Medical ethnobotany of the Albanian Alps in Kosovo

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Abstract

Background: Ethnobotanical studies are crucial in South-Eastern Europe for fostering local development and also for investigating the dynamics of Traditional Environmental Knowledge (TEK) related to plants in one of the most crucial European hotspots for biocultural diversity. The current medico-ethnobotanical survey was conducted in rural alpine communities in Kosovo. The aims of the study were twofold: 1) to document the state of TEK of medicinal plants in these communities; 2) to compare these findings with that of similar field studies previously conducted among local populations inhabiting the Montenegrin and Albanian side of the same Alpine range.

Methods: Field research was conducted in 36 villages on the Kosovar side of the Albanian Alps. Snowball sampling techniques were used to recruit 91 elderly informants (≥ 50 years-old) for participation in semi-structured interviews and structured surveys regarding the use of the local flora for medicinal and food purposes. Standard ethnobotanical methods were employed and prior informed consent was obtained for all study participants.

Results and Conclusion: The uses of 98 plants species belonging to 39 families were recorded; the most quoted botanical families were Rosaceae, Asteraceae, and Lamiaceae. Mainly decoctions and infusions were quoted as folk medicinal preparations and the most common uses referred to gastrointestinal and respiratory disorders, as well as illnesses of the uro-genital system. Among the most uncommon medicinal taxa quoted by the informants, Carduus nutans L., Echinops bannaticus Rochel ex Schrad., and Orlaya grandiflora Hoffm. may merit phytochemical and phytopharmacological investigations.

Comparison of the data with other ethnobotanical field studies recently conducted on the Albanian and Montenegrin sides of the same Alps has shown a remarkable link between the medical ethnobotany of Montenegrin and Kosovar side of the Albanian Alps. Moreover, folk uses of the most quoted wild medicinal taxa recorded in Kosovo often include those recorded both in Albania and in Montenegro, thus suggesting a hybrid character of the Kosovar local plant knowledge. This may be also explained with the fact that Montenegro and Kosovo, despite their differences in the ethnic composition, have shared a common history during the last Century.

Keywords: Albanian Alps, Ethnobotany, Traditional Medicine, Kosovo, Medicinal plants

Background

Ethnobotanical studies in South-Eastern Europe are seen as a crucial initial step for local rural development based on eco-tourism, small-scale trade of local medicinal plants, high-quality local foods, eco-museums, and community-based bio-conservation strategies [1].

However, this region is also considered very special for conducting studies having a human ecological focus, since it represents a unique hotspot of biological and cultural diversity in Europe, thus allowing cross-cultural comparisons of traditional environmental knowledge (TEK) concerning medicinal plants. In very recent years, the Western Balkans have been the focus of a remarkable number of ethnobotanical studies [2-9], mainly focused on mountainous communities [10-15].

In this study, we investigated the Kosovo side of the Albanian Alps (in Albanian known as Bjeshkët e
Nemuna or Alpet Shqipëtare; in Serbo-Croatian known as Prokletije), which extends within a triangle among the Dinaric Mountains in the North-West, the Sharri (Šar) Mountains in the South-East and the Rhodope Mountains in the East and North-East. This covers a very pristine, and sometimes, remote area of ca. 3,500 km², which is geo-politically divided among the sovereign states of Albania, Kosovo, and Montenegro.

About 1,000 km² of these mountains belong to the Kosovo territory. The Albanian Alps system consists of 24 groups of mountains with 152 peaks higher than 2,000 m a.s.l. (the highest altitude in the Kosovo territory is reached by Maja e Gjeravicës at 2,460 m a.s.l.), with a large number of gorges, canyons, valleys, which make them among the most inaccessible [16], but also magnificent areas of the Balkans [17].

Due to the rich levels of biodiversity characteristic to this region, three national parks were established in the past in the Albanian Alps: one in Montenegro (Prokletije National Park) and two others in Albania (Theth and Valbona National Parks). A fourth national park in the area has been proposed to be located in Kosovo. Furthermore, Kosovo, Albania, and Montenegro are planning to join these parks and to create the cross-border Balkan Peace Park [18].

In general, Kosovo is characterised by a continental climate and in higher altitudes it is influenced by Alpine features [19]; for this reason, it has cold winters and hot summers, with an average temperature of 11.4°C. The Alpine area of Kosovo is characterised by total annual precipitation levels exceeding 2,000 mm. Specific geomorphological, soil and climatic features provide an interesting richness and diversity of plant life in the Albanian Alps massif, with a flora belonging to three different bio-geographic zones: the Mediterranean, the Central-European and the Central-South European regions [17,20-22].

These unique features are reflected in the high plant biodiversity, which includes 1,609 taxa and ca. 150 vegetation units [23]. The most representative vegetation units are: oriental hornbeam forest (Carpinetum orientalis scardicum), hop hornbeam mixed and with oriental hornbeam forest (Ostryo-Carpinion orientalis), thermophilous oak forests community (Quercus frainetto Ten., Quercetum frainetto-cerris scardicum, and Quercetum petraeae-cerris), chestnut forests (Castanetum sativae), beech forests (Fagetum montanum), and pine forests (Pinetum heldreichii typicum, Pinetum heldreichii thalictrum, Pinetum puecis, and Pinetum mughi typicum) [22,24].

People have withstood the extreme conditions of these areas for centuries - including very harsh winters. Until very recent decades, limitations in infrastructure and communication forced local residents to be self-sufficient in the provision of their healthcare. As a result, their primary pharmacopoeia consisted of local medicinal plants.

While recent studies on the Albanian and Montenegrin sides of the Albanian Alps have reported findings on TEK of wild medicinal and food plants [10,12,13,15], no ethnobotanical surveys have been conducted thus far in Kosovo, with the exception of a very recent work carried out by our research group in the Gollak area [9], and a review on folk botanical names in diverse Albanian-speaking areas in South-Eastern and Southern Europe [25].

The aims of this study were twofold: 1) to document the ethnobotanical knowledge related to the use of local medicinal plants in the Albanian Alps region of Kosovo; and 2) to compare the recorded data with the ethnobotanical studies recently conducted in the Albanian and Montenegrin sides of the same Albanian Alps. This was done with the overarching goal in mind of elucidating the role played by cultural/ethnic components in shaping use patterns of wild medicinal plants.

Methods

Field study

Ethnobotanical field research was conducted in 36 villages belonging to the municipalities of Pejë and Deçan, located close to the Koprivnik and Strellc mountains, and which represent the central group of the Albanian Alps located in the western part of Kosovo (Figure 1).

The settlements and villages investigated are relatively small in terms of inhabitants (≤ 500 inhabitants per village). The native residents are ethnic Albanians, who speak Gheg varieties of the Albanian language. The exact population is currently unknown, as no population census has been conducted in Kosovo since 1981. Most recently, the area populations have been negatively affected by...
We found that 98 species (belonging to 39 families) are employed in the traditional medicine of the area. These includes three fern species, three gymnosperms and 92 angiosperms (84 dicotyledonous and 8 monocotyledons); 74 taxa are wild. Of these species, Achillea millefolium L., Cornus mas L., Hypericum perforatum L., Juglans regia L., Juniperus communis L., Malus sylvestris Mill., Plantago major L., Sambucus nigra L. were cited more then 30% of the informants. From 98 species presented in Table 1, 23 species are also included in the official Pharmacopoeia of Europe [35].

The predominantly quoted botanical families were Rosaceae (12%), Asteraceae (10%), and Lamiaceae (5%). These same three “top” families were found to be also predominant among the wild medicinal taxa used in the folk medicine of the Alps in Montenegro, Albania, and in the Gollak region in Kosovo [9,11-14].

The most frequently quoted manner of preparation of medicinal plants was represented by decoctions (51%) and infusions (26%). The most frequently cited medicinal uses referred to gastrointestinal (26%), respiratory (19%) troubles, and illnesses affecting the urogenital system (12%). The first two categories were also the most frequently quoted in the ethnobotanical studies conducted on the Montenegrin and Albanian sides [11-14].

Most uncommon medicinal plants
Upon analysis of the bio-pharmacological literature on the quoted medicinal species available on PubMed, we found that it could be worthwhile to further investigate the following reports:

1. The internal use of cold water macerates of the inflorescences of Carduus nutans L. in the treatment of eczema (this taxon is scarcely known in the phytochemical and pharmacological literature). In 2000 a Turkish research group pointed out the hepatoprotective effects of extracts from this plant [36];
2. The internal use of decoction of the roots of Echinops bannaticus Rochel ex Schrad. for kidney stones (despite a few studies on other species of the genus Echinops, this Balkan species is largely under-investigated); and
3. The internal use of decoctions of aerial parts of Orlaya grandiflora Hoffm. for its laxative effects (the plant is completely unknown in the phytopharmacological literature).

Results and Discussion
The Kosovar medico-ethnobotany of the Albanian Alps
The results of the field survey are presented in Table 1; plants are arranged in alphabetical order by genus. For each species, the botanical name and family, local names, English name, botanical status, preparation/administration and folk medical or food uses are reported.
Table 1 Medicinal plant uses recorded on the Kosovar side of the Albanian Alps in the current study.

| Botanical taxon, botanical family and voucher specimen code | Folk name(s) quoted by respondents | English name | Status | Quotation frequency | Part(s) used | Administration | Treated disease (s) or folk medical uses(s) |
|-------------------------------------------------------------|------------------------------------|--------------|--------|---------------------|-------------|---------------|---------------------------------------------|
| Abies alba Mill. (Pinaceae) 13/DE/10 | Bredhi i bardhë | European silver fir | W | ++ | Resin | Boiled in oil | Stomach pain, Eczemas |
| | | | | | | Topically applied | Skin infections |
| | | | | | Mixed and boiled with milk butter | Skin hematomas, Skin infections |
| Achillea millefolium L. (Asteraceae) 03/DE/10 | Hajdukati | Yarrow | W | ++ | Areal parts | Infusion | Anti-diarrhoeal, Stomach pain, Anti-diabetic, Eczema |
| | | | | | | Tincture topical used in wound | Antibacterial |
| Aconitum divergens Pančić (Ranunculaceae) 04/DE/10 | Pelini i egër (i zi) | | W | ++ | Areal parts | Infusion | Stomach disorders, Oral cavity antisepctic, Anti-haemorrhoidal |
| Adiantum capillus-veneris L. (Adiantaceae) 01/DE/10 | Majdanozi i egër | Southern maidenhair fern | W | + | Areal parts | Decoction | Bronchitis, Sour throat, Expectorant |
| | | | | | | Leaves | Anti-rheumatic |
| | | | | | | Squeezed and topically applied to the wound | Anti-bacterial, Skin infections |
| Aesculus hippocastanum L. (Sapindaceae) 06/DE/10 | Geshtenja egër | Horse chestnut | W | ++ | Leaves | Infusion | Expectorant, Anti-rheumatic |
| | | | | | | Fruits | Antitussive, Anti-hypertensive |
| | | | | | | Tincture | Anti-rheumatic |
| Agropyron repens (L.) P. Beauv. (Poaceae) 08/DE/10 | Pirovina | Couch grass | W | + | Roots | Decoction | Anti-rheumatic, Anti-anemic, Stomach and hepatic disorders, Lithontriplic |
| | | | | | | Infusion | Anti-rheumatic |
| Allium cepa L. (Amaryllidaceae) 11/DE/10 | Qepa | Onion | C | + | Leaves | Decoction | To treat influenza |
| | | | | | | Bulb | Extracted with cold mineral water | Anti-hypertensive |
| Allium porrum L. (Amaryllidaceae) 09/DE/10 | Purrini | Garden leek | C | + | Leaves and stem | Eaten fresh | Anti-cholesterolemic |
| Allium sativum L. (Amaryllidaceae) 10/DE/10 | Hudhra | Garlic | C | + | Bulb | Tincture | Improve blood circulation, Anti-diabetic, Antibacterial, Anti-hypertensive |
| | | | | | | Bulb | Anti-rheumatic |
| Alnus glutinosa (L.) Gaethn. (Betulaceae) 05/DE/10 | Verni | Black alder | W | + | Cortex | Decoction, used to wash whole body | Anti-rheumatic |
| | | | | | | Leaves | Disinfectant on wounds |
| Althaea officinalis L. (Malvaceae) 07/DE/10 | Mellaga e bardhe | Marshmallow | W | ++ | Roots | Extracted with cold water | Expectorant |
| Medicinal plant | Common name | Family | Uses | Form | Medicinal uses |
|-----------------|-------------|--------|------|------|----------------|
| *Arctium lappa* L. | Bullushtra | Asteraceae | To treat lung disorders, Oral cavity antisepic, Expectorant | Decoction | Areal parts |
| *Aristolochia clematitis* L. | Fiku i egër | Aristolochiaceae | Gastrointestinal disorders, Bronchitis, Lithontriptic | Decoction | Areal parts |
| *Artemisia absinthium* L. | Pelini i butë | Asteraceae | Stomach disorders, Anti-diabetic | Infusion | Areal parts |
| *Betula verrucosa* Ehrh. | Meshtekna | Betulaceae | Kidney infections | Decoction | Cortex |
| *Brassica oleracea* L. | Lakra | Brassicaceae | Anti-rheumatic, Anti-bacterial | Decoction | Leaves |
| *Capsella bursa-pastoris* (L.) Medik. | Shtrapër | Brassicaceae | Fever, Eczemas | Infusion | Whole plant |
| *Capsicum annuum* L. | Speci djegës | Solanaceae | Anti-rheumatic, Appetizing, Lung disorders | Fruits | Eaten fresh fruits |
| *Carduus nutans* L. | Gjemb gomari | Asteraceae | eczemas, Extracted with cold water | Decoction | Sweet chestnut |
| *Castanea sativa* Mill. | Gështenja e butë | Fagaceae | Kidney disorders, Hepatitis | Decoction | Fruits |
| *Centaurea cyanus* L. | Kokoçeli | Asteraceae | Eye infections | Decoction | Flowers |
| *Centaurea cyanus* Rafin. | Kiçica | Gentianaceae | Stomach disorders, Urinary system infections | Extracted with cold water | Areal parts |
| *Cichorium intybus* L. | Çikorja | Asteraceae | Anti-haemorrhoidal, Anti-diarrhoeal | Decoction | Stem |

*Table 1 Medicinal plant uses recorded on the Kosovar side of the Albanian Alps in the current study. (Continued)*
| Plant Name                                      | Use               | Part Used   | Treatment                                      |
|------------------------------------------------|-------------------|-------------|------------------------------------------------|
| *Chelidonium majus* L. (Papaveraceae) 31/DE/10 | Tamblaqoku       | W +         | Areal parts Infusion Bronchitis Lithontriptic   |
|                                                  |                   |             | Stomach ulcers                                |
| *Citullus vulgaris* Schrad. (Cucurbitaceae) 33/DE/10 | Shalqni           | C +         | Fruit juice Fruit juice applied into the ear Ear-ache |
|                                                  |                   |             | Seeds Eaten dried seeds of watermelon, apple, melon To prevent prostate cancer |
| *Citrus limon* (L.) Burm. f. (Rutaceae) 35/DE/10 | Limoni            | C +         | Fruits Lemon juice mixed with honey             |
|                                                  |                   |             | Anti-tussive Respiratory infections             |
| *Comus mas* L. (Cornaceae) 24/DE/10             | Thana             | W ++        | Areal parts Infusion Tincture Anti diabetic     |
|                                                  | Dogwood           |             | Stomach disorders                              |
|                                                  |                   |             | Anti-diabetic                                  |
| *Corylus avellana* L. (Betulaceae) 25/DE/10     | Lajthia           | W +         | Leaves Decoction Anti-anemic                   |
|                                                  | Hazel             |             | Anti-diabetic                                  |
| *Crataegus monogyna* Jacq. (Rosaceae) 19/DE/10  | Murrizi           | W ++        | Areal parts Infusion Fruits Decoction Anti hypertensive Insomnia |
|                                                  | Oneseed           |             | Heart rhythm regulator Anti-hypertensive        |
|                                                  |                   |             | Anti-hypertensive                              |
|                                                  |                   |             | Insomnia                                       |
| *Cucumis melo* L. (Cucurbitaceae) 36/DE/10      | Pjpri             | C +         | Seeds Eaten dried seeds of watermelon, apple, melon To prevent the prostate cancer |
|                                                  | Melon             |             | Anti-helminthic                                |
|                                                  |                   |             | To prevent prostate cancer                     |
| *Cucurbita pepo* L. (Cucurbitaceae) 26/DE/10    | Kungulli          | C +         | Seeds Eaten                                    |
|                                                  | Pumpkin           |             | Anti-helminthic                                |
|                                                  |                   |             | To prevent prostate cancer                     |
| *Cynonia oblonga* Mill. (Rosaceae) 23/DE/10     | Ftoni             | C +         | Leaves Infusion Respiratory inflammations       |
|                                                  | Quince            |             | Anti-helminthic                                |
|                                                  |                   |             | To prevent hemorrhoidal Stomach infections      |
| *Cynodon dactylon* (L.) Pers. (Poaceae) 34/DE/10| Bar magari        | W +         | Roots Decoction Anti-haemorrhoidal             |
|                                                  | Bermuda grass     |             | Stomach disorders                              |
| *Daucus carota* L. (Apiaceae) 37/DE/10          | Karota            | C +         | Storage root Boiled and eaten                  |
|                                                  | Carrot            |             | Anti-haemorrhoidal Stomach infections          |
| *Digitatis grandiflora* Mill. (Plantaginaceae) 38/DE/10| Naprastak         | W +         | Whole plant Infusion Hart disorders            |
|                                                  | Big-flowered foxglove |           | Anti-haemorrhoidal                             |
| *Echinops bannaticus*alachex Schrad. (Asteraceae) 40/DE/10| Gjembardhva       | W +         | Roots Decoction Lithontriptic                  |
| *Equisetum arvense* L. (Equisetaceae) 39/DE/10  | Képutja e arave   | W +         | Stem and Leaves Infusion Lithontriptic         |
|                                                  | Horsetail         |             | Urinary system infections                      |
| *Euphorbia cyparissias* L. (Euphorbiaceae) 41/DE/10| Bima e lythev     | W +         | Stem Fresh leaves topically applied Warts       |
|                                                  | Cypress spurge    |             | Anti-rheumatic                                 |
| *Feuncilicum vulgare* Mill. (Apiaceae) 43/DE/10 | Kopra e eger      | W +         | Flowers Decoction Constipation                 |
| *Fragana vesca* L. (Rosaceae) 42/DE/10          | Dredheza e egër   | W +         | Leaves Infusion Neuro-relaxant                 |
| *Genitanac asclepiadea* L. (Gentianaceae) 45/DE/10| Utrobyca          | W +         | Roots Tincture Anti-rheumatic                  |
| *Genitanac latro L.* (Gentianaceae) 44/DE/10    | Saneza            | W ++        | Roots Tincture Anti-diabetic                   |
|                                                  |                   |             | Improve the blood circulation                  |
|                                                  |                   |             | Bronchitis Stomach ulcers Hepatitis            |
|                                                  |                   |             | Anti-rheumatic                                 |
|                                                  |                   |             | Anti-asthmatic                                 |
|                                                  |                   |             | Anti-rheumatic                                 |
|                                                  |                   |             | Anti-diabetic                                  |
| Plant Name                                      | Use                                           | Parts Used | Preparation                  | Benefits                                                                 |
|-----------------------------------------------|-----------------------------------------------|------------|------------------------------|-------------------------------------------------------------------------|
| Galium verum L. (Rubiaceae)                    | Yellow bedstraw                               | W +        | Flowers Infusion             | Urinary system infections                                               |
| Helleborus odorus Waldst. et. Kit. (Ranunculaceae) | Shpendra fragrant hellebore                   | W +        | Fruits Applied in tooth     | Tooth-ache                                                              |
| Humulus lupulus L. (Cannabaceae)               | Common hop                                    | W +        | Fruits Infusion              | Kidney inflammations, Neuro-relaxant                                    |
| Hypericum perforatum L. (Hypericaceae)         | St. John’s wort                               | W +++      | Flowers Decoction            | Stomach pain                                                            |
| Iris sp. (Iridaceae)                           | Lule purriri                                  | W          | Leaves Squeezed and topically applied to the ear | Ear ache                                                                |
| Juglans regia L. (Juglandaceae)                | Common walnut                                 | W/C +++    | Roots Decoction              | Lung inflammations, Anti-asthmatic Bronchitis                            |
| Juniperus communis L. (Cupressaceae)           | Juniper                                       | W ++       | Fruits Decoction             | Back pains                                                              |
| Lagenaria sicera L. (Molina) Standl. (Cucurbitaceae) | Bottle gourd                                  | C +        | Fruits Decoction             | Kidney inflammations, Anti rheumatic                                     |
| Linaria petopoennisica Boiss. et. Heldr. (Plantaginaceae) | Lanilist                                      | W          | Seeds Decoction              | Constipation                                                            |
| Plant Name | Common Name | Part Used | Application | Condition |
|------------|-------------|-----------|-------------|-----------|
| Linaria vulgaris Mill. (Plantaginaceae) 56/DE/10 | Gjineshtra Common toadflax | W + | Decoction | Urinary system inflammations |
| Linum hirsutum L. (Linaceae) 54/DE/10 | Liri | W + | Seeds | Decoction | Anti-haemorrhoidal Urinary system inflammations |
| Lycopersicon esculentum Mill. (Solanaceae) 55/DE/10 | Domatja Tomato | C + | Fruits | Beaked fruits mixed with sugar topically applied in wound | Wound infections |
| Malus dasyphylla Borkh. (Rosaceae) 60/DE/10 | Molla sherbete Apple | W + | Fruits | Squeezed and topically applied to the ear | Earache |
| Malus sylvestris Mill. (Rosaceae) 61/DE/10 | Molla e pyllit Molla e egër European wild apple | W ++ | Areal parts | Infusion | Anti-tussive Expectorant |
| Matricaria recutita L. (Asteraceae) 59/DE/10 | Kamomili Chamomile | W ++ | Areal parts | Infusion | Stomachache Oral cavity inflammations Gingivitis Urinary system infections |
| Melissa officinalis L. (Lamiaceae) 58/DE/10 | Bari i bletës Lemon balm | W + | Areal parts | Infusion | For treating abdominal pains during pregnancy Neuro-relaxant |
| Mentha longifolia (L.) Huds. (Lamiaceae) 63/DE/10 | Menta Horse mint | W + | Areal parts | Infusion | Neuro-relaxant Anti-diarrhoeal Anti-hypertensive |
| Morus nigra L. (Moraceae) 64/DE/10 | Mani i zi Black mulberry | W + | Leaves | Decoction | Anti-diabetic |
| Oregano vulgare L. 65/DE/10 (Lamiaceae) | Qaji i bjeshkës Oregano | W + | Areal parts | Infusion | Respiratory inflammations, flu |
| Orlaya grandiflora (L.) Hoffm. (Apiaceae) 66/DE/10 | Tortilis White lace flower | W + | Areal parts | Decoction | Constipation |
| Petroselinum crispum (Mill) Fuss (Apiaceae) 70/DE/10 | Majdanozi Parsley | C + | Leaves | Boiled with garlic and carrot | Stomach infections |
| Pinus sylvestris L. (Pinaceae) 69/DE/10 | Çetina Scots pine | W ++ | Cones | 40 cones mixed with honey (1 kg) eaten after one month Decoction | Bronchitis |
| Phaseolus vulgaris L. (Fabaceae) 77/DE/10 | Fasulja Common bean | C + | Seeds | 2-3 soup spoons in the morning | Anti-acid |
Table 1 Medicinal plant uses recorded on the Kosovar side of the Albanian Alps in the current study. (Continued)

| Plant | Common Name | Scientific Name | Family | Freq. | Part | Uses | Other Uses |
|-------|-------------|----------------|--------|-------|------|------|------------|
| Plantago lanceolata L. | Narrowleaf plantain | Plantaginaceae | 73/DE/10 | ++ | Leaves | Fresh leaves applied topically in wound | Wound infections |
| Plantago major L. | Common plantain | Plantaginaceae | 67/DE/10 | ++ | Leaves | Infusion | Back pains |
| Polygonum bistorta L. | Meadow bistort | Polygonaceae | 75/DE/10 | + | Roots | Macerated roots (200-300 g) mixed honey (1 kg) | Respiratory infections, Expectorant |
| Populus nigra L. | Black poplar | Salicaceae | 72/DE/10 | + | Cortex | Decoction | Urinary system inflammations, Bronchitis, Anti-diabetic |
| Prunus avium (L.) L. | Wild cherry | Rosaceae | 71/DE/10 | + | Fruits | Infusion | Anti-diabetic, Anti-hypertensive, Respiratory inflammations |
| Prunus domestica L. | Plum | Rosaceae | 68/DE/10 | + | Fruits | Decoction | Constipation |
| Prunus spinosa L. | Blackthorn | Rosaceae | 74/DE/10 | + | Fruits | Decoction | Anti-hypertensive, Anti-asthmatic, Respiratory inflammations |
| Pteridium aquilinum | Bracken | Dennstaedtiaceae | 76/DE/10 | + | Leaves | Decoction | Anti-bacterial, Diuretic |
| Pyrus pyraster (L.) Du Roi | Wild pear | Rosaceae | 78/DE/10 | + | Fruits | Tincture | Anti-hypertensive, Anti-cholesterolemic |
| Robinia pseudoacacia L. | Black locust | Fabaceae | 82/DE/10 | + | Flowers | Decoction | Respiratory inflammations |
| Rosa canina L. | Dog rose | Rosaceae | 80/DE/10 | + | Fruits | Infusion | Drunk as a tea, Anti-hypertensive, Anti-cholesterolemic |
| Rubus fruticosus L. | Blackberry | Rosaceae | 79/DE/10 | ++ | Leaves | Fresh leaves applied topically in wound | Skin infections |
| Rubus idaeus L. | Raspberry | Rosaceae | 80/DE/10 | + | Leaves | Decoction | Sore throat, Increase immunity |
| Sambucus ebulus L. | Dwarf elderberry | Adoxaceae | 83/DE/10 | ++ | Areal parts | Topically in applied in pain place | Anti-rheumatic, Menstrual pains, Regulation of menstrual cycle |
| Sambucus nigra L. | Elderberry | Adoxaceae | 85/DE/10 | +++ | Stem cortex | Extracted with sunflower oil | To treat sunburns |

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Table 1 Medicinal plant uses recorded on the Kosovar side of the Albanian Alps in the current study. (Continued)

| Plant Name                     | Author | Use                                                                 | Description                              |
|--------------------------------|--------|----------------------------------------------------------------------|------------------------------------------|
| Salix purpurea L. (Salicaceae) | Shelgu | Flowers Infusion mixed with lemon and sugar                          | Anti-asthmatic                           |
|                               |        | Fruits Drunk fruit juice                                            | Anti-anaemic                             |
|                               |        | Areal parts Decoction                                               | Anti-allergic                            |
|                               |        | Leaves Applied topically in breast                                 | Anti-fever                               |
| Salvia officinalis L. (Lamiaceae) | Sherbela | Flowers Infusion                                                    | Antitussive                              |
|                               |        | Fruits Decoction                                                    | Antipyretic                              |
| Sempervivum tectorum L. (Crassulaceae) | Bar veshi | Flowers Infusion                                                    | Ear ache                                 |
|                               |        | Areal parts Decoction                                               | Head-ache                                |
| Solanum tuberosum L. (Solonaceae) | Patajja | Flowers Decoction mixed with lemon fruits                           | Bronchitis                               |
| Taraxacum officinale F.H. Wigg. (Asteraceae) | Lule dielli | Whole parts Infusion                                               | Anti-haemorrhoidal                       |
|                               |        | Areal parts Decoction                                               | Anti-diabetic                            |
| Thymus spp. (Lamiaceae) 93/DE/10 | Shpirti i nënes | Whole plant Infusion                                               | Respiratory inflammations                |
|                               |        | Areal parts Decoction                                               | Expectorant                              |
| Tilia platyphyllos Scop. (Malvaceae) | Blini | Whole parts Infusion                                               | Lung inflammations                       |
|                               |        | Areal parts Decoction                                               | Expectorant                              |
| Trifolium pratense L. (Fabaceae) | Terfoja e kuqe | Flowers Decoction                                                    | Anti-diarrhoeal                          |
|                               |        | Areal parts Decoction                                               |                                          |
| Triticum vulgare L. (Poaceae) 89/DE/10 | Gruni Karapeli | Flowers Decoction                                                    | Kidney disorders                         |
|                               |        | Whole parts Infusion                                               | Constipation                             |
|                               |        | Areal parts Decoction                                               | Anti-rheumatic                           |
|                               |        | Flowers Decoction                                                    | Neuro-relaxant                           |
|                               |        | Whole plant Infusion                                               |                                          |
| Urtica dioica L. (Urticaceae) 97/DE/10 | Hithi | Leaves Eaten fresh                                                  | Anti-anaemic                             |
|                               |        | Leaves and stem Tincture                                            | Improve blood circulation                |
|                               |        | Roots and Leaves Decoction                                          | Alopecia                                 |
|                               |        | Roots Decoction                                                     | Anti-haemorrhoidal                       |
| Vaccinium myrtillus L. (Ericaceae) 98/DE/10 | Boronica | Areal parts Decoction                                               | Anti-diabetic                            |
|                               |        | Fruits Decoction                                                    | Neuro-relaxant                           |
|                               |        | Fruits Eaten fresh                                                  | Urinary inflammations                    |
|                               |        |                                                                 | Lung inflammations                       |
|                               |        |                                                                 | Stomach disorders                        |
|                               |        |                                                                 | Anti-hypertensive                        |

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Figure 3 and Table 3 illustrate the similarity between the wild medicinal plants used and recorded in the current study and those recorded in the Montenegrin and Albanian sides of the same Albanian Alps.

The link between the medical ethnobotany of the Montenegrin and Kosovar sides of the Alps - despite the different ethnicity/language of the local populations - appears stronger than the link between the ethnobotany of these two locations and the ethnobotany of Albania.

This apparent paradox could be explained in a number of ways:

1. Different sampling techniques may have been adopted during the field survey in the three locations or the socio-economic background of the interviewees could have been different. For example, on the Albanian side of the Alps, the previous ethnobotanical studies selected local informants from very remote areas, which remained quite isolated during Communist times and with very limited access to urban environments and culture. It could be especially worthwhile to further assess the influence of the popular phytotherapeutical literature on folk medicine in Montenegro and Kosovo, since during the Yugoslavian time this kind of popularised knowledge was said to be "en-vogue". For example, this is very evident in the Montenegrin data, where a

| Plant | Uses | Quote Frequency |
|-------|------|-----------------|
| *Veratrum album* L. (Melanthiaceae) | Leaves - Decoction | ++ |
| | Roots - Decoction | +++ |
| *Zea mays* L. (Poaceae) | Leaves - Sunflower oil | ++ |
| | Roots - Infusion | +++ |

+ quoted by less than 5% of the participants; ++ quoted by more than 5% and less than 30% of the participants; +++ quoted by more than 30% of the participants.

Table 2 Summary of the field ethnobotanical studies considered in the cross-cultural data analysis.

| Area and country                          | Study participants | Year(s) when the field studies were conducted | Number of study participants | Reference(s) |
|-------------------------------------------|--------------------|---------------------------------------------|-------------------------------|--------------|
| Albanian Alps (Kosovo)                    | Albanians          | 2010                                        | 91                            | Current study|
| Prokletije mountains (Montenegro)         | Bosniaks and Serbs | 2006 and 2007                               | 75                            | [15]         |
| Northern Albanian Alps (Albania)          | Albanians          | 2004, 2005, and 2007                        | 62                            | [11-14]      |

Figure 2 Location of the study area in Kosovo and of the sites where previous ethnobotanical works have been conducted in Albania and Montenegro [11-14].
number of possible “modern” uses of local medicinal plants (i.e. *Hypericum perforatum* used as an anti-depressive) were recorded.

2. The study sites chosen in Kosovo and Montenegro are on average located at lower elevations than the sites selected in Northern Albania, thus resulting in a partially different ecological setting and availability of certain species in the environments.

3. Both the Montenegrin and Kosovar side of the Albanian Alps have had a common history for the most part of the 20th Century, since belonging to the same country (former Yugoslavia). This may have “homogenised” eventual pre-existing differences in plant perceptions/uses between the Albanian and Slav communities. Moreover, a few South-Slav communities (i.e. Bosniaks [2-4,7,8]) could be surely considered much more “herbophilic” than the Albanian ones, and this may have influenced the folk medicine of the Kosovar population to a certain degree during

Table 3 Jaccard similarity index of the wild medicinal plants used in the Kosovar, Albanian, and Montenegrin Alps.

| Group I                        | Group 2                        | Species used in both groups | Species used in one group only (Group 1/Group 2) | Jaccard Index |
|--------------------------------|--------------------------------|----------------------------|--------------------------------------------------|---------------|
| Albanians in Albania           | Albanians in Kosovo            | 13                         | 24/45                                            | 15.9          |
| Albanians in Albania           | Serbs and Bosnias in Montenegro| 21                         | 16/94                                            | 16.0          |
| Serbs and Bosnias in Montenegro| Albanians in Kosovo            | 32                         | 83/36                                            | 21.2          |

Table 4 Comparison of the most quoted folk medicinal uses of wild taxa in the current study and in ethnobotanical studies previously conducted in Albania and Montenegro [11-14] (Same or similar uses are underlined)

| Botanical taxon | Used part(s) | Pathologies treated in the folk medicine of the Kosovar Alps | Pathologies treated in the folk medicine of the Montenegrin Alps [15] | Pathologies treated in the folk medicine of Albanian Alps [11-14] |
|-----------------|--------------|-------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------|
| *Centaurium* erinthraea Rafn. | Aerial parts | Stomach-disorders, Diabetes, Fever, Kidney stones and UTIs | Stomach disorders and loss of appetite, Diabetes, Fever | |
| *Cornus* mas L. | Fruits       | Stomach disorders, Diabetes, Rheumatisms, Anaemia           | Dhiarroea, Intestinal troubles, Stomach-ache                       | |
| *Gentiana* spp. | Roots        | Blood circulation-related diseases (including hypertension), Bronchitis and asthma, Stomach disorders, Rheumatisms | Stomach-ache, Cardiovascular diseases | |
| *Hypericum* spp. | Flowering aerial parts | Stomach disorders, Bronchitis and asthma, Hypertension, Skin infections, sunburns, and eczemas, Haemorrhoids, Anti-cholesterolemic | Gastritis, Anxiety and depression, Skin inflammations and burns | Stomach and digestive disorders, Anxiety, Respiratory diseases, Fever, UTIs |
| *Origanum* vulgare L. | Aerial parts | Respiratory diseases, Digestion, UTIs | Respiratory diseases, Digestive | Respiratory diseases, Digestive, Diuretic |
| *Plantago* spp. | Aerial parts | Stomach-ache, Respiratory diseases, Mouth and skin inflammations, Fever, Haemorrhoids, Back-pains | Respiratory diseases, Wounds, Diuretic | |
| *Urtica dioica* L. | Roots        | Haemorrhoids, Alopecia, Rheumatism, Fever, Arthritis, Anaemia, Alopecia, UTIs | Haemorrhoids, Alopecia, Genital problems | |

UTIs: Urinary Tract Infections
the last century, who have always lived in contacts with the Slavs.

4. The Montenegrin study included self-declaring Serbian and Bosniak communities. However, a large part of the Bosniak community living in the Gusinje area is represented also by “bosniakised” Albanians, whose Catholic tribes settled on this side of the Albanian Alps and converted to Islam a couple of centuries ago [37]. This could mean that the ethnobotanical data of Montenegro and Kosovo may actually refer to the same core of Muslim Albanians.

Despite the commonalities found on the quoted medicinal plants, Table 4 shows the different uses of the wild taxa, which have been most quoted in all three sides of the Alps.

From Table 4 it is interesting to underline that the folk uses of the wild medicinal taxa recorded in Kosovo often include both the uses recorded in Albania and those in Montenegro. It would then appear that the medico-ethnobotany of Kosovo - because of its history in the last century and the exposure to the South-Slavic ethnobotanical traditions - has possibly incorporated both Albanian and Slavic plant uses.

Conclusions

Medicinal plants still play a crucial role in the sphere of human health in the Albanian Alps, not only in the Montenegrin and Albanian territory, but also on the Kosovar side. Oftentimes, these mountainous communities have limited or non-existent access to Western biomedical modalities, and are instead self-reliant on their TEK. The local flora is thus incredibly important to provide the first health care within the households of the Albanian Alps.

Moreover, the biodiversity richness and unique biocultural heritage of the local people here is something to be highly valued. Steps towards this end are evident in the formation of protected parks for biodiversity conservation - but further efforts in conservation of the human TEK diversity and cultural heritage are necessary as well. TEK-dependent activities such as sustainable gathering of wild medicinal taxa, their small-scale trade, and production of local high quality plant-based foods and dairy products can all contribute to the growing eco-tourism initiatives. Thus, TEK is a critical component to success in the future economic development and biocultural conservation efforts of the region.

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Competing interests

The authors declare that they have no competing interests.

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