The Medicinal and Poisonous Herbal Species of Plešivica Hills (NW Croatia)

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Summary

During the floristic research of different habitat types of Plešivica hills, the floristic composition has shown a great number of medicinal and poisonous plants with 186 taxa that belonged to 52 families. The most dominant families were *Asteraceae, Fabaceae, Lamiaceae* and *Rosaceae*. An interesting fact to be pointed out is a large number of plant species that are at the same time poisonous and medicinal. The difference between them is in plant organs or dosage. The highest number of species was noted on ruderal habitats such as roadsides, paths and hedges (137 species), sides of the ditches (94 species), vineyards (72 species), plough-fields (63 species), gardens (54 species) and meadows (48 species).

Key words

medicinal plants, poisonous plants, life form, duration of life, phytogeographical elements, time of flowering

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Introduction

During history, many plants were used for curing various diseases or reducing their symptoms. Therefore, these species are called medicinal plants. According to the World Health Organization (WHO), plants are considered medicinal if one or more plant organs contain biologically active substances (alkaloids, glycosides, saponins, tannins, essential oils, resins, mucus, etc.) that can be used for therapeutic purposes or for the chemical-pharmaceutical synthesis.

Active substances can be located in one or more parts of the plant or can be evenly distributed in several plant organs. All plant species, including those in the daily diet, contain some substances that can negatively affect the human body. Plants are considered poisonous if they contain substances that negatively affect human or animal health (Knežević, 2006). Poisonous substances can be found in all or only in some parts of plants, mostly in fruits and seeds. The toxic properties of plants originate from different poisonous contents, primary glycosides and alkaloids. Its poison affects digestive and respiratory organs, skin and very often it affects the organism through blood (Grdinić and Kremer, 2009). Many herbal species that are considered poisonous are used as medicinal herbs in the conventional medicine, as well as in alternative medicine, phytotherapy, aromatherapy, homeopathy and other forms of treatments.

After the pharmaceutical industry had developed, the use of medicinal herbs has been slowly forgotten (Križanić, 2005). However, in recent times, people tend to reconnect with nature, so they opt for alternative medicine and natural treatments. In this process, medicinal herbs play a very important role. The modern version of alternative medicine is phytotherapy (herbal medicine), which preserves health and prevents diseases with the use of whole plants, plant organs, plant products or plant extracts (Kuštrak, 2005). The most widespread plant property for many flowering plants is the ability to produce aromatic substances (odor). Mainly, these are the essential oils (EOs) that develop stronger or weaker smell by evaporating. These plants are called aromatic plants and are used in aromatherapy as a part of phytotherapy (Marković, 2005). EOs are extracted from different plant parts and also are used in aromatherapy. They are obtained by steam distillation or pressing and can be used by inhalation, massage or in other ways. Along with herbal medicine, homeopathy is another widespread method in treating humans or animals. This system of alternative medicine was created 250 years ago, and it is based on the doctrine of "like cures like" ("similia similibus curentur"), that claims that the substance which induces symptoms in healthy people would cure similar symptoms in sick people (Bielau, 2005).

People tend to grow medicinal herbs on their agricultural land and it shows to be an increasing practice. However, wild plants are of the great value, as they are mentioned in numerous books on alternative medicine and presented to the public in different ways. For the same reason, they're becoming more and more popular. On the other hand, medicinal plants of specific areas are rarely described and noted. Therefore, this floristic research contributes to the cognition of medicinal and poisonous plants distribution on Plešivica hills.

Material and methods

The floristic observations of Plešivica hills were carried out during growing seasons of 2002 and 2003.

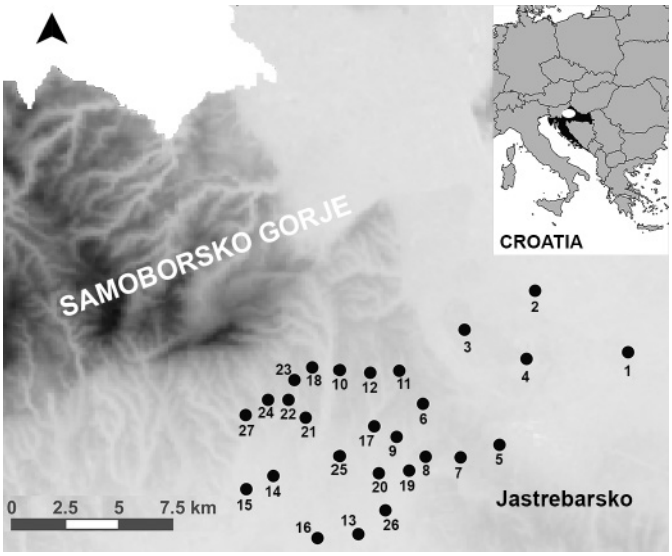

Figure 1. Geographical coverage of the studied area with locations (1 – Beter, 2 – Novo Selo Okićko, 3 – Gonjeva, 4 – Stankovo, 5 – Desinec, 6 – Prhoč, 7 – Breznik, 8 – Zdihovo, 9 – Donja Reka, 10 – Kupeč Dol, 11 – Laškovec, 12 – Prilipje, 13 – Čeglje, 14 – Pribić, 15 – Krašić, 16 – Vukšin Šipak, 17 – Malunje, 18 – Ivančići, 19 – Jastrebarsko, 20 – Črnilovec, 21 – Miladini, 22 – Sv. Jana, 23 – Bukovac, 24 – Belčići, 25 – Petrovina, 26 – Volavje, 27 – Slavetić)

The medicinal and poisonous plants were investigated on cultivated habitats (plough-fields, gardens with orchard), semi-cultivated habitats (vineyards, meadows) and ruderal habitats (roadsides, paths, hedges and ditches) at 27 localities (Figure 1).

Usual identification keys and iconography were used for the identification (Hegi, 1906-1931; Javorka and Csapody, 1934; Bonnier, 1962; Tutin and Heywood, 1964-1993; Domac, 1994; Knežević, 2006). The nomenclature of plants is in accordance with Flora Croatica Database (Nikolić, 2017). The list of species is presented in alphabetic order of families. All species and subspecies are listed with data of the habitat where the species were noted, as well with data of life forms, duration of life, phytogeographical elements and the time of flowering.

The spectrum of the life forms (T – therophytes, H – hemicryptophytes, G – geophytes, P – phanerophytes, Ch – chamaephytes) and life cycle duration (1 – annual, 2 – biennial, peren – perennial, w. peren – woody perennial) for each species are based on Garcke (1972) and Hulina (1991). Floral elements (euras - Euroasian origin, cosmop – cosmopolites, eur – European origin, circ – Circum-Holarctic origin, sue - South-European origin, submed – sub-Mediterranean origin, mie - Middle-European origin, med – Mediterranean, cult – cultivated, kont – continental origin, adv – adventive, prealp – prealpine origin) are based mainly on Garcke (1972), but the absent floral elements of the local flora are taken from Kovačević (1976), Šegulja (1977), Hulina (1991) and Vrbek (2000). The flowering period varies depending on climate conditions, but according to the literature data (Garcke, 1972; Šarić, 1978; Šilić, 1983; Hulina, 1991; Dubravec and Dubravec, 2001; Knežević, 2006), some approximate values are listed in Table 1.

The medicinal and poisonous plants were analysed on the basis of existing literature data: Kušan 1956, Gelenčir 1987, Marušić 1988, Pahlow 1989, Gelenčir and Gelenčir 1991, Boericke 1994, Vermeulen 1994, Lockie and Geddes 1996, Forenbacher 1998, Mindel 1998, Galle Toplak 2001, Bielau 2005, Križanić 2005, Marković 2005, Knežević 2006, Grdinić and Kremer 2009.

Results and discussion

During floristic observations of Plešivica hills, 186 medicinal and/or poisonous plant taxa that are used in traditional medicine, phytotherapy, aromatherapy or homeopathy were noted. These species belong to 52 families (Table 1). Families with the largest number of taxa are *Asteraceae* (22 taxa), *Fabaceae* (15 taxa), *Lamiaceae* (13 taxa) and *Rosaceae* (11 taxa). Similar distribution was found by Neblea et al. (2012) in the western part of Bucegi Mountains (Meridional Carpathians) in Romania, and by Etcheverry et al. (2012) in the Salta Province in north-western Argentina.

The largest number of medicinal and/or poisonous plants were recorded on ruderal habitats on roadsides, paths, and hedges (137 species), followed by the sides of ditches (94 species), vineyards (72 species), plough-fields (63 species), gardens (54 species) and meadows (48 species).

The analysis of life forms of medicinal and/or poisonous plants showed that the most numerous were hemicryptophytes (96 species). The following were therophytes (45 species), phanerophytes (20 species), geophytes (16 species) and chamaephytes (9 species). Predominance of hemicryptophytes is compatible with continental Central European position of Croatia, while significant participation of therophytes points to the anthropogenic influence on the environment (Dujmović Purgar, 2006).

The spectrum of life cycle duration of medicinal and/or poisonous plants showed predominance of the perennial herbaceous plants (109 species). The following were annual plants (45 species), woody plants (21 species) and biennial plants (11 species). Predominance of the perennial herbaceous plants is in accordance with prevailing of hemicryptophytes, earlier assessed in the observed area (Dujmović Purgar, 2006).

Table 1. The medicinal and poisonous herbal species of Plešivica hills

No	Taxa	Life form	Duration of life	Floral element	Flowering period	Part used	Conventional medicine	Traditional medicine	Phytotherapy	Aromatherapy	Homeopathy	Poisonous	Plough-fields	Gardens	Meadows	Vineyards	Roadsides, paths and hedges	The ditches
	EQUISETACEAE																	
1	*Equisetum arvense* L.	G	peren	cosmop	3-4	herba	+	+	+			+	+		+	+	+	
2	*Equisetum palustre* L.	G	peren	circ	3-5	herba						+						+
	CUPRESSACEAE																	
3	*Juniperus communis* L.	P	w. peren	euras	4-5	herba, fructus lignum		+	+	+							+	
	AMARANTHACEAE																	
4	*Amaranthus deflexus* L.	T	1	adv (South America)	6-8	folium						+					+	
5	*Amaranthus lividus* L.	T	1	cosmop	6-9	folium						+				+		
6	*Amaranthus retroflexus* L.	T	1	cosmop	6-9	herba, folium, semen		+				+	+	+		+	+	+
	APIACEAE																	
7	*Daucus carota* L.	H	2	euras	6-9	radix, semen		+	+	+		+		+	+	+	+	+
8	*Foeniculum vulgare* Mill.	H	2	med		radix, herba		+	+	+							+	
9	*Heracleum sphondyllium* L.	H	peren	euras	6-9	herba		+				+				+	+	+
10	*Pastinaca sativa* L.	H	2	euras	8-9	fructus herba		+						+	+	+	+	+
11	*Pimpinella saxifraga* L.	H	peren	euras	6-10	radix		+									+	+
	ARALIACEAE																	
12	*Hedera helix* L.	P	w. peren	eur	9-10	folium	+	+	+		+	+					+	
	ASCLEPIADACEAE																	
13	*Vincetoxicum hirundinaria* Medicus	H	peren	euras	5-9	rhizoma		+				+					+	
	ASTERACEAE																	
14	*Achillea millefolium* L.	H	peren	cosmop	5-9	flos, herba	+	+	+	+			+	+		+	+	+
15	*Ambrosia artemisiifolia* L.	T	1	adv (North America)	8-9	pollen					+		+	+	+	+	+	+
16	*Arctium lappa* L.	H	peren	euras	7-9	radix		+	+	+			+			+	+	
17	*Artemisia absinthium* L.	Ch	peren	euras	7-9	folium, herba, radix		+	+		+							+
18	*Artemisia vulgaris* L.	H	peren	cosmop	8-9	folium		+			+		+		+	+	+	+
19	*Bellis perennis* L.	H	peren	mie	3-9	folium, flos		+			+							+
20	*Bidens tripartita* L.	T	1	euras	7-10	herba		+					+				+	+
21	*Carlina acaulis* L.	H	peren	prealp	6-9	radix		+										+
22	*Centaurea jacea* L.	H	peren	euras	6-10	folium		+						+	+	+	+	+
23	*Chamomilla recutita* (L.) Rausch.	T	1	cosmop	5-8	flos	+	+	+	+	+		+				+	+

Table 1. The medicinal and poisonous herbal species of Plešivica hills (Continued)

No	Taxa	Life form	Duration of life	Floral element	Flowering period	Part used	Conventional medicine	Traditional medicine	Phytotherapy	Aromatherapy	Homeopathy	Poisonous	Plough-fields	Gardens	Meadows	Vineyards	Roadsides, paths and hedges	The ditches
24	*Cirsium arvense* (L.) Scop.	G	peren	euras	6-9	folium		+					+	+	+	+	+	+
25	*Cirsium oleraceum* (L.) Scop.	H	peren	euras	8-9	herba, radix		+							+			+
26	*Conyza canadensis* (L.) Cronq	T	1	adv (North America)	6-10	herba		+	+		+		+	+	+	+	+	+
27	*Erigeron annuus* (L.) Pers.	H	peren	adv (North America)	6-10	folium		+				+	+	+	+	+	+	+
28	*Eupatorium cannabinum* L.	H	peren	med	7-9	herba, radix		+				+					+	+
29	*Helianthus tuberosus* L.	G	peren	adv (North America)	8-10	tuber		+									+	
30	*Pulicaria dysenterica* (L.) Bernh.	H	peren	sue	7-9	herba		+							+	+	+	+
31	*Senecio vulgaris* L.	T	1	cosmop	3-10	herba		+				+		+		+	+	
32	*Solidago gigantea* Ait.	H	peren	adv (North America)	7-9	herba, radix	+	+			+	+					+	
33	*Solidago virgaurea* L.	H	peren	euras	8-9	herba, radix		+	+		+						+	
34	*Tanacetum vulgare* L.	H	peren	euras	7-9	folium, herba		+				+		+	+	+		+
35	*Tussilago farfara* L.	G	peren	euras	3-4	folium	+	+	+							+	+	
	BORAGINACEAE																	
36	*Anchusa officinalis* L.	H	2	mie	5-9	herba		+				+	+					
37	*Cerinthe minor* L.	H	2	sue	5-7	herba		+					+		+			+
38	*Pulmonaria officinalis* L.	H	peren	kont	3-4	herba	+	+									+	
39	*Symphytum officinale* L.	H	peren	eur	4-8	radix, folium	+	+	+		+	+		+		+	+	+
40	*Symphytum tuberosum* L.	G	peren	sue	4-8	radix, folium		+				+					+	
	BRASSICACEAE																	
41	*Alliaria petiolata* (Bieb.) Cavara & Grande	H	peren	euras	4-5	herba		+				+					+	+
42	*Armoratia rusticana* Gaert., Meyer & Schreb.	H	peren	euras	4-7	radix		+						+		+		+
43	*Barbarea vulgaris* R.Br.	H	2	cosmop	4-7	herba		+									+	
44	*Brassica rapa* L.	T	1	adv	4-9	radix	+	+					+			+		+
45	*Capsella bursa-pastoris* (L.) Medik.	T	1	cosmop	3-10	herba, radix		+	+	+			+	+		+	+	+
46	*Cardamine hirsuta* L.	T	1	cosmop	3-6	herba		+				+	+			+	+	+
47	*Cardamine pratensis* L.	H	peren	circ	4-6	herba		+				+						+
48	*Sinapis arvensis* L.	T	1	cosmop	5-9	semen		+				+						+
49	*Thlaspi arvense* L.	T	1	submed	4-6	herba		+				+	+				+	
	CANNABACEAE																	
50	*Humulus lupulus* L.	H	peren	euras	6-8	strobulus		+									+	+
	CAPRIFOLIACEAE																	
51	*Lonicera caprifolium* L.	P	w. peren	euras	5-7	flos, herba, radix, fructus		+				+					+	
52	*Sambucus ebulus* L.	H	peren	euras	6-7	flos, folium, radix		+				+					+	
53	*Sambucus nigra* L.	P	w. peren	eur	5-6	flos	+	+	+		+	+					+	
	CARYOPHYLLACEAE																	
54	*Saponaria officinalis* L.	H	peren	euras	6-9	herba, radix		+				+					+	
55	*Silene latifolia* Poir. ssp. *alba* (Mill.) Greuter et Bourdet	H	peren	euras	5-9	folium		+					+	+	+		+	+
56	*Silene vulgaris* (Moench) Garcke	H	peren	euras	5-9	radix		+						+			+	
57	*Stellaria graminea* L.	H	peren	euras	5-8	herba		+				+			+			
58	*Stellaria holostea* L.	Ch	peren	euras	3-6	herba		+									+	+
59	*Stellaria media* (L.) Vill	T	1	cosmop	3-10	herba, radix		+			+		+	+		+	+	+
	CELASTRACEAE																	
60	*Euonymus europaeus* L.	P	w. peren	euras	5-7	cortex, fructus, semen, folium		+				+					+	

Table 1. The medicinal and poisonous herbal species of Plešivica hills (Continued)

No	Taxa	Life form	Duration of life	Floral element	Flowering period	Part used	Conventional medicine	Traditional medicine	Phytotherapy	Aromatherapy	Homeopathy	Poisonous	Plough-fields	Gardens	Meadows	Vineyards	Roadsides, paths and hedges	The ditches
	CHENOPODIACEAE																	
61	*Atriplex patula* L.	T	1	euras		-						+	+	+		+		
62	*Chenopodium album* L.	T	1	cosmop	6-10	herba, radix		+				+	+	+		+	+	+
63	*Chenopodium polyspermum* L.	T	1	euras	7-8	herba, radix		+				+	+	+		+		
	CICHORIACEAE																	
64	*Cichorium intybus* L.	H	peren	euras	6-9	herba, radix	+	+				+		+	+	+	+	+
65	*Lactuca serriola* L.	T	1	euras	7-9	herba	+	+						+			+	+
66	*Lapsana communis* L.	T	1	euras	5-9	folium		+						+			+	
67	*Sonchus arvensis* L.	G	peren	cosmop	7-9	-						+		+		+		+
68	*Sonchus oleraceus* L.	T	1	cosmop	6-10	herba		+						+		+		+
69	*Taraxacum officinale* Wiggers	H	peren	cosmop	3-10	herba, flos, radix	+	+	+		+		+	+		+	+	+
	CONVOLVULACEAE																	
70	*Calystegia sepim* (L) R.Br.	H	peren	cosmop	6-9	folium, radix		+					+	+		+	+	+
71	*Convolvulus arvensis* L.	H	peren	cosmop	5-9	herba		+					+	+	+	+	+	+
	CORNACEAE																	
72	*Cornus sanguinea* L.	P	w. peren	eur	2-3	fructus, cortex		+				+				+	+	+
	CORYLACEAE																	
73	*Corylus avellana* L.	P	w. peren	eur	2-3	folium, cortex, semen		+									+	
	DIPSACACEAE																	
74	*Dipsacus fullonum* L.	H	2	cosmop	6-8	folium, radix		+									+	+
75	*Knautia arvensis* (L.) Coult.	H	peren	euras	5-9	herba, radix		+			+				+	+	+	
76	*Succisa pratensis* Moench	H	peren	euras	7-9	herba, radix		+						+	+		+	
	EUPHORBIACEAE																	
77	*Euphorbia cyparissias* L.	H	peren	eur	4-7	folium, semen		+				+					+	+
78	*Euphorbia esula* L.	H	peren	eur	6-8	herba						+	+				+	
79	*Euphorbia falcata* L.	T	1	sue	4-9	-						+			+		+	
80	*Euphorbia helioscopia* L.	T	1	cosmop	4-10	herba		+				+	+	+		+	+	
81	*Euphorbia peplus* L.	T	1	cosmop	7-10	-						+					+	
82	*Euphorbia polychroma* Kern.	H	peren	kont	5-6	-						+					+	
83	*Euphorbia villosa* W.K.	H	peren	eur	4-6	-						+				+		
	FABACEAE																	
84	*Anthylis vulneraria* L.	H	peren	eur	5-6	flos		+									+	
85	*Coronilla varia* L.	H	peren	eur	5-9	herba		+				+			+		+	
86	*Galega officinalis* L.	H	peren	med	6-8	herba		+				+			+		+	
87	*Glycyrrhiza glabra* L.	H	peren	eur	6-9	radix, herba	+					+					+	
88	*Lathyrus vernus* (L.) Bernh.	H	peren	eur	3-6	semen, rhizoma		+									+	
89	*Medicago sativa* L.	Ch	peren	euras	6-9	herba		+				+				+	+	+
90	*Melilotus albus* Medik.	H	2	euras	6-9	herba		+							+		+	
91	*Melilotus officinalis* (L.) Pallas	H	2	euras	6-9	flos	+	+	+			+					+	
92	*Ononis arvensis* L.	H	peren	eur	7-8	herba, radix		+							+		+	
93	*Ononis spinosa* L.	Ch	peren	med	6-9	radix		+									+	
94	*Robinia pseudacacia* L.	P	w. peren	adv (North America)	5	flos, folium		+			+	+					+	
95	*Trifolim pratense* L.	H	peren	euras	5-9	flos		+					+	+		+	+	+
96	*Trifolium repens* L.	H	peren	cosmop	5-9	flos		+					+			+		+
97	*Vicia cracca* L.	H	peren	euras	6-8	semen		+				+	+			+	+	+
98	*Vicia sativa* L.	T	1	cosmop	5-7	herba		+						+			+	+
	FAGACEAE																	
99	*Quercus pubescens* Willd.	P	w. peren	submed	4-5	cortex	+										+	
	GENTIANACEAE																	
100	*Centaurium erythraea* Rafn.	T	1	cosmop	7-9	herba	+	+					+		+			
	GERANIACEAE																	
101	*Geranium robertianum* L.	T	1	cosmop	5-9	herba, radix		+									+	
102	*Geranium sanguineum* L.	H	peren	sue	5-8	herba, radix		+									+	
	HYPERICACEAE																	
103	*Hypericum perforatum* L.	H	peren	euras	6-9	herba	+	+			+	+		+	+		+	+
	JUGLANDACEAE																	
104	*Juglans regia* L.	P	w. peren	cult	4-5	folium		+	+								+	

Table 1. The medicinal and poisonous herbal species of Plešivica hills (Continued)

No	Taxa	Life form	Duration of life	Floral element	Flowering period	Part used	Conventional medicine	Traditional medicine	Phytotherapy	Aromatherapy	Homeopathy	Poisonous	Plough-fields	Gardens	Meadows	Vineyards	Roadsides, paths and hedges	The ditches
	LAMIACEAE																	
105	*Ajuga reptans* L.	H	peren	euras	4-7	herba		+	+								+	+
106	*Glechoma hederacea* L.	H	peren	circ	4-9	herba, folium		+				+	+			+	+	+
107	*Lycopus europaeus* L.	H	peren	euras	7-9	herba		+										+
108	*Mentha arvensis* L.	H	peren	circ	6-10	folium	+	+	+	+			+		+	+	+	+
109	*Mentha longifolia* (L.) Hudson	H	peren	cosmop	6-9	herba		+	+	+		+		+	+		+	+
110	*Nepeta cataria* L.	H	peren	euras	7-9	folium, flos		+	+								+	
111	*Origanum vulgare* L. *ssp. vulgare*	H	peren	euras	6-10	herba, radix		+	+	+					+		+	
112	*Salvia pratensis* L.	H	peren	submed	5-8	folium		+									+	+
113	*Stachys annua* L.	T	1	eur	6-10	-						+	+				+	
114	*Stachys officinalis* (L.) Trev.	H	peren	eur	6-7	folium		+							+		+	
115	*Stachys palustris* L.	H	peren	circ	6-9	-						+	+		+	+	+	+
116	*Teucrium chamedrys* L.	Ch	peren	sue	6-8	herba		+	+					+				
117	*Thymus serpyllum* L.	Ch	peren	eur	5-9	herba	+	+	+	+					+		+	
	LYTHRACEAE																	
118	*Lythrum salicaria* L.	H	peren	circ	6-8	herba	+	+					+		+	+	+	+
	MALVACEAE																	
119	*Abutilon theophrasti* Med.	T	1	sue	7-8	semen, herba		+					+					+
120	*Althaea officinalis* L.	H	peren	cosmop	7-9	radix, folium, flos	+	+	+					+			+	
121	*Malva sylvestris* L.	H	peren	eur	5-10	folium, flos	+	+	+							+		
	OLEACEAE																	
122	*Ligustrum vulgare* L.	P	w. peren	euras	5-7	folium, cortex		+				+					+	
	ONAGRACEAE																	
123	*Epilobium hirsutum* L.	H	peren	euras	6-9	herba		+				+	+				+	+
	PAPAVERACEAE																	
124	*Chelidonium majus* L.	H	peren	euras	4-9	herba, radix	+	+	+		+	+		+			+	
125	*Fumaria officinalis* L.	T	1	euras	5-9	herba		+	+			+	+					
126	*Papaver rhoeas* L.	T	1	cosmop	4-8	flos, semen	+	+				+	+		+		+	+
	PLANTAGINACEAE																	
127	*Plantago lanceolata* L.	H	peren	cosmop	5-9	herba, radix	+	+	+		+				+	+	+	+
128	*Plantago major* L.	H	peren	cosmop	6-9	herba		+	+		+		+			+	+	+
129	*Plantago media* L.	H	peren	euras	5-9	herba			+				+	+				
	POLYGONACEAE																	
130	*Biderdykia convolvulus* (L.) Dumort.	T	1	euras	6-10	-						+	+			+	+	+
131	*Polygonum aviculare* L.	T	1	cosmop	5-11	herba	+	+				+	+	+		+	+	
132	*Polygonum hydropiper* L.	T	1	circ	7-9	herba		+										+
133	*Polygonum lapathifolium* L.	T	1	cosmop	6-9	herba		+				+	+	+		+	+	+
134	*Polygonum persicaria* L.	T	1	cosmop	6-9	herba		+				+	+	+	+			
135	*Rumex acetosa* L.	H	peren	cosmop	5-9	herba		+				+	+	+	+		+	+
136	*Rumex acetosella* L.	H	peren	cosmop	5-8	folium		+				+				+		
137	*Rumex crispus* L.	H	peren	cosmop	6-8	herba, radix		+				+	+		+	+	+	+
138	*Rumex obtusifolius* L.	H	peren	euras	6-8	radix		+				+	+			+		+
	PORTULACACEAE																	
139	*Portulaca oleracea* L.	T	1	cosmop	7-10	herba		+								+		
	PRIMULACEAE																	
140	*Anagalis arvensis* L.	T	1	cosmop	5-10	herba		+				+	+	+		+		
141	*Lysimachia nummularia* L.	Ch	peren	euras	5-7	herba, radix		+	+				+	+				+
142	*Primula vulgaris* Huds.	H	peren	sue	3-5	flos, radix	+										+	
	RANUNCULACEAE																	
143	*Clematis vitalba* L.	P	w. peren	mie	6-8	herba		+			+	+					+	
144	*Consolida regalis* S.F. Gray	T	1	euras	5-9	flos		+			+	+	+					
145	*Nigella arvensis* L.	T	1	submed	6-8	semen		+				+		+				
146	*Ranunculus acris* L.	H	peren	cosmop	5-9	radix		+				+		+	+		+	+
147	*Ranunculus bulbosus* L.	G	peren	euras	4-7	herba		+							+			+
148	*Ranunculus ficaria* L.	G	peren	mie	3-5	herba		+				+					+	+

Table 1. The medicinal and poisonous herbal species of Plešivica hills (Continued)

No	Taxa	Life form	Duration of life	Floral element	Flowering period	Part used	Conventional medicine	Traditional medicine	Phytotherapy	Aromatherapy	Homeopathy	Poisonous	Plough-fields	Gardens	Meadows	Vineyards	Roadsides, paths and hedges	The ditches
	RESEDACEAE																	
149	*Reseda lutea* L.	H	peren	cosmop	5-10	-						+				+		
	ROSACEAE																	
150	*Agrimonia eupatoria* L.	H	peren	circ	5-9	herba, radix	+	+							+			
151	*Crataegus monogyna* Jacq.	P	w. peren	euras	4-5	fructus	+	+	+		+						+	
152	*Fragaria vesca* L.	H	peren	euras	4-5	herba, folium		+									+	+
153	*Geum urbanum* L.	H	peren	cosmop	5-10	herba, radix		+						+		+	+	
154	*Potentilla erecta* (L.)Rauschel	H	peren	euras	5-7	rhizoma	+	+	+								+	
155	*Potentilla reptans* L.	H	peren	cosmop	5-8	rhizoma		+					+	+	+	+	+	+
156	*Prunus avium* L.	P	w. peren	cult	4	fructus, cortex		+									+	
157	*Rosa canina* L.	P	w. peren	cosmop	5-6	herba, fructus	+	+	+	+							+	+
158	*Rubus caesius* L.	Ch	w. peren	euras	5-10	fructus		+					+			+	+	+
159	*Rubus fruticosus* L.	P	w. peren	euras	6-9	folium, fructus	+	+					+				+	
160	*Rubus idaeus* L.	P	w. peren	cult	6-7	folium, fructus											+	
	RUBIACEAE																	
161	*Galium aparine* L.	T	1	cosmop	5-10	herba		+					+			+	+	+
162	*Galium mollugo* L.	H	peren	euras	5-9	herba		+						+	+	+	+	+
163	*Galium verum* L.	H	peren	cosmop	5-9	herba	+	+							+		+	+
	SALICACEAE																	
164	*Salix alba* L.	P	w. peren	euras	3-4	folium, cortex	+	+								+		
165	*Salix daphnoides* Vill.	P	w. peren	prealp	3-4	cortex	+											+
166	*Salix fragilis* L.	P	w. peren	euras	3-5	cortex	+										+	
	SCROPHULARIACEAE																	
167	*Linaria vulgaris* Mill.	G	peren	euras	6-10	herba		+				+		+	+	+	+	+
168	*Melampyrum nemorosum* L.	T	1	eur		-						+	+				+	
169	*Verbascum blattaria* L.	H	2	eur	5-7	folium, flos		+				+			+		+	+
170	*Verbascum phlomoides* L.	H	2	eur	7-9	flos	+	+				+					+	
171	*Veronica officinalis* L.	Ch	peren	circ	3-6	herba	+	+										+
	SOLANACEAE																	
172	*Solanum nigrum* L.	T	1	cosmop	6-10	herba, radix, fructus		+				+	+	+		+		
	URTICACEAE																	
173	*Urtica dioica* L.	H	peren	cosmop	7-9	herba, radix	+	+	+			+	+	+		+	+	+
	VALERIANACEAE																	
174	*Valeriana officinalis* L.	H	peren	euras	4-6	radix, rhizoma	+	+	+	+	+					+		
	VERBENACEAE																	
175	*Verbena officinalis* L.	T	1	cosmop	6-9	herba		+					+		+	+	+	+
	VIOLACEAE																	
176	*Viola arvensis* Murr.	T	1	eur	3-6	herba, flos	+					+	+					
	AMARYLLIDACEAE																	
177	*Galanthus nivalis* L.	G	peren	submed	1-4	bulbus		+				+					+	+
	IRIDACEAE																	
178	*Iris pseudacorus* L.	G	peren	euras		rhizoma		+			+							+
	JUNCACEAE																	
179	*Juncus effusus* L.	H	peren	euras	6-8	radix		+									+	+
	LILIACEAE																	
180	*Ornithogalum umbellatum* L.	G	peren	eur	5 6	bulbus		+			+	+					+	
	POACEAE																	
181	*Cynodon dactylon* (L.)Pers.	G	peren	cosmop	6-7	rhizoma		+								+	+	
182	*Elymus repens* (L.) Gould	G	peren	euras	6-8	rhizoma	+	+					+	+		+	+	+
183	*Lolium perenne* L.	H	peren	cosmop	5-9	semen		+						+				+
184	*Setaria viridis* (L.) P.B.	T	1	euras	6-8	semen		+								+		
185	*Sorghum halepense* (L.) Pers.	G	peren	cosmop	6-9	herba		+				+	+		+	+		+
186	*Trisetum flavescens* (L.) Beauv.	H	peren	circ	5-6	-						+					+	

Life forms: T – therophytes, H – hemicryptophytes, G – geophytes, P – phanerophytes, Ch – chamaephytes; Life cycle duration: 1 – annual, 2 – biennial, peren – perennial, w. peren – woody perennial

Floral elements: euras - Euroasian origin, cosmop – cosmopolites, eur – European origin, circ – Circum-Holarctic origin, sue - South-European origin, submed – sub-Mediterranean origin, mie - Middle-European origin, med – Mediterranean, cult – cultivated, kont – continental origin, adv – adventive, prealp – prealpine origin

According to the phytogeographic analysis of medicinal and/or poisonous plants, the greatest number of the taxa was of the Euro-Asian origin (67 species) and widespread cosmopolites (51 species). The following were taxa of European origin (22 species) and Circum-Holarctic origin (10 species). All other floral elements were represented with less than 10 species. A large number of existing floral elements points to intermediate climatic characteristics of the observed area (Trinajstić, 1995).

The list of medicinal and poisonous species recorded on Plešivica hills counts 39 species (21%) that are included in Croatian Pharmacopoeia (NN, 2007) as medicinal plants. Different plant parts are in use as an official drugs (Figure 2). Herb (above ground part of the plant) is used in 15 species (38%), roots/rhizomes in five species (13%), as well as flowers. Leaves and barks are used in three species (8%) and fruit in one species (2%).

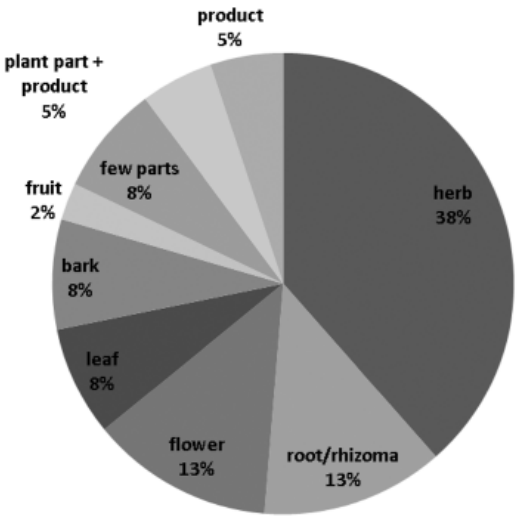

Figure 2. Spectrum of plant organs used as official drugs in plant species represented in flora of Plešivica hills and included in Croatian Pharmacopoeia (NN, 2007)

Less common are herbal species from which more than one plant part can be used as a drug. These species contain active substances from different chemical groups (alkaloids, glycosides, saponins, mucus, tannins, vitamins, essential oil) that have different pharmacological effect and their preparations could be used for a treatment of different disorders (Grdinić and Kremer, 2009).

Officinal diuretic drugs are root of *Ononis spinosa*, herb of *Equisetum arvense*, inflorescence of *Sambucus nigra* as well as berries and essential oil of *Juniperus communis*. Drugs with carminative effect are herb of *Artemisia absinthium*, berries of *Juniperus communis*, root and rhizome of *Valeriana officinalis* and essential oils of *Chamomilla recutita* and *Mentha arvensis*. Drugs with mucus that have an expectorant effect are the flower and leaf of *Malva sylvestris*, *Althaea officinalis* and root of *Glycyrrhiza glabra*, *Plantago lanceolata* and leaves of *Hedera helix*. Analgesic effects show white bark of *Salix alba*, root of *Chelidonium majus* and flower of *Papaver rhoeas*. Flower of *Papaver rhoeas* also has hypnotic and sedative effects, as well as the root and rhizome of *Valeriana officinalis* and herbs of *Hypericum perforatum* and *Verbena officinalis*.

Active substances of some plant species have multiple uses. Evident example for this is *Achillea millefolium* (yarrow) from the *Asteraceae* family. Herb of yarrow (*Millefolii herba*) is official digestive, but also used as a carminative, analgesic, antipyretic, diaphoretic, anti-hemorrhoidal, anti-inflammatory and anti-rheumatic healing remedy (Grdinić and Kremer 2009, Kuštrak, 2005). Gelenčir and Gelenčir (1991) inform that yarrow's herb is used in the traditional medicine for trauma healing, against internal bleeding, for bronchial asthma and catarrh of the stomach, as well as for healing of kidney stones, gallstones and white discharge. The same authors report about the possibility of using yarrow's essential oil in medicine, pharmacy or cosmetics.

Forage legumes of high quality (fam. *Fabaceae*), such as clovers (*Trifolium*), are important part of Plešivica hills (Dujmović Purgar and Hulina, 2006). They have healing activity, although they are not recognized as officinal drugs (Pahlow, 1989). The red clover (*Trifolium pratense*) was used in alternative medicine to cure stomach illnesses, dermal illnesses or for blood detoxication. It was used as well to prevent coughing and gastritis (Gelenčir and Gelenčir, 1991). As a source of tannin, it can be applied in the case of a mucose membrane, especially intestine's membrane (Pahlow, 1989). Additionally, the red clover has attracted attention because of its estrogenic properties (Fugh-Berman, 2001).

Species from family *Lamiaceae* are spotted in all habitats of Plešivica hills, they are especially numerous in ruderal habitats. The use of widespread species like *Ajuga reptans* (blue bugle) and *Glechoma hederacea* (ground ivy) is discontinued in conventional medicine but is still present in alternative medicine. Blue bugle is applied to prevent diarrhea, bleeding and inflammation of oral cavity, while ground ivy helps in cases of stomach and intestine inflammation, respiratory tract illness and wounds that are difficult to cure. Species *Stachys officinalis* in small doses acts like an astringent and antidiuretic, while in higher doses causes diarrhea and vomiting. Its medical properties were known in ancient civilizations of Egypt, Greece and Rome, as well in the middle age, while contemporary medicine shows weaker interest (Gelenčir and Gelenčir, 1991).

Medicinal species can also be found among weeds. For example, Knežević (2006) suggests *Abutilon theophrasti* as a medicinal species, while aeroallergens species *Ambrosia artemisiifolia* is used in homeopathy in a purpose of curing pollen allergy to this species. Species *Pulicaria dysenterica* is used as a cure for intestinal diseases. Some other weed species show medicinal activities: *Anchusa officinalis*, *Arctium lappa*, *Brassica rapa*, *Cichorium inthybus*, *Cirsium arvense* and *Linaria vulgaris*. In homeopathy following species are applied: *Colchicum autumnale*, *Phytolacca americana* and *Symphytum officinale*. Therefore, it is important to devote more research to positive effects of this plant species on human health.

Some weeds are poisonous, such as widespread *Amaranthus retroflexus*. The plant contains oxalates (Willfort, 2002) and a nephrotoxic substance whose structure and way of action still are not specified (Forenbacher, 1998; Amoli et al., 2009). Therefore, it is considered poisonous. Nevertheless, its seed was the precious food of Indian tribes (Hulina, 2011). However, extermination of the plant was abandoned by American programme of biological weed control because of verification of medicinal properties of its leaves and seed.

Species *Symphytum officinale*, one of the oldest medicinal plants, in the underground part contains allantoin that is used externally for wound healing, especially after amputations or burns. It also has a positive effect on bone gaining. On the other hand, it contains pyrolytic alkaloids that are poisonous (Pahlow, 1989).

Some species do not affect human or animal health, but they affect milk quality and several of them are *Artemisia vulgaris*, *Cichorium intybus*, *Galium mollugo*, *Galium verum*, *Mentha arvensis* and *Rumex acetosa* (Dujmović Purgar and Hulina, 2006).

Conclusion

The floristic composition, especially weeds of the Plešivica hills, shows a great number of medicinal and poisonous species. Namely, 186 plant taxa were recorded for the investigated area. The list includes 170 medicinal plant species, 84 poisonous species, including 68 species that have both medicinal and poisonous properties. Ruderal habitats are the richest in medicinal and poisonous plants. According to this information, habitats that have not agricultural significance can get new value (as a source of medicinal herbs).

The list of medicinal and poisonous species recorded at Plešivica area counts 39 species (21%) that are included in Croatian Pharmacopoeia (NN, 2007) as medicinal plants. They belong to different pharmacological groups and can be used to treat different diseases. Some species that are in use in traditional medicine are worth mentioning, such as *Ajuga reptans*, *Glechoma hederacea*, *Lotus corniculatus*, *Medicago sativa*, *Mentha* spp., *Robinia pseudoaccacia*, *Salvia pratensis*, *Taraxacum officinale*, *Thymus* sp., *Trifolium repens* and *Trifolium pratense*. It is important to emphasize that some species are medicinal and poisonous at the same time, e.g. *Amaranthus retroflexus, Equisetum arvense* and *Symphytum officinale*.

This brief overview shows the richness of Plešivica hills flora with medicinal plant species in terms of official pharmacological action. In traditional and homeopathic medicine, as well as in Phytotherapy and Aromatherapy, many plant species are used, but some of them have never been used in the official medicine or their use is abandoned.

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