

## THE URBAN FLORA OF THE CITY OF MOSTAR (BOSNIA AND HERZEGOVINA)

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**Maslo, S.: The urban flora of the city of Mostar (Bosnia and Herzegovina). Nat. Croat., Vol. 23, No. 1, 101–145, 2014, Zagreb.**

In this paper, an attempt is made for the first time to present a complete list of the vascular flora of the urban area of Mostar, Bosnia and Herzegovina. A total of 965 plant taxa were collected during different seasons of the year and from various biotopes within the city. The most common families are *Asteraceae s.l.* (11.09%), *Poaceae* (10.67%) and *Fabaceae* (7.25%), while therophytes (38.86%) are the most abundant life form. The analysis of the urban flora of the city of Mostar showed that Mediterranean plants predominate (27.00%). Native species accounted for 84.35 % of the total number of taxa. The significant proportion of Mediterranean plants and the relatively high proportion therophytes indicate that the flora of Mostar has developed under the influence of the Mediterranean climate and a significant anthropogenic influence. The percentage contribution of endemics (2.80%) is also important.

**Key words:** urban flora, vascular plants, Mostar, Bosnia and Herzegovina, the Balkans

**Maslo, S.: Urbana flora Mostara (Bosna i Hercegovina). Nat. Croat., Vol. 23, No. 1, 101–145, 2014, Zagreb.**

U ovom radu prikazan je popis vaskularne flore urbanog područja grada Mostara u Bosni i Hercegovini. Ukupno 965 biljnih svojiti je prikupljeno i određeno tijekom svih godišnjih doba i s različitim staništa. Porodice s najvećim brojem svojita su *Asteraceae s. l.* (11,09%), *Poaceae* (10,67%) i *Fabaceae* (7,25%). Analize flore pokazuju da su terofiti (38,86%) najzastupljeniji životni oblik te da prevladavaju mediteranske biljke (27,00%). Samonikle biljke čine 84,35% ukupnog broja svojita. Značajan udio mediteranskih biljaka, kao i razmjerno visoki udio terofita, ukazuju da se flora Mostara razvija pod utjecajem mediteranske klime, kao i znatnog antropogenog utjecaja. Udio endemičnih biljaka je 2,80%.

**Ključne riječi:** urbana flora, vaskularne biljke, Mostar, Bosna i Hercegovina, Balkanski poluotok

### INTRODUCTION

The city of Mostar is situated at an altitude of 40–70 m a.s.l., on the banks of the Neretva and Radobolja rivers, about 60 km distant from the Adriatic Sea. The Mostar valley, with two large plains, the Bišće polje to the south and Bijelo polje to the north, stretches from Salakovac in the north, to the south of Buna, between 43°20' N and 17°44' E. The city is the cultural, educational and economic centre of South Bosnia and Herzegovina. The oldest written testament to the existence of medieval Mostar dates back to the 15th century, prior to the invasion of the Ottoman Turks. According to the 1991 census, the municipality of Mostar had 126,066 inhabitants while the city of Mostar itself had 75,865 inhabitants.

The geomorphology of the region is dominated by alluvial formations along the Neretva River. There are five general zones of Neogene layers: sandstone, breccias and conglomerate, sand-gravel, sand marls and limestone. The geology of the area consists

of Perm Triassic strata, ranging from plaster-anhydrites, unconsolidated limestone, clay and mudstones, compressed during folding episodes, exposed on the surface and thrust upon Mesozoic rocks (PICHLER, 1898). The pedological substrate consists mostly of terra rossa and brown soils on limestone and rendzina soils. The climate is sub-Mediterranean, with short mild winters, usually without snow, and long hot summers.

According to the Biogeographic Map of Europe (RIVAS-MARTÍNEZ *et al.*, 2004), Mostar is in the Euro-Siberian Region, Alpino-Caucasian Subregion, Apennino-Balkan Province, and Illyrian sector. With respect to natural vegetation the Mostar area is mostly characterized by a degradation stage of xero-thermophyllous deciduous lower forest and thickets of oriental hornbeam (the order *Ostryo-Carpinetalia orientalis* Lakušić *et al.* 1982) of the *Rusco aculeati-Carpinetum orientalis* Blečić et Lakušić 1966 association (LAKUŠIĆ *et al.*, 1982; MURATSPAHIĆ *et al.*, 1991; REDŽIĆ *et al.*, 1992).

Fragments of natural vegetation are still present at some locations on the hills of the city.

The first data about the flora of Mostar and its surroundings were published during the period of Austro-Hungarian rule from the end of the 19th century and the beginning of the 20<sup>th</sup> century: (STRUSCHKA, 1880; BECK-MANNAGETTA, 1886-1889, 1901, 1903, 1916; FORMANEK, 1888, 1889; VANDAS, 1889, 1909; MURBECK, 1891; ZAWODNY 1897; PICHLER, 1898/9, 1902; JANCHEN, 1906; LINDBERGH, 1906; SAGORSKI, 1911). In the period between the two World Wars, investigation of the flora was continued by MALY (1919, 1920, 1928, 1936, 1940) and BECK-MANNAGETTA (1927).

Therefore, the work with Beck's Flora was concluded (MALY, 1950; BJELČIĆ, 1967, 1974, 1983) and some findings of individual species, mostly of neophytes were published (KORICA, 1950, 1952; SLAVNIĆ, 1960, 1964, 1965; FUKAREK, 1962; ŠILIĆ, 1973, 2000, 2009; ŠOLIĆ, 1974; STEFANOVIĆ 1978; ABADŽIĆ, 1986; BJELČIĆ, 1986; MIŠIĆ, 1998; ŠOLJAN, 2002, 2003, 2004.).

In the last five decades numerous papers have been published about the flora and vegetation of European cities (SUKOPP; 1990, 2002; PYŠEK, 1998; WITTING, 2004; KELCEY & MÜLLER, 2011). Investigations in southern parts of Europe have been intensified in the last two decades (for references see MILOVIĆ, 2012). The urban flora of Bosnia and Herzegovina remains almost unexplored since, until today, only the cities of Sarajevo and Mostar have been studied (TOMOVIĆ-HADŽIAVDIĆ & ŠOLJAN, 2006; JASPRICA *et al.*, 2011).

In the first work (TOMOVIĆ-HADŽIAVDIĆ & ŠOLJAN, 2006) the authors described the urban flora of Sarajevo. They conducted fieldwork at the end of the recent war and described mostly flora from the central part of the city. They put the emphasis of their study on the changes in the flora and habitat due to the influences of the war. The authors find that major anthropogenic changes occurred during the war. In the second work (JASPRICA *et al.*, 2011), the authors made a comparison between the urban flora found in Split and Dubrovnik (Croatia), and Mostar (Bosnia and Herzegovina). According to the authors Split and Dubrovnik are typical Mediterranean cities and their urban floras are comparable with those of other Mediterranean cities. They also found that Mostar is not completely comparable with Dubrovnik and Split even though they share some characteristic.

## MATERIALS AND METHODS

### Study area

Roughly 1000 taxa were collected during different seasons of the year and from various biotopes within the city. The research covered only central parts of the Mostar valley, from Rudnik and Zalik in the N, Luka and Donja Mahala in the S, Bjelušine and

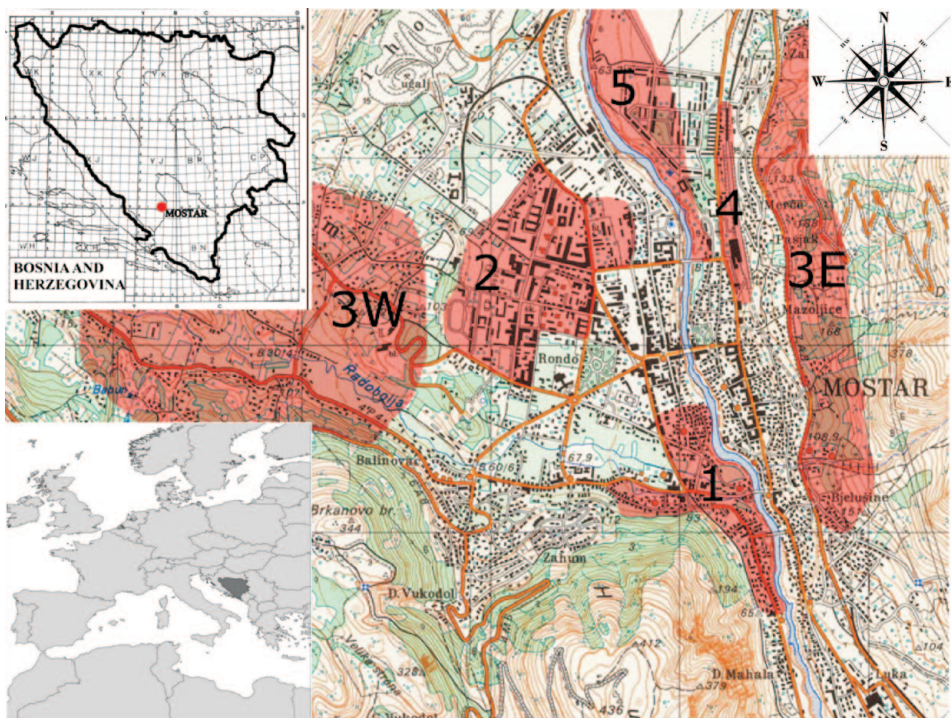


Fig.1. Location and boundaries of the researched area.

Gornje Mazoljice to the E, Cim and Ilići to the W (Fig. 1). The landscape of the study area has become more fragmented due mostly to the effects of continuous human disturbances.

Five main zones were distinguished in the territory of the city (Fig. 1):

**1. Old town with surrounding city quarter (mahalle)**

Walls represent a specific type of habitat of anthropogenic origin, to a great extent resembling natural rock faces. They constitute vertical surfaces covered by only a shallow layer of fine-grained soil. Where walls are found adjacent to rocky cliffs, petrophytic species typical of rock crevices (ferns in particular) often encroach upon wall habitats. In the old part of Mostar, walls are usually shaded, either permanently or at least for part of the day. Plenty of native species have colonized shaded walls near the Old Bridge in the old part of the city (*Asplenium ceterach* L. ssp. *ceterach*, *Asplenium ruta-muraria* L., *Asplenium trichomanes* L. ssp. *quadrivalens* D.E.Mey., *Cheilanthes persica* (Bory) Mett. ex Kuhn., *Cymbalaria muralis* P.Gaertn., B.Mey. et Scherb., *Parietaria judaica* L., *Veronica cymbalaria* Bod.). On shady and moist walls along the Radobolja River *Adiantum capillus-veneris* L. is present in extended and compact populations; few other vascular plants can grow in this environment, but Bryophytes from the class Liverworts (*Hepaticae*) are very frequent. The presence of vegetation in old sites is closely related to the climate, structure and material of the artefacts and the type of management. Archaeological structures are not the most favourable substrate for vegetation but some plants from rocky habitats may colonise walls and stones. Only a few species are adapted to this very particular

environment, above all the characteristic species of the class *Parietarietea judaicae* Oberdorfer 1977 (BRULLO & GUARINO, 1998). The constant humidity of such environments favours the growth of a quite large number of species, including those normally found in other natural settings (LISCI & PACINI, 1993).

Even vegetation of open drains, ruderal plant communities of the class *Chenopodietea albi* Braun-Blanquet 1951 is present in this part of the city (235 taxa recorded in area, 24% of total flora, among them 33 are neophytes).

## 2. New part of the city

Vegetation of trampled habitats belong to the class *Polygono-Poetea annuae* Rivas-Martínez 1975. These habitats are constantly mechanically disturbed by trampling, which not only damages the vegetative and generative organs of plants but also changes the mechanical properties of the soil (MEDVECKA, 2009). Only a few stress-tolerant species are able to survive such conditions. Therefore the communities are usually species-poor. They are dominated by therophytes *Polygonum aviculare* L., *Poa annua* L., *Lepidium rudemale* L., accompanied by stress-tolerant species such as *Plantago major* L., *Lolium perenne* L., *Cynodon dactylon* (L.) Pers. and *Taraxacum officinale* Weber. Even some neophytes are common such as *Eleusine indica* (L.) Gaertn. This type of vegetation is very common on unpaved pathways, roads, parking places and playgrounds in the new part of the city. Nitrophilous plant communities of the class *Chenopodietea albi* Braun-Blanquet 1951. grow in the gaps between the houses; (194 taxa recorded in the area, 10% of total flora, among them 29 are neophytes).

## 3. Suburban areas

Xerophilous vegetation of Mediterranean rocky grasslands and meadows class *Thero-Brachypodietea* Braun-Blanquet. 1947 covers large area of the slopes of Stolac Hill (east part of the city, 3 E on the map). It is presented by thermophilous communities of rocky meadows and pastures where species from Balkan, Illyrian, and south-eastern European floral elements play a dominant role such as *Chrysopogon gryllus* (L.) Trin., *Dichanthium ischaemum* (L.) Roberty, *Stipa bromoides* (L.) Dörlf., *Scorzonera villosa* Scop. Most of the endemic and threatened taxa are recorded just here (*Anthyllis vulneraria* L. ssp. *praepropera* (A.Kern.) Bornm., *Cardamine maritima* Port. Ex. DC., *Onosma javorkae* Simonk., *Onosma stellulata* Waldst. et Kit., *Scutellaria orientalis* L. subsp. *pinnatifida* Edmondson, *Trifolium dalmaticum* Vis., *Verbascum orientale* (L.) All.). The presence of non-native species is quite low, but *Opuntia vulgaris* Miller covers quite a large area on the natural rock faces.

The west part of the area (Cim and Ilići) is mostly characterized by a degradation stage of xero-thermophyllous deciduous lower forest (west part of the city, 3 W on the map). This is the result of the degradation of primary forest vegetation as a result of long-lasting human activities. Fragments of natural forest are still present in the area of Ilići, while some species are disappearing from the city's flora, such as *Erythronium dens-canis* L., *Primula vulgaris* Huds., *Corydalis solida* (L.) Swartz, *Galanthus nivalis* L.

Even vegetation of trampled habitats and vegetation of ruderal plant communities are present here (532 taxa recorded in the area, 55% of total flora, among them are 16 neophytes).

## 4. Railway station with surrounding

The anthropogenic impact in this area is so marked that it has led to the conversion of not only primary to secondary, but also of secondary to less organized communities.



Soils, without consideration of their origin nature and type, are nitrified and disturbed. These are communities on cultivated surfaces such as: vegetation of abandoned nitrified places from the class *Chenopodietea albi* Braun-Blanquet 1951, vegetation of arable and abandoned places from the class *Stellarietea mediae* R. Tx., Lohmeyer & Preising in R. Tx. ex von Rochow 1951 and vegetation of trampled habitats class *Polygono-Poetea annuae* Rivas-Martínez 1975. Whereas communities of the *Chenopodietea albi* class are very frequent at the sites of the railway stations, the vegetation of the bordering areas is dominated more and more by species of trampled habitats (411 taxa recorded in the area, 43% of total flora, among them 44 are neophytes).

## 5. Areas near the Neretva River

Plant cover in this area is strongly determined by the soils. The area of Sjeverni logor is composed mostly of natural conglomerates. On this shallow and rocky carbonate soil communities of Mediterranean rocky grasslands and meadows (the class *Thero-Brachypodietea* Braun-Blanquet 1947) occur. Especially important is the finding of a small population of *Alkanna tinctoria* Tausch which is the only known locality in Bosnia and Herzegovina. River banks, composed mostly of conglomerate, are quite steep. These are characterized by a great number of endemics: *Asperula scutellaris* Vis., *Astragalus monspessulanus* L. ssp. *illyricus* (Bernhardt) Chater, *Centaurea rupestris* L. ssp. *ceratophylla* (Ten.) Gugler, *Edraianthus tenuifolius* (Waldst. et Kit.) A.DC., *Genista sylvestris* Scop. ssp. *dalmatica* (Bartl.) H. Lindb., *Micromeria croatica* (Pers.) Schott., *Micromeria kernerii* Murb., *Rhamnus intermedius* Steud. et Hohst., *Tanacetum cinerariifolium* (Trevir.) Sch. Bip., and *Teucrium arduini* L.

Fragments of white willow (the alliance *Salicion albae* R. Tx. 1955) appear in some places. On the left bank of the Neretva River just north of Carinski Bridge *Salix alba* L., *Fraxinus angustifolia* Vahl., *Ulmus minor* Miller., *Robinia pseudoacacia* L. and *Morus alba* L. are the most common trees; even single trees of *Alnus glutinosa* (L.) Gaertner and *Populus nigra* L. grow here. The most frequent shrubs are *Sambucus nigra* L., *Ficus carica* L., *Vitex agnus-castus* L. *Cornus sanguinea* L. *Rubus caesius* L. and *Amorpha fruticosa* L. The herb layer is well developed and often dominated by only a few species. Periodical floods deposit a lot of organic material, therefore nitrophilous species prevail: *Alliaria petiolata* (M. Bieb.) Cavara et Grande., *Bidens frondosa* L., *Calystegia sepium* (L.) R. Br., *Chelidonium majus* L., *Polygonum lapathifolium* L., *Urtica dioica* L. A large proportion of nitrophilous, ruderal, weed and alien species, which do not belong to natural stands of floodplain forest from the alliance *Salicion albae*, clearly depict disturbance of the habitat (672 taxa recorded in the area, 70% of total flora, among them 38 are neophytes)

## METHODS

This study is based on the author's collections and field observations made from the spring of 1996 to the end of 2012. Voucher material is deposited in the Herbarium of the National Museum of Bosnia and Herzegovina (SARA). In the floristic list all taxa that are native or spread spontaneously outside cultivation (non-native plants, CUAD) in the area of Mostar are included. Taxa in the research area present exclusively in culture are not included in this study.

Identification of plants was carried out using monographs, keys and guides: HAYEK (1924-1933), TUTIN *et al.* (1968-1980, 1993), JOSIFOVIĆ *et al.* (1970-1977), JÁVORKA (1979), PIGNATTI (1982), DOMAC (1994).

Plant nomenclature follows NIKOLIĆ (2013). Nomenclature of some taxa was adjusted according to the database GRIN Taxonomy for Plants (2013). Family *Asteraceae* is considered in its broader sense (*sensu lato*).

In the list of urban flora (Appendix 1), taxa are listed in alphabetic order. Designations for: family, life form, floral element, origin (of non-native plants) and endemic/threatened status are provided.

The life-form categories follow RAUNKIAER (1934), PIGNATTI (1982), DIKLIĆ (1984) and marked with the standard abbreviations in the list of urban flora: **Ch** (Chamaephyta), **G** (Geophyta), **H** (Hemmicriptophyta), **Hy** (Hydrophyta), **P** (Phanerophyta) and **T** (Therophyta).

The analysis of floral elements follows HORVATIĆ (1963) and HORVATIĆ *et al.* (1976/1968). Data about the plant taxa which could not be classified according to the above mentioned source are taken from HORVATIĆ (1967), JOSIFOVIĆ *et al.* (1970-1977) and GAJIĆ (1984).

## 1. MEDITERRANEAN FLORAL ELEMENT

- 1.1. Circum-Mediterranean plants (**CIME**)
- 1.2. West-Mediterranean plants (**WEME**)
- 1.3. East-Mediterranean plants (**EAME**)
- 1.4. Illyrian Mediterranean plants
  - 1.4.1. Illyrian-South European plants (**ILSE**)
  - 1.4.2. Illyrian-Adriatic plants
    - a) Illyrian-Adriatic endemic plants (**ILAE**)
    - b) Illyrian-Apennine plants (**ILAP**)
- 1.5. Mediterranean-Atlantic plants (**MEAT**)
- 1.6. European Mediterranean plants (**EUME**)
- 1.7. Mediterranean-Pontic plants (**MEPO**)

## 2. ILLYRIAN-BALKANIC FLORAL ELEMENT

- 2.1. Illyrian-Balkan endemic plants (**ILBE**)
- 2.2. Balkanic-Apennine plants (**BAAP**)

## 3. SOUTH EUROPEAN FLORAL ELEMENT

- 3.1. South European-Mediterranean plants (**SEME**)
- 3.2. South European-Pontic plants (**SEPO**)
- 3.3. South European-mountain plants (**SEMO**)
- 3.4. South European-continental plants (**SECO**)
- 3.5. South European-Atlantic plants (**SEAT**)

## 4. EAST EUROPEAN-PONTIC FLORAL ELEMENT (EEUP)

5. SOUTHEAST EUROPEAN FLORAL ELEMENT (SEEU)
6. CENTRAL EUROPEAN FLORAL ELEMENT (CEEU)
7. EUROPEAN FLORAL ELEMENT (EURO)
8. EURASIAN FLORAL ELEMENT (EUAS)

## 9. CIRCUM-HOLARTIC PLANTS (CIHO)

## 10. WIDESPREAD PLANTS (WISP)

## 11. CULTIVATED &amp; ADVENTITIOUS PLANTS (CUAD)

Origin, i.e. type and time of immigration, is mainly taken from PYŠEK *et al.* (2002). The terminology presented below is adjusted according to MITIĆ *et al.* (2008). The groups are:

## 1. NATIVE PLANTS

2. NON-NATIVE PLANTS (Cultivated & Adventitious plants -**CUAD**)

- **archaeophytes**, established non-native plants introduced intentionally or unintentionally before 1500 A.D.
- **neophytes**, non-native plants introduced intentionally or unintentionally after 1500 A.D.
- **casual plants**, non-native plants not permanently established.

Endemic species in a broader sense are defined according to ŠILIC (1990) and are marked with the abbreviation “**end**”. Taxa listed in the proposal for the Red List of the flora of Bosnia and Herzegovina by ŠILIC (1996) are marked with their corresponding IUCN category: Extinct (**Ex**), Probably vanished (**Ex?**), Endangered (**E**), Vulnerable (**V**), Rare (**R**) and Insufficiently Known (**K**).

## ANALYSIS OF THE FLORA

In this research, a total of 965 vascular plant taxa from 472 genera and 107 families were recorded. The taxonomical analysis includes 814 native and 151 non-native species. The families with the highest number of taxa are: *Asteraceae* s.l. (11.09%), *Poaceae* (10.67%) and *Fabaceae* (7.25%) (Tab. 1).

**Tab. 1.** The most abundant families in the flora of the city of Mostar.

Family	No. of taxa	% of total number of taxa
<i>Asteraceae</i> s.l.	107	11.09
- <i>Asteraceae</i> s.s.	(72)	7.46
- <i>Cichoriaceae</i>	(35)	3.63
<i>Poaceae</i>	103	10.67
<i>Fabaceae</i>	70	7.25
<i>Lamiaceae</i>	62	6.42
<i>Brassicaceae</i>	56	5.80
<i>Scrophulariaceae</i>	36	3.73
<i>Apiaceae</i>	33	3.42
<i>Caryophyllaceae</i>	32	3.32
<i>Rosaceae</i>	31	3.21
<i>Liliaceae</i>	27	2.80
<i>Boraginaceae</i>	25	2.60
<i>Ranunculaceae</i>	23	2.38
Other families (93)	360	37.31
Total	965	100.00

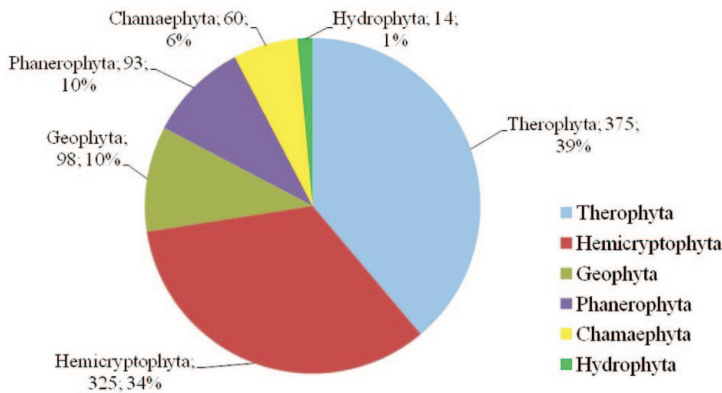


Fig. 2. Life form spectrum of the urban flora of the city of Mostar.

Analysis of life-forms shows the domination of therophytes (38.86%), followed by hemicryptophytes (33.68%). The group with the smallest number of taxa (14 or 1.45%) is the hydrophytes (Fig. 2).

The most common floral elements were Mediterranean plants (260; 26.94%), South-European plants (180; 18.65%), cultivated and adventive plants (151; 15.65%), Euroasian plants (141; 14.61%), and widespread plants (130; 13.47%, Fig. 3). Native species accounted for 84.35% of the total species number, the corresponding figure being 6.63 % for neophytes and 2.49% for archeophytes. There were 6.53% casual plants.

A total of 27 taxa (2.80% of total flora) have the status of endemic plants and 55 taxa (5.70%) are considered to be threatened (ŠILIĆ, 1996).

## DISCUSSION AND CONCLUSION

The flora of the city of Mostar has 965 vascular plant taxa within 472 genera and 107 families.

Tab. 2. Comparison of number of taxa among the different cities.

City	No. of taxa	Area (km <sup>2</sup> )	No. of inhabitants	Literature
Mostar (Bosnia and Herzegovina)	965	20	80.000	This study
Omiš (Croatia)	614	3.5	6.400	TAFRA <i>et al.</i> (2012)
Patras (Greece)	818	58	180.000	CHRONOPOULOS & CHRISTODOULAKIS (2003)
Podgorica (Montenegro)	1227	86	140.000	STEŠEVIĆ & JOVANOVIĆ (2008)
Thessaloniki (Greece)	718	61	1000.000	KRIGAS & KOKKINI (2005)
Split (Croatia)	842	30	175.000	RUŠČIĆ (2002)
Šibenik (Croatia)	617	4	40.000	MILOVIĆ (2000)
Zadar (Croatia)	926	30	70.000	MILOVIĆ & MITIĆ (2012)



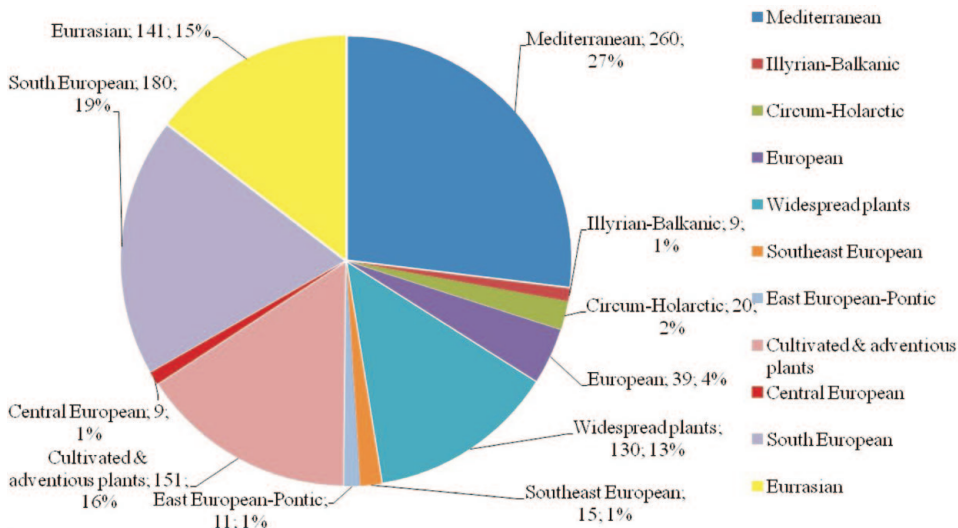


Fig. 3. Floral elements spectrum of the urban flora of the city of Mostar

The total number of taxa in city of Mostar is largely similar to the numbers for some Mediterranean cities (Tab. 2) in Croatia, Greece (Patras, Thessaloniki) and Montenegro. As expected, the highest number of taxa was recorded on the embankments of the Neretva River, (672 taxa recorded in area, 70% of total flora). According to BRANDES (1995), the embankments of a river flowing through the centre of an old town are very rich in plant species.

Tab. 3. Families with the highest number of taxa in the different cities (for references see Tab. 2).

Families	Mostar	Omiš	Podgorica	Split	Šibenik	Zadar
<i>Asteraceae s.l.</i>	11.1%	13.2%	11.2%	13.9%	12.9%	12.4%
<i>Poaceae</i>	10.7%	11.2%	11.7%	8.8%	10.8%	11.0%
<i>Fabaceae</i>	7.3%	12.9%	9.2%	8.4%	10.7%	9.8%

Among families, the highest numbers of taxa were found in *Asteraceae s. l.* (11.09%), *Poaceae* (10.67%) and *Fabaceae* (7.25%). These families are also dominant in other Mediterranean and sub-Mediterranean cities. (Tab. 3).

The plant life-form spectrum of Mostar is similar to the spectra found in the Mediterranean (HORVAT, 1949) and some other Mediterranean cities (HRUSKA *et al.*, 2003; KRIGAS & KOKKINI, 2005; TSIOTSIU & CHRISTODOULAKIS, 2004). The number of taxa with a short life cycle is particularly evident in the highly anthropized urban habitats and conditions of the Mediterranean climate.

Mediterranean plants prevailed in all cities (Tab. 5). The presence of South European, widespread and non-native plants is also pronounced. This correlates with the situation

**Tab. 4.** Plant life-form spectra in the different cities, the urban flora of Italy (HRUSKA, 1989) and in the Mediterranean (HORVAT, 1949), for other references see Tab. 2.

City	Terophyta	Hemicryptophyta	Phanerophyta	Geophyta	Chamaephyta	Hydrophyta
Mostar	38.86%	33.68%	9.64%	10.16%	6.22%	1.45%
Split	37.8%	29.6%	15.6%	9.5%	6.7%	-
Šibenik	47.65%	27.55%	10.7%	6.81%	7.29%	-
Zadar	42.98%	26.57%	12.85%	11.02%	6.26%	0.32%
Omiš	40.07%	28.34%	14.82%	7.98%	8.63%	0.16%
Urban flora of Italy	31-61%	22-49%	5-25%	4-12%	1-11%	-
Mediterranean	43%	29%	12%	11%	6%	-

**Tab. 5.** Comparison of the floral elements among the different cities (for references see Tab. 2).

Floral element	Mostar	Split	Šibenik	Zadar	Omiš
Mediterranean	26.94%	36.2%	39.71%	32.83%	37.95%
Illyrian-Balkan	0.93%	0.2%	0.49%	0.32%	-
South European	18.65%	16.7%	19.94%	17.06%	16.45%
East European-Pontic	1.14%	0.4%	0.49%	0.97%	0.65%
Southeast European	1.55%	0.7%	0.49%	0.65%	0.81%
Central European	0.93%	0.7%	0.32%	0.43%	-
European	4.04%	2.7%	2.69%	2.48%	1.47%
Eurasian	14.61%	8.8%	7.46%	9.61%	7.82%
Circum-Holarctic	2.07%	1.1%	0.65%	0.86%	0.65%
Widespread plants	13.47%	15.8%	17.18%	15.55%	16.78%
Cultivated & Adventitious plants	15.65%	16.6%	10.53%	19.22%	17.43%
Total	100%	100%	100%	100%	100%

in some other Mediterranean cities (HRUSKA *et al.*, 2003, TSIOTSIOU & CHRISTODOULAKI, 2004, KRIGAS & KOKKINI, 2005, STEŠEVIĆ *et al.*, 2009; JASPRICA *et al.*, 2011). Many native Mediterranean plant species can tolerate arid conditions and they are well-adapted to ecological conditions such as limited water supply, high air temperature and insolation (DUNN & HENEGHAN, 2011).

The data provided by this study differ from those given by JASPRICA *et al.* (2011). This may be explained by the significantly longer investigation period and the considerably larger size of the area surveyed in the present study. Comparison between flora of Mostar and some others urban floras of the region was difficult due to the different terminology used or lack of information (TOMOVIĆ-HADŽLAVDIĆ & ŠOLJAN, 2006; STEŠEVIĆ & JOVANOVIĆ, 2008)).

In this study, non-native species accounted for only 15.65 % of the flora. This value is much lower than values reported for Central European cities (PYŠEK, 1989). In contrast, CELESTI-GRAPOV & BLASI (1998) point out that in Mediterranean settlements even the most urbanized plots reflect the characters of the surrounding landscape and are rich in native species, while non-native species are relatively few.

Most non-native taxa were neophytes, of which taxa originating in the Americas dominated (48 species, 75%). Very disturbed urban habitats, such as tree beds and pavements, had the highest percentages of adventives while in less disturbed non-urban habitats, percentages of adventives were very low. Neophytes were predominant in railway station areas (44 species, 69%) and embankments around the Neretva River (38 species, 59%). In the Mediterranean region, forest communities along rivers show a large number of adventive species. This peculiarity is linked to the special microclimatic conditions in this type of ecosystem where summer drought is absent (QUEZEL *et al.*, 1990).



**Fig. 4.** *Scutellaria orientalis* L. subsp. *pinnatifida* Edmondson at its only habitat in the Bosnia and Herzegovina on the slopes of Stolac Hill.

The destruction after the war in Bosnia created plenty of new habitats. New habitats, like ruins and burned areas, create space for expansion of already established and newly introduced alien species. Only a few years after the war, various plants had colonised the ruined houses. Plants spreading during wars have been called polemochores (MACK, 2003; SUKOPP, 2003). I found two new non-native species (*Paspalum dilatatum* Poiret in Lam. and *Senecio inaequidens* DC.) in the central part of the city of Mostar in 1996. They were not recorded for the Mostar flora before 1992. Previously, these taxa had been recorded in most of the Balkan countries (cf. ILIJANIĆ & TOPIĆ, 1986; ILIJANIĆ, 1990; GLASNOVIĆ, 2007; ANAGNOU-VERONIKI *et al.*, 2008; KALIGARIČ, 1992; PAVLETIĆ & TRINAJSTIĆ, 1994; BOROVEČKI-VOSKA, 2013; ANASTASIU & NEGREAN, 2008; VLADIMIROV & PETROVA, 2009).

Due to the presence of seminatural habitats within the city of Mostar, 27 endemic and 55 threatened taxa are recorded, especially on the banks of the Neretva River and the slopes of Stolac Hill. Some of these species are acutely vulnerable and are likely to disappear from the flora of the Bosnia and Herzegovina if nothing is done.

The majority of endemic species are recorded from areas near the Neretva River and former military area Sjeverni logor. A high percentage of endemic Illyrian-Adriatic plants, such as *Moltkia petraea* (Tratt.) Griseb, *Micromeria kernerii* Murb., *Teucrium arduini* L., *Cardamine maritima* Port. ex. DC. was recorded. Although the flora might be rich in urban habitats, fast growing urbanization on the hills of Mostar can cause problems for the survival of some rare species. For example, a small population of the taxon *Scutellaria orientalis* L. subsp. *pinnatifida* Edmondson on the slopes of Stolac Hill is the last known locality in Bosnia and Herzegovina (Fig. 4). *Scutellaria orientalis* L. is a highly polymorphic species extending from Spain and NW Africa to Central Asia and W China. This wide area of distribution is discontinuous, and there are several rather well characterized subspecies. However, only two subspecies occur in Europe: *Scutellaria orientalis* L. subsp. *pinnatifida* Edmondson occurs only in the Balkans (for distribution see HAYEK, 1928-1931), *Scutellaria orientalis* L. subsp. *hispanica* (Boiss) Greuter & Burdet in the south of the Iberian Peninsula (VALDÉS & TALAVERA, 1991).

In this study 16 taxa were recorded for the first time in Bosnia and Herzegovina. Among them, seven are native (*Aegilops uniaristata* Vis., *Erodium malacoides* (L.) L'Her., *Orobancha hederæ* Duby., *Phalaris aquatica* L., *Setaria gussonei* Kerguelen, *Solanum nigrum* L. ssp. *schultesii* (Opiz) Wessely and *Vulpia ciliata* Dumort), and nine are non-native (*Commelina benghalensis* L., *Commelina communis* L., *Duchesnea indica* (Andrews) Focke., *Impatiens balsamina* L., *Mirabilis jalapa* L., *Opuntia vulgaris* Mill., *Oxalis articulata* Savigny., *Paspalum dilatatum* Poir et in Lam. and *Senecio inaequidens* DC.).

My study has confirmed that the floras of urban areas are extremely rich and diverse. The greater diversity of the flora of Mostar is attributable both to geographic and cultural factors, and to the marked presence of Mediterranean species which, favoured by the urban climate, have successfully settled in this environment.

This study showed that the urban flora of Mostar is very close to the Mediterranean flora. The urban flora of Mostar showed many characteristics in common with the floras of some Dalmatian cities, both qualitatively and quantitatively, despite the fact that coastal cities belong to other climatic and biogeographic regions. In addition, there is a significant difference in history, habitat types and anthropogenic influences between Mostar and Dalmatian cities. In summary, the urban flora of Mostar can be considered a typical sub-Mediterranean urban flora.

## ACKNOWLEDGEMENTS

I would like to thank to my colleague Jessica Andersson for improving the English of this paper.

Received January 16, 2013

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## SAŽETAK

### Urbana flora Mostara (Bosna i Hercegovina)

S. Maslo

U radu je prikazan popis flore urbanog područja Mostara u Bosni i Hercegovini. Detaljna floristička istraživanja provedena su od 1996. do 2012. Na relativno malenom području utvrđeno je ukupno 965 svojta vaskularnih biljaka od kojih su 814 samonikle. Svojtje koje rastu isključivo u kulturi nisu prikazane u ovom radu. Ukupno je 16 svojta po prvi put utvrđeno u Bosni i Hercegovini. Najzastupljeniji je mediteranski florni element (27%), a među životnim oblicima terofiti (39%). Najveći broj svojta nalazi se u okviru porodica *Asteraceae s. l.* (11%), *Poaceae* (10%) i *Fabaceae* (7%). Utvrđene su 64 svojtje neofita. Najveći broj neofita (48 svojta ili 75%) potječe iz Amerika.

Udio endemičnih svojta je 3%. Prema popisu biljnih vrsta za Crvenu knjigu Bosne i Hercegovine, 55 svojta ili 6% flore u Mostaru nalazi se u nekoj od kategorija ugroženosti. Većina ih raste uz obalu Neretve, kao i na istočnim padinama grada (brdo Stolac). Nagla i neplanska poslijeratna urbanizacija dovodi do nestanka posljednjih staništa nekih vrsta. U Mostaru se nalazi posljednje poznato nalazište svojte *Scutellaria orientalis* L. subsp. *pinnatifida* Edmondson u Bosni i Hercegovini.

Utvrđene su sličnosti između flora Mostara, nekih dalmatinskih gradova i Podgorice, i to prema porodicama s najvećim brojem svojta, životnim oblicima i flornim elementima.

## APPENDIX 1

## The urban vascular flora of the city of Mostar

No. of taxa	Taxa	Family	Life-form	Chorological group	Endemic taxa	Threatened taxa	Non-native plants (CUAD)			Localitets				
							Neophytes	Archaeophytes	Casual	1	2	3	4	5
1.	<i>Abutilon theophrasti</i> Medik.	Malvaceae	T	CUAD				arc					+	
2.	<i>Acanthus balcanicus</i> Heywood et I.Richardson	Acanthaceae	H	SEME									+	
3.	<i>Acanthus spinosissimus</i> Pers.	Acanthaceae	H	ILAP		V							+	+
4.	<i>Acer campestre</i> L.	Aceraceae	P	EURO									+	+
5.	<i>Acer monspessulanum</i> L.	Aceraceae	P	SEME									+	+
6.	<i>Acer negundo</i> L.	Aceraceae	P	CUAD			Am-N		+					+
7.	<i>Achillea millefolium</i> L.	Asteraceae	H	WISP						+	+	+	+	
8.	<i>Achillea nobilis</i> L.	Asteraceae	H	EUAS									+	
9.	<i>Achillea virescens</i> (Fenzl) Heimerl	Asteraceae	H	SEME									+	+
10.	<i>Achnatherum calamagrostis</i> (L.) P.Beauv.	Poaceae	H	SEME										+
11.	<i>Acinos arvensis</i> (Lam.) Dandy	Lamiaceae	T	EUAS					+		+			+
12.	<i>Adiantum capillus – veneris</i> L.	Adiantaceae	H	MEAT		V			+					+
13.	<i>Adonis aestivalis</i> L.	Ranunculaceae	T	CUAD				arc						+
14.	<i>Adonis annua</i> L.	Ranunculaceae	T	CIME										+
15.	<i>Adonis flammea</i> Jacq.	Ranunculaceae	T	CUAD				arc						+
16.	<i>Aegilops geniculata</i> Roth	Poaceae	T	CIME					+		+			+
17.	<i>Aegilops neglecta</i> Req. Ex Bertol	Poaceae	T	CIME					+		+			+
18.	<i>Aegilops triuncialis</i> L.	Poaceae	T	CIME					+	+	+	+	+	+
19.	<i>Aegilops uniaristata</i> Vis.	Poaceae	T	ILAP										+
20.	<i>Aethionema saxatile</i> (L.) R.Br.	Brassicaceae	Ch	SEME									+	+
21.	<i>Agrimonia eupatoria</i> L.	Rosaceae	H	CIHO						+			+	+
22.	<i>Agrostemma githago</i> L.	Caryophyllaceae	T	CUAD				arc						+
23.	<i>Agrostis stolonifera</i> L.	Poaceae	H	CIHO					+					+
24.	<i>Ailanthus altissima</i> (Mill.) Sw.	Simaroubaceae	P	CUAD			As-E		+	+	+	+	+	+
25.	<i>Ajuga chamaepitys</i> (L.) Schreb.	Lamiaceae	T	CIME					+		+			+
26.	<i>Ajuga genevensis</i> L.	Lamiaceae	H	EURO									+	+
27.	<i>Ajuga reptans</i> L.	Lamiaceae	H	EUAS									+	+
28.	<i>Alcea biennis</i> Winterl.	Malvaceae	H	CUAD				cas	+				+	+
29.	<i>Alcea rosea</i> L.	Malvaceae	H	CUAD				cas	+				+	+









135. <i>Bidens subalternans</i> DC.	Asteraceae	T	CUAD		Am-S		+	+	+	
136. <i>Bidens frondosa</i> L.	Asteraceae	T	CUAD		Am-N		+			+
137. <i>Bifora radians</i> M.Bieb.	Apiaceae	T	SEME							+
138. <i>Biscutella cichoriifolia</i> Loisel.	Brassicaceae	T	SEME				+		+	
139. <i>Blackstonia perfoliata</i> (L.) Huds. ssp. <i>serotina</i> (Koch ex Rc.) Vollm.	Gentianaceae	T	MEAT							+
140. <i>Bombycilaena erecta</i> (L.) Smol- jan.	Asteraceae	T	SEPO						+	
141. <i>Borago officinalis</i> L.	Boraginaceae	T	CIME							+
142. <i>Brachypodium distachyon</i> (L.) P.Beauv.	Poaceae	T	CIME						+	
143. <i>Brachypodium pinnatum</i> (L.) Beauv.	Poaceae	H	EURO						+	
144. <i>Brachypodium sylvaticum</i> (Huds.) P.Beauv.	Poaceae	H	EUAS				+			+
145. <i>Brassica nigra</i> (L.) W.D.J.Koch	Brassicaceae	T	CUAD			cas				+
146. <i>Brassica oleracea</i> L.	Brassicaceae	Ch	CUAD			cas				+
147. <i>Brassica rapa</i> L.	Brassicaceae	T	CUAD			cas				+
148. <i>Briza maxima</i> L.	Poaceae	T	CIME						+	+
149. <i>Bromus arvensis</i> L.	Poaceae	T	CUAD		arc					+
150. <i>Bromus commutatus</i> Schrad.	Poaceae	T	EURO							+
151. <i>Bromus erectus</i> Hudson ssp. <i>erectus</i>	Poaceae	H	SEME						+	+
152. <i>Bromus hordeaceus</i> L. ssp. <i>hordeaceus</i>	Poaceae	T	SEME					+	+	+
153. <i>Bromus inermis</i> Leys.	Poaceae	H	EUAS						+	+
154. <i>Bromus madritensis</i> L.	Poaceae	T	MEAT				+		+	+
155. <i>Bromus racemosus</i> L.	Poaceae	T	WISP							+
156. <i>Bromus rigidus</i> Roth	Poaceae	T	EEUP							+
157. <i>Bromus squarrosus</i> L.	Poaceae	T	SEPO						+	+
158. <i>Bromus sterilis</i> L.	Poaceae	T	WISP							+
159. <i>Broussonetia papyrifera</i> L Herit ex Vent.	Moraceae	P	CUAD		As-E		+	+	+	+
160. <i>Bryonia dioica</i> Jacq.	Cucurbitaceae	Ch	SEME							+
161. <i>Bunias erucago</i> L.	Brassicaceae	T	SEME				+		+	+
162. <i>Bunium ferulaceum</i> Sibth. et Sm.	Apiaceae	G	SEME							+
163. <i>Bupleurum praealtum</i> L.	Apiaceae	H	EUAS						+	+
164. <i>Bupleurum veronense</i> Turra	Apiaceae	T	ILSE						+	+
165. <i>Calamagrostis pseudophrag- mites</i> (Haller fil.) Koeler	Poaceae	H	EURO							+
166. <i>Calamintha glandulosa</i> (Req.) Benth.	Lamiaceae	H	SEPO				+	+	+	+
167. <i>Calamintha sylvatica</i> Bromf.	Lamiaceae	H	EURO					+	+	+
168. <i>Calendula officinalis</i> L.	Asteraceae	T	CUAD			cas				+





205. <i>Centaurea calcitrapa</i> L.	Asteraceae	T	MEAT										+	+	+	+
206. <i>Centaurea deusta</i> Ten. ssp. <i>concolor</i> (DC.) Hayek	Asteraceae	H	CIME										+	+	+	+
207. <i>Centaurea fritschii</i> Hayek	Asteraceae	H	EUAS			R								+		
208. <i>Centaurea glaberrima</i> Tausch ssp. <i>divergens</i> (Vis.) Hayek	Asteraceae	H	ILAE	EN	R									+		+
209. <i>Centaurea jacea</i> L.	Asteraceae	H	EUAS										+	+	+	+
210. <i>Centaurea rupestris</i> L. ssp. <i>ceratophylla</i> (Ten.) Gugler	Asteraceae	H	ILAE	EN	R									+		+
211. <i>Centaurea scabiosa</i> L.	Asteraceae	H	EUAS											+		+
212. <i>Centaurea solstitialis</i> L. ssp. <i>solstialis</i>	Asteraceae	T	SEPO										+	+	+	+
213. <i>Centaureum erythraea</i> Rafn.	Gentianaceae	T	WISP													+
214. <i>Cephalanthera longifolia</i> (L.) Fritsch	Orchidaceae	G	EUAS			R									+	
215. <i>Cephalanthera rubra</i> (L.) Rich.	Orchidaceae	G	EUAS			R									+	
216. <i>Cephalaria leucantha</i> (L.) Roemer & Schultes	Dipsacaceae	H	CIME												+	+
217. <i>Cerastium brachypetalum</i> Pers. ssp. <i>brachypetalum</i>	Caryophyllaceae	T	SEMO												+	+
218. <i>Cerastium glomeratum</i> Thuill.	Caryophyllaceae	T	WISP												+	+
219. <i>Cerastium grandiflorum</i> Waldst. et Kit.	Caryophyllaceae	H	ILAE	EN	R										+	
220. <i>Cerastium ligusticum</i> Viv. ssp. <i>trichogynum</i> (Moschl) P.D.Sell. et Whitehead	Caryophyllaceae	T	WEME												+	+
221. <i>Cerastium semidecandrum</i> L.	Caryophyllaceae	T	SEPO												+	+
222. <i>Cercis siliquastrum</i> L.	Fabaceae	P	CUAD						cas					+	+	+
223. <i>Cerinthe minor</i> L. ssp. <i>auriculata</i> (Ten.) Domac	Boraginaceae	H	ILAP	EN	V										+	
224. <i>Chaenorhinum minus</i> (L.) Lange ssp. <i>minus</i>	Scrophulariaceae	T	EURO													+
225. <i>Chaerophyllum coloratum</i> L.	Apiaceae	H	ILAE	EN	R										+	+
226. <i>Chamomilla recutita</i> (L.) Rauschert	Asteraceae	T	WISP												+	+
227. <i>Cheilanthes persica</i> (Bory) Mett. ex Kuhn	Adiantaceae	H	MEAT											+		+
228. <i>Chelidonium majus</i> L.	Papaveraceae	H	WISP											+	+	+
229. <i>Chenopodium album</i> L.	Chenopodiaceae	T	WISP											+	+	+
230. <i>Chenopodium ambrosioides</i> L.	Chenopodiaceae	T	CUAD			Am-N								+	+	+
231. <i>Chenopodium botrys</i> L.	Chenopodiaceae	T	EUAS											+		+
232. <i>Chenopodium hybridum</i> L.	Chenopodiaceae	T	WISP											+		+
233. <i>Chenopodium murale</i> L.	Chenopodiaceae	T	WISP											+		+
234. <i>Chenopodium opulifolium</i> Schrad. ex W.D.J. Koch & Ziz	Chenopodiaceae	T	WISP													+
235. <i>Chenopodium polyspermum</i> L.	Chenopodiaceae	T	WISP													+
236. <i>Chenopodium vulvaria</i> L.	Chenopodiaceae	T	SEME													+
237. <i>Chondrilla juncea</i> L.	Asteraceae	H	EUAS											+	+	+



273. <i>Crepis neglecta</i> L.	Asteraceae	T	EUME									+	+
274. <i>Crepis sancta</i> (L.) Babc.	Asteraceae	T	SEME									+	+
275. <i>Crepis setosa</i> Haller f	Asteraceae	T	SEPO									+	+
276. <i>Crepis vesicaria</i> L. ssp. <i>vesicaria</i>	Asteraceae	T	CIME									+	+
277. <i>Crocus reticulatus</i> Steven ex Adams	Iridaceae	G	EEUP									+	+
278. <i>Cruciata laevipes</i> Opiz.	Rubiaceae	H	EUAS					+	+	+	+	+	+
279. <i>Crupina crupinastrum</i> (Moris) Vis.	Asteraceae	T	CIME									+	
280. <i>Cucurbita pepo</i> L.	Cucurbitaceae	T	CUAD					cas	+			+	
281. <i>Cupressus sempervirens</i> L.	Cupressaceae	P	CUAD					cas				+	+
282. <i>Cuscuta campestris</i> Yunker	Cuscutaceae	T	CUAD			Am-N			+	+	+	+	+
283. <i>Cuscuta epithymum</i> L.	Cuscutaceae	T	WISP									+	+
284. <i>Cuscuta europaea</i> L.	Cuscutaceae	T	EUAS										+
285. <i>Cyclamen hederifolium</i> Aiton.	Primulaceae	G	SEME		V							+	+
286. <i>Cymbalaria muralis</i> P.Gaertn., Mey. et Scherb.	Scrophulariaceae	H	SEME						+				
287. <i>Cynodon dactylon</i> (L.) Pers.	Poaceae	G	WISP						+	+	+	+	+
288. <i>Cynoglossum columnae</i> Ten.	Boraginaceae	T	EAME		R							+	
289. <i>Cynoglossum creticum</i> Mill.	Boraginaceae	T	CIME									+	
290. <i>Cynosurus echinatus</i> L.	Poaceae	T	SEME									+	+
291. <i>Cyperus fuscus</i> L.	Cyperaceae	T	WISP										+
292. <i>Cyperus longus</i> L.	Cyperaceae	Hy	SEME						+				+
293. <i>Dactylis glomerata</i> L. ssp. <i>glomerata</i>	Poaceae	H	EUAS						+	+	+	+	+
294. <i>Dactylis glomerata</i> L. ssp. <i>hispanica</i> (Roth.) Nyman	Poaceae	H	CIME						+	+	+	+	+
295. <i>Dactylorhiza sambucina</i> (L.) Soó	Orchidaceae	G	EURO									+	
296. <i>Dasypyrum villosum</i> (L.) P.Candargy	Poaceae	T	MEPO						+	+	+	+	+
297. <i>Datura stramonium</i> L.	Solanaceae	T	CUAD			Am-N			+	+	+	+	+
298. <i>Daucus carota</i> L.	Apiaceae	H	EUAS						+	+	+	+	+
299. <i>Desmazeria rigida</i> (L.) Tutin	Poaceae	T	MEAT						+			+	+
300. <i>Dianthus sylvestris</i> Wulfen in Jacq. ssp. <i>sylvestris</i>	Caryophyllaceae	H	SEMO									+	+
301. <i>Dianthus sylvestris</i> Wulfen in Jacq. ssp. <i>tergestinus</i> (Reichenb.) Hayek	Caryophyllaceae	H	ILAE		R							+	+
302. <i>Dichanthium ischaemum</i> (L.) Roberty	Poaceae	H	SEME						+	+	+	+	+
303. <i>Dictamnus albus</i> L.	Rutaceae	Ch	EUAS									+	
304. <i>Digitaria ciliaris</i> (Retz.) Koeler	Poaceae	T	WISP									+	+
305. <i>Digitaria sanguinalis</i> (L.) Scop.	Poaceae	T	WISP						+	+		+	+





































831. <i>Silene vulgaris</i> (Moench) Garcke	Caryophyllaceae	H	SEME									+	+	+	+				
832. <i>Sinapis alba</i> L.	Brassicaceae	T	CIME												+				
833. <i>Sinapis arvensis</i> L.	Brassicaceae	T	CUAD				arc								+				
834. <i>Sisymbrium officinale</i> (L.) Scop.	Brassicaceae	T	WISP									+	+		+	+			
835. <i>Sium latifolium</i> L.	Apiaceae	Hy	CEEU													+			
836. <i>Smyrniium perfoliatum</i> L.	Apiaceae	H	CIME									+		+	+	+			
837. <i>Solanum dulcamara</i> L.	Solanaceae	Ch	WISP									+				+			
838. <i>Solanum elaeagnifolium</i> Cav.	Solanaceae	H	CUAD				Am-S									+			
839. <i>Solanum lycopersicum</i> L.	Solanaceae	T	CUAD				Am-S									+	+		
840. <i>Solanum melongena</i> L.	Solanaceae	T	CUAD								cas						+		
841. <i>Solanum nigrum</i> L. ssp. <i>nigrum</i>	Solanaceae	T	WISP									+	+			+	+		
842. <i>Solanum nigrum</i> L. ssp. <i>schultesii</i> (Opiz) Wessely	Solanaceae	T	WISP														+	+	
843. <i>Solanum tuberosum</i> L.	Solanaceae	G	CUAD				Am-S											+	
844. <i>Solanum villosum</i> Mill.	Solanaceae	T	SEME														+	+	
845. <i>Sonchus arvensis</i> L.	Asteraceae	T	WISP												+	+	+		
846. <i>Sonchus asper</i> (L.) Hill ssp. <i>glaucescens</i> (Jord.) Ball	Asteraceae	H	CIME												+			+	
847. <i>Sonchus oleraceus</i> L.	Asteraceae	T	WISP									+	+			+	+		
848. <i>Sorbus domestica</i> L.	Rosaceae	P	CIME															+	
849. <i>Sorghum bicolor</i> (L.) Moench	Poaceae	T	CUAD				Unkn											+	
850. <i>Sorghum halepense</i> (L.) Pers.	Poaceae	H	CUAD								cas	+	+			+	+		
851. <i>Sparganium erectum</i> L. ssp. <i>neglectum</i> (Beeby) Schinz et Thell.	Sparganiaceae	Hy	EUAS									+						+	
852. <i>Spiranthes spiralis</i> (L.) Chevall	Orchidaceae	G	EURO				E											+	
853. <i>Stachys annua</i> L.	Lamiaceae	T	EURO															+	
854. <i>Stachys cretica</i> L. ssp. <i>salviifolia</i> (Ten.) Rech. f.	Lamiaceae	H	ILAP														+	+	+
855. <i>Stachys germanica</i> L.	Lamiaceae	H	EUME														+		
856. <i>Stachys palustris</i> L.	Lamiaceae	H	CIHO									+						+	
857. <i>Stachys recta</i> L.	Lamiaceae	H	SEMO														+		
858. <i>Stachys subcrenata</i> Vis.	Lamiaceae	H	CIME														+		
859. <i>Stachys thirkei</i> K.Koch	Lamiaceae	H	SEME															+	
860. <i>Stellaria media</i> (L.) Vill. ssp. <i>media</i>	Caryophyllaceae	T	WISP									+	+		+	+	+	+	
861. <i>Stenbergia lutea</i> Ker.	Amarylidaceae	G	CIME				V					+							
862. <i>Stipa bromoides</i> (L.) Dörlf.	Poaceae	H	CIME															+	
863. <i>Stipa pennata</i> L.	Poaceae	H	EUAS														+	+	
864. <i>Symphoricarpos albus</i> (L.) S.F.Blake	Caprifoliaceae	P	CUAD								cas							+	







