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The Ecological Aspect of Ethnobotany and Ethnopharmacology of Population in Bosnia and Herzegovina

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A B S T R A C T

This paper contains first systematical revision of the results on traditional use of wild medicinal and aromatic herbs on the territory of Bosnia and Herzegovina (B&H) – west of Balkan Peninsula; Southeast of Europe. There have been detected 227 plants belonging to 71 different plant families, which are being used with ethno therapeutic purpose. Results were obtained by method of open ethno botanical interview which comprised 150 persons, whose average age was 63. Medicinal plants in ethno therapy are being used either in fresh, raw or dried condition. Different herbal parts, depending on period of vegetation season, sometimes even in winter, are basis for preparation of infusions (59%), decoct (19%), tinctures (4%). Especially original are balms known as Bosnian »mehlems«, which are fresh cuted herbal parts mixed with lukewarm resin, raw cow butter or honey. In ethno therapy are mostly being used aerial plant organs. Majority of herbs is being used for treatment of illnesses of respiratory (22%), gastrointestinal (19%) and urinary and genital system (9%), for treatment of skin conditions (11%), as well as for nervous system and heart diseases (16%). The most original plants on the field of ethno pharmacology, comparing with ethno therapy practice of other regions, are as follows: Ballota nigra, Aesculus hippocastanum, Calluna vulgaris, Centaurea cyanus, Euphrasia rostkoviana, Geranium robertianum, Gentiana asclepiadea, Helichrysum italicum, Lycopodium clavatum, Marrubium vulgare, Nepeta cataria, Populus tremula, Ruta graveolens, Tamus communis, Teucrium montanum, T. chamaedrys, *and endemic plants* Gentiana lutea subsp. symphyandra, Teucrium arduini, Micromeria thymifolia, Satureja montana, S. subspicata, Rhamnus fallax *and* Viola elegantula. *There haven't been noticed significant differences in the frequencies of medicinal plants use among different ethnical groups. But, it has been perceived that longer ethno therapeutic tradition possess inhabitants of sub- and Mediterranean areas, as well as inhabitants of the mountain areas of B&H, regardless their ethnicity.*

Key words: *human ecology, folk medicine, ethno therapy, wild medicinal plants, natural resources, Balkan*

Introduction

Modern man's relationship toward his diet and medical treatment since centuries ago is the most important part of both human ecology and process of anthropogenesis[1–7].

Man – *Homo sapiens recens* has been using wild flora in his diet since centuries ago, in the medicinal treatments, too. On the basis of human relationship toward use of wild flora with both healing and supplementary diet purposes could be made conclusions on process of anthropogenesis and ethno genesis, especially in some regions of the Earth [8,9]. Thus, on the territory of Bosnia and Herzegovina (B&H) man has been turned to the natural resources in his surroundings since Neolithic days, especially to the wild medicinal flora.

Despite the fact that we are living at the beginning of the 21st century medicinal aspect of vascular flora has been insufficiently investigated[10]. It has been estimated that only 1% of vascular flora has been investigated on its pharmacological and physiological activity. On the other hand, the number of various pathological conditions of human organism that couldn't be covered by conventional pharmaceutical means has been increasing. Ordinary people tend to avoid standard pharmaceuticals whenever it is possible and to replace them with an ade-

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quate phyto pharmaceuticals. For these reasons the interest for phytotherapy and research in this field has been increasing over the last decades. A wise man said »There is a plant for every disease; it just has to be discovered«. Our environment is still rich in various plants containing potential medicals even for the most dangerous diseases. Those plants just have to be discovered. Starting point of this kind of investigations should be complex ethno botanical research. The results of these have by now revealed numerous secrets insufficiently known to the modern science. Finally, the most important are the active principles contained in certain plant. A wise man also said »The most important thing is to kill the pain«. The chemical composition, microscopy features of questioning species or its pharmaceutical aren't so important. This statement is true. Therefore, ethno botanical investigations have got importance. There are numerous sources from all over the world that confirm afore named facts[11–16]. The connection between ethno botany and phytochemistry[17] as well as ethno botany and ethnopharmacology[18–20] becomes closer and closer every day. Integration of ethno botany and phytochemistry becomes a modern dream.

A very same situation is in B&H, the country with for centuries long tradition, the country with a large number of different cultures, customs and a very high number of plants, too. Medicinal plants represent a very important potential resource for development of the economy[21].

Area of B&H has been inhabited since Neolithic age. From that period originate numerous cultural monuments which are witnesses of the ancient civilizations. Ever since, through the history, nations from this area have been linked to their environment. They have used fruits of the nature in their daily diet and healing practice. The first written records about use of plants in the medicine in this area could be found in the documents of Bosnian Franciscans from 1150. They have recorded their knowledge about healing of the volk in several well known medicinal books[22].

During Ottoman period, from 1435, the list of medicinal plants has been enriched with new plant species introduced from the Asia. A large number of these plants have been used as medicinal plants or as a spices[23]. Even today, numerous plant species from that part of the world are favorite medical, edible, and horticultural plants or spices. About 1878, after Austro-Hungarian occupation of the country when some new influences came into life both in culture and customs, the list of plants used in traditional medicine has been expanded as well as experiences in the phytotherapy. Around that time have been opened first chemist's shops that salad all known medicinal herbs.

The usage of medicinal plants in treatment of various animal and human diseases has continued since then, based on the past experiences. The first document of Bosnian famous herb's collector24 has been written at the beginning of the 20th century. In those papers were recorded all known plants and prescriptions for treatment of diseases in Herzegovina. Significant influence on use of medicinal plants in a healing process has had translation in Bosnian language of famous Al-Kanun papers[25]. New experiences from the neighboring countries Serbia and Montenegro[26], Croatia[27], and some others, came later on.

Today, at the beginning of the 21st century, the interest for phyto pharmaceuticals becomes more pointed out. Almost everybody tries to find a good medicine, healthy meal or delicious spice in wild growing plants. This could have tremendous economic importance, which is confirmed by many authors[28–33].

The results of the investigations on flora of B&H that were carried out during the last 20 years[34,35] have shown that the number of potentially medical, edible, vitamin and aromatic plant species and fungi is even larger. However, a large number of plants and fungi still have to be investigated in taxonomical sense by modern instruments and techniques. The first step in this process should be to create ethno botanical inventory of wild species that are medicinal or aromatic by modern ethno botanical methods.

In order to develop successful herbal therapy it is necessary to carry out basic systematical investigations of growing wild vascular flora that exhibits certain physiological and pharmacological activity, and therefore could be used in preparation of certain phyto pharmaceuticals. These lead us to the special goal and objective of this paper, which is the establishment of national ethno botanical database on biological, ecological, ethnopharmacological and pharmaceutical/technological aspects of plant resources in B&H. This paper covers the results of the first two years of undertaken ethno botanical investigations in B&H.

The objectives of this paper are:

- Inventory and making records on medicinal and aromatic herbs usage by Bosnian community
- Assessment of usage of the wild medicinal and aromatic plants;
- Assessment of the most common plants that are being used in B&H;
- Gathering of data on preparatory procedures for herbal drugs;
- Analysis of taxonomy for medicinal and aromatic herbs;
- Analysis of plant's ecology, which means analysis of ecological conditions of places inhabited by growing wild medicinal and aromatic herbs;
- To determine ecologic and plant geographic areas that are rich by medicinal plants used with ethno therapeutical purposes;
- To determine geographical areas and groups of people that use the medicinal plant in ethno therapy the most frequently.
- To determine biogeography-ecological areas of B&H, as well as habitat types inhabited by plants used in ethno therapy;
- Estimation of conservatory status for the most used medicinal herbs on the territory of B&H.

Material and methods

Study area

B&H is situated in the north western part of Balkan Peninsula with total land area of 51,129 km^2 and inhabited by population of 4 600 000[35]. The total length of the land boundaries is 1,459 km and coastline 20 km. Neighboring countries are Croatia (932 km) to the north, west, and south, and Serbia and Montenegro (527 km) to the east (Figure 1).

This is mainly hilly/mountainous region. Only 5% of the total country area belongs to plains, 24% to hills, 42% to mountains and 29% to karsts. Karsts fields cover some 19% of the karsts area. Mean altitude above sea level is around. 500 m (from the sea level in Neum-Klek to the Maglic Mt top 2,387 m).

The climate is very heterogeneous: Mediterranean sub-Mediterranean, temperate continental, continental and mountainous climate. Hydrological network is rich with numerous rivers belonging to the Black Sea confluence (Una, Vrbas, Bosna and Drina), and rivers belonging to the Adriatic Sea confluence (Neretva, Trebižat, Trebišnica).

From plant geographic standpoint, this area belongs to the three regions: Mediterranean with Adriatic province, Euro siberian-boreo American with Illyrian province, Moesian province, and the province of relic pine forests. The highest peaks belong to the alpine-high Nordic region with high Dinaric province more than 50% of the territory is covered with natural forests. The rest is covered by the meadows, rocky grassland and arable land. From an ecological standpoint, the largest part of the country is clean and acceptable, due to this being suitable for utilization of plant resources from their natural habitats in dietary and healing purposes.

B&H has got about 5,000 vascular plants, including species, subspecies and varieties, then about 3,000 species of blue-green algae and other algae, as well as from 3,000–5,000 fungi and lichen species. This makes B&H one of the richest European countries. Considering relatively small country area, B&H is one of the countries with the highest level of species diversity or biodiversity.

Besides, B&H is one of the richest countries considering the number of endemic plant species. It was estimated that there are some 500 vascular plant species and even more algae and blue-green algae[36]. The level of their investigation is still extremely very low. According to the official data, only 40 vascular plant species has been in use as official medicinal herbs in B&H[37,38]. The similar situation is with fungi. According to the ethno botanical sources, up to 350 plant species was in use[35].

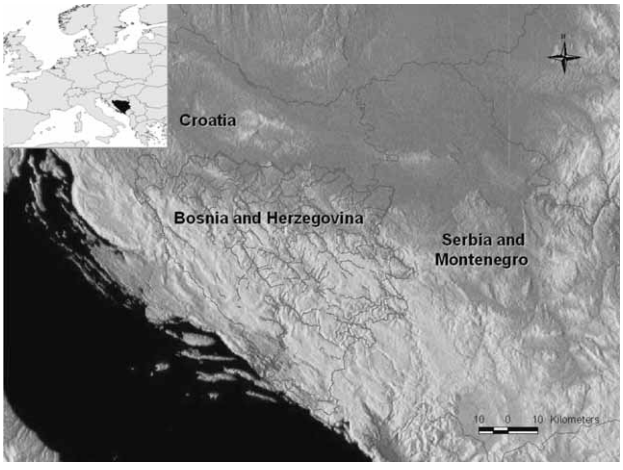

Fig. 1. Geographical position of investigated area.

Data collection

Field work

Intensive ethno botanical and floristic investigations in all parts of B&H have been carried out by author of this paper during the last 15 years. However, intensive fieldwork took place in seasons: spring, summer and early autumn, starting in the year 2000 to 2004. They have included all important transects:

a. from the Adriatic sea in the south to the river Sava in the north – Neum (village Hutovo, 5 informants); Stolac (village Žegulja, 6 informants); Trebinje (villages Trebinjska šuma, Lastva, 8 informants); Sarajevo (villages Obhodža, Buča Potok, Miljevići and Vučija Luka, 22 informants); Tuzla (villages Stupari and Husino, 21 informants); Brčko (villages Maoča and Bosanska Bijela, 10 informants);
b. from the river Una in the west to the river Drina in the east – Bihać (villages Ripač, Lohovo, Martin Brod and Klokot, 15 informants); Banja Luka (villages Vinac, Torlakovac, Barevo, Surjan and Manjača, 41 informants); Zvornik (village Drinjača and Kriva Drina, 4 informants); and
c. from 0 m to 1,800 m above sea level – periodically inhabited by people – Bjelašnica Mt. (6 informants), Vranica Mt. (7 informants), and Vlašić Mt. (5 informants). Besides, a large number of ethno botanical experiences have been collected during vegetation's mapping of the entire B&H territory[39–41].

Basic method used for data gathering was open ethno botanical interview. Form of ethno botanical interview contained as follows:

- Name and age of person being interviewed
- Area/Region
- Time of interview took place
- Local / scientific name of medicinal herb
- Herbal part being used
- Preparation procedure
- Purpose of usage
- Habitat type
- Other important observations (such as estimation of conservation state)

There have been interviewed over 150 adults, whose average age was 63, and which were in any way involved

in gathering and use of medicinal herbs in ethno therapy. These persons were members of different ethnical groups. Approximately 60% of these were Muslims, 39% Catholics and Orthodox, and few Jewess or members of other ethnical groups. Gender ratio was as follows: around 70% were female and 30% male. Besides, by every field trip interviewed were also persons which for any reason used to spend some time in nature, and on the other hand, which were familiar with usage or importance of wild flora in healing or dietary purposes (mountaineers, shepherds, medicinal herb's pickapers). In many occasions, collected herbal material was shown by author to the locals (in the villages, suburbs, mountain settlements, camping places), and for each specimens that was recognized to be in use in ethno therapy collected were all related data, including photos and herbarized material. Communication with locals wasn't copped with any kind of difficulty due to the fact that entire population of the investigated area uses the same local language. Moreover, all interviewed persons, except few of them, were freely willing to make ethno botanical dialog. By these dialogs, author has expressed his deepest respect to each interviewed individual, especially to its ethno botanical knowledge. High level of co-operation was achieved for author is well known to the locals as author of numerous TV shows on nature and medicinal herbs.

All plant material was placed within herbaria and stored in the Herbaria of medicinal flora at the Center of Ecology and Natural Resources at the Faculty of Science, University of Sarajevo (CEPRES HERB!) and in the Herbaria of the National Museum of B&H (SARA!). Each determined specimen has got its own herbaria number (voucher specimens code).

Laboratory work

Entire plant material was determined by the author, some questioning taxa have been finally determined by comparing them with relevant specimens from SARA and CEPRES HERB herbaria and thanks to the literature[42–46]. Nomenclature of plant species was made in accordance with Flora Europaea[47]. Habitat types were determined on the basis of species ecological inclination toward certain plant community, according to the methodology of Braun-Blanquet[48]. Traditional way of usage and preparation were estimated on the basis of literature[49]. Determination of ecological conditions was carried out according to the author's judgment, and syntaxonomy according to Oberdorfer[50]. It is important to point out that in some cases recorded were many modes of usage and preparation procedures for certain herb, thus spectrum of present species concerned only the most frequent ones, whereby less frequent ones were named in Table 1. Categories of medicinal herb's usage were developed on the basis of human's functional systems and consultation with experienced local herbalists (Table 5). Categorization of herb's part being used, as well as way of its preparation and usage purpose was made following primary elements.

Data analyses

These researches have been carried out in order to gather data on:

Number of medicinal and aromatic plant used in ethno therapy

Local herb names

Number of plant families and the most frequent families

The most frequent plant species mentioned in these investigations

Types of habitats and plant communities where registered species live

Plant parts (drugs)

Medicinal usage

Forms and presence of preparations

Conservatory status.

Results

General data on medicinal plants – the most frequently named plants

This paper is focused onto ethno botanical usage of growing wild plants which was analyzed on the ground of data obtained through the interviews of autochthonous population. Although some of the named herbs were also used as an additional food, paper is concerned only with its medicinal usage.

During these investigations it have been recorded 227 vascular plants of wild flora that have significant importance in ethno phytotherapy in B&H. Overview of these plants along with its main data was given in the Table 1. Besides one lichen all other species are vascular plants. The most frequent used plants in the whole B&H are: *Achillea millefiolium* (130 times), *Agrimonia eupatoria* (115 times), *Artemisia absinthium* (113 times), *Althaea officinalis* (76 times), *Arctostaphyllos uva-ursi* (67 times), *Betula pendula* (56 times), *Capsella bursa-pastoris* (46 times), *Centaurium umbellatum* (66 times), *Crataegus monogyna* (101 times), *Equisetum arvense* (46 times), *Gentiana symphyandra* (35 times), *Glychyrhiza glabra* (14 times), *Hypericum perforatum* (115 times), *Malva silvestris* (104 times), *Matricaria chamomilla* (112 times), *Melissa officinalis* (27 times), *Mentha longifolia* (26 times), *Ononis spinosa* (46 times), *Helichrysum italicum* (27 times), *Orchis morio* (32 times), *Origanum vulgare* (56 times), *Polygonum aviculare* (36 times), *Potentilla erecta* (27 times), *Rosa canina* (97 times), *Rubus fruticosus* (46 times), *Ruta graveolens* (27 times), *Salvia officinalis* (56 times), *Sambucus nigra* (68 times), *Satureja montana* (34 times), *Teucrium montanum* (58 times), *Thymus serpyllum* (123 times), *Tussilago farfara* (86 times), *Urtica dioica* (71 times), *Vaccinium myrtillus* (53 times), *Valeriana officinalis* (34 times) and other plant species mentioned less than 20 times. For the first time in B&H, as a medicinal herbs used by ordinary people, recorded were following species: *Aconitum toxicum, Adonis vernalis, Antennaria dioica, Ballota nigra, Calamintha*

TABLE 1
MEDICINAL AND AROMATIC WILD FLORA OF BOSNIA AND HERZEGOVINA USAGE IN ETHNO THERAPY

Voucher specimens	Scientific plant name	Local plant name	Plant family	Plant part used*	Habitat/** Commu-nity	Use in human therapy	Preparation and or/ Administration process
110101	*Abies alba* Mill.	Jelika, jela	Pinaceae	R, F	F., V.-P.	For a serious wounds	Resin, Bosnian balm
210101	*Achillea millefolium* L.	Hajdučka trava, sporiš, kunica	Asteraceae (=Compositae)	AP	Arrh.	Wounds, stomach, liver	Fresh juice, infusion
210201	*Aconitum toxicum* Reichb.	Bosanski jedić	Ranunculaceae	RH	Aden.	Rheumatism	Infusion, external usage
220101	*Acorus calamus* L.	Iđirot	Araceae	RH	Ph.	Stomach disorders	Infusion, tincture
310101	*Adiantum capillus – veneris* L.	Vilina vlas	Adiantaceae	AP	Ad.	Plug, kidney, menstrual problems	Infusion
210202	*Adonis vernalis* L.	Gorocvjet	Ranunculaceae	AP	Sec.	Heart disorder, urine excretion problems	Infusion, tincture
210301	*Aesculus hippocastanum* L.	Divlji kesten	Hippocastanaceae	S	Q.p.	Skin diseases, blood vessels, rheumatism	Decoction
210401	*Agrimonia eu patoria* L.	Petrovac	Rosaceae	AP	P.s., B.e.	Gall disorder, against roundworm	Infusion
220201	*Agropyron repens* (L.) P. Beauv.	Pirika	Poaceae (=Gramineae)	RH	Agr., P.m.	Urine excretion, rheumatism	Infusion
210501	*Ajuga reptans* L.	Ivica	Lamiaceae (=Labiatae)	AP	Arrh.	Diarrhea, wound	Infusion, traditional balm
210402	*Alchemilla vulgaris* L.	Virnjak, gospin plašt	Rosaceae	AP, L	Arrh.	Liver disorder, menstruation problem, skin diseases	Infusion
220301	*Allium ursinum* L.	Strimuža, medvjeđi luk	Alliaceae	AP, BU	F.	Respiratory system disorder	Fresh plant with yogurt
210601	*Althaea officinalis* L.	Bijeli sljez	Malvaceae	L, R	Bid.	Cough, skin disorder, tonic	Maceration
220501	*Anacamptis pyramidalis* (L.) L.C.Rich.	Kaćun piramidalni,	Orchidaceae	T	Arrh., B.e.	Cough, strengthen potency	Decoction, traditional beverage,
210701	*Angelica archangelica* L.	Anđelika	Apiaceae (=Umbelliferae)	R	Art., Onop.	Stomach hardship disorder, skin diseases	Tincture, infusion
210102	*Antennaria dioica* (L.) Gaertn.	Srcopuc	Asteraceae (=Compositae)	AP	Vacc.	Against bleeding, stomach disorders	Infusion
210901	*Anthyllis vulneraria* L.	Ranjenik	Fabaceae (=Leguminosae)	AP	Art.	Wound, contusion, skin disorder	Infusion
210103	*Arctium lappa* L.	Čičak, repuh	Asteraceae (=Compositae)	R	Onop.	Skin disorder, root of hair regeneration, diabetes	Decoction
210801	*Arctostaphylos uva-ursi* (L.) Spreng.	Mlivnjak	Ericaceae	L, R	P.s.	Kidney and urinary system disorder	Infusion
210104	*Artemisia absinthium* L.	Pelin	Asteraceae (=Compositae)	AP	Art.	Appetite improvement, leucorrhea, against of nematodes	Infusion, tincture, powder,
210105	*Artemisia vulgaris* L.	Metlika, divlji pelin	Asteraceae (=Compositae)	SH	Onop.	Nervous system disorders	Infusion

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MEDICINAL AND AROMATIC WILD FLORA OF BOSNIA AND HERZEGOVINA USAGE IN ETHNO THERAPY

Voucher specimens	Scientific plant name	Local plant name	Plant family	Plant part used*	Habitat/** Commu-nity	Use in human therapy	Preparation and or/ Administration process
210100	*Asarum europaeum* L.	Kopitnjak	Aristolochiaceae	AP, R	F., Q.p.	Asthma, alcoholism	Infusion
210110	*Asperula odorata* L.	Lazarkinja	Rubiaceae	AP	F.	Water disease, catarrh lung,	Infusion
210121	*Atropa belladona* L.	Velebilje	Solanaceae	L, R	Atr., E.a.	Respiratory system disorder serious asthma	Smoking of leaves
210502	*Ballota nigra* L.	Crna kopriva	Lamiaceae (=Labiatae)	AP	Onop.	Hysteria	Infusion
210131	*Berberis vulgaris* L.	Žutika, šimširika	Berberidaceae	B, L,	P.s.	Hepatitis, bleeding, tonic	Infusion, decoction,
210141	*Betula pendula* Roth.	Breza	Betulaceae	F, J, L	Q.r.-p., Bet.	Urinary system, fever	Infusion
210106	*Bidens tripartita* L.	Koziji rogovi	Asteraceae (=Compositae)	AP	Bid., Ch.	Serious coldness, respiratory system disorders. skin diseases	Infusion
210503	*Calamintha officinalis* Moench	Marulja	Lamiaceae (=Labiatae)	AP	Q.p.	Sedative, tonic	Infusion
210107	*Calendula arvensis* L.	Neven	Asteraceae (=Compositae)	FL	Ch.	Cancer of lung, liver and skin disorders	Infusion, decoction,
210084	*Calluna vulgaris* (L.) Hull.	Vris	Ericaceae	AP	C.-U.	Kidney disorders, urinary infections, strengthen sex potency	Infusion
210151	*Capsella bursa-pastoris* (L.)Med.	Rusomača	Brassicaceae (=Cruciferae)	AP	Ch.	Internal bleeding	Fresh juice, Infusion
210108	*Carlina acaulis* L.	Vilino sito	Asteraceae (=Compositae)	AP	B.e.	Catarrh of stomach, recovery	Infusion
210702	*Carum carvi* L.	Kim	Apiaceae (=Umbelliferae)	F	Arrh.	Stomach diseases	Infusion, oil
210160	*Castanea sativa* Mill.	Kesten, maron	Cupuliferae	L	Q.r.-p.	Inflammation of tonsillitis	Infusion, Decoction
210109	*Centaurea cyanus* L.	Različak	Asteraceae (=Compositae)	FL	C.c.	Eye disease, liver disorder	Infusion
210170	*Centaurium umbellatum* Gilib.	Kičica, ženski kantarion	Gentianaceae	AP	E.a.	Stomach disorders, fever, women diseases	Infusion, tincture, alcoholic beverage
410000	*Cetraria islandica* Achr.	Islandska mahovina	Parmeliaceae	AP	S.t.	Cough, inflammation of urinary system	Maceration, Powder
210180	*Chamaenerion angustiL* (L.)Scop.	Kiprovina vrbolika	Onagraceae	AP, L	E.a.	Stomach disorders, liver and prostate gland inflammation	Infusion
210190	*Chelidonium majus* L.	Rosopas	Papaveraceae	AP	Ch.	Wart on skin, cancer of lung	Fresh juice, infusion,
210110	*Cichorium intybus* L.	Cikorija, vodopija	Asteraceae (=Compositae)	R	Art.	Water disease	Infusion
210111	*Cnicus benedictus* L.	Blaženi čkalj	Asteraceae (=Compositae)	L	Ch.	Cancer of stomach	Infusion, Tincture
220601	*Colchicum autumnale* L.	Mrazovac	Liliaceae	S	Mol., Arrh.	Gout, rheumatism, neuralgia	Tincture, Infusion
210703	*Conium maculatum* L.	Kukuta	Apiaceae (=Umbelliferae)	AP	Onop., Glech.	Face neuralgia, lymph glands inflammation.	Tincture, Infusion
220602	*Convallaria majalis* L.	Đurđevak	Liliaceae	AP	Q.p.	Heart – tachycardia, neurosis	Tincture

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Voucher specimens	Scientific plant name	Local plant name	Plant family	Plant part used*	Habitat/** Commu-nity	Use in human therapy	Preparation and or/ Administration process
210210	*Cornus mas* L.	Drijen	Cornaceae	F	Q.p.	Chronic diarrhea	Fresh fruit, syrup, infusion
210191	*Corydalis cava* (L.) Schweigg.&Koerte	Mlađa, šupaljka	Papaveraceae	BU	F.	Stomach ulcer	Powder, Decoction
210161	*Corylus avellana* L.	Lijeska	Cupuliferae	L, B, S	F., Q.p.	Widen vein on leg	Decoction, Infusion
210220	*Cotinus coggygria* Scop.	Ruj	Anacardiaceae	L	Q.p.	Skin diseases, fever	Infusion
210403	*Crataegus monogyna* Jacq.	Jednosjemeni glog	Rosaceae	FL, L	P.s.	Heart diseases	Infusion, Tincture
210404	*Crataegus oxyacantha* L.	Crveni glog	Rosaceae	FL, L, F	P.s.	Heart diseases	Infusion, Tincture
220070	*Crocus neapolitanus* (L.) Hill	Šafran	Iridaceae	ST	F., Q.r.-p.	Women disease, cough, hysteria	Infusion, tincture, syrup
210230	*Cyclamen purpurascens Miller*	Ciklama	Primulaceae	T	Q.p.	Respiratory system disorders	Maceration
210240	*Cynoglossum officinale* L.	Mišinac, mali gavez	Boraginaceae	AP, L, R	Art.	Burn, bone fracture external	Maceration
210122	*Datura stramonium* L.	Kužnjak, tatula	Solanaceae	L	Ch.	Asthma, neurosis	Smoking of the leaves
210704	*Daucus carota* L.	Divlja mrkva	Apiaceae (=Umbelliferae)	R, F	Art.	Stomach diseases, hepatitis	Infusion
210250	*Digitalis ambigua* Murr.	Velelisni naprstak	Scrophulariaceae	L	E.a.	Heart diseases, blood circulatory disorders	Mild infusion, Tincture
210251	*Digitalis ferruginea* L.	Pustikara	Scrophulariaceae	L	P.s., Orig.	Heart diseases	Mild infusion, Tincture
210252	*Digitalis lanata* Ehrh.	Vunasti naprstak	Scrophulariaceae	L	O.-C.o., Orig.	Heart diseases	Mild infusion, Tincture
310201	*Dryopteris filix-mas* (L.)Schott.	Muška paprat	Aspidiaceae	RH	F., V.-P.	Against of worm in stomach	Infusion
210260	*Drosera rotundifolia* L.	Rosulja	Droseraceae	AP	S.f.	Whooping cough, atherosclerosis	Infusion
310301	*Equisetum arvense* L.	Poljska preslica	Equisetaceae	AP	P.m., C.c.	Urinary system disorders, prostate gland inflammation	Infusion
210705	*Eryngium campestre* L.	Kotrljan	Apiaceae (=Umbelliferae)	R	B.e.	Water disease, hepatitis	Infusion
210253	*Euphrasia rostkoviana* Hayne (=E. officinalis L.)	Vidac	Scrophulariaceae	AP	B.e.	Strengthen of eyesight	Infusion
210270	*Fagus sylvatica* L.	Bukva	Fagaceae	J	F.	Fever, recovery	Decoction, infusion
210405	*Filipendula ulmaria* (L.) Maxim.	Suručica	Rosaceae	FL	Mol.	Rheumatism, water disease	Infusion, tincture, syrup
210406	*Fragaria vesca* L.	Jagoda šumska	Rosaceae	L, RH	P.s., E.a.	Recovery, diarrhea	Infusion, Decoction
210294	*Frangula alnus* Miller	Krušina	Rhamnaceae	B	Aln., Q.r.-p.	Chronic constipation	Decoction

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Voucher specimens	Scientific plant name	Local plant name	Plant family	Plant part used*	Habitat/** Commu-nity	Use in human therapy	Preparation and or/ Administration process
210340	*Fraxinus excelsior* L.	Bijeli jasen	Oleaceae	L, M	F.	Catalyze of perspire proess, fever	Infusion
210341	*Fraxinus ornus* L.	Crni jasen	Oleaceae	M	Q.p.	Constipation	Infusion
210200	*Fumaria officinalis* L.	Dimnjača	Fumariaceae (=Papaveraceae p.p.)	AP	Ch.	Blood recovery, tonic	Infusion, fresh juice
210902	*Galega officinalis* L.	Piskavica	Fabaceae (=Leguminosae)	AP	Agr.	Diabetes	Decoction
210526	*Galeopsis segetum* Necker	Smrdljiva kopriva	Lamiaceae (=Labiatae)	AP	Ch.	Respiratory system disorders	Infusion
210171	*Gentiana asclepiadea* L.	Trava od utrobice	Gentianaceae	R	F., V.-P.	Liver diseases	Infusion, decoction, tincture
210172	*Gentiana symphyandra* Murb.	Lincura dinarska	Gentianaceae	R	S.t.	Stomach and heart disorders, recovery	Macerate, decoction, tincture
210350	*Geranium macrorrhizum* L.	Zdravac planinski	Geraniaceae	RH	A.f.	Stomach disorders	Infusion, Decoction
210351	*Geranium robertianum* L.	Iglica, zdravac	Geraniaceae	AP	F.	Male fertility improvement	Infusion
210407	*Geum urbanum* L.	Blaženak	Rosaceae	RH, (=R)	P.a., Glech.	Heart diseases, recovery	Decoction, tincture, infusion
210504	*Glechoma hederacea* L.	Dobričica	Lamiaceae (=Labiatae)	AP	Glech., Art.	Respiratory system disorders, hysteria	Infusion
210123	*Gnaphalium uliginosum* L.	Smilika	Asteraceae (=Compositae)	AP, FL	Mol.	Stomach diseases, diabetes	Decoction, Syrup
210903	*Glycyrrhiza glabra* L.	Sladić	Fabaceae (=Leguminosae)	R	Agr.	Stomach diseases, liver inflammation	Infusion
210254	*Gratiola officinalis* L.	Proljevak	Scrophulariaceae	AP	Mol.	Provocation of vomiting,	Infusion
220505	*Gymnadenia conopsea* (L.) R.Br.	Vranjak, salep	Orchidaceae	T	B.e., Arrh.	Lung diseases, strengthen of sex potency	Decoction, Traditional Beverage
210360	*Hedera helix* L.	Bršljan	Araliaceae	L	Q.p.	Gall disorders, skin diseases	Infusion
210112	*Helichrysum italicum* (Roth.) G.Don	Smilje	Asteraceae (=Compositae)	FL	S.-Ch.	Liver and gall disorders, cough	Infusion
201203	*Helleborus odorus* Waldst. & Kit.	Kukurjek	Ranunculaceae	RH, R	P.s., F.	Liver and skin disease	Decoction, Infusion
210204	*Hepatica nobilis* Schreb.	Jetrenjarka	Ranunculaceae	AP, L	Q.p., F.	Hepatitis, gall stone melting	Infusion
210370	*Herniaria hirsuta* L.	Sitnica, kilavica	Caryophyllaceae	AP	S.-Ch., B.e.	Urinary system and kidney disorders	Infusion
210113	*Hieracium pilosella* L.	Runjika, zečija loboda	Asteraceae (=Compositae)	AP, R	B.e.	Urinary system, prostate gland	Infusion
210380	*Humulus lupulus* L.	Hmelj	Cannabaceae	«FL«	P.a., P.s.	Hysteria, against of libido	Infusion
210123	*Hyoscyamus niger* L.	Bunika crna	Solanaceae	L	Onop.	Asthma, neurosis	Smoking the leaves
210390	*Hypericum perforatum* L.	Kantarion žuti,	Gutiferae	AP	Orig., B.e.	Stomach disorders, skin diseases, neurosis	Infusion, oil

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Voucher specimens	Scientific plant name	Local plant name	Plant family	Plant part used*	Habitat/** Commu-nity	Use in human therapy	Preparation and or/ Administration process
210505	*Hyssopus officinalis* L.	Miloduh, isop	Lamiaceae (=Labiatae)	AP, S	S.-Ch.	Lung diseases	Infusion
210114	*Inula helenium* L.	Anduz, oman	Asteraceae (=Compositae)	R	Atr.	Lung diseases, skin diseases	Inhalation on smoke, decoction
220071	*Iris florentina* L.	Perunika bijela	Iridaceae	RH	Amph., Sec.	Cough, stomach diseases	Decoction, Syrup
220072	*Iris germanica* L.	Perunika ljubičasta	Iridaceae	RH	Amph., Sec.	Cough, stomach diseases	Decoction, Syrup
210400	*Juglans regia* L.	Orah	Juglandaceae	L	P.a.	Liver diseases, skin disorders, strengthen of sex potency	Decoction, Infusion
110301	*Juniperus communis* L.	Kleka obična	Cupressaceae	«F«	Jun., V.-P.	Kidney and urinary system disorders	Decoction
110302	*Juniperus oxycedrus* L.	Crvena kleka	Cupressaceae	«F«	Jun., Q.p.	Skin diseases	Decoction
110303	*Juniperus sabina* L.	Planinska somina	Cupressaceae	«F«	V.-P.	Venereal diseases	Decoction
210506	*Leonurus cardiaca* L.	Srdačica	Lamiaceae (=Labiatae)	AP	Glech., Ch.	Heart diseases	Infusion, Tincture
210710	*Levisticum officinale* Koch	Selen, ljupčac	Apiaceae (=Umbelliferae)	R	Ch.	Lung diseases, neurosis	Infusion, fresh the leaves
310201	*Lycopodium clavatum* L.	Crvotočina	Lycopodiaceae	»S«	V.-P.	Liver diseases, wound	Powder
210527	*Lycopus europaeus* L.	Vučija noga	Lamiaceae (=Labiatae)	AP	Mol.	Heart diseases, lung inflammation	Infusion
210233	*Lysimachia vulgaris* L.	Protivak	Primulaceae	AP	Mol.	Diarrhea, regulation of menstrual cycle	Infusion
210420	*Lythrum salicaria* L.	Vrbičica	Lythraceae	AP	Mol.	Diarrhea, skin diseases	Infusion
210602	*Malva moschata* L.	Sljez livadski	Malvaceae	FL, L	Arrh.	Cough, skin diseases	Maceration
210603	*Malva silvestris* L.	Crni sljez	Malvaceae	FL, L	Ch.	Cough, skin diseases	Maceration
210507	*Marrubium vulgare* L.	Očajnica	Lamiaceae (=Labiatae)	AP	Art., B.e.	Heart diseases, stomach diseases	Infusion
210115	*Matricaria recutita* L. (= *M. chamomilla* L.)	Kamilica, tritica	Asteraceae (=Compositae)	FL	Ch.	Stomach diseases, skin disorders, Compress for eye	Infusion
210904	*Melilotus officinalis* (L.) Lam.	Kokotac	Fabaceae (=Leguminosae, Paplionaceae)	AP	Onop.	Skin diseases, eyes, fatigue	Infusion
210508	*Melissa officinalis* L.	Matičnjak, limun trava	Lamiaceae (=Labiatae)	L	Q.p.	Nervous and heart diseases	Infusion
210509	*Mentha longifolia* (L.) Huds.	Dugolisna nana	Lamiaceae (=Labiatae)	AP	Bid.	Stomach diseases	Infusion
210510	*Mentha arvensis* L.	Njivska nana, metvica	Lamiaceae (=Labiatae)	L	Ch.	Stomach diseases, heart disorders	Infusion
210511	*Mentha pulegium* L.	Verem trava	Lamiaceae (=Labiatae)	AP	Bid.	Nervous diseases	Infusion
210410	*Menyanthes trifoliata* L.	Gorka djetelina	Menyanthaceae	L	C.d.	Nervous diseases, stomach hardship	Infusion, Tincture

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Voucher specimens	Scientific plant name	Local plant name	Plant family	Plant part used*	Habitat/** Commu-nity	Use in human therapy	Preparation and or/ Administration process
210512	*Micromeria thymifolia* (Scop.) Fritsch.	Timjanoliki vrisić	Lamiaceae (=Labiatae)	AP	S.-Ch.	Stomach and lung diseases	Infusion
210430	*Morus alba* L.	Bijeli dud	Moraceae	L, F	P.a.	Diabetes	Infusion
210431	*Morus nigra* L.	Crni dud	Moraceae	F	P.a.	Diabetes	Infusion
210152	*Nasturtium officinale* R. Br.	Dragušac	Brassicaceae (=Crucuferae)	L, AP	Pot.	Recovery, bronchial asthma	Fresh juice
210513	*Nepeta cataria* L.	Mačija metvica	Lamiaceae (=Labiatae)	AP	Onop.	Hysteria, for barren woman	Infusion
210205	*Nigella sativa* L.	Čurekot, Mačkovi brkovi	Ranunculaceae	S	Ch.	Excretion of urine, Women fertility im-provement	Infusion, Powder
210440	*Nuphar lutea* Sm.	Lopoč	Nymphaeaceae	RH	Pot.	Neurosis, heart hardship	Infusion, tincture, decoction
210905	*Ononis spinosa* L.	Gladišika, zečji trn	Fabaceae (=Leguminosae, Papilionaceae)	R	B.e.	Melting of kidney stone	Infusion, oil
220502	*Orchis morio* L.	Salep, kaćun	Orchidaceae	T	B.e.	Cough, strengthen of sex potency	Decoction
220503	*Orchis simia* Lam.	Kaćun	Orchidaceae	T	B.e., Arrh.	Cough, strengthen of sex potency	Decoction
210514	*Origanum vulgare* L.	Mravinac	Lamiaceae (=Labiatae)	AP	Orig.	Cough	Infusion
210450	*Paeonia officinalis* L.	Božur	Paeoniaceae	RH	Q.p.	Epilepsy, neurosis	Infusion, Decoction
210294	*Paliurus spina-christi* Mill.	Drača	Rhamnaceae	F	Pal.	Diarrhea, recovery	Powder, Decoction
210193	*Papaver rhoeas* L.	Boliglava, bulka	Papaveraceae	FL	Sec.	Neurosis, serious cough	Infusion
210706	*Pastinaca sativa* L.	Paštrnjak	Apiaceae (=Umbelliferae)	F	Arrh.	Stomach malignant diseases	Decoction, Infusion
210116	*Petasites hybridus* (L.) P.Gaertn., B.Meg. et Schreb.	Repuh	Asteraceae (=Compositae)	L	Aden.	Liver diseases, stomach disorders, plague	Infusion, Decoction
210707	*Peucedanum oreoselinum* (L.) Moench	Pukovica	Apiaceae (=Umbelliferae)	L	Orig.	Epilepsy, nervous diseases	Infusion
210124	*Physalis alkekengi* L.	Ljoskavac	Solanaceae	F	P.s.	Urine excretion, asthma	Infusion
210708	*Pimpinella saxifraga* L.	Bedrenika	Apiaceae (=Umbelliferae)	R	B.e.	Cough, stomach hardship	Infusion, Maceration
110103	*Pinus heldreichii* Christ	Munika	Pinaceae	Re, SH	P.h.-n.	Contusion, wounds	Resin, Traditional Balm
110104	*Pinus mugo* Turra	Planinski bor	Pinaceae	Re, SH	Pin.m.	Wounds	Resin, traditional balm
110105	*Pinus nigra J.F.* Arnold	Crni bor	Pinaceae	Re, SH	P.h.-n.	Wounds, rheumatism	Resin, traditional balm
110106	*Pinus silvestris* L.	Bijeli bor	Pinaceae	Re, SH	Pin.sil., V.-P..	Wound, rheumatism	Resin, traditional balm

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Voucher specimens	Scientific plant name	Local plant name	Plant family	Plant part used*	Habitat/** Commu-nity	Use in human therapy	Preparation and or/ Administration process
220504	*Planthera bifolia* (L.) Rchb.	Vimenjak	Orchidaceae	T	F., V.-P.	Cough	Decoction, Traditional Beverage
210460	*Plantago lanceolata* L.	Muška bokvica	Plantaginaceae	L, R	Arrh., Agr.	Cough, skin diseases	Infusion
210461	*Plantago media* L.	Srednja bokvica	Plantaginaceae	L	B.e.	Cough, wounds	Fresh juice, Infusion
210462	*Plantago major* L.	Ženska bokvica	Plantaginaceae	L, R	P.m.	Stomach ulcer, wounds	Fresh juice, Infusion
220604	*Polygonatum odoratum* (Mill.) Druce	Pokosnica	Liliaceae	RH	F., Q.p.	Bone fracture	Decoction, Infusion
210321	*Polygonum aviculare* L.	Troskot	Polygonaceae	AP	P.m.	Prostate gland inflammation	Infusion
210322	*Polygonum bistorta* L.	Srčenjak, srčanica	Polygonaceae	R	Arrh.	Serious diarrhea, bleeding	Decoction, Infusion
210323	*Polygonum hydropiper* L.	Papreni lisac	Polygonaceae	AP	Bid.	Prostate gland, bleeding	Infusion, Decoction
210330	*Populus nigra* L.	Bijela toplola	Salicaceae	Bu	P.a.	Diabetes	Infusion
210331	*Populus tremula* L.	Jasika	Salicaceae	Bu	Q.r.-p.	Hepatitis	Decoction, Infusion
210408	*Potentilla erecta* (L.) Raeusch.	Trava od srdobolje	Rosaceae	RH	Nard., Mol., S.f.	Diarrhea, wounds, bleeding	Decoction, Infusion
210231	*Primula veris* L. (Incl. *P. officinalis* (L.) Hill.)	Jaglac	Primulaceae	R	B.e., Cor.	Cough	Decoction, Maceration
210515	*Prunella vulgaris* L.	Celinčica	Lamiaceae (=Labiatae)	AP	Glech., P.s.	Anthrax, bleeding	Infusion
210409	*Prunus spinosa* L.	Trnjina	Rosaceae	FL, F	P.s.	A serious diarrhea	Maceration, syrup, cigarette
210241	*Pulmonaria officinalis* L.	Plućnjak	Boraginaceae	L, AP	F.	Cough, wounds	Infusion, Decoction
210300	*Punica granatum* L.	Nar	Punicaceae	B	O.-C.o.	Diarrhea, stomach worms	Decoction, Infusion
210271	*Quercus cerris* L.	Hrast cer	Fagaceae	B	Q.p.	Thinness, psoriasis	Decoction, Maceration
210272	*Quercus petraea* (Matt.) Liebl.	Hrast kitnjak	Fagaceae	B	F.	Thinness, recovery	Decoction, Maceration
210273	*Quercus pubescens* Willd.	Hrast medunac	Fagaceae	B	Q.p.	Recovery, skin diseases	Decoction, Maceration
210274	*Quercus robur* L.	Hrast lužnjak	Fagaceae	B	Q.r.-p.	Recovery, skin diseases	Decoction, Maceration
210280	*Reseda luteola* L.	Katanac, rezeda	Resedaceae	AP	Ch.	Sting of poisonous snake	Infusion
210290	*Rhamnus cathartica* L.	Pasdrijen	Rhamnaceae	B	Q.p.	Chronic constipation	Infusion, Decoction
210291	*Rhamnus fallax* Boiss.	Balkanska krušina	Rhamnaceae	B	Rh.f.	Mange, skin diseases	Decoction with milk
210300	*Ribes grossularia* L.	Ribizla	Grossulariaceae	F	F.	Prostate gland inflammation, urinary system disorders	Infusion

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210410	*Rosa canina* L.	Šipurak	Rosaceae	F	P.s.	Diarrhea, roundworm, recovery	Infusion, maceration, decoction
210411	*Rosa arvensis* Huds.	Divlje ruže	Rosaceae	FL, F	P.s., Q.p.	Skin diseases	Maceration, Decoction
210112	*Rubia peregrina* L.	Broćac	Rubiaceae	AP	Q.i.	Kidney diseases, hepatitis	Decoction, Infusion
210412	*Rubus idaeus* L.	Malina	Rosaceae	F	E.a.	Recovery, diarrhea, skin diseases	Infusion
210413	*Rubus fruticosus* L.	Kupina	Rosaceae	L, F	P.s.	Serious diarrhea, skin diseases	Decoction, maceration, infusion
210320	*Rumex crispus* L.	Masnik	Polygonaceae	L, F	Agr.	Diarrhea, skin diseases	Decoction, Maceration
220605	*Ruscus aculeatus* L.	Veprina	Liliaceae	RH	O.-C.o.	Hemorrhoids, blood vessels	Decoction
220606	*Ruscus hypoglossum* L.	Veprina mekolisna	Liliaceae	RH	F.	Skin diseases, water disease	Decoction
210470	*Ruta graveolens* L.	Ruta, sedef	Rutaceae	AP	S.-Ch.	Heart disorders	Fresh juice, Infusion
210332	*Salix alba* L.	Bijela vrba	Salicaceae	B	S.al.	Heart disorders	Decoction
210333	*Salix fragilis* L.	Krta vrba	Salicaceae	B	S.al.	Fever	Decoction
210334	*Salix purpurea* L.	Rakita	Salicaceae	B	S.p.	Fever	Decoction
210528	*Salvia officinalis* L.	Kadulja	Lamiaceae (=Labiatae)	L	S.-Ch.	Respiratory systemand skin diseases	Infusion
210529	*Salvia pratensis* L.	Kadulja livadska	Lamiaceae (=Labiatae)	L	B.e.	Skin diseases	Infusion
210480	*Sambucus nigra* L.	Bazga, zoha	Caprifoliaceae	FL	F., S.al.	Fever, neurosis	Infusion
210414	*Sanguisorba officinalis* L.	Dinjica, krvara	Rosaceae	R	Mol.	Sting of snake, diabetes	Fresh juice, Decoction
210709	*Sanicula europaea* L.	Milogled	Apiaceae (=Umbelliferae)	R, AP	F.	Bleeding, serious wounds	Infusion
210371	*Saponaria officinalis* L.	Sapunjača	Caryophyllaceae	R	Bid.	Plug serious disease, deep wound	Decoction, Infusion
210516	*Satureia montana* L.	Vrijesak bijeli	Lamiaceae (=Labiatae)	AP	S.-Ch.	Blood diseases – leukemia	Infusion
210517	*Satureia subspicata* Bartl. ex Vis.	Vrijesak crveni	Lamiaceae (=Labiatae)	AP	S.-Ch.	Blood diseases, plug disorders	Infusion
210490	*Sedum acre* L.	Žuti žednjak	Crassulaceae	AP	S.-Ch.	Plug serious diseases, skin wart	Fresh juice
210491	*Sempervivum hirtum* L.	Čuvarkuća žuta	Crassulaceae	L, Su.	Amph.	Ear inflammation, skin diseases	Fresh juice, decoction
210153	*Sinapis arvensis* L.	Slačica	Brassicaceae (=Cruciferae)	S	Ch.	Heart burn, skin diseases	Seed with a little water
210154	*Sisymbrium officinale* (L.) Scop.	Strižica	Brassicaceae (=Cruciferae)	L	Sis.	Chronic hoarseness	Infusion
210125	*Solanum dulcamara* L.	Razvodnik, piskavica	Solanaceae	S	Aln., P.a.	Coldness, rheumatism	Infusion
210126	*Solanum nigrum* L.	Pomoćnica crna	Solanaceae	AP	Ch.	Swelling, skin disorders	Compress

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210117	*Solidago virgaurea* L.	Zlatica	Asteraceae (=Compositae)	AP	E.a., F.	Prostate gland inflammation, urinary system disorders	Infusion
210415	*Sorbus torminalis* (L.) Crantz	Brekinja	Rosaceae	F	F.	Diarrhea, recovery	Decoction
210518	*Stachys officinalis* (L.) Trevis.	Čistac	Lamiaceae (=Labiatae)	AP	Q.r.-p.	Blood diseases	Infusion
210243	*Symphytum officinale* L.	Gavez crni	Boraginaceae	R	Bid.	Bone fracture, baldness disorders	Decoction with milk
220080	*Tamus communis* L.	Bljušt	Dioscoreaceae	RH	Q.p.	Serious asthma, rheumatism	Fresh root with honey
210118	*Tanacetum macrophyllum* (Waldst. & Kit.). Sch. Bip.ultz	Vratić	Asteraceae (=Compositae)	FL, L	Aden.	Neurosis and nervous system disorders	Infusion
210119	*Tanacetum vulgare* L.	Vratić	Asteraceae (=Compositae)	FL	Atr.	Mange and worms	Infusion
210120	T*araxacum officinale* Weber	Maslačak, radić	Cichoriaceae (=Compositae)	R	Arrh., Agr.	Liver disorders, diabetes	Infusion, Decoction with milk
110201	*Taxus baccata* L.	Tisa	Taxaceae	W	F.	Against of spell	Dried small Branch
210121	*Telekia speciosa* (Schreb.) Baumg.	Kolotoč	Asteraceae (=Compositae)	R	Atr.	Bronchial asthma	Inhalation on root smoke
210519	*Teucrium arduini* L.	Arduinijeva iva	Lamiaceae (=Labiatae)	AP	A.f.	Stomach diseases	Infusion
210520	*Teucrium chamaedrys* L.	Dubačac	Lamiaceae (=Labiatae)	AP	B.e.	Diarrhea	Fresh juice, Infusion
210521	*Teucrium montanum* L.	Iva trava	Lamiaceae (=Labiatae)	AP	S.-Ch.	Liver and stomach diseases	Infusion
210522	*Teucrium polium* L.	Iva mediteranska	Lamiaceae (=Labiatae)	AP	S.-Ch.	Stomach diseases	Infusion
210523	*Teucrium scordium* L.	Iva, dubačac	Lamiaceae (=Labiatae)	AP	Agr.	Diarrhea	Infusion
210524	*Thymus serpyllum* L.	Čubra, majkina dušica	Lamiaceae (=Labiatae)	AP	B.e.	Neurosis, cough, stomach diseases	Infusion, Powder
210525	*Thymus* pulegioides L.	Timijan, majkina dušica	Lamiaceae (=Labiatae)	AP	B.e., S.-Ch.	Neurosis, cough, stomach diseases	Infusion, Powder
210500	*Tilia cordata* Miller	Sitnolisna lipa	Tiliaceae	FL	Q.p.	Cough, fever	Infusion
210501	*Tilia platyphyllos* Scop.	Krupnolisna lipa	Tiliaceae	FL	F.	Cough, fever	Infusion
210122	*Tussilago farfara* L.	Podbjel	Asteraceae (=Compositae)	L, FL	Onop.	Cough, serious lung diseases	Infusion
210510	*Urtica dioica* L.	Kopriva, žara	Urticaceae	L	Onop.	Anemia, kidney and skin disorders	Fresh juice, infusion, decoction
210802	*Vaccinium myrtillus* L.	Borovnica	Ericaceae	F	Vacc.	Diabetes	Infusion
210803	*Vaccinium vitis-idaea* L.	Brusnica	Ericaceae	L	Vacc.	Kidney diseases	Infusion
210520	*Valeriana officinalis* L.	Odoljen	Valerianaceae	R	Aden., Ph.	Neurosis, heart diseases	Tincture
210521	*Valeriana montana* L.	Planinski odoljen	Valerianaceae	R	F.	Neurosis, heart disorders	Tincture

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220522	*Veratrum album* L.	Čemerika bijela	Liliaceae	R	Aden.	Louse and skin diseases	Infusion, Decoction
210255	*Verbascum phlomoides* L.	Divizma	Scrophulariaceae	FL	Onop.	Lung tuberculosis	Infusion
210256	*Verbascum thapsus* L.	Divizma	Scrophulariaceae	FL	Onop.	Lung tuberculosis	Infusion
210530	*Verbena officinalis* L.	Verbena	Verbenaceae	AP	Art.	Fever, rheumatism	Infusion
210257	*Veronica officinalis* L.	Čestoslavica	Scrophulariaceae	AP	V.-P.	Sting of snake, catarrh of lung	Infusion
210482	*Viburnum opulus* L.	Čibukovina	Caprifoliaceae	B	Aln.	Against of spontaneous abortions	Infusion, Decoction
210540	*Vinca minor* L.	Zimzelen	Apocynaceae	L	F., Q.p.	Hemorrhoids, malaria	Infusion, Powder
210550	*Viola biflora* L.	Dvocvjetna ljubičica	Violaceae	FL	Pin.m.	Cough, skin diseases	Infusion
210551	*Viola odorata* L.	Ljubica mirisna	Violaceae	FL	P.s.	Cough, skin diseases	Infusion, Decoction
210552	*Viola elegantula* Schott	Lijepa ljubičica	Violaceae	FL	Arrh.	Cough, skin diseases	Infusion
210553	*Viola tricolor* L.	Daninoć, maćuhica	Violaceae	AP	Arrh., Sec.	Cough, skin diseases	Infusion
210560	*Viscum album* L.	Imela bijela	Loranthaceae	AP	F.	Epilepsy, heart hardship	Maceration, Infusion

officinalis, Centaurea cyanus, Chamaenerion angustifolium, Galega officinalis, Gnaphalium uliginosum, Micromeria thymifolia, Ruscus aculeatus, R. hypoglossum, Salvia pratensis, Teucrium arduiini, and *Valeriana montana*.

Medicinal use of analyzed plants

Analyzed plants are being used for treatment of a wide range of human diseases. Its medicinal usage is presented in Table 2.

Since ancient time, majority of herbal drugs have being used for treatment of respiratory illnesses such as cough, inflammation of throat, bronchus or lungs (up to 27%). Besides, 19% of all detected plants have being used for treatment of gastrointestinal disorders (stomach illnesses, ulcer of stomach and intestine, strengthening of appetite). It has been found that 11% of these plants have being used for treatment of different kind of skin conditions (wounds, inflammations, psoriasis etc.). Significant proportion of plants has also being used for treatment of urinary system infections, kidney's inflammation, bacterial infections, prostate disorders, strengthening of sexual potentials (9%). It has been perceived that people quite often use plants to prevent insomnia, nervous tensions, stress (9%) or to strengthen heart muscle and treat its rhythm disorders (7%).

TABLE 2
MEDICINAL PLANTS USE IN ETHNOTHERAPY

Medicinal usage	Number of species	Proportion (%)
Respiratory system disorders	51	22.46
Gastrointestinal tract disorders	43	18.94
Skin system diseases	26	11.45
Liver and bladder disorders	22	9.69
Urogenital tract disorders	22	9.69
Nervous system disorders	21	9.25
Cardiovascular system disorders	16	7.07
Metabolism (strengthening of the organism) disorders	12	5.29
Blood system disorders	7	3.08
Rheumatism	4	1.76
Senses (eyes, ears) disorders	3	1.32
Total:	227	100

Herbal parts being used and mode of its preparation

A various vegetative organs, such as leaves, flowers, root, fruits, rhizome, over ground flowering parts, underground parts, essential oils, resin, bark, bulbs, and in smaller proportion other herbal parts (Table 3). Mostly

TABLE 3
MEDICINAL PLANT PART USES

Usage plant part	Number of species	Proportion (%)
Herba (Aerial part)	73	32.16
Folium (Leaf)	34	14.98
Radix (Root)	27	11.89
Flos (Flower)	22	9.69
Rhizoma (Rhizome)	16	7.05
Fructus (Fruit)	14	6.17
Cortex (Bark)	11	4.85
Tuber and bulb	7	3.08
Aetheroleum (Oil)	5	2.2
Semen (Seed)	4	1.76
Colophonium/lignum (Colophony, resin/wood)	4	1.76
Stigmae/spore	2	0.88
Manna/pix	2	0.88
Gemmae (Buds)	2	0.88
Pyroleum	1	0.44
Glandullae (Gland)	1	0.44
Stipes	1	0.44
Lichen	1	0.44
Total:	227	100

are being used over ground flowering parts (32%) and leaves (15%). Reason for such herbal part's usage is probably simplicity of its detection and collection. But, on the other hand, root is often used herbal part (12%) and flowers (10%).

Determined plants species, or more precisely their parts, have been used for preparation of various forms used in the treatment of above mentioned diseases (Table 4).

The most frequent way of preparation procedure was to make infusion or decoct (almost 80%) due to simplicity of the procedure. Approximately 7% of plants are being used in order to get fresh juices and about 8% to prepare some kind of tincture or macerate. There are only few cases when person is being treated by inhalation on smoke which is being produced by slow burning process of certain medicinal plant. Special attention should pay to the preparation of balms, so called mehlems, which are being used for wound's healing, skin diseases, rheuma, schiatic or as cosmetic's product.

TABLE 4
MEDICINAL PLANTS PREPARATIONS

Preparation	Number of species	Proportion (%)
Infusion	134	59.03
Decoction	44	19.38
Fresh juice	16	7.05
Tincture	9	3.96
Maceration	9	3.96
Ointment	7	3.09
Smoking/ Inhalation on smoke	5	2.20
Powder	3	1.32
Total:	227	100

Diversity of medicinal plants

Plant taxonomy

Taxonomically analyzed, all detected plants origin from 71 different plant families (Table 5). There is only one species, *Cetraria islandica,* which belongs to the family Parmeliaceae (Lichenes) and all the rest are vascular plants. Ferns (Pteridophyta) are presented with four species belonging to the four different families. Coniferous division (Pinophyta) is presented with nine species originating from three families. Majority of herbs make Magnoliophytina, of which Dicotyledones (Magnoliatae) are 196 species from 57 families. The most frequent ones are species of Labiatae (13%), then Compositae (10%), Rosaceae (7%) and Umbelliferae family (4%). Monocotyledones (Liliopsida) are 31 species from 6 families, of which the most numerous are Liliaceae and Orchidaceae (5%).

Ecology and habitats

Detected plants inhabit, from ecology standpoint, quite different places, whose main characteristics were determined on the basis of syntaxonomic order that certain plant's community belongs too. All plants were comprised within 53 vegetation orders (Table 6). The largest proportion belongs to the following orders: *Fagetalia, Brometalia erecti*, *Quercetalia pubescentis*, *Prunetalia spinosae*, *Arrhenatheretalia*, *Scorzonero-Chrysopogonetalia, Adenostyletalia*, *Onopordetalia*, *and Chenopodietalia* and in smaller proportion some of the other vegetation orders (Table 6).

Discussion

List of used plants

The determined list of plants in accordance with the modern propositions about use of medicinal plants from native populations represents main group of plants that includes species well known in traditional phytotherapy. It comprises species that have been used or are still in use in phytotherapy in some parts of B&H. After comparison with species used in neighboring countries[26,27,49] it is concluded that there is high similarity among them. There has been established significant similarity in the way of usage of certain plants in B&H and some parts of Croatia[14], as well as in Albania and Turkey[51–53], and some other region[54]. This indicates similar ethno genesis of people of Balkan peninsula. There is also a significant number of species used in official pharmacy[38]. Besides them, there are also plant species that have been used for

TABLE 5
FREQUENCY OF MEDICINAL PLANTS FAMILIES

Botanical family	Number of species	Proportion (%)
Lamiaceae	30	13.21
Asteraceae	23	10.13
Rosaceae	15	6.61
Apiaceae	10	4.41
Scrophulariaceae	8	3.54
Liliaceae	6	2.64
Solanaceae	6	2.64
Pinaceae	5	2.21
Fagaceae	5	2.21
Ranunculaceae	5	2.21
Salicaceae	5	2.21
Orchidaceae	5	2.21
Fabaceae	5	2.21
Violaceae	4	1.77
Polygonaceae	4	1.77
Rhamnaceae	4	1.77
Brassicaceae	4	1.77
Ericaceae	4	1.77
Papaveraceae	3	1.32
Plantaginaceae	3	1.32
Boraginaceae	3	1.32
Primulaceae	3	1.32
Cupressaceae	3	1.32
Iridaceae	3	1.32
Gentianaceae	3	1.32
Malvaceae	3	1.32
Valerianaceae	2	0.88
Cupuliferae	2	0.88
Tiliaceae	2	0.88
Crassulaceae	2	0.88
Moraceae	2	0.88
Caryophyllaceae	2	0.88
Geraniaceae	2	0.88
Oleaceae	2	0.88
Rubiaceae	2	0.88
Caprifoliaceae	2	0.88
Other families presented with one species	35	15.42
Total	227	100

TABLE 6
ECOLOGY AND HABITATS OF MEDICINAL PLANTS

Ecological Order	Number of species	Proportion (%)
Fagetalia	26	11.45
Brometalia erecti	17	7.51
Quercetalia pubescentis	16	7.06
Chenopodietalia	14	6.17
Prunetalia spinosae	13	5.73
Arrhenatheretalia	12	5.30
Scorzonero-Chrysopogonetalia	11	4.87
Adenostyletalia	10	4.41
Onopordetalia	10	4.41
Epilobietalia angustifoliae	9	3.96
Molinietaliia	8	3.52
Bidentetalia	7	3.08
Artemisietalia	7	3.08
Agrostetalia	5	2.20
Quercetalia robori-petraeae	5	2.20
Populetalia albae	5	2.20
Vaccinietalia	3	1.32
Plantaginetalia majoris	3	1.32
Ostryo-Carpinetalia orientalis	3	1.32
Glechometalia hederaceae	3	1.32
Amphoricarpetalia	3	1.32
Vaccinio-Picetalia	3	1.32
Alnetalia glutinosae	3	1.32
Secalinetalia	2	0.88
Nardetalia	2	0.88
Arabidetalia flavescentis	2	0.88
Juniperetalia	2	0.88
Potametalia	2	0.88
Origanetalia	2	0.88
Pinetalia heldreichii-nigrae	2	0.88
dctlpar*Pinetalia mugi*	2	0.88
Seslerietalia tenuifoliae	2	0.88
Salicetalia albae	2	0.88
Other 11 orders presented with one species	11	4.84
Total:	227	100

ages in the ethno therapy, but they aren't so well known. Significant attention should be in coming investigations paid to these plants.

Considering extremely high percentage of endemic species and poor knowledge on vascular plants, particularly from high mountainous ecosystems and other less accessible habitats in B&H, it is possible to speak about group of plants that includes more than 200 species of potentially medicinal plants[30]. They should be systematically investigated regarding their pharmacognosy, pharmacology, pharmaceutical and technological potentials. This list has a large possibilities and chances in discovering of even new active principles. Similar proportions of potential medicinal plants have been determined during systematical investigations of medicinal flora on certain mountains in B&H [31,32].

Local plant names

The most common names of plant species are given in the Table 1. During these investigation it has been recorded more than 1,000 various names. Even in the same region in use are various names for the same species. This is particularly the case with the species that are the most frequently used. For example, *Achillea millefolium* has the following local names: »kunica«, »sporiš«, »and hajdučka trava«,« hajdučica«,« ajdučica«. The same case is with large number of other species. Some species have same local names, although they are completely different species. For example, local name »macina trava« have species *Valeriana officinalis* and *Nepeta cataria*. The species *Nepeta cataria* has been mainly used in Herzegovina for treatment of female's sterility, and for the same purposes has also been used *Valeriana officinalis*. The local name »bunika« has been used for species *Atropa belladona* and *Hyosciamus albus*. Also, local name »kacun« has been used in some parts of Bosnia for species *Colchicum autumnale*, *Orchis morio* and *Crocus vernus*. Same local name »vris« has been used in certain parts for the same species: *Calluna vulgaris, Satureia montana, Satureia subspicata, Vaccinium myrtillus*. However, it is necessary to be very careful in use of local names for they could vary significant from one place to another and mark quite often completely different species. Some of them could even be harmful for use in human phytotherapy.

Use of some taxonomic group of plants in ethno therapy

There have been detected 227 plants, of which there was only one *Cetraria islandica* belonging to the tallophytes. In ethno therapeutic purpose entire aerial part of *Cetraria* is being prepared like some kind of decocts and used for healing of anemia, cold and cough. All the rest were vascular plants. In this area there was no record found on usage of mosses in ethno botany (Bryophytes). On the other hand, it has been detected more frequent usage of ferns. *Lycopodium clavatu*m is very popular in treatment of liver illnesses. Beside traditional usage of *Equisetum arvense* in treatment of urinary inflammations and kidney's stone, it is common to use it to fight heavy cough. *Adiantum capilus veneris* is believed to have magical powers in treatment of female reproductive system. *Dryopteris filix-mas have* since ancients being used for making syrup against gastric parasites (Nematodes) at children.

Hills and mountains of B&H territory are covered with coniferous woods, which has resulted with widespread use of conifer in ethno therapeutic purposes (entirely nine species). Resin of species *Abies alba* and genus *Pinus* is main ingredient for preparation of traditional products: Bosnian mehlems, creams and compresses. These are being used for healing of malignant wounds, serious contusions and rheuma. In some regions fresh resin is being chewed for gumms protection and against infections of mouth cavity, throat, as well as for teeth strengthening.

Angiosperm (Magnoliophytina) comprises 213 species of 63 different plant families. Dicotyledonous (Magnoliatae) comprises 196 species of 165 genera. Although entire flora of B&H is dominated by species of family Asteraceae, in medicinal flora the most abundant are species of family Lamiaceae (13%), with usage of it's over ground herbal organs, leaves and flowers. These are mostly ingredients for preparation of different kind of tea (infuse) which is common for treatment of respiratory system illnesses, stomach discomfort, nervous tension, such as genera: *Mentha*, *Thymus*, *Origanum*, *Glechoma*, *Ajuga*, *Calamintha*, *Salvia*, *Prunella.* Species of genus *Satureja* (all endemics and inhabiting karsts) are traditionally being used for treatment of lymphatic system illnesses (Hodgkin syndromes), and it is believed also that they cure some forms of leukemia, especially *Satureja montana.* Species of genus *Teucrium*, especially *T. montanum*, are being used for preparation of cold tea against wide range of internal illnesses, of which in this manner the most treated ones are liver illnesses. *Mentha pulegium* is being used for treatment of depressions, anxiety and insomnia. Species of family Compositae are abundant in ethno therapy up to 10%. Mostly used parts of these, for treatment of stomach illnesses, are roots, leaves and flowers (*Helichrysum*, *Artemisia*). Urinary system inflammations are successfully being treated with *Hieracium pilosella*, and cough or illnesses of the lungs with *Inula helenium*. Root of *Cichorium intybus* is being used to improve secretion of excessive water from human body, and *Cnicus benedictus* has proved itself as a medicine for malignant illnesses of internal organs. Rosaceae family is next when it comes to the abundance of plants in ethno therapy. In this paper listed were 15 species, of which are being used following parts: leaves, flowers, fruits and underground organs. They are mostly being used for preparation of teas, decocts and fresh juices, with purpose to improve general state of organisms, to prevent diarrhea and to fight all sorts of inflammatory processes. Plant families coming next coincide mainly with the local flora of vascular plants (Table 5).

Monocotyledons (Liliatae) comprise 17 species of 11 genera. Dominant ones are Liliaceae (six species) and Orchidaceae (five species). Rhizome of genus *Polygonatum* is being used for preparation of decocts assigned to treat bone fractures. Rhizome of genus *Ruscus* is being used to prepare decocts for treatment of veins, prostate illnesses and hemorrhoids. Although being toxic, seed of species *Colchicum autumnale* is usually being mixed with other herbs in the way to prepare effective medicine against serious headache. Preparatory procedure for famous Bosnian drink »salep« requires underground organs from species of family Orchidaceae. These are special decocts made of *Orchis* tubers, which are slowly being cooked on temperate temperature for about ten hours. There are areas in B&H where it is still custom to organize evening sessions of salep drinking. Many people believe in its magical power to re-gain strength to the males.

Obtained spectrum of taxonomical position of species has shown that dominant role play plants containing a wide spectrum of essential oils, bitter matters, tannins, glycosides, alkaloids, and other active principles. It is known that species from family *Lamiaceae* are rich in essential oils. The similar situation is with species from families *Asteraceae* and *Apiaceae*. Species from the family *Rosaceae* are rich in various tannins. Spectrum of systematic position indicates quite good spectrum of active principles and pharmaceutical activity. Similar proportions of plant families presence were obtained on some locations that differed significant regarding its ecological and geographical conditions[55–59].

After comparisons with the results of previous investigations on taxonomy of medicinal and potentially medicinal plant species in B&H[34] it was determined 260 species from 71 families. The highest proportion have families *Rosaceae, Lamiaceae, Asteraceae, Ranunculaceae, Scrophulariaceae* and others from the class *Magnoliopsida*.

Plant part uses and mode preparations

Dominant role play species whose above aerial (ground) plants (herba), leaves (folium) and flower (flos) have been in use (Table 3). Climate have created suitable conditions for development of geophytes. For these reasons are very frequent species whose underground organs (rhizoma et radix, tuber et bulbus) have been in use. However, determined spectrum of usage parts indicates possibilities of wide use of these species in modern phytotherapy.

Medicinal plants in this region are being used in fresh, raw or dry condition. Inhabitants of local villages often use fresh and raw herbs. Young and juicy leaves of *Achillea millefolium* and *Plantago major* are always being used in fresh squashed condition. Yellow juice of *Chelidonium majus*, as well as of genera *Sedum* and *Sempervivum* are also used exclusively in fresh condition. Fresh and warmed up leaves of *Arctium lappa* and *Petasites hybridus* have been showing great success in medicinal treatment of contusions and rheumatism. Fresh coniferous resin is being chewed. Fresh birch juice has being drunk in early spring, before shooting off the leaves, to improve function of the kidneys. Leaves of *Nasturtium officinale* have being consumed as an aphrodisiac over the whole year. Fruits of *Physalis_alkekengi* have being consumed in order to improve urination, and even in certain cases to help healing asthma. For heart muscles strengthening before meals consumed are fresh leaves of *Ruta graveolens*.

Spectrum of usage of medicinal plants shows that people mostly use simple preparations such as infusions, and certain varieties of decoctions. There is a similar situation in many others, even very distant areas[60–62], most probably, for being the simplest preparatory procedure.

Infusion's preparation is significantly different over the certain regions. There are areas where infusion has being prepared by putting one spoon of herbs into boiling water and cooking it for about few minutes. In other areas distinct amount of dried or fresh herbs is being cocked with lid on for even longer period of time. Some people pour water on already used herbal mixture and boil it again. This is some kind of infusion.

None of the interviewed persons knew exactly how much of the herbs should be used in order to get the most effective infusion. Everyone did it, more or less, by its own judgment.

Decoct or (»uvarak«) is being prepared in different ways. The most common way is to put certain amount of solid herbal materials into the water, such as root, rhizome, fruit or seed and cook it on a mild temperature for as long as decocts mass thicken and turn into jelly. There are also some cases when special decocts are being prepared. Thus bone's fracture are being treated with decoct which is made of pulverized root and steam of *Symphytum officinale*. At first certain amount of herbal material is being boiled in water at a mild temperature for a few hours, when preparation is almost done, it is being removed from the temperature source and poured over with fresh goat's milk in exact proportion as a starting water's amount. Then it should be cooked again till mass thicken enough. There is a similar preparatory procedure for *Arctium lappa* root's decoct. This preparation is being used for hair root's strengthening and treatment of skin conditions.

Especially valuable is decoct of oak (*Quercus* sp.) which is being prepared by cooking of young oak's bark, usually of *Q. robur*, in natural apple essig. Final decocts mass is afterwards being added to raw lard or cow's butter and used for treatment of all sort of skin conditions, such as psoriasis.

Species of genus *Sempervivum* have been used for preparation of special decoct by putting the juice of these species into the home made bread which is being done on the fire for two hours. This preparation is very effective in treatment of chronic inflammation of the middle ear.

In this region quite often are applied fresh juices gained from different plant's parts. In the early spring, usually before shooting out of leaves, it is being made cut into birch's bark *Betula pendula* and a cup is being placed underneath of the cut in order to collect fresh juice of birch. It supposes to be drunk before fermentation took place.

In some regions, in the early spring, it is being cut into young shoot out of walnut's root *Juglans regia* and tip of it is being put into dark bottle which is afterwards being buried 50 cm deep into the ground and left for a few days. This preparation is used to treat gall's stone and strengthen entire body after winter's weaknesses.

Besides, it is important to pay attention to traditional preparations used in the treatment of heavy wounds, rheumatism, and malignant diseases. They are called »mehlem« (Bosnian balm), and represent special mixtures of raisins of conifer in which are being dissolved fresh plant parts. Wide known is a »mehlem« from fir resin (*Abies alba*) that heals even the deepest wounds.

In many cases Bosnian balm is being prepared by putting fresh collected herbal juice into fresh cow's but-

ter and creamed over hurting spot. In similar way are being treated heavy burns and disrupted skin, with balms originating from following species: *Plantago sp*., *Calendula sp*., *Arctium lappa.* There are few herbalists which are devoted only to preparation of Bosnian balms.

Among ordinary people beloved are also tinctures which are being made by putting distinct amount of herbs into pure brandy (made of plums and wine), and leaving it for about ten days. Alcohol proportion in such tinctures ranges between 35% and 42%. It is advised to drink one small cup of these before the meal.

Medicinal herbs usage in ethno therapy

The analyzed species have been in use in prevention and treatment of various diseases from the simplest ones, such as cold, to very serious ones, such as malignant diseases of internal organs, as well as for the strengthening and maintenance of body beauty and condition.

Wide spectrum of names for various diseases has been mentioned in investigations. Most of them is named in Table 1 whose conditions are classified in several groups. The largest number of species has been used in treatment of chronic diseases of respiratory system, gastrointestinal tract, digestive organs, skin diseases etc. Other groups make diseases of liver, bladder, and urogenital tract. Next are cardiovascular system, nervous system, and other, mainly chronic diseases (Table 2). During investigations it has been determined that certain species have been used for treatment of several diseases.

There are many species in this area with high ethno botanical and ethnopharmacological significance. But, some of them are more valuable than others. One of these is *Gentiana symphyandra,* a very popular plant in ethnomedicine, used as an excellent tonic, but in the central Bosnia it has been used for successful treatment of heart diseases. Extremely good results are achieved by usage of plum's tincture in treatment of heart arrhythmia and serious ischemia. People avoiding consumption of alcohol use water extraction of gentian. These should be drank before each meal (three times daily) over the period of 40 days. *Teucrium montanum*, the most popular species in ethnomedicine has being used in treatment of stomach and liver diseases, and in some areas as an excellent drug for heavy nervous disorders. To treat these it is advised to drink cold infusion several times a day instead of water over the period of 40 days. This herb has been beloved and highly rated among ordinary people for centuries, which is way it is custom to use proverb stating that »iva makes living from a dead man«. Odorous flowers and leaves of endemic species *Satureja montana*, *S. subspicata* and *Micromeria thymifolia* are being used to prepare teas for treatment of respiratory system's and lymphatic nodule's inflammation and for betterment of blood's state. In Herzegovina were even registered several cases of young people being healed of leukemia by consuming these cold teas. Endemic species *Teucrium arduini* is being used in the form of tea to help healing stomach discomforts. Fruits of wild chestnut *Aesculus hippocastanum* are being carried in the pockets by people who suffer chronic rheumatism and sciatica. Leaves of *Alchemilla sp.* are being used in the form of tea to treat liver cyrosis. Tea made of long time ago forgotten species *Ballota nigra* is being used to calm nervous system, achieving excellent results during the last war in B&H. Cold compresses made with flowers of *Centaurea cyanus* and *Euphrasia rostkoviana* are being used to treat eye diseases and to improve sight. Mild tincture prepared of *Gentiana_asclepiadea* roots is being used for diseases of internal organs, especially liver and pancreas. Excellent cure for treatment of male sterility is believed to be tea made of over ground plant's part of species *Geranium robertianum* and *Hypericum perforatum*. On the other hand, female sterility has been treated with tea made of *Nepeta cataria* over ground parts and root of *Valeriana* officinalis since centuries ago. Stomach discomfort and disorders of heart's rhythm are being treated with tea of *Marrubium vulgare* over ground parts. Dried root of *Inula helenium* is being burnt in order to create a smoke which is then inhalation to prevent acute respiratory system's inflammation. Besides, this smoke is often being used during the religious ceremonies of Muslim's community. Fresh rhizome of *Cyclamen purpurascens* is being pulverized and mixed with salbei's honey (*Salvia officinalis*) for treatment of malignant lung's diseases. By removing of periderma from poplar's bark (*Populus tremula*) remains white part which is being prepared as decoct that cures all forms of hepatitis. Decoct of *Polygonum bistorta* rhizome represents medicine for treatment of heart's diseases, which is why locals name it »srčenjak«, meaning »of the heart«. This is the most beloved plant among Bosnian highlanders. Decoct prepared of *Rumex crispus* roots stops diarrhea, especially by little children. Similar usage have leaves of *Teucrium chamaedrys*. During the recent war, when dysentery and enter colitis were widespread diseases and lack of official medicines was undoubted fact, the best healing results were achieved by usage of cold tea prepared with afore named herb. In sudden situations suffices to consume 3–5 leaves of these bitter herb in order to improve patient's condition. Thus people living in mountainous areas used to carry always few branches of this magical herb. When someone loses its voice it is advised to drink *Sisymbrium officinale* tea, according to the people tales. So, even in this modern era, many singers visit herbalist asking to be treated with this herb in order to maintain their voice's quality. Asthma is being treated with fresh rhizome of *Tamus communis* that is previously mixed with honey. Although being highly, in pharmacological sense, active herb, which is by some people used to treat exclusively rheuma and sciatica, it is very appreciated as a medicine against malignant carcinoma. Indeed, there have been recorded many cases of people being »signed off« by official medicine, which have extended their lives for next 4–5 years by simple usage of these herb.

At the end, *Ruta graveolens* is a wild plant cultivated by almost every house hold for being believed to be some kind of holly plant. If some quantity of its leaves eaten

each morning before the meal along with honey of *Satureja montana* or *S. subspicata*, serious heart difficulties could be removed. During his investigation author has recorded few cases of people being treated in these manner and stating to feel excellent, though some of them have survived hard miocard's infarct.

When parents want to protect newborns from children shock they put under baby's neck a little branch of *Ruta graveolens*. Adults quite often carry in the upper pocket of jacket small branch or a piece of yew wood (*Taxus baccata*), for a »good luck« and protection from evil forces.

By comparing the achieved ethno botanical results with similar research of other authors [63–67] established were significant mark ups of ethno therapy in B&H which are being reflected in completely different preparation procedures and usage of medicinal herbs, as well as in specific list of species being used with these purposes. There have been recorded many cases of usage, from taxonomy standpoint, the same species with entirely adverse ethnopharmacological purpose[71–73]. These proves that, beyond reasonable doubt, on the territory of B&H exist original forms of medicinal herbs usage, or exist of, so called Bosnian ethno therapy, which is in many aspects well known and esteemed all around Balkan peninsula. This is indicated also by newly published data of World Health Organization which consider traditional, complementary and alternative medicinalpractice[74].

Ecology and conservation status

Wide range of ecological conditions and habitat types on the territory of B&H have led to the creation of completely different vegetation cover on the horizontal profile, moving from the South, sub-Mediterranean climate, toward inland, and on the vertical profile, up hills high mountains. Because of that, different plants are being used in different biogeographically regions. It has been custom to travel in far places where can be found some important medicinal plants and prepared by local herbalists. Thus, people travel into sunny Herzegovina to collect odorous herbs, in the Sava river valley to dig *Valeriana* and *Angelica* roots, and into high mountains to find yellow gentian *Gentiana symphyandra*.

The results of the analyses of ecological and phytocoenlogical belonging of determined plant species indicate that they inhabit 53 various habitat's and ecosystems types (Table 6), which points out ecological heterogeneous and floristic richness of this area.

Majority of species grows in the ecosystems of broadleaved deciduous woods of order *Fagetalia*, termophilous meadows of order *Brometalia erecti*, termophilous woods of order *Quercetalia pubescentis*, shrub communities of order *Prunetalia spinosae*, mesophilous meadows of order *Arrhenatheretalia*, sub Mediterranean rocky meadows of order *Scorzonero-Chrysopogenetalia*, and tall herb's communities of order *Adenostyletalia* and nitrified habitats of order *Onopordetalia*. There is a certain correlation between presence and distribution of certain vegetation types in B&H and number of species. These proportions of certain ecological groups of species indicate specific ethno genesis and anthropogenesis in this region. Namely, since the human society has been developing in the zone of orders *Fagetalia* (in the continental) and in the zone of order *Quercetalia pubescentis* (in Mediterranean and sub-Mediterranean part of BiH human beings have used the largest number of plant species just from those areas. Going on the vertical profile towards the highest mountain peaks, the number of human settlements decreases as well as the density of human population. For these reasons the number of species from those ecosystems is a very small – ecosystems of dark coniferous woods of order *Vaccinio-Piceetalia.*

Since the region of high mountain ecosystems was never inhabited, medicinal plants from this region haven't been in use. Beside species *Gentiana symphyandra* almost no other species from the high mountainous tundra of the Dinaric Alps has been used in the phytotherapy. However, the results of the investigations of medicinal flora on some Dinaric Alps mountains[75] have shown high frequency of potentially medicinal plants that deserve more attention since they contain significant sources of less known active principles. Due to the overexploitation that took place in the past, and trend of currently increasing poverty, many medicinal herbs are now highly endangered. Although being on the Red List, many of them are still being exploited without any sort of control. The most endangered species is *Gentiana symphyandra* whose root is much esteemed and being bought off in many stations all over the country. According to the IUCN's categorization[76], this is highly endangered species that is under threat of distinction from its natural habitat. Next on the list of endangered plants is *Centaurium umbellatum* for by it's over ground parts collection disrupted gets also the root, which is very sensitive organ. All species of the family Orchidaceae (especially *Orchis morio*) are endangered because of tuber's overexploitation that takes place over the entire vegetation season. Similar status have got *Arctostaphyllos uva-ursi*, very rare plant which is intensively being used and collected on the Bosnian territory, then *Lycopodium clavatum*, *Glycyrrhiza glabra*, *Primula veris*, *Pinus heldreichii*, *Rhamnus fallax*, *Ruscus hypoglossum*, *Satureia subspicata*, *Tamus communis*, *Vaccinium vitis-idaea*, *Menyanthes trifoliata* and *Acorus calamus*. Intensive collection of *Helichrysum italicum* makes it more endangered day after day

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EKOLOŠKI ASPEKT ETNOBOTANIKE I ETNOFARMAKOLOGIJE STANOVNIŠTVA BOSNE I HERCEGOVINE

S A Ž E T A K

Ovaj rad sadrži prve sistematski obrađene rezultate tradicionalne uporabe divljih ljekovitih i aromatičnih biljaka na teritoriji Bosne i Hercegovine – B&H (zapadni dio Balkanskog poluotoka; jugoistočna Evropa). Ustanovljeno je 227 biljaka koje spadaju u 71 biljnu familiju, a koje su bile upotrebljavane u etnoterapijske svrhe. Rezultati su ostvareni metodom direktnog etnobotaničkog intervjua koji je obuhvatio 150 osoba prosječne starosne dobi od 63 godine. Ljekovite biljke u etnoterapiji bile se korištene u svježem, sirovom ili osušenom stanju. Različiti biljni dijelovi zavisno od perioda vegetacijske sezone, ponekad i zimi, su osnova za pripremu infuzuma (59%), dekokta ili uvaraka (19%) i tinktura (4%). Naročito su originalni melemi poznati kao bosanski »mehlemi« koji se prave od svježe ubranih biljnih dijelova pomiješanih sa mlakom smolom, sirovim kravljim maslom ili medom. U etnoterapiji su najčešće korišteni nadzemni dijelovi biljke. Najviše biljaka upotrebljavano je u liječenju bolesti respiratornog (22%), gastrointestinalnog (19%) i urogenitalnog sustava (9%). U liječenju kožnih oboljenja (11%), te živčanog sustava i srčanih bolesti (16%). U usporedbi sa drugim područjima, utvrđena je originalna upotreba u etnofarmakologiji sljedećih biljnih vrsta: *Ballota nigra, Aesculus hippocastanum, Calluna vulgaris, Centaurea cyanus, Euphrasia rostkoviana, Geranium robertianum, Gentiana asclepiadea, Helichrysum italicum, Lycopodium clavatum, Marrubium vulgare, Nepeta cataria, Populus tremula, Ruta graveolens, Tamus communis, Teucrium montanum, T. chamaedrys* i endemičnih biljka *Gentiana lutea* subsp. *symphyandra, Teucrium arduini, Micromeria thymifolia, Satureja montana, S. subspicata, Rhamnus fallax* i *Viola elegantula*. Nisu utvrđene značajne razlike u učestalosti uporabe ljekovitih biljaka među različitim etničkim skupinama. Međutim, primijećeno je da stanovnici submediteranskog i mediteranskog područja posjeduju dužu etnoterapijsku tradiciju, kao i stanovnici planinskih područja B&H, bez obzira na njihovu etničku pripadnost.