, *L 357*: d2, *H 5470*: e2.
Cuscuta campestris Yunck. – *K 4316*: b2.
Ipomoea indica Merrill – *K 2976*: d2.

Crassulaceae
Sedum album L. – *L 925*: a1, *L 196*: c1, *L 117*: d1.
S. sediforme (Jacq.) Pau – *L 926*: a1, *L 197*: c1, *L 300*: d1.
S. urvillei DC. – *L 136*: a1, *L 153*: b1, *L 197*: c1.

Cruciferae
Berteroa orbiculata DC. – *L 791*: b2
B. obliqua (Sm.) DC. – *K 3405*: b1, *L 947*: b2
Brassica oleracea subsp. *robertiana* (Gay) Bonnier & Layens – *K & H 3439*: b2.
Capsella bursa-pastoris (L.) Medik. subsp. *bursa-pastoris* – *L 586*: a2, *L 792*: b2, *L 631*: d2; c2, e2 (obs.).

Cardaria draba (L.) Desv. subsp. *draba* – *L 793*: b1, b2 (obs.).
Clypeola jonthlaspi L. – *L 588*: a1, *L 587*: a2, *K 3375*: b1, *L 541*: b2, *L 571*: d1.
Diplotaxis tenuifolia (L.) DC. – *L 468*: a1, *L 467*: a2, *L 142*: b1, *L 985*: b2, *L 331*: c1, *L 227*: d1, *H 5302*: e1.
Erophila verna subsp. *praecox* (Steven) Walters – *L 590*: a1, *L 589*: a2, *L 695*: b1, *L 572*: d1.
Erysimum cheiri (L.) Grantz – *L 1011*: c1.
Lepidium graminifolium L. subsp. *graminifolium* – *K 4333*: b2.
L. latifolium L. – *K & H 3422*: b2.
Sisymbrium irio L. – *L 655*: a2, *K 3378*: b1, *K 4323*: b2, *L 753*: c1, *L 752*: c2, *L 634*: d1, *L 228*: d2.
S. orientale L. – *L 666*: a1, *L 667*: a2, *K 3406*: b1, *K & H 3430*: b2, *L 184*: c1, *L 185*: c2, *L 637*: d1, *L 513*: d2, *H & Ko 5297*: e1, *H & Ko* 5278: e2.

Cucurbitaceae
Ecbalium elaterium (L.) A. Rich. – *L 479*: a2, *L 315*: b2, *L & K 436*: c2; e1, e2 (obs.).

Euphorbiaceae
Euphorbia exigua L. – *L 675*: a1, a2 (obs.).
E. helioscopia L. – a2, b2, cd, d2, e2 (obs.).
E. prostrata Aiton – *L 1012*: a2, *L 580*: b2, *L 303*: c2, *L 452*: d2, *H 5482*: e1; e2 (obs.).
Mercurialis annua L. – *L 601*: a1, *L 600*: a2, *L 505*: b1, *L 561*: c1, *L 456*: d1, *L 457*: d2; b2, c2, e1, e2 (obs.).
Ricinus communis L. – *K 2975*: b2.

Geraniaceae
Erodium ciconium (L.) L'Hér. – *L 816*: b1, *K 3368*: b2, *L 646*: d2, *H & Ko 5295*: e1, *H & Ko 5279*: e2.
E. cicutarium (L.) L'Hér. subsp. *cicutarium* – *L 676*: a1, *L 861*: c1, *L 647*: d1; a2, b2, c2 (obs.).
E. moschatum (L.) L'Hér. – *L 602*: a1, *L 703*: b2.
Geranium molle L. – *L 677*: a1, *L 482*: a2, *L 958*: b1, *L 553*: b2, *L 862*: c2, *L 579*: d2; e2 (obs.).
G. rotundifolium L. – *L 705*: b1, *L 626*: b2, *L 730*: c2, *H & Ko 5291*: e1, *H & Ko 5282*: e2.

Guttiferae
Hypericum perforatum L. – b2 (obs.).

Hydranginaceae
Philadelphus coronarius L. – *K & H 3437*: b2.

Labiatae
Ballota nigra subsp. *foetida* Hayek – *L 931*: a2, *L 317*: b1, *L 158*: b2, *L 120*: d2, *H 5317*: e2; c2 (obs.).
Lamium amplexicaule L. subsp. *amplexicaule* – *L 604*: a2, *L 707*: b1, *L 554*: b2, *L 582*: d2; c2, e2 (obs.).
Marrubium peregrinum L. – *K 4293*: b1, *K & H 3431*: b2.
Mentha longifolia subsp. *petiolata* (Boiss.) Kokkini – *H 5468*: e2. – Taxonomy according to Kokkini (1983: 82).
M. spicata L. – *K 4327*: b2.
M. ×*villoso-nervata* Opiz – *L 884*: d2.
Micromeria juliana (L.) Reichenb. – *L 305*: a1, *K & H 3410*: b1, *L 202*: c1.
Salvia verbenaca L. – *L 932*: a2, *L & K* 443: c2.
Thymus sibthorpii Benth. – *L 1007*: a1, *L 374*: b1.

Leguminosae
Gleditsia triacanthos L. – b2 (obs.).
Hippocrepis unisiliquosa L. – *L 524*: a2.
Lotus corniculatus L. – *L 159*: b2, *L 121*: d2, *H 5310*: e2.
Medicago arabica (L.) Huds. – *H & Ko 5280*: e2.

M. coronata (L.) Bartal. – *L 682*: a2, *L 827*: b1, *L 28*: b2, *L 981*: c1.
M. lupulina L. – *L 486*: a2, *L 829*: b1, *L 996*: b2, *L & K 444*: c2, *L 122*: d2.
M. minima (L.) Bartal. – *L 683*: a1, *L 607*: a2, *K 3373*: b1, *L 710*: b2, *L 757*: c2, *L 723*: d1, *L 782*: d2, *H 5309*: e2.
M. orbicularis (L.) Bartal. – b2 (obs.).
M. sativa L. subsp. *sativa* – *L 988*: a2, *K 3752*: b2, *L 361*: d2.
Melilotus alba Medik. – *K 4330*: b2.
M. indica (L.) All. – *L 879*: a2, K 3379: b1, *L 871*: d1; e2 (obs.).
M. officinalis (L.) Pallas – *K 3778*: b2.
Robinia pseudacacia L. – *L 160*: b1, *L 161*: b2; e2 (obs.).
Trifolium fragiferum L. – *K 4304*: b2.
T. repens L. subsp. *repens* – *L 935*: a2, *K 3744*: b2, *L 204*: c2, *L 242*: d2, *H & Ko 5272*: e2.
T. resupinatum L. – *L 608*: a1, *L 936*: a2, *L 567*: b1, *L 831*: b2, *L 758*: c2, *L 534*: d1.
T. uniflorum L. – *L 608*: a1, *L 567*: b1, *L 534*: d1
Trigonella monspeliaca L. – *K 4290*: b1, *L 783*: d1, *H & Ko* 5286: e1.
Vicia sativa subsp. *nigra* (L.) Ehrh. – *L 968*: b2.
V. villosa Roth subsp. *villosa* – *K 3791*: b2.

Malvaceae
Malva moschata L. – *L 163*: b1, *K 3766*: b2, *L 206*: c1, *L 124*: d2.
M. parviflora L. – *L 207*: c2, *L 243*: d1.
M. sylvestris L. – *L 687*: a1, *L 488*: a2, *L 319*: b1, *K 3792*: b2, *L 731*: c1, *L 346*: c2, *L 125*: d1, *K 2987*: d2, *H & Ko 5274*: e1, *H & Ko 5294*: e2.

Moraceae
Broussonetia papyrifera (L.) Vent. – *K & H 3434*: b2, *L 208*: c2, *L 126*: d2.
Ficus carica L. – *L 165*: b1, *L 970*:b2; a1, d1, c1, e1 (obs.).
Morus alba L. – *K 3419*: b2.

Oleaceae
Olea europaea L. – *L 938*: a2.

Orobanchaceae
Orobanche ramosa subsp. *mutelii* (F. W. Schultz) Cout. – *L 784*: d1.

Oxalidaceae
Oxalis corniculata L. – *K 4321*: b2.
O. corymbosa DC. – *L 489*: a2, *K & H 3417*: b2, *L 209*: c2, *L 101*: d2, *H 5467*: e2.

Papaveraceae
Fumaria officinalis L. – *L 839*: b1, *L 713*: b2, *L 724*: d2.
Hypecoum imberbe Sm. – *L 841*: b1, *L 840*: b2.
H. pseudograndiflorum Petrovič – *L 714*: b2.
Papaver apulum Ten. – *L 842*: b2, *L 744*: d2.
P. rhoeas L. – *L 939*: a2, *K 3386*: b1, *K & H 3423*: b2, *L 886*: d1, *L 725*: d2, *H & Ko 5273*: e1.

Plantaginaceae
Plantago afra L. – *K 4320*: b2.
P. bellardii All. subsp. *bellardii* – *K 4305*: b2.
P. coronopus L. subsp. *coronopus* – *H 5311*: e2.
P. lagopus L. – *L 688*: a2, *K 3372*: b1, *K & H 3427*: b2.
P. lanceolata L. – *L 972*: b1, *L 999*: b2; e2 (obs.).
P. major subsp. *intermedia* (DC.) Arcang. – *K 3763*: b2, *H 5477*: e2.
P. major L. subsp. *major* – *K 4329*: b2, *L 348*: c2.

Polygonaceae
Fallopia aubertii (L. Henry) Holub – *L 525*: a2; b2 (obs.).
Polygonum arenastrum Boreau – *K 3788*: b2, *L & K 447*: c2.
P. aviculare L. subsp. *aviculare* – *L 612*: a2, *L 558*: b2, *L 210*: c2, *L & K 420*: d2, *H 5473*: e2.
P. aviculare subsp. *neglectum* (Besser) Arcang. – *L 491*: a2, *L 397*: b2.
Rumex conglomeratus Murray – *K & H 3442*: b2.
R. cristatus DC. – *L 873*: d2, *H 5318*: e2.
R. pulcher subsp. *raulinii* (Boiss.) Rech. fil. – *L 942*: a2, *K & H 3416*: b2, *H 5319*: e2.
R. pulcher subsp. *woodsii* (De Not.) Arcang. – *K 3765*: b2.

Portulacaceae
Portulaca oleracea L. – *L 168*: b2, *L 349*: c2, *L 248*: d1, *L 129*: d2.

Primulaceae
Anagallis arvensis L. – *L 880*: a2.

Punicaceae
Punica granatum L. – *K 3384*: b1; b2 (obs.).

Ranunculaceae
Consolida ajacis (L.) Schur – *K 3755*: b2.
C. regalis subsp. *paniculata* (Host) Soó – *K 4331*: b2.
Ranunculus arvensis L. – *K & H 3433*: b2.

Resedaceae
Reseda lutea L. – *L 846*: b1, *L169*: b2.

Rhamnaceae
Paliurus spina-christi Mill. – *L 250*: d2.

Rosaceae
Potentilla laciniosa Nestler – *L 170*: b1. – Taxonomy according to Strid (1986: 405).
P. reptans L. – *H 5308*: e2.
Prunus dulcis (Mill.) D.A. Webb – *L 377*: b1, *L 171*: b2.
Sanguisorba minor subsp. *muricata* Briq. – *K & H 3436*: b2.

Rubiaceae
Galium aparine L. – *L 538*: a1, *L 539*: a2, *L 569*: b1, *L 716*: b2, *L 460*: d1, *L 536*: d2.
G. spurium L. – *H & Ko 5284*: e1.

Salicaceae
Populus alba L. – *K & H 3418*: b2.

Sapindaceae
Koelreuteria paniculata Laxm. – *L 322*: b1, *H 5303*: e1; e2 (obs.) .

Saxifragaceae
Saxifraga tridactylites L. – *L 689*: a1.

Scrophulariaceae
Antirrhinum majus L. – *L 761*: c1, *L 727*: d1.
Cymbalaria muralis P. Gaertn. & al. – *K & H 3413*: b1.
Verbascum leucophyllum Griseb. – *K 4294*: b1.
V. sinuatum L. – *K 3761*: b2.
V. undulatum Lam. – *K 2942*: a1, *K & H 3408*: b1, *L 974*: b2, *L 211*: c1, *L 130*: d1, *L 748*: d2.

Veronica anagallis-aquatica L. – *K 3756*: b2.
V. arvensis L. – *L 975*: b1, *L 850*: b2.
V. cymbalaria Bodard – *L 615*: a2, *L 851*: b1.
V. persica Poir. – *L 717*: b2, *H & Ko 5283*: e2.
V. polita Fr. – *L 616*: a2, *L 853*: b1, *L 718*: b2.

Simaroubaceae
Ailanthus altissima (Mill.) Swingle – *L 173*: b2, *L 212*: c2, *L 102*: d1, *L 132*: d2; a1, e1, e2 (obs.).

Solanaceae
Datura stramonium L. – *K 2977*: d2.
Hyoscyamus albus L. – *L 881*: a1, *L 540*: a2, *L 174*: b1, *L 570*: b2, *L 213*: c1, *L 214*: c2, *L 253*: d1, *L 254*: d2; e1 (obs).
Solanum elaeagnifolium Cav. – *L & K 426*: a2, *L 175*: b2, *L 215*: c2, *L 292*: d2; e1, e2 (obs.).
S. nigrum subsp. *schultesii* (Opiz) Wessely – *L 378*: b2.

Ulmaceae
Celtis australis L. subsp. *australis* – *K 3401*: b1.
Ulmus minor subsp. *canescens* (Mellville) Browicz & Zielinski – *L 176*: b1.

Umbelliferae
Anthriscus caucalis M. Bieb. – *L 855*: b1, *L 856*: b2, *L 762*: c2, *L 876*: d1, *L 887*: d2.
Apium graveolens L. – *K 3758*: b2.
Daucus carota subsp. *major* (Vis.) Arcang. – *K 4297*: b2.
Eryngium campestre L. – *K 3760*: b2.
Foeniculum vulgare Mill. – *L 133*: d2.
Petroselinum crispum (Mill.) A. W. Hill – *H 5320*: e2.
Torilis arvensis subsp. *neglecta* (Schult.) Thell. – *L 177*: b2.
T. nodosa (L.) Gaertn. – *K 1826*: a2, *K 3377*: b1, *K & H 3428*: b2; e2 (obs.).

Urticaceae
Parietaria judaica L. – *L 494*: a1, *L 493*: a2, *K 3786*: b1, *L 178*: b2, *L 216*: c1, *L 217*: c2, *L 255*: d1, *L 585*: d2; e1, e2 (obs.).
Urtica pilulifera L. – *L 945*: a1, *L 859*: b1, *L 719*: b2, *L 352*: c2, *K 2981*: d2; e2 (obs.).
U. urens L. – *L 751*: d2; e1, e2 (obs.).

Verbenaceae
Verbena officinalis L. – *K 3767*: b2.

Vitaceae
Parthenocissus inserta (D. Kerner) Fritsch – *H 5300*: e1; e2 (obs.).
Vitis vinifera L. subsp. *vinifera* – *L 882*: a1, *L 294*: d2.

Zygophyllaceae
Peganum harmala L. – *K 3383*: b1, *K 4332*: b2; a1 (obs.).
Tribulus terrestris L. – *L 137*: a1, *L 138*: a2, *L 380*: b1, *L 381*: b2, *L 353*: c1, *L 354*: c2, *L 134*: d1, *L 135*: d2; e1, e2 (obs.).

MONOCOTYLEDONEAE

Cyperaceae
Cyperus longus L. – *L 994*: b2, *H 5465*: e2.
Scirpus holoschoenus L. – *H 5321*: e2.

Commelinaceae
Trandescantia virginiana L. – *K 3759*: b2.

Gramineae
Agrostis cf. *castellana* Boiss. & Reut. – *K 2984*: d2, *H 5466*: e2.
Arundo donax L. – *K 2974*: b2.
Avena barbata Link – *L 929*: a1, *L 271*: c1, *L 776*: d1, a2, c2, d2 (obs.).
A. sterilis L. subsp. *sterilis* – *L 155*: b2.
Bromus diandrus Roth – *L 819*: b2, *K 3748*: b2.
B. hordaceus L. subsp. *hordaceus* – *L 820*: b1.
B. madritensis L. – *L 522*: a2, *L 821*: b1, *L 756*: c1, *L 777*: d1, *H & Ko 5292*: e1, *H & Ko 5276*: e2.
B. sterilis L. subsp. *sterilis* – *K & H 3438*: b2, *L 740*: d2.
B. tectorum L. – *L 648*: d1; d2 (obs.).
Cynodon dactylon (L.) Pers. – *K 1858*: b2, *L 516*: d2, *H 5472*: e2.
Dactylis glomerata L. – *K 3370*: b1, b2 (obs.).
Dasypyrum villosum (L.) P. Candargy – *K 3770*: b2.
Digitaria sanguinalis (L.) Scop. – *L 316*: b1, *K 4300*: b2, *L 222*: d2.
Eleusine indica (L.) Gaertn. – *L 483*: a2, *K 4310*: b2, *L 272*: c2, *L 359*: d2, *H 5462*: e2.
Hordeum murinum subsp. *leporinum* (Link) Arcang. – *L 156*: b1, *K & H 3440*: b2, *L 883*: c1, *L 741*: d1, *L 779*: d2, *H & Ko 5277*: e2.
H. vulgare L. – *L 890*: d1.
Koeleria cristata (L.) Pers. – *L 930*: a1, *K 3371*: b1. – Taxonomy according to Dogan (1985: 332).
Lolium perenne L. – *L 960*: b1, *K 1861*: b2, *L 118*: d2, *H 5484*: e2.
Lophochloa cristata (L.) Hyl. – *K & H 3429*: b2, *L 742*: d2, *H & Ko 5285*: e1, *H 5306*: e2.
Melica ciliata L. subsp. *ciliata* – *K 3380*: b1, *K 3768*: b2, *L 342*: c1, *H 5326*: e1, *H 5315*: e2; a1 (obs.).
Paspalum paspalodes (Michaux) Scribn. – *L 371*: b2.
Phalaris canariensis L. – *K 3749*: b2.
Poa annua L. – *K 3757*: b2, *L 517*: d2, *H & Ko 5284*: e2.
P. bulbosa L. – *L 823*: b1; b2 (obs.).
Setaria glauca (L.) P. Beauv. – *L 394*: b2. – Taxonomy according to Scholz (1985: 600)
S. verticillata (L.) P. Beauv. – *L 372*: b1, *L 273*: c2, *L 119*: d2.
S. viridis (L.) P. Beauv. – *L 484*: a2, *K 4302*: b2, *L 343*: c1, *L 344*: c2, *L 285*: d1, *L 238*: d2, *H 5463*: e2.
Sorghum halepense (L.) Pers. – *L 962*: b1, *K 3789*: b2.
Sporobolus indicus (L.) R. Br. – *K 2352*: a2, *L 200*: c2, *H 5461*: e2.
Stipa capensis Thunb. – *L 201*: c1, *L 239*: d1, *L & K 413*: d2, *H & Ko 5290*: e2.
Triticum durum Desf. – *K 1843*: a1, *L 903*: d2.
T. turgidum L. – *K 1842*: a1.

Liliaceae
Allium guttatum subsp. *sardoum* (Moris) Stearn – *K & H 3409*: b1, *L 205*: c1, *L 123*: d1.
A. paniculatum L. subsp. *paniculatum* – *L 937*: a1.
Asphodelus fistulosus L. – *K 2972*: b1.
Muscari comosum (L.) Mill. – *L 609*: a2, *L 711*: b1.
Ornithogalum umbellatum L. – *L 610*: a2, *L 556*: b2.
Scilla autumnalis L. – *L 487*: a1, *L 345*: c1.

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