

BOTANICAL SURVEY OF MEDICINAL PLANTS USED IN THE TRADITIONAL TREATMENT OF HUMAN DISEASE IN MOUNTAIN HAY MEADOWS FROM GURGHIIULUI MOUNTAINS

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Abstract: The aim of this study was to identify the medicinal and aromatic plants from mountain hay meadows (6520 - Natura 2000 habitat) of Gurghiuului Mountains and to analyze the correlation of these herbs with their therapeutic compounds as well as the human diseases on which they can be used on therapeutic purpose. The area covered by this study was the Gurghiuului Mountains. Regarding the vegetation, this area is characterized by the predominance of forest ecosystems, along with semi-natural mountainous grasslands. The floristic inventory for the studied area included numerous medicinal plants with therapeutic chemical compounds. These medicinal plants were grouped in this study according to the dominant active principles used in phytotherapy. Two plant associations were identified: *Festuco rubrae-Agrostietum capillaris* Horvat 1951 and *Poo-Trisetum flavescens* Knapp ex Oberdorfer 1957. This survey demonstrates that the medicinal plant area in the Gurghiuului Mountains is a promising economic resource for developing this region, but it needs planned exploitation.

Keywords: grasslands, habitats, medicinal plants.

1. Introduction

Today is increasing interest in the health benefits of medicinal plants. This is with good reason as they might offer a natural safeguard against the development of certain conditions and be a putative treatment for some diseases (Tahraoui et al., 2007). Ethnobotanical studies have become increasingly valuable in the development of health care and conservation programs (Nadembega et al., 2011; Wright et al., 2007; Tahraoui et al., 2007). The green pharmaceuticals are receiving extraordinary

importance and popularity. Ethnobotany and ethnopharmacology have contributed to the discovery of many important plant-derived drugs.

Vegetal product research can be guided by ethnopharmacological knowledge. In the same time, it can make a contribution to drug innovation by providing novel chemical structures and/or mechanisms of action. Both plant-derived drugs and crude plants have to take the same pharmaco-economic hurdle that

has become important for new synthetic drug (De Smet, 1997).

An increased interest worldwide for the estimation of therapeutic potential of herbal medicine, prompted us to study grasslands with plants showing medicinal potential, especially herbs used in a variety of human disorders. Sustainable use of wild populations of medicinal plants requires robust assessment of the distribution and abundance of target species (Nkomo et al., 2014). In different countries, many medicinal plants are widely distributed and used across regions. However, relatively few are cultivated. Thus, the conservation of these plants requires efforts that are directed to key habitats, including secondary forests, disturbed areas and agrolandscapes (Aguilar-Støen and Moe, 2007).

Medicinal plants growing in semi-natural and natural ecosystems are a valuable commodity because they are a cheap resource; the quality of spontaneous herbs is seldom superior to those cultivated and their consumers acceptance is higher.

Our study represents an inventory on medicinal plants identified in the mountain hay meadows from the area of the Gurghiului Mountains. The collected data represent the preliminary information required in view of a future phytochemical investigation on the most used plants.

2. Materials and Methods

2.1 Study area

Gurghiului volcanic mountains are on the western edge of the Eastern Carpathians Center (Mureș County). They fall into the group of the youngest mountains in Romania. By their geographical location they fall in the temperate mountains, wet and cool climate. This climate together with edaphic conditions is responsible for the richness and diversity of flora existing in the study area.

2.2 Botanical survey

The survey was carried out during the year 2014-2015 and subsequent data analysis that was completed in 2016. The study of medicinal plants was done in Natura 2000 habitat, 6520 – Mountain hay meadows, comprising semi-natural mountain meadows. This study of medicinal plants was carried out based on our own research in the field by using classic techniques, procedures promoted in literature, and some statistical analysis (Oroian, 1998; Sămărghișan et Oroian 1999; Tămaș, 1999; Oroian et Sămărghișan, 2000; Sămărghișan, 2005; Oroian, 2011; Coldea, 2012; Rácz et al, 2012).

The type of habitat has been coded in accordance with existing interpretations of habitats in Romanian manuals (Cristea et al., 2004; Gafta et Mountford, 2008). Habitat structure characterization was done using phytosociological surveys. The inventory of the medicinal species was based on the active principles contained therein, and data obtained from bibliographic information (Istudor, 1998; Palade, 1998; Sămărghișan et Oroian 1999; Tămaș, 1999; Oroian et Sămărghișan, 2000; Istudor, 2001; Palade et al, 2003; Cristea et al., 2004; Doniță et al. 2005; Aguilar-Støen et Moes, 2007; Gafta et Mountford, 2008; Stănescu et al., 2002; Stănescu et al.2002b; Yberrt et al., 2013; Council Directive 92/43/EEC; Romanian Pharmacopoeia; European Pharmacopoeia).

3. Results and discussions

3.1 Medicinal plants recorded

Two plant associations were identified: *Festuco rubrae-Agrostietum capillaris* Horvat 1951 and *Poo-Trisetetum flavescentis* Knapp ex Oberdorfer 1957.

They were classified according to Coldea (2012) as follows: Cls. Molinio-Arrhenatheretea, Ord. Arrhenatheretalia, All.

Arrhenatherion Koch 1926, Ass. *Poo-Trisetetum flavescens* Knapp 1951 em. Oberdorfer 1983; All. Cynosurion R.Tx.1947, Ass. *Festuco-Agrostetum capillaris* Horvat 1951.

The phytocoenosis of these two associations belong to **6520** – Mountain hay meadows habitat of community interest listed in Annex I of Habitats Directive (Council Directive 92/43/EEC). The flora of these associations included many medicinal plants. We mention that the phytosociological surveys were recorded at different altitudes ranging between 504-1255 m, and 29 surveys were processed. A part of the plants identified in these surveys were medicinal species. Thus, in the *Festuco rubrae-Agrostietum capillaris* association 74 taxa out of 148 identified, contained certain therapeutic chemical compounds, while in the *Poo-Trisetetum flavescens* association 57 taxa out of 141 identified, contained certain therapeutic chemical compounds.

The most common herbs, whose presence in phytosociologic surveys is very high (**81-100%**) are: *Achillea millefolium*, *Plantago lanceolata*, *Prunella vulgaris* and *Trifolium pratense*, followed by those with high

frequency (**61-80%**): *Alchemilla xanthochlora*, *Carum carvi*, *Equisetum arvense*, *Euphrasia rostkoviana*, *Pimpinella saxifraga*, *Plantago media*, *Rumex acetosella*, *Thymus pulegioides*, *Veronica chamaedrys*, *Viola tricolor* etc. The following species have an average frequency between **41-60%**: *Daucus carota*, *Fragaria vesca*, *Galium mollugo*, *Galium verum*, *Mentha longifolia*, *Polygala vulgaris*, *Potentilla erecta* etc.

3.2 Therapeutic uses of medicinal plants

The medicinal plants were gathered according to the dominant active principles for which they are used in traditional medicine or phytotherapy. From the total medicinal species recorded in inventory, the most numerous species contain: tannins (16,66% of the species), essential oils (12,22% of the species), coumarins (11,11% of the species), flavonoids (10% of the species), saponins (8,88% of the species), alkaloids and mucilage (6,66% each), iridoids, bitter compounds and organic acids, vitamins and provitamins (4,44% each) (Stănescu et al., 2002; Stănescu et al.2002b; Stănescu et al. 2004; Wright et al., 2007; Eșianu et Ștefănescu, 2016) etc. (**Table 1**).

Table 1. Checklist of medicinal species used in traditional medicine and phytotherapy according to the dominant active principles

The dominant active principles	Species	Medicinal vegetal products
MUCILAGE	<i>Anchusa officinalis</i>	Flos et folium
	<i>Plantago lanceolata</i>	Folium
	<i>Plantago major</i>	Folium
	<i>Plantago media</i>	Folium
	<i>Tussilago farfara</i>	Folium
	<i>Verbascum lychnitis</i>	Flos
PHENOLIC GLYCOSIDES	<i>Filipendula ulmaria</i>	Flos
	<i>Populus tremula</i>	Gemma
	<i>Salix alba</i>	Cortex
ANTHRAQUINONE DERIVATIVES	<i>Rumex acetosa</i>	Herba
	<i>Rumex acetosella</i>	Herba
	<i>Rumex crispus</i>	Rhizoma
NAPHTODIANTHRONES	<i>Hypericum maculatum</i>	Herba

	<i>Hypericum perforatum</i>	Herba
CARDIAC GLYCOSIDES	<i>Digitalis grandiflora</i>	Folium
SAPONINS	<i>Bellis perennis</i>	Flos
	<i>Equisetum arvense</i>	Herba
	<i>Ononis arvensis</i>	Radix
	<i>Polygala comosa</i>	Herba
	<i>Polygala vulgaris</i>	Herba
	<i>Primula veris</i>	Rhizoma cum radicibus
	<i>Trifolium pratense</i>	Flos
	<i>Viola tricolor</i>	Herba
FLAVONOIDS	<i>Crataegus monogyna</i>	Folium, fructus et flos
	<i>Eupatorium cannabinum</i>	Rhizoma et radix
	<i>Linaria vulgaris</i>	Herba
	<i>Pilosella officinarum</i>	Herba
	<i>Prunella vulgaris</i>	Herba
	<i>Trifolium repens</i>	Herba
	<i>Veronica chamaedrys</i>	Herba
	<i>Veronica officinalis</i>	Herba
	<i>Vincetoxicum hirsutifolium</i>	Radix
	<i>Viola tricolor</i>	Herba
COUMARINS	<i>Cruciata glabra</i>	Herba
	<i>Cruciata laevipez</i>	Herba
	<i>Galium mollugo</i>	Herba
	<i>Galium verum</i>	Herba
	<i>Heracleum sphondylium</i>	Radix, folium et fructus
	<i>Medicago falcata</i>	Herba
	<i>Medicago lupulina</i>	Herba
	<i>Medicago sativa</i>	Herba
	<i>Melilotus officinalis</i>	Flos et herba
	<i>Pastinaca sativa</i>	Radix
	<i>Pimpinella saxifraga</i>	Radix
TANNINS	<i>Agrimonia eupatoria</i>	Herba
	<i>Alchemilla xanthochlora</i>	Herba
	<i>Anthyllis vulneraria</i>	Flos
	<i>Fragaria vesca</i>	Folium
	<i>Fragaria viridis</i>	Folium
	<i>Geranium robertianum</i>	Herba
	<i>Geum urbanum</i>	Rhizoma
	<i>Lysimachia nummularia</i>	Herba
	<i>Lythrum salicaria</i>	Herba
	<i>Polygonum bistorta</i>	Rhizoma
	<i>Potentilla argentea</i>	Rhizoma
	<i>Potentilla erecta</i>	Rhizoma
	<i>Potentilla recta</i>	Rhizoma
	<i>Potentilla reptans</i>	Rhizoma
	<i>Salix alba</i>	Cortex
DEPSIDES	<i>Cichorium intybus</i>	Herba et radix
ESSENTIAL OILS	<i>Achillea millefolium</i>	Flos
	<i>Carum carvi</i>	Fructus
	<i>Juniperus communis</i>	Pseudo-fructus
	<i>Mentha longifolia</i>	Folium
	<i>Origanum vulgare</i>	Herba
	<i>Petasites hybridus</i>	Rhizoma

	<i>Picea abies</i>	Turiones
	<i>Thymus glabrescens</i>	Herba
	<i>Thymus pulcherrimus</i>	Herba
	<i>Thymus pulegioides</i>	Herba
ALLANTOIN	<i>Symphytum officinale</i>	Radix
GLYCORESINS	<i>Convolvulus arvensis</i>	Herba
IRIDOIDS	<i>Ajuga reptans</i>	Herba
	<i>Euphrasia rostkoviana</i>	Herba
	<i>Lamium album</i>	Herba
	<i>Stachys germanica</i>	Herba
	<i>Stachys officinalis</i>	Herba
ALKALOIDS	<i>Clematis vitalba</i>	Folium
	<i>Colchicum autumnale</i>	Semen
	<i>Echium vulgare</i>	Herba
	<i>Genista tinctoria</i>	Herba
	<i>Senecio jacobaea</i>	Herba
	<i>Veratrum album</i>	Rhizoma
BITTER COMPOUNDS	<i>Centaureum erythraea</i>	Herba
	<i>Gentiana asclepiadea</i>	Radix
	<i>Glechoma hederacea</i>	Herba
	<i>Taraxacum officinale</i>	Radix et herba
BITTER-AROMATIC COMPOUNDS	<i>Artemisia vulgaris</i>	Herba
ORGANIC ACIDS, VITAMINS and PROVITAMINS	<i>Daucus carota</i>	Radix
	<i>Rosa canina</i>	Fructus
	<i>Rubus idaeus</i>	Folium
	<i>Urtica dioica</i>	Folium

Inexhaustible green treasure of Gurghiuului Mountains can be an important source of active ingredients for achieving herbal extracts used in various diseases. The most numerous herbs are used in disorders of the digestive system (37 sp.), respiratory system (18 sp.), skin disorders (15 sp.), muscular and skeletal systems (10 sp.) genitourinary system (8 sp.),

in gynecological disorders (4 sp.), cardiovascular, CNS disorders and geriatrics (2 sp. each) (**Table 2**).

As shown in **Table 2**, the majority of plants were reported to be used for more than one type of disease.

Table 2. Medicinal plant species used in various disorders

PHYTOTHERAPY FOR DIGESTIVE SYSTEM DISORDERS	Phytotherapy of mouth <ul style="list-style-type: none"> gingivitis, stomatitis, thrush, periodontitis, dental abscesses, tonsillitis 	<i>Achillea millefolium</i> , <i>Agrimonia eupatoria</i> , <i>Centaureum erythraea</i> , <i>Geum urbanum</i> , <i>Lysimachia nummularia</i> , <i>Lythrum salicaria</i> , <i>Polygonum bistorta</i> , <i>Potentilla</i> sp., <i>Thymus</i> sp.
	Hyperacid gastritis and ulcer disease	<i>Equisetum arvense</i> , <i>Hypericum</i> sp., <i>Medicago sativa</i> , <i>Melilotus officinalis</i> , <i>Plantago</i> sp., <i>Rubus idaeus</i> , <i>Symphytum officinale</i>
	Gastric hypoacidity - dyspepsia, anorexia	<i>Artemisia vulgaris</i> , <i>Centaureum erythraea</i> , <i>Euphrasia rostkoviana</i> , <i>Gentiana asclepiadea</i>

	Acute and chronic liver disease	<i>Achillea millefolium</i> , <i>Hypericum</i> sp., <i>Taraxacum officinale</i> , <i>Thymus</i> sp.
	Functional disorders of the gallbladder and biliary tract	<i>Achillea millefolium</i> , <i>Agrimonia eupatoria</i> , <i>Cichorium intybus</i> , <i>Eupatorium cannabinum</i> , <i>Hypericum</i> sp., <i>Mentha longifolia</i> , <i>Pastinaca sativa</i> , <i>Petasites hybridus</i> , <i>Taraxacum officinale</i>
	Phytotherapy in constipation	<i>Cichorium intybus</i> , <i>Convolvulus arvensis</i> , <i>Rumex</i> sp.
	Phytotherapy in diarrhea	<i>Achillea millefolium</i> , <i>Agrimonia eupatoria</i> , <i>Geum urbanum</i> , <i>Lythrum salicaria</i>
	Vomiting - nausea	<i>Mentha longifolia</i>
	Abdominal colic	<i>Achillea millefolium</i> , <i>Mentha longifolia</i>
	Flatulence (bloating)	<i>Carum carvi</i> , <i>Mentha longifolia</i>
	Helminthiasis - anthelmintic plant	<i>Achillea millefolium</i> , <i>Gentiana asclepiadea</i> , <i>Rosa canina</i> , <i>Thymus</i> sp.
PHYTOTHERAPY FOR CARDIOVASCULAR SYSTEM DISORDERS	Heart failure	<i>Digitalis grandiflora</i>
	Cardiac neurosis	<i>Crataegus monogyna</i>
	Angina pectoris	<i>Crataegus monogyna</i>
PHYTOTHERAPY FOR RESPIRATORY SYSTEM DISORDERS	Immuno-stimulatory plant	<i>Achillea millefolium</i> , <i>Equisetum arvense</i> , <i>Hypericum</i> sp., <i>Rosa canina</i>
	Central and peripheral antitussives	<i>Plantago</i> sp., <i>Tussilago farfara</i> , <i>Verbascum lychnitis</i>
	Expectorant	<i>Primula veris</i> , <i>Picea abies</i> , <i>Polygala</i> sp., <i>Viola tricolor</i>
	Asthma	<i>Ajuga reptans</i> , <i>Origanum vulgare</i> , <i>Petasites hybridus</i>
PHYTOTHERAPY FOR GENITOURINARY SYSTEM DISORDERS	Diuretic	<i>Equisetum arvense</i> , <i>Juniperus communis</i> , <i>Lamium album</i> , <i>Ononis arvensis</i> , <i>Taraxacum officinale</i> , <i>Viola tricolor</i> , <i>Urtica dioica</i>
	Urolithiasis	<i>Equisetum arvense</i> , <i>Rosa canina</i> , <i>Urtica dioica</i>
PHYTOTHERAPY FOR GYNECOLOGICAL DISORDERS	Menopausal Disorders	<i>Genista tinctoria</i> , <i>Medicago</i> sp.
	Dysmenorrhea	<i>Achillea millefolium</i> , <i>Artemisia vulgaris</i>
PHYTOTHERAPY FOR SKIN DISORDERS	Acne	<i>Taraxacum officinale</i> , <i>Viola tricolor</i>
	Eczema	<i>Achillea millefolium</i> , <i>Taraxacum officinale</i> , <i>Viola tricolor</i>
	Dermatomycosis	<i>Achillea millefolium</i> , <i>Populus tremula</i> , <i>Thymus</i> sp.
	Alopecia (hair loss)	<i>Urtica dioica</i>
	Wounds	<i>Equisetum arvense</i> , <i>Hypericum</i> sp., <i>Populus tremula</i> , <i>Plantago</i> sp., <i>Symphytum officinale</i>
	Light burns	<i>Hypericum</i> sp., <i>Populus tremula</i>
	Bruises	<i>Achillea millefolium</i> , <i>Symphytum officinale</i>

PHYTOTHERAPY FOR LOCOMOTORY SYSTEM DISORDERS	Plant products with anti-inflammatory / analgesic, anti-rheumatic and hyperemic action	<i>Hypericum</i> sp., <i>Juniperus communis</i> , <i>Medicago sativa</i> , <i>Mentha longifolia</i> , <i>Picea abies</i> , <i>Populus tremula</i> , <i>Salix alba</i> , <i>Taraxacum officinale</i> , <i>Urtica dioica</i>
PHYTOTHERAPY FOR CNS SYSTEM DISORDERS	Sleep disturbances; Nervousness; Depression.	<i>Hypericum</i> sp.
PHYTOTHERAPY IN GERIATRY		<i>Crataegus monogyna</i> , <i>Urtica dioica</i>

There is major interest in the health benefits of herbs and botanicals (Foote et Cohen, 1998). In the same time, there are an increasing number of papers claiming that plants or plant-derived active principles may function as agent against many human diseases. Most of these researches have determined the level of clinical support for the traditional use of common or folklore medicines. Many plant species are known as sources of treating human ailments, this study documents the plants from Gurghiului Mountains, used in Romania by traditional healers for the treatment of different human disease.

Our study confirms that wild medicinal plants and natural products obtained from these are still a major source of medicine for the people living in the studied area.

Conclusions

The medicinal plants generally have significant less adverse effects compared with synthesized substances and also people have a better tolerance to these plants than synthetic drugs. In this paper we summarize information on medicinal and aromatic plants with current information in the international literature and highlight the current state of ethnopharmacological, phytochemical and clinical research on some of the more widely used and better known species. Mountain hay meadows from Gurghiului Mountains can be an important source of active substances for achieving herbal extracts used in various

diseases, but it can also provide a comparative basis for future similar floristic research to be carried out in the Eastern Carpathians.

The most numerous herbs identified in study area are those used for: disorders of the digestive, respiratory, dermatological disorders, musculoskeletal and urogenital systems. Further experimental investigation of these medicinal and aromatic plants may possibly offer effective and alternative affordable management of some human disease.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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