

Plants Used in Podkarpackie Voivodeship (Poland) To Treat Urinary Diseases

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Abstract

Background

This manuscript contains the results of Podkarpackie Voivodeship (Poland) ethnomedical studies on the treatment of urinary tract diseases using wild and cultivated plants. The study concerns plants mainly used for the supportive treatment of urinary tract infections, urolithiasis and benign prostatic hyperplasia. In this present study, we aim to collect and assess the ethnomedicinal potential of plants used in Podkarpackie Voivodeship (Poland) to treat urological diseases.

Methods

This article is based on interviews with fourteen recognized traditional healers (urban areas) and nine informants (rural areas) living in the south-eastern region of Poland - Podkarpackie Voivodeship. The survey took place between November 2019 and January 2021. For each plant mentioned in herbal remedies, polish name, part used, mode of preparation, and their properties, according to the healers and informants, were recorded.

Results

For the analysis, 123 species that belong to 43 families were selected. The most common families used to treat urinary diseases in Podkarpackie herbal medicine are the Compositae (18 species), Rosaceae and Apiaceae (11 species in each), Leguminosae (9 species), and Ericaceae (6 species). Of the species listed, *Apium graveolens* L., *Arctium lappa* L., *Arctostaphylos uva-ursi* (L.) Spreng., *Elymus repens* (L.) Gould, *Juniperus communis* L., *Matricaria chamomilla* L., *Petroselinum crispum* (Mill.) Fuss, *Solidago virgaurea* L., *Urtica dioica* L., and *Viola tricolor* L. were the most frequently mentioned. Most plants are used in multicomponent blends, which are given in the form of infusions or decoction. The described plants have mainly antiseptic, diuretic, spasmolytic and anti-inflammatory properties.

Conclusions

The results of the research described in this paper indicate that herbal treatment of urinary tract diseases is still used in Poland in the Podkarpackie Voivodeship. It is mainly used by people who do not want to use allopathic medicine, especially antibiotics. They are both inhabitants of large cities and villages. The latter often because of the multi-generational tradition, prefer self-healing.

Background

The urological diseases are most commonly associated with the filtration and carrying out of urine from the body. These diseases can occur in people regardless of gender. In males health problem concerns the

urinary tract and/or the reproductive organs, while in females this problem usually affects only the urinary tract. The most numerous are bacterial infections of the lower urinary tract, especially recurrent (asymptomatic bacteriuria, urethritis, cystitis, prostatitis), urolithiasis, benign prostatic hyperplasia (1).

Urinary tract infections (UTI) occur in the entire population, but they are particularly sensitive to young children, pregnant women and postmenopausal women, as well as men with prostatic hyperplasia. The prevalence of UTI increases with age. The vast majority of infections (over 90%) are infections that start with the urethra and, if not treated, continue to spread *via* single urinary tract to the kidney or bilaterally (2).

Urolithiasis is one of the most commonly diagnosed disease of urinary tract and the frequency of its occurrence is about 9% of the general population (3,4). Urolithiasis occurs both in men and women, and is diagnosed in about 10% of men and 6% of women (5). Urinary stones are most common in women and men between the ages of 20 and 60 and the occurrence peak of the disease is 50 years old. Over a period of five years the risk of disease recurrence and the chance of second stone formation is a 30% to 50%(6).

Benign prostatic hyperplasia (BPH) is an age-related disease of the prostate present in 70% of men at the age of 60 years. BPH is characterized by histopathological hyperplastic changes of smooth muscle cells and epithelial cells within the prostatic transition and periurethral zones (7,8).

Herbal medicines have a long history of use around the world. It is assumed that they are safer than synthetic drugs and may support some drug therapies. Natural products usually can be used continuously without significant metabolic and clinical consequences (9,10). One of the divisions assumes that there are three main categories of plants used in the treatment of urological diseases - botanical diuretics, urinary antiseptic and anti-adhesion, and herbs used to treat benign prostatic hyperplasia (11). Numerous plants are traditionally considered diuretic, what the preliminary clinical trials confirm, both in healthy and people with urologic disease. Although the precise mechanism of this action, in many cases, remains unclear (12). The classic herbal diuretic drugs are not diuretics at all but aquaretics. These usually contain volatile oils, flavonoids, saponins, or tannins, which increase the volume of urine by promoting blood flow in the kidneys, thereby raising the glomerular filtration rate. However, they do not retard the resorption of Na^+ and Cl^- in the renal tubules, so quantities of these electrolytes are retained in the body and not excreted with the water (13). An increased urine flow can find another application in the prevention of kidney stones. There are many causes for the formation of kidney stones, but the major determinant is an increased urinary concentration of the constituents making up the stones (14). Diuretic herbs can prove useful for minor infections, which benefit from an increased volume of urine, e.g. pyelonephritis (local infection of the renal tissues), urethritis or ureteritis (inflammation of the urethra or of a ureter) and cystitis (inflammation of the urinary bladder). Some of the herbs also exhibit antibacterial properties that, in combination with the increased urinary output, are useful in combating infection. There are two major mechanisms of this process - targeted killing of microbes and interference in their adhesion to epithelial cells (12).

It is commonly believed that traditional, rural folk medicine is more characteristic of underdeveloped communities located usually in the eastern part of Europe (Poland, Lithuania, Belarus, and Ukraine). Traditional folk medicine and self-treatment are strongly associated with Polish culture and tradition. Folk treatment methods have not only not disappeared in the rural areas but ethnological, sociological and medical studies suggest that they seem to be enjoying social acceptance (15–20).

Between the 1940s and 1980s, folk medicine was identified with ignorance. Folk methods of treatment were vigorously fought against while folk healers were forced to abandon their practice. It appeared that in accordance with the plans and prospects of the “socialist health service” these methods of treatment were destroyed, disintegrated and forgotten. It turns out, however, that many practices of folk “medicine” continue to be used in local communities (19).

The present paper collects information about the plants used to treat urological diseases in Polish traditional medicine applied in the region of the Podkarpackie Voivodeship. This data was obtained through interviews with traditional healers and local informants. The purpose of this survey was to document the treatment practices of traditional healers in relation to urinary tract diseases, with the use of medicinal plants.

Materials And Methods

Study area

The study was conducted in Podkarpackie Voivodeship, a province in south-eastern Poland (Fig.1). This region is also known as Subcarpathian Voivodeship or Subcarpathia Province. It covers an area of over 17,000 square kilometers and its administrative capital is Rzeszów. It borders with the following provinces: Małopolskie (in the west), Świętokrzyskie (in the north-west), Lublin (in the north), Ukraine (in the east) and Slovakia (in the south). Forests cover about 35% of the region's area, including the Bieszczady National Park and parts of the Magura National Park (21).

Data collection

A survey was carried out from November 2019 to January 2021. This article is based on interviews with 14 recognized traditional healers living and healing in cities (Jasło, Krosno, Łańcut, Rzeszów, Sanok, Tarnobrzeg) and 9 informants living in rural areas (Blizne, Domaradz, Golcowa and Lutczka) in the Podkarpackie Voivodeship. Among the traditional healers two of them were herbalists in markets. In Fig. 1 (in brackets) the number of healers/informants coming from a given place was given. The informants were mostly local older people interested in herbalism, family members and friends. They only provided information on the symptoms reported by the sick, the plants used and how they were prepared. In the case of traditional healers data were collected based on the completed questionnaire sent *via* e-mail. The questions concerned sociodemographic data, diagnosis methods, types of urinary tract diseases most commonly found in patients and recommended medications. This article is based on knowledge obtained from recognized traditional healers and informants who were born or have lived most of their

lives in the studied region. Participants were given the option to choose whether they want to share their knowledge.

Botanical identification

Plant names have been checked and updated with the online website The Plant List version 1.1 (22) of the Royal Botanic Gardens, Kew, and Missouri Botanical Garden, accessed between April 2019 and December 2020, and the online website Atlas of Vascular Plants of Poland (23). The common names of the plants were identified by referring to research articles. Informations on the plant part used, method of preparation and properties were obtained from the healers and informants based on a questionnaire and interview.

Results And Discussion

Socio-demographic data and the characteristics of healers professional practice

The questionnaire was completed by 14 healers (about 30% of all invited), whose age was between 43 and 71 years. They were all men and had higher level medical education – medical doctor (6) and physiotherapist (8). Eleven of them additionally completed herbal medicine courses. Three healers did not provide details of education in relation to phytotherapy. Apart from the two owners of herbal shops, the others met with patients in a consultation room usually twice a week.

Diagnostic methods

All practicing healers (12) had an early interview with patients and next made a decision about treatment based on medical report (urine test and/or imaging of the urinary or genitourinary system). Herbalists from markets (2) did not give patients a final diagnosis and did not use medical records. The herbs they recommended could not be used for more than 7 days. In the absence of improvement after this time, patients were to consult a primary care physician. The most frequently occurring symptoms and diseases were: pain during urination and frequent urination (infection of bladder or urethra, stone in bladder, prostatitis or enlarged prostate); blood in the urine (infection, stone, tumour); pain in the loin and/or groin (stone, infection, kidney tumour); sediments in urine (infection and/or stone). All respondents mentioned these symptoms.

Herbal remedies

In total, 123 species belonging to 43 plant families used in Podkarpackie Voivodeship by healers and reported by informants for the treatment of urinary diseases were examined. Table 1 presents the plant nomenclature, the main Polish name, English common name, part used, utilization and administration, and number of citations. All the healers and informants reported that about 1 tablespoon of dried herb for a glass of water is used to prepare the infusion or decoction. In the case of fresh raw materials, the quantity was about half lower. Most often, dried material was used. If the plant was used only in mixtures, it was written in brackets - (used in blends).

Plants are listed alphabetically by plant family, and then by species within them. The greatest numbers of plant species used to treat urinary diseases were found to come from the Compositae (18 species), Rosaceae (11 species), Apiaceae (11 species), Leguminosae (9 species) and Ericaceae (6 species). A literature search of reported species reveals that the majority lack the necessary supporting data to prepare a scientific explanation for their traditional uses in treating urinary diseases. The study therefore evaluates the available scientific evidence for all reported species, to identify any possible scientific bases for their use.

Medical treatment strategies declared by healers

All traditional healers (14) have declared that suspected malignant tumour, urinary tract obstruction and severe cardiovascular disorders disqualify patients from herbal treatment. Table 2 summarizes the most common urological diseases diagnosed in reporting patients.

All healers reported using only herbal blends and commercial herbal preparations. None used individual herbs. 11/14 respondents made these blends themselves. In order to eliminate the infection (most often diagnosed ailment), mainly herbs containing phenolic glycosides (hydroquinone derivatives) were used, i.e. *Arctostaphylos uva-ursi* (L.) Spreng. and *Vaccinium vitis-idaea* L.. They were usually present in all blends in various combinations with *Solidago virgaurea* L., *Calluna vulgaris* (L.) Hull, and *Filipendula ulmaria* (L.) Maxim. Herbs containing tannins were also found in the antibacterial blends - *Fragaria vesca* L., *Ribes nigrum* L., and *Hypericum perforatum* L., as well as plants containing essential oils - *Juniperus communis* L., *Petroselinum crispum* (Mill.) Fuss, *Levisticum officinale* W.D.J.Koch, and *Ononis spinosa* L..

Commercial herbal blends used by 3 healers were *Urosan*, *Urovit* and *Uromix*. Commercial herbal preparations used by all 14 healers were *Urosept* (pills), *Urogran* (herbal granules), *Uverex* (pills), *Diuronis* (liquid), *Nefrosept* (liquid), *Alliofil* and "Tabletki z czosnku" (garlic tablets).

In addition to phenolic glycosides, phenolic acids, found in *Arctostaphylos uva-ursi* (L.) Spreng. and *Vaccinium vitis-idaea* L. in free form and as tannin hydrolysis products, have also antimicrobial activity. Herbalists making their own mixtures tried to make them also anti-inflammatory, diuretic and antispasmodic, hence the frequent addition of *Matricaria chamomilla* L., *Taraxacum campylodes* G.E.Haglund., *Urtica dioica* L. and *Urtica urens* L..

9/14 healers declare that they recommend the use of *Vaccinium microcarpum* (Turcz. Ex Rupr.) Schmalh. to reduce bacterial colonization. They recommend drinking juice and fruit infusions/decoctions with the indication that they are a dietary agents for long-term use.

The next diagnosed condition is urolithiasis, often accompanied by infection. All healers 14/14 declare the use of antibacterial herbs first, and then use diuretic herbs, or rather phytoaquatics. 11/14 healers recommend their own blends that include generally *Betula pendula* Roth, *Betula pubescens* Ehrh., *Arctostaphylos uva-ursi* (L.) Spreng., *Urtica dioica* L., *Urtica urens* L., *Genista tinctoria* L., *Phaseolus*

vulgaris L., *Solidago virgaurea* L., *Levisticum officinale* W.D.J.Koch, *Ononis spinosa* L., *Equisetum arvense* L., *Elymus repens* (L.) Gould, *Taraxacum campylodes* G.E.Haglund, and *Petroselinum crispum* (Mill.) Fuss.. 3/14 healers recommended herbal treatments based on the recipes of Father Klimuszko. All healers recommend using commercial drug "Fitolizyna" (paste).

In relation to benign prostatic hyperplasia, the treatment of all healers was identical. They recommended antibacterial therapy and the use of commercial preparations. The three most commonly used are *Prosterol* or *Prosterol fix* (pills, blend), *Poldanen* (pills) and *Peposterol* (pills) and possibly a blend of Father Klimuszko, Polish religious and herbalist.

Infusions and decoctions were made from one tablespoon of herbs per glass of water and applied three times a day, on average for two weeks. All healers state that their herbal therapies for some urinary tract diseases are highly effective. They emphasized that the basis of success are accurate diagnosis and medical documentation of the disease, e.g. blood and urine analysis, imaging tests.

Medical treatment strategies declared by informants

In general, rural herbalists treated urinary tract diseases based on symptoms, without medical records. Benign prostatic hyperplasia was not isolated as a separate disease. Urinary tract tumors were also not recognized. Mainly infections and symptoms of urolithiasis were treated. Many of the herbs currently used by professional healers have been used in rural medicine. This is evidenced by the number of citations given in Table 1 in the last column. Values of about 20 testify that the medicinal properties of the plant were known to both rural herbalists and modern healers practicing in cities. These plants are well tested for composition and pharmacological activity and are described in the literature. However, there is a group of herbs whose use is mentioned only in rural medicine and there is no scientific basis for the use of these plants.

The information obtained shows that rural herbalists mainly use individual plants in medicine, which gives little effect in the case of urinary tract diseases. People who undergo ineffective treatment then choose commercial herbal preparations themselves after consulting a pharmacist.

Plants used in Podkarpackie Voivodeship whose therapeutic effect on urinary tract has been confirmed by scientific findings (in alphabetical order)

Achillea millefolium L.

The Compositae is one of the most widely known families, including a large number of flowering plants classified into about 23,000 species. One such species is *Achillea*, whose members have various pharmaceutical properties. They have been recommended as useful tonic, sedative and diuretic (24). In addition, it is common to see the consumption of herbal teas from different species of *Achillea* in folk medicine. *In vitro* and *in vivo* clinical tests have confirmed the possibility of various therapeutic applications. Various authors note that *Achillea millefolium* has important traditional and ethnomedicinal properties when drunk as tea, including treating urinary disorders; it has been used in various countries,

particularly in Europe (24–26). The varied effects of these plants may be due to the presence of numerous secondary metabolites, i.e. phenolic acids, flavonoids, terpenoids and sterols. De Souza et al. (27) demonstrated that *A. millefolium* extract, when orally administrated in rats, are able to effectively increase diuresis. This effect depends on the activation of bradykinin B2 receptors and the activity of cyclooxygenase.

Acorus calamus L.

For centuries, *Acorus calamus* has been used in Polish folk medicine for the treatment of urinary diseases (15). It is also used in modern medicine. Ghelani et al. (28) in studies conducted on male albino Wistar rats showed the diuretic and antiurolithiatic effect of the ethanolic extract from *A. calamus*. The use of this extract caused increased diuresis and limited excretion of calcium, oxalate, phosphate and uric acid.

Aegopodium podagraria L.

Aegopodium podagraria is a perennial herb of the carrot family (Apiaceae). It is indigenous to Europe, western and eastern Siberia, the Caucasus, and Central Asia mountainous regions and has been naturalized in North America. Koyro et al. (29) demonstrated that the essential oil of the flowers has the diuretic and uricosuric activity. Another study examined the influence of the extract and tincture of the aerial parts of *A. podagraria* in rats receiving excess fructose combined with hydrochlorothiazide (30). The authors observed that plant tested extract significantly enhances kaliuresis.

Amaranthus retroflexus L.

Amaranthus retroflexus is an upright annual herb which was probably introduced into Europe from North America. Currently it is common throughout Poland (31). The plant is known to have a number of toxic principles; for example, Osweiler et al. (32) demonstrated that *A. retroflexus* induced production of perirenal edema in pigs. Microscopical lesions include renal tubular degeneration and necrosis. Kessell et al. (33) observed acute renal failure to be associated with *Amaranthus* species, including *A. retroflexus* ingestion by lambs.

Apium graveolens L.

In traditional medicine, some medicinal plants, i.e. corn silk, barley and celery were used to relieve some renal pains. *Apium graveolens* is a popular vegetable added to many dishes such as salads, which has been used in Chinese medicine to reduce blood pressure and in Arabian medicine to relieve renal points (12,34–36) observed that celery accentuates urinary Ca^{2+} excretions in experimental model of nephrocalcinosis, and produced a significant reduction of blood urea nitrogen and serum creatinine. Renal functions were analyzed in 1st, 5th and 10th day.

Arctostaphylos uva-ursi (L.) Spreng.

In Europe and America, *Arctostaphylos uva-ursi* is particularly often used to treat lower urinary tract infections. The key constituents of the dried leaves are the phenolic glycoside arbutin and its derivate hydroquinone, both of which antiseptic activity in inflammation of the urinary tract (37). Although arbutin is the major pharmacological active constituent of the *A. uva-ursi* leaves extract, experimental studies indicate that their global pharmacological action requires the use of the whole extract. Haslam (38) described that the dried leaves of *Arctostaphylos uva-ursi* have a soothing astringent effect, and that they can be used as a diuretic in kidney disorders and aliments of the bladder and urinary tract. The principal phenolic metabolites in the leaf are arbutin, gallotannins, and galloyl esters of arbutin.

Betula pendula Roth and *Betula pubescens* Ehrh.

Of the hundred *Betula* species identified in the world, only 7 of them were used in traditional medicine. Especially the use of *B. pendula* has been documented. The results of tests published by Rastogi et al. (39) show the biological properties of this plant. Extracts of *B. pendula* leaves are traditionally used against rheumatic pin and arthritic diseases. In addition, different experiments suggest that these extracts possess mild diuretic action and anti-inflammatory properties. *B. pendula* extract reduces the growth and proliferation of activated T lymphocytes in a dose-dependent manner, and this has been attributed to the action of secondary metabolites (i.e. phenolic acids and flavonoids) within the leaves (40,41). Also, an ethanol–water (1:1; v/v) extract from the *Betula* spp. leaves has been found to have an antiadhesive effect against the binding of uropathogenic *Escherichia coli* to the bladder cell surface (cell line T24). Decreased bacterial adhesion (IC_{50} 415 mg/mL \pm 7.19) was observed, and this action is linked with the prevention of urinary tract infections (42).

Bidens tripartita L.

Another member of the Composite is *Bidens tripartita*. It is used in oriental medicine to increase sweat secretion and as a diuretic (43,44).

Carum carvi L.

In folk medicine dried fruit of *Carum carvi* is often used because of its carminative and therapeutic properties for gastrointestinal complaints (45). In traditional Moroccan medicine, *C. carvi* fruits are used as diuretics, however, their effect has not been confirmed in controlled studies. On the other hand, Lahlou et al. (46) report that the aqueous extract of *C. carvi* demonstrated diuretic properties in normal rats.

Daucus carota L.

In traditional medicine, *Daucus carota* has been used mainly to treat nephrosis and other urinary disorders. Sodimbaku et al. (47) have observed that the carrot has dose-dependent nephroprotective activity against gentamicin-induced nephrotoxicity in rats. This protection was manifested by lowering the levels of serum urea, blood urea nitrogen, uric acid and creatinine. Also, concurrent treatment with *D. carota* extract significantly inhibited gentamicin-induced weight loss.

Elsholtzia ciliata (Thunb.) Hyl.

Elsholtzia ciliata is widely distributed throughout China, Korea, and Europe. In Poland it mainly occurs in eastern areas (48). An *in vivo* study found that ethanol extract of this plant inhibits renal interstitial fibrosis induced by unilateral ureteral obstruction. This effect may be mediated by inhibiting the expression of KIM1 (kidney injury molecule 1), TNF- α (tumor necrosis factor α), TGF- β (transforming growth factor β) Smad3 and MMP 9 (matrix metalloproteinase 9) protein, which are markers of inflammation and renal histopathological alterations. An *in vitro* study based on MTT (3-(4,5-methylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay showed *E. ciliata* ethanolic extract to have no cytotoxic effect, even at a concentration of 200 μ g/ml. The study was conducted for 24 hours on the mouse macrophage cells RAW 264.7 cells and human renal mesangial cells (49).

Elymus repens (L.) Gould

Elymus repens is native from temperate Europe to Central Asia and is now found in Africa. Its traditional use is associated with diuretic properties and relief of pain and spasm of the urinary tract. It is often used to treat enuresis and urinary incontinence, for the control of symptoms of the urinary disease, urinary calculi and urinary infections (cystitis, urethritis, prostatitis) (50). In clinical study, the effects of the combined treatment of *A. repens* with potassium citrate were assessed in patients with nephrolithiasis. After five months the treated group showed a significant reduction in the total number (-1.0 ± 0.2 vs. 0.0 ± 0.2 stones) and diameter of the stones (-3.6 ± 0.9 mm vs. 0.0 ± 0.8 mm), as well as a reduction in the urinary excretion of uric acid (51). It was also shown that under *in vitro* conditions, *E. repens* has antiadhesive effects against the binding of uropathogenic *Escherichia coli* on the surface of the bladder cell (cell line T24). Decreased bacterial adhesion (IC_{25} 630 mg/mL) was observed, and this effect has been linked with the prevention of urinary tract infections (42). In a clinical trial in patients with micturition disorders, an ethanolic extract of *Elymus repens* caused a reduction of urinary incontinence, dysuria, nocturia and tenesmus due to adenoma of prostate, prostatitis and cystitis (52).

Equisetum arvense L.

The genus *Equisetum* consists of 30 species of rush like, long-standing herbs. *Equisetum arvense* extract is used as a pain relieving agent and a mild diuretic. It is very effective in removing water from the body. This activity is due to the action of different components, i.e. potassium, equisetonin, calcium, magnesium, caffeic acid and ascorbic acid (53–55). Recently, Carneiro et al. (56) observed that a standardized dried extract of *E. arvense* had a diuretic effect that was stronger than hydrochlorothiazide in healthy male volunteers. There was no effect of *E. arvense* on the excretion of electrolytes in urine and it was approved as safe for oral use.

Foeniculum vulgare Mill.

Foeniculum vulgare is a biennial medicinal and aromatic plant, and its bulbs and fronds have a culinary application (57). El Bardai et al., (58) showed that administration of *F. vulgare* fruit extract significantly

increased, both, urinary volume, potassium and sodium excretion. The dose was chosen according to these used in Moroccan traditional medicine.

Fraxinus excelsior L.

In world folk medicine, *Fraxinus* species have been used for their diuretic and therapeutic effects on bladder inflammation. In Polish folk medicine, the bark and leaves of *Fraxinus excelsior*, native to Europe, are used to treat various conditions, including wound healing, diarrhea and dysentery (59). Aqueous and ethanol extracts from *F. excelsior* leaves facilitated renal excretion, increased sodium and chloride, potassium and urea excretion. It is believed that flavonoids are mainly responsible for this activity (60). Also, daily oral administration of *Fraxinus excelsior* aqueous extract in hypertensive rats, produced a significant urination, increase urinary excretion of sodium, potassium and chlorides (61).

Humulus lupulus L.

Humulus lupulus is widely used in the brewing industry. Chalkones, bitter acids and terpenes have been identified in hop cones (62). In traditional medicine, hops are used to treat sleep disorders. In addition, some *in vitro* and *in vivo* experiments support the value of hops as traditional antibacterial and antifungal remedies, and others show them to have diuretic activity.

Juniperus communis L.

In folk and official medicine, juniper berries (*Juniperus communis*) are believed to have diuretic, antiseptic, stomachic and carminative activities. Juniper berries contain 0.5-2% of essential oil, which is source of phenolic compounds, carbohydrates, fatty acids and sterols. It was found that the diuretic activity of juniper berries is the result of the action of essential oil and hydrophilic constituents (63).

Lycopodium clavatum L.

Lycopodium clavatum is a pteridophyte growing in the tropics, subtropically, as well as in European forests. This plant is used to relieve gastric inflammations, simplifies digestion and for the treatment of chronic kidney disorders (64). It has been shown that *L. clavatum* can play a role in alternative treatment of gout by inhibiting xanthine oxidase. Alcoholic and aqueous extracts (50-100 μ g/mL) of the whole plant inhibit oxidase activity in 13-58% (65).

Nigella sativa L.

Nigella sativa seeds are traditionally used for culinary purposes in the Indian subcontinent, in Arab countries and Europe. They are also used in the folk treatment of asthma, hypertension, diabetes and various inflammations. The seeds and its oil are used as a carminative and in food as a spice (66), but are rarely cultivated as a spice in Poland (atlas-roslin.pl). Zaoui et al., (67) found that the dichloromethane extract of *N. sativa* seeds possesses a strong diuretic action in spontaneously hypertensive rats. The

diuretic effect of the extract was about 16% greater than that of frusemide, which increased diuresis by 30%. Diuresis was accompanied by an increase in the excretion of chloride, sodium, potassium and urea.

Petroselinum crispum (Mill.) Fuss

Petroselinum crispum, commonly known as parsley, is used as carminative, gastro tonic, diuretic and an antiseptic of the urinary tract. In addition, in Bulgarian phytotherapy, various parts of *P. hortense* (leaves, seeds and roots) are thought to have diuretic activity (68).

Ribeiro et al., (69) investigated the action of aqueous-ethanol extract from the seeds of *P. sativum* which was administered to rats. Increased urinary urinary volume and sodium excretion was observed, and these effects were similar to that of furosemide. Yarnell (12) notes that *P. crispum* has strong potency, which was comparative properties of other herbal diuretics, including *Taraxacum officinale* and *Ononis compestris*, whose potential is regarded as medium. The key active compounds of *P. sativum* are various phenolics, including flavonoids such as apigenin and appinin, and these compounds have a range of biological properties, including diuretic activities (68). In addition, Kreydiyyeh and Usta (70) suggest that aqueous parsley seed extract has a diuretic effect, and the mechanism of action of parsley seems to be mediated by through an inhibition of the Na⁺-K⁺ pump that would lead to a reduction in Na⁺ and K⁺ reabsorption leading thus to an osmotic water flow into the lumen, and diuresis. In other experiments, Alyami and Rabah (71) report no significant difference in urine volume, nor the pH, sodium, chloride, potassium, magnesium, urea, creatinine, uric acid or citric acid composition of urine, nor any inhibition of urinary tract stone formation following the consumption of parsley leaf tea. Saeidi et al. (72) have also observed that aqueous extracts of *P. sativum* have a therapeutic effect on calcium oxalate stones in rats and that it reduces the number of calcium oxalate deposits. It has been observed that *P. sativum* extract significantly increases the calcium level and decreases the magnesium level in serum.

Plantago major L.

Plantago major a perennial herb, is found wild throughout the whole Europe and temperate Asia. Folk medicine uses all parts of this plant in the preparation of medications helpful in the treatment, among others, cough, diarrhea, or treatment of urolithiasis (73). The ethanol extract of *P. major* significantly inhibited the growth of calcium oxalate crystals (dihydrate variety) *in vitro*. It has been shown that *P. major* extract was better than allopurinol and potassium citrate in the reduction of the risk of renal outcomes (74).

Rosa canina L.

Rosa canina a plant native to the Poland is also found in other European countries (75). Its fruit is extensively used worldwide in foods such as jelly and jam, in various beverages such as tea, and in traditional medicine to treat urate metabolism disorders. The final product in the purine metabolism are urates, in the metabolism of which is involved xanthine oxidase (XO). These processes occur in the liver. An imbalance of serum urate production and excretion induces hyperuricemia, which also develops into

gout and kidney stones, and accelerates the progression of renal diseases. *In vitro* studies have shown that *R. canina* extracts inhibited XO activity and significantly reduced the levels of serum urate eight hours after administration. It is suggested that this hot water extract may serve as a functional food for individuals with a high urate level, and as a therapeutic reagent for hyperuricemic patients (76). The aqueous extract of *Rosa canina* reduced the content of calcium in the kidneys and urine, and also reduced the size of CaOx stones in the kidneys. It also increased the excretion of citrate without affecting urine volume and pH (77).

Sambucus ebulus L. and *Sambucus nigra* L.

Sambucus ebulus is a herbaceous plant well-known in traditional European Medicine for its healing effects in many disorders; however, its toxicity limits its value as a food (78). Dimkov (79) indicates that decoction of *S. ebulus* has diuretic and diaphoretic properties. Also, Beaux et al., (80) report increased excretion of sodium in rats after administration of *S. nigra* flower extract. According to Walz and Chrubasik (81), *S. nigra* concentrate can be safely administered to patients with idiopathic nephrolithiasis. This concentrate did not affect urine pH or hydrogen ion concentration.

Taraxacum campylodes G.E.Haglund

Taraxacum campylodes is a widespread perennial of the Asteraceae. It is commonly considered as weed, but has a wide range of chemical components which confer healing properties. Most of the active substances found in *T. campylodes* are phenols and terpenes; however, carbohydrates, proteins, fatty acids, vitamins and minerals are also present. This range of compounds has resulted in the plant being used for centuries as a natural drug in the treatment of gout and diarrhea, as well as problems associated with the bladder, spleen and liver (82). Leaf ethanol extract (1 g/ml) demonstrates a diuretic effect in a group of women treated with the extract every five hours for four days, with no side effects observed (83–85).

Urtica dioica L. and *Urtica urens* L.

Urtica dioica is a temperate and tropical plant. It is common throughout Poland (31). Traditionally, the leaves and roots of plant have a very wide range of ethnomedicinal applications, although in different capacities. *Urtica urens* also demonstrates similar pharmacological properties (86). The extract of *U. dioica* increase diuresis by 11% when administered at a low dose (4 mg/kg/h) and by 84% at a high dose (24 mg/kg/h); it also induces natriuresis by 28% and 143% at the same respective low and high doses (87). Studies on the effects of *U. dioica* preparations on humans have been limited (86,88). *In vitro* studies have found that, like *Betula* spp. and *Elymus repens*, *Urtica* spp. shows an antiadhesive effect against the binding of uropathogenic *Escherichia coli* on the surface of bladder cells (IC_{25} 630 mg/mL) (42). *Urtica dioica* ethanol extract at a dose of 1g/kg (po) does not affect diuretic activity, while a dose of 500 mg/kg (ip) causes a significant increase in this activity(86).

Vaccinium myrtillus L.

Vaccinium myrtillus is a small deciduous shrub, which is very popular in Poland and other European countries. The leaves are used in folk medicine as decoctions and infusions for treating conditions associated with the urinary tract thanks to their astringent and antiseptic properties (89). *Vaccinium vitis-idaea* is another evergreen small shrub growing in Europe; its berries are known to have the same properties as *V. myrtillus* fruits, while the leaves have diuretic and urinary antiseptic activities, which have been attributed to their high concentration of tannins, arbutin and arbutin derivatives (89).

Viola tricolor L.

Viola tricolor has a long history in phytomedicine. Its aerial parts have been described and used for centuries in Europe for the therapy of skin disorders, upper-respiratory problems, and also used as a diuretic (90). The Polish flora records that *V. tricolor* inhabits areas throughout the country at lowland and lower mountain locations (91). Saponins (5.98%) and flavonoids (1.81-1.99%) are responsible for its anti-inflammatory properties. *Viola tricolor* tincture has been shown to have a moderate diuretic effect (diuretic index 1.103) (92).

Pharmacological activities of the most cited plants important in the treatment of urinary diseases

Apium graveolens L., *Arctostaphylos uva-ursi* (L.) Spreng., *Betula* spp., *Elymus repens* (L.) Gould, *Equisetum arvense* L., *Juniperus communis* L., *Levisticum officinale* W.D.J.Koch, *Ononis spinosa* L., *Petroselinum crispum* (Mill.) Fuss, *Solidago virgaurea* L., *Taraxacum campylodes* G.E.Haglund, *Urtica* spp., *Vaccinium myrtillus* L., *Vaccinium vitis-idaea* L., *Viola tricolor* L. are all known to have diuretic and urinary tract *disinfectant* activity (93). These herbs usually contain monosaccharides, flavonoids, volatile oils, saponins, terpenes, or tannins, which increase the volume of urine, by promoting blood flow in the kidneys, thereby raising the glomerular filtration rate. Lien et al., (94) identify the most common chemical ingredients in plants used in the treatment of kidney disease and/or kidney protection, and their possible mechanisms of action in traditional Chinese medicine. Antioxidant polyphenols may prevent nephropathy by interacting with the reactive oxygen species or free radicals. Many of the antioxidants contain a component part bound to oxidizable functional groups such as ferulic acid and isoferulic acid, flavonoids, isoflavonoids, and tannins (95).

Arbutin is particularly important in the treatment of infection. This compound is a phenolic glycoside and is present, among others, in *Arctostaphylos uva-ursi* (L.) Spreng. and *Vaccinium vitis-idaea* L.. This compound is primarily hydrolyzed in the intestines to hydroquinone, and then absorbed, metabolized, and excreted via the urine. Part of the antimicrobial activity of quinones has been attributed to the ability of these compounds to irreversibly complex with nucleophilic amino acids in proteins. They affect the cell surface-exposed adhesins, cell wall polypeptides, and membrane-associated enzymes. In turn, flavonoids are synthesized by plants as a defense against microbial infection. Both flavonoids and tannins are believed to act in a manner similar to quinones in inactivating microbial adhesions, enzymes, and cell envelope transport proteins, as well as possible direct inactivation of microorganisms. Tannins have been reported to elicit antimicrobial activity against filamentous fungi, yeasts, and bacteria (96,97).

The triterpene saponins may stimulate microcirculation due to their surfactant properties. The diuretic action of these compounds is believed to be associated with local irritation of kidney epithelia. The diuresis caused by plants such as *Ononis* spp., *Betula* spp. and *Solidago* species is relatively mild, and the effect may originate from the accompanying flavonoids and essential oils. An alternative theory is that the potassium content of these plants is in fact the diuretic agent (98). Some essential fatty acids may exhibit both anti-inflammatory and pro-inflammatory properties, modulating the immune response (94).

The chemical composition of many plants used in folk medicine to treat urinary diseases remains unclear, as does that of the plants used in contemporary medicine. Experimental data on the pharmacological effects of this plant are poor. Some of the plants from the traditional folk pharmacopaeia are still in use, but a large group have been discarded, and the body of scientific evidence on the effectiveness and safety of their use can be sparse. A precise chemical analysis of the composition of these plants, based on *in vivo* and *in vitro* studies, may allow the rediscovery of valuable therapeutics for the treatment of urinary disease. The following plants have a long history of use in folk medicine; however the literature indicates they are rarely used in contemporary Polish phytomedicine, and merit further analysis: *Allium ursinum* L., *Angelica sylvestris* L., *Bryonia alba* L., *Elsholtzia ciliata* (Thunb.) Hyl., *Galium aparine* L., *Onopordum acanthium* L., *Quercus robur* L., *Raphanus raphanistrum* subsp. *sativus* (L.) Domin, *Sanguisorba officinalis* L., *Silene vulgaris* (Moench) Garcke, *Stellaria media* (L.) Vill., *Trifolium arvense* L., *Trigonella caerulea* (L.) Ser. These plants have been used in Podkarpackie folk medicine, but according to literature sources, are not used in contemporary phytomedicine (99)).

Conclusions

The present study identified 123 species belonging to 43 plant families used in Podkarpackie Voivodeship by healers and reported by informants for the treatment of urinary diseases. Many of these plants are successfully used in herbal medicine in other countries, as documented by literature data. The results of the research described in this paper indicate that herbal treatment of urinary tract diseases is still used in Poland in the Podkarpackie Voivodeship. It is mainly used by people who do not want to use allopathic medicine, especially antibiotics. They are both inhabitants of large cities and villages. The latter often because of the multi-generational tradition, prefer self-healing. Most reporting patients suffer from bacterial infections (over 60%). The two primary herbs for treating these diseases are *Arctostaphylos uva-ursi* (L.) Spreng. and *Vaccinium vitis-idaea* L., always in blends. Healers currently treating in the Podkarpackie Voivodeship achieve great success in the treatment of selected urinary tract diseases. The basis of this success is accurate diagnosis of diseases using biochemical analyzes and imaging, and additionally supported by knowledge about the biological activity of herbs. An important element of therapy are also herbal medicines produced by few companies. For the benefit of patients, herbal treatment should be developed and the number of commercial drugs based on them should be increased. Information on the medicinal properties of herbs should also be disseminated so that patients have a conscious choice between herbal and allopathic medicine.

In turn, single herbs used in rural medicine are definitely ineffective or work too weakly. Attention should also be paid to the use of plants, which are mentioned by rural herbalists, but there is no scientific basis for their use. These plants definitely require confirmation of their medicinal properties and lack of toxicity. This requires careful research. The practices of rural herbalists from the Podkarpackie Voivodeship in the treatment of urinary tract diseases are currently not applicable due to their low effectiveness. In contrast, healers who have medical or herbal education are achieving great success in the treatment of these diseases. Knowledge about the use of herbs should be growing so that patients can self-heal in mild ailments.

List Of Abbreviations

AP, aerial parts; Ba, bark; BPH, benign prostatic hyperplasia; d, day; Fl, flower; FS, flowering shoots; Fr, fruit; h, hour; In, inflorescence; JB, juniper berry; KIM1, kidney injury molecule 1; MMP, matrix metalloproteinase; LS, leaf stalk; Lf, leaf; m, month; Rz, rhizome; Ro, root; Se, seed; Sp, spores; TGF- β , transforming growth factor β ; TNF- α , tumor necrosis factor α ; UTI, urinary tract infections; w, week; WP, whole plant; XO, xanthine oxidase.

Declarations

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Competing interests

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Authors' contributions

BO and MB conceptualized the study and WR reviewed the research proposal. KU conducted the ethnobotanical survey and analyzed the obtained data. BO, WR and MB drafted the manuscript. All the

authors participated in writing and giving feedback on the manuscript. All authors have read and approved the final manuscript.

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References

1. Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. Urinary tract infections: epidemiology, mechanisms of infection and treatment options. *Nat Rev Microbiol.* 2015;13(5):269–84.
2. Medina M, Castillo-Pino E. An introduction to the epidemiology and burden of urinary tract infections. *Ther Adv Urol.* 2019;11:1756287219832172.
3. Romero V, Akpinar H, Assimos DG. Kidney stones: a global picture of prevalence, incidence, and associated risk factors. *Rev Urol.* 2010;12(2–3):e86.
4. Gambaro G, Croppi E, Bushinsky D, Jaeger P, Cupisti A, Ticinesi A, et al. The risk of chronic kidney disease associated with urolithiasis and its urological treatments: a review. *J Urol.* 2017;198(2):268–73.

5. Abbagani S, Gundimeda SD, Varre S, Ponnala D, Mundluru HP. Kidney stone disease: Etiology and evaluation. *Int J Appl Biol Pharm Technol.* 2010;1:175–82.
6. Tasian GE, Kabariti AE, Kalmus A, Furth SL. Kidney stone recurrence among children and adolescents. *J Urol.* 2017;197(1):246–52.
7. McVary KT, Roehrborn CG, Avins AL, Barry MJ, Bruskewitz RC, Donnell RF, et al. Update on AUA guideline on the management of benign prostatic hyperplasia. *J Urol.* 2011;185(5):1793–803.
8. Foo KT. Current consensus and controversies on male LUTS/BPH (part one). *Asian J Urol.* 2017;4(3):137.
9. Nasri H. Toxicity and safety of medicinal plants. *J HerbMed Pharmacol.* 2013;2(2):21–2.
10. Bahmani M, Baharvand-Ahmadi B, Tajeddini P, Rafieian-Kopaei M, Naghdi N. Identification of medicinal plants for the treatment of kidney and urinary stones. *J Ren Inj Prev.* 2016;5(3):129–33.
11. Jambor J. Fitoterapia chorób układu moczowego. *Prz Urol.* 2012;1(71):23–9.
12. Yarnell E. Botanical medicines for the urinary tract. *World J Urol.* 2002;20(5):285–93.
13. Dutta KN, Chetia P, Lahkar S, Das S. Herbal plants used as diuretics: a comprehensive review. *J Pharm Chem Biol Sci.* 2014;2(1):27–32.
14. Hesse A. Urinary stones: Diagnosis, treatment, and prevention of recurrence. Karger Medical and Scientific Publishers; 2009.
15. Kuźniewski P, Augustyn-Puziewicz J. Przewodnik ziołolecznictwa ludowego, wyd. II uzupełniający. Warszawa–Wrocław, PWN. 1986;
16. Tylkowa D. Medycyna ludowa w kulturze wsi Karpat polskich: Tradycja i współczesność. Zakład Narodowy im. Ossolińskich; 1989.
17. Paluch A. "Zerwij ziele z dziewięciu miedz": Ziołolecznictwo ludowe w Polsce w XIX i początku XX wieku. Polskie Tow. Ludoznawcze; 1991.
18. Penkala-Gawęcka D. Medycyna komplementarna w Polsce i jej badanie (na przykładzie badań w małym miasteczku wielkopolskim). *Lud.* 1991;74:169–91.
19. Piątkowski W, Majchrowska A. Health, illness and dying in Polish folk medicine. *Prog Heal Sci.* 2015;5(1):214–24.
20. Kujawska M, Łuczaj Ł, Sosnowska J, Klepacki P. Rośliny w wierzeniach i zwyczajach ludowych: słownik Adama Fischera. Wrocław: Polskie Towarzystwo Ludoznawcze; 2016.
21. Statystyczny GU. Area and Population in the territorial profile in 2013. Warszawa Główny Urząd Stat. 2013;
22. The Plant List. Version 1.1, 2013 (<http://www.theplantlist.org/>)
23. [Http://www.atlas-roslin.pl](http://www.atlas-roslin.pl). Atlas roślin.
24. Mohammadhosseini M, Sarker SD, Akbarzadeh A. Chemical composition of the essential oils and extracts of Achillea species and their biological activities: A review. *J Ethnopharmacol.* 2017;199:257–315.

25. Benedek B, Kopp B. *Achillea millefolium* L. s.l. revisited: recent findings confirm the traditional use. *Wien Med Wochenschr.* 2007;157(13–14):312–4.
26. Saeidnia S, Gohari AR, Mokhber-Dezfuli N, Kiuchi F. A review on phytochemistry and medicinal properties of the genus *Achillea*. *DARU J Fac Pharmacy, Tehran Univ Med Sci.* 2011;19(3):173.
27. de Souza P, Crestani S, da Silva R de CV, Gasparotto F, Kassuya CAL, da Silva-Santos JE, et al. Involvement of bradykinin and prostaglandins in the diuretic effects of *Achillea millefolium* L. (Asteraceae). *J Ethnopharmacol.* 2013;149(1):157–61.
28. Ghelani H, Chapala M, Jadav P. Diuretic and antiurolithiatic activities of an ethanolic extract of *Acorus calamus* L. rhizome in experimental animal models. *J Tradit Complement Med.* 2016;6(4):431–6.
29. Oo K, Ov T, Si S, Shtrygol Y. Study of the composition of the goutweed flowers essential oil, its renal effects and influence on uric acid exchange. *Pharmacogn Commun.* 2012;2(3):46–9.
30. Tovchiga O V. Renal effects of goutweed (*Aegopodium podagraria* L.) preparations in rats with the metabolic disorders induced by fructose and hydrochlorothiazide. *Ukr Biopharm J.* 2014;4(33):60–6.
31. Rutkowski L. Klucz do oznaczania roślin naczyniowych Polski nizowej. Wydawn. Naukowe PWN; 1998.
32. Osweiler GD, Buck WB, Bicknell EJ. Production of perirenal edema in swine with *Amaranthus retroflexus*. *Am J Vet Res.* 1969;30:557–66.
33. Kessell AE, Boulton J, Krebs GL, Quinn JC. Acute renal failure associated with *Amaranthus* species ingestion by lambs. *Aust Vet J.* 2015;93(6):208–13.
34. Al Razziqi RM, Al Jawad F, Al Jeboori A. *Apium graveolens* accentuates urinary Ca²⁺excretions in experimental model of nephrocalcinosis. *Int J Green Pharm.* 2011;5(2):100.
35. Fazal SS, Singla RK. Review on the Pharmacognostical & Pharmacological Characterization of *Apium Graveolens* Linn. *Indo Glob J Pharm Sci.* 2012;2(1):36–42.
36. Kooti V, Ghasemiboroon M, Ahangarpoor A, Hardani A, Amirzargar A, Asadi-Samani M, et al. The effect of hydro-alcoholic extract of celery on male rats in fertility control and sex ratio of rat offspring. *J Babol Univ Med Sci.* 2014;16(4):43–9.
37. Kozlowski J. [Arctostaphylos uva-ursi Spreng.[common bearberry]-an indispensable drug plant [ecology; conservation]].[Polish]. Wiad Zielar. 1984;
38. Haslam E. Natural polyphenols (vegetable tannins) as drugs: possible modes of action. *J Nat Prod.* 1996;59(2):205–15.
39. Rastogi S, Pandey MM, Rawat AKS. Medicinal plants of the genus *Betula*—Traditional uses and a phytochemical-pharmacological review. *J Ethnopharmacol.* 2015;159:62–83.
40. Gründemann C, Gruber CW, Hertrampf A, Zehl M, Kopp B, Huber R. An aqueous birch leaf extract of *Betula pendula* inhibits the growth and cell division of inflammatory lymphocytes. *J Ethnopharmacol.* 2011;136(3):444–51.

41. Raudonė L, Raudonis R, Janulis V, Viškelis P. Quality evaluation of different preparations of dry extracts of birch (*Betula pendula* Roth) leaves. *Nat Prod Res.* 2014;28(19):1645–8.
42. Rafsanjany N, Lechtenberg M, Petereit F, Hensel A. Antiadhesion as a functional concept for protection against uropathogenic *Escherichia coli*: in vitro studies with traditionally used plants with antiadhesive activity against uropathogenic *Escherichia coli*. *J Ethnopharmacol.* 2013;145(2):591–7.
43. Sezik E, Yesilada E, Shadidoyatov H, Kulivey Z, Nigmatullaev AM, Aripov HN, et al. Folk medicine in Uzbekistan. I. Toshkent, Djizzax, and Samarcand provinces. *J Ethnopharmacol.* 2004;92(2–3):197–207.
44. Pozharitskaya ON, Shikov AN, Makarova MN, Kosman VM, Faustova NM, Tesakova S V, et al. Anti-inflammatory activity of a HPLC-fingerprinted aqueous infusion of aerial part of *Bidens tripartita* L. *Phytomedicine.* 2010;17(6):463–8.
45. Johri RK. Cuminum cymimum and *Carum carvi*: An update. *Pharmacogn Rev.* 2011;5(9):63–72.
46. Lahlou S, Tahraoui A, Israili Z, Lyoussi B. Diuretic activity of the aqueous extracts of *Carum carvi* and *Tanacetum vulgare* in normal rats. *J Ethnopharmacol.* 2007;110(3):458–63.
47. Sodimbaku V, Pujari L, Mullangi R, Marri S. Carrot (*Daucus carota* L.): Nephroprotective against gentamicin-induced nephrotoxicity in rats. *Indian J Pharmacol.* 2016;48(2):122.
48. Hojden B. Marzynieta grzebieniasta-zapomniany uzyteczny chwast. *Wiadomości Zielar.* 1995;37(02).
49. Kim T-W, Kim Y-J, Seo C-S, Kim H-T, Park S-R, Lee M-Y, et al. *Elsholtzia ciliata* (Thunb.) Hylander attenuates renal inflammation and interstitial fibrosis via regulation of TGF- β and Smad3 expression on unilateral ureteral obstruction rat model. *Phytomedicine.* 2016;23(4):331–9.
50. Kasote DM, Jagtap SD, Thapa D, Khyade MS, Russell WR. Herbal remedies for urinary stones used in India and China: A review. *J Ethnopharmacol.* 2017;203:55–68.
51. Brardi S, Imperiali P, Cevenini G, Verdacchi T, Ponchietti R. Effects of the association of potassium citrate and *Agropyrum repens* in renal stone treatment: results of a prospective randomized comparison with potassium citrate. *Arch Ital Urol Androl.* 2012;84(2):61–7.
52. Al-Snafi AE. Chemical constituents and pharmacological importance of *Agropyron repens* – A review. *Res J Pharmacol Toxicol.* 2015;1(2):37–41.
53. Mamedova KT, Gysejnova ID. Effect of *Equisetum arvense* L. on diuresis. *Dokl Nauk Azerbaidzhana.* 1996;51:175–9.
54. Sandhu NS, Kaur S, Chopra D. *Equisetum arvense*: pharmacology and phytochemistry-a review. *Asian J Pharm Clin Res.* 2010;3(3):146–50.
55. Jinous A. Phytochemistry and pharmacological properties of *Equisetum arvense* L. *J Med Plants Res.* 2012;6(21).
56. Carneiro DM, Freire RC, Honório TC de D, Zoghaib I, Cardoso FF de S, Tresvenzol LMF, et al. Randomized, double-blind clinical trial to assess the acute diuretic effect of *Equisetum arvense* (field horsetail) in healthy volunteers. *Evidence-Based Complement Altern Med.* 2014;2014.

57. Rather MA, Dar BA, Sofi SN, Bhat BA, Qurishi MA. *Foeniculum vulgare*: A comprehensive review of its traditional use, phytochemistry, pharmacology, and safety. *Arab J Chem.* 2016;9:S1574–83.
58. Bardai S El, Lyoussi B, Wibo M, Morel N. Pharmacological evidence of hypotensive activity of *Marrubium vulgare* and *Foeniculum vulgare* in spontaneously hypertensive rat. *Clin Exp Hypertens.* 2001;23(4):329–43.
59. Kostova I, Iossifova T. Chemical components of *Fraxinus* species. *Fitoterapia.* 2007;78(2):85–106.
60. Casadebaig J, Jacob M, Cassanas G, Gaudy D, Baylac G, Puech A. Physicochemical and pharmacological properties of spray-dried powders from *Fraxinus excelsior* leaf extracts. *J Ethnopharmacol.* 1989;26(2):211–6.
61. Eddouks M, Maghrani M, Zeggwagh N-A, Haloui M, Michel J-B. *Fraxinus excelsior* L. evokes a hypotensive action in normal and spontaneously hypertensive rats. *J Ethnopharmacol.* 2005;99(1):49–54.
62. Zanolli P, Zavatti M. Pharmacognostic and pharmacological profile of *Humulus lupulus* L. *J Ethnopharmacol.* 2008;116(3):383–96.
63. Stanić G, Samaržija I, Blažević N. Time-dependent diuretic response in rats treated with Juniper berry preparations. *Phyther Res An Int J Devoted to Pharmacol Toxicol Eval Nat Prod Deriv.* 1998;12(7):494–7.
64. Banerjee J, Biswas S, Madhu NR, Karmakar SR, Biswas SJ. A better understanding of pharmacological activities and uses of phytochemicals of *Lycopodium clavatum*: A review. *J Pharmacogn Phytochem.* 2014;3(1):207–10.
65. Kong LD, Cai Y, Huang WW, Cheng CHK, Tan RX. Inhibition of xanthine oxidase by some Chinese medicinal plants used to treat gout. *J Ethnopharmacol.* 2000;73(1–2):199–207.
66. Ali BH, Blunden G. Pharmacological and toxicological properties of *Nigella sativa*. *Phytother Res.* 2003;17(4):299–305.
67. Zaoui A, Cherrah Y, Lacaille-Dubois MA, Settaf A, Amarouch H, Hassar M. Diuretic and hypotensive effects of *Nigella sativa* in the spontaneously hypertensive rat. *Therapie.* 2000;55(3):379–82.
68. Farzaei MH, Abbasabadi Z, Ardekani MRS, Rahimi R, Farzaei F. Parsley: a review of ethnopharmacology, phytochemistry and biological activities. *J Tradit Chinese Med.* 2013;33(6):815–26.
69. Ribeiro R de A, de Barros F, de Melo MMRF, Muniz C, Chieia S, das Graças Wanderley M, et al. Acute diuretic effects in conscious rats produced by some medicinal plants used in the state of São Paulo, Brasil. *J Ethnopharmacol.* 1988;24(1):19–29.
70. Kreydiyyeh SI, Usta J. Diuretic effect and mechanism of action of parsley. *J Ethnopharmacol.* 2002;79(3):353–7.
71. Alyami FA, Rabah DM. Effect of Drinking Parsley Leaf Tea on Urinary Composition and Urinary Stones' Risk Factors. *Saudi J Kidney Dis Transpl.* 2011;22(3):511–4.

72. Saeidi J, Bozorgi H, Zendehdel A, Mehrzad J. Therapeutic Effects of Aqueous Extracts of Petroselinum Sativum on Ethylene Gly-col-Induced Kidney Calculi in Rats. *Urol J.* 2012;9(1):361-366.
73. Samuelsen AB. The traditional uses, chemical constituents and biological activities of *Plantago major* L. A review. *J Ethnopharmacol.* 2000;71(1–2):1–21.
74. Aziz SA, See TL, Khuay LY, Osman K, Bakar MAA. In vitro effects of *plantago major* extract on urolithiasis. *Malaysian J Med Sci MJMS.* 2005;12(2):22.
75. Soukand R, Quave CL, Pieroni A, Pardo-de-Santayana M, Tardio J, Kalle R, et al. Plants used for making recreational tea in Europe: a review based on specific research sites. *J Ethnobiol Ethnomed.* 2013;9(1):58.
76. Edwards NL. The role of hyperuricemia in vascular disorders. *Curr Opin Rheumatol.* 2009;21(2):132–7.
77. Tayefi-Nasrabadi H, Sadigh-Eteghad S, Aghdam Z. The effects of the hydroalcohol extract of *Rosa canina* L. fruit on experimentally nephrolithiasic Wistar rats. *Phyther Res.* 2012;26(1):78–85.
78. Jimenez P, Tejero J, Cordoba-Diaz D, Quinto EJ, Garrosa M, Gayoso MJ, et al. Ebulin from dwarf elder (*Sambucus ebulus* L.): a mini-review. *Toxins (Basel).* 2015;7(3):648–58.
79. Dimkov P. Bulgarian folk medicine. *Naturop Nat Life.* 1977;1.
80. Beaux D, Fleurentin J, Mortier F. Effect of extracts of *Orthosiphon stamineus* benth, *Hieracium pilosella* L., *Sambucus nigra* L. and *Arctostaphylos uva-ursi* (L.) spreng. in rats. *Phyther Res.* 1999;13(3):222–5.
81. Walz B, Chrubasik S. Impact of a proprietary concentrate of *Sambucus nigra* L. on urinary pH. *Phyther Res.* 2008;22(7):977–8.
82. Lis B, Grabek-Lejko D. Dandelion (*Taraxacum officinale*) – potential health benefits. *Nauk Przyr Technol.* 2016;10(3).
83. Schütz K, Carle R, Schieber A. Taraxacum—a review on its phytochemical and pharmacological profile. *J Ethnopharmacol.* 2006;107(3):313–23.
84. González-Castejón M, García-Carrasco B, Fernández-Dacosta R, Dávalos A, Rodriguez-Casado A. Reduction of adipogenesis and lipid accumulation by *Taraxacum officinale* (Dandelion) extracts in 3T3L1 adipocytes: an in vitro study. *Phyther Res.* 2014;28(5):745–52.
85. González-Castejón M, Visioli F, Rodriguez-Casado A. Diverse biological activities of dandelion. *Nutr Rev.* 2012;70(9):534–47.
86. Joshi BC, Mukhija M, Kalia AN. Pharmacognostical review of *Urtica dioica* L. *J Green Pharm.* 2014;8(4):201–9.
87. Tahri A, Yamani S, Legssyer A, Aziz M, Mekhfi H, Bnouham M, et al. Acute diuretic, natriuretic and hypotensive effects of a continuous perfusion of aqueous extract of *Urtica dioica* in the rat. *J Ethnopharmacol.* 2000;73(1–2):95–100.
88. Upton R. Stinging nettles leaf (*Urtica dioica* L.): Extraordinary vegetable medicine. *J Herb Med.* 2013;3(1):9–38.

89. Ieri F, Martini S, Innocenti M, Mulinacci N. Phenolic Distribution in Liquid Preparations of *Vaccinium myrtillus* L. and *Vaccinium vitis idaea* L. *Phytochem Anal.* 2013;24(5):467–75.
90. Rimkiene S, Ragazinskiene O, Savickiene N. The cumulation of Wild pansy (*Viola tricolor* L.) accessions: the possibility of species preservation and usage in medicine. *Med.* 2003;39(4).
91. Zajac A, Zajac M, Tertil R, Harman I. *Atlas rozmieszczenia roślin naczyniowych w Polsce*. Nakładem Pracowni Chorologii Komputerowej Instytutu Botaniki Uniwersytetu ...; 2001.
92. Toiu A, Muntean E, Oniga I, Voștinaru O, Tămaș M. Pharmacognostic research on *Viola tricolor* L. (Violaceae). *Rev Med Chir Soc Med Nat Iasi.* 2009;113(1):264–7.
93. Lamer-Zarawska E, Kowal-Gierczak B, Niedworok J. *Fitoterapia i leki roślinne*. Wydawnictwo Lekarskie PZWL; 2007.
94. Lien EJ, Lien LL, Wang R, Wang J. Phytochemical analysis of medicinal plants with kidney protective activities. *Chin J Integr Med.* 2012;18(10):790–800.
95. Mehta A. 11 Pharmacology of Medicinal Plants with Antioxidant Activity. *Plants as a Source Nat Antioxidants.* 2014;225.
96. Barnes J, Anderson LA, Phillipson JD. *Herbal medicines: a guide for healthcare professionals*. pharmaceutical press; 2003.
97. Talapatra SK, Talapatra B. *Chemistry of Plant Natural Products: Stereochemistry, Conformation. Synth Biol Med.* 2015;
98. Hostettmann K, Marston A. *Saponins*. Cambridge University Press; 2005.
99. Ożarowski A. *Ziołolecznictwo: poradnik dla lekarzy*. Państwowe Zakład Wydawnictw Lekarskich; 1983.

Tables

Table 1

Plants reported for the treatment of urinary diseases in Podkarpackie Voivodeship

Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
Acoraceae					
<i>Acorus calamus</i> L.	tatarak pospolity	Rz	decoction, infusion	diuretic (urinary stones) (2)	2
Adoxaceae					
<i>Sambucus ebulus</i> L.	bez hebd	Ro	decoction, infusion	diuretic (kidney diseases and edema) (1)	1
<i>Sambucus nigra</i> L.	dziki bez czarny	Fl, Ba, Lf	infusion, as tea	diuretic (urethritis) (10), spasmolytic (8)	10
<i>Viburnum opulus</i> L.	kalina koralowa	Ba	infusion (used in blends)	spasmolytic (4)	4
Amaryllidaceae					
<i>Allium ursinum</i> L.	czosnek niedźwiedzi	Lf	fresh	anti-inflammatory (urethritis, cystitis) (1)	1
Apiaceae					
<i>Aegopodium podagraria</i> L.	podagrycznik pospolity	AP	infusion	analgesic (kidney pain) (3)	3
<i>Ammi visnaga</i> (L.) Lam.	aminek egipski	Fr	decoction (used in blends)	spasmolytic (ureteral contractions, tenesmus, preventive in urolithiasis) (1)	1
<i>Anethum graveolens</i> L.	koper ogrodowy	Fr	decoction, as tea	diuretic and spasmolytic (3)	3
<i>Angelica archangelica</i> L.	dziegieł litwor	Ro	decoction (used in blends)	diuretic and spasmolytic (3)	4
<i>Apium graveolens</i> L.	seler zwyczajny	Lf, Ro	infusion, as tea, ethanolic extract	diuretic (ischuria, cystitis, urinary stones, edema) (21), antiseptic (8)	22

^a Number of informants who cited the properties are indicated in the brackets. Sometimes rural informants only knew the name of the plant used, but did not know its properties.

Plant parts: AP, aerial parts; Ba, bark; Fl, flower; FS, flowering shoots; Fr, fruit; In, inflorescence; JB, juniper berry; LS, leaf stalk; Lf, leaf; Rz, rhizome; Ro, root; Se, seed; Sp, spores; WP, whole plant;

If the plant is used only in mixtures, it is written in brackets - (used in blends).

Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
<i>Carum carvi</i> L.	kminek zwyczajny	Fr	decoction, as tea	diuretic (5)	5
<i>Daucus carota</i> L.	marchew zwyczajna	Ro	fresh	diuretic (edema) (1)	1
<i>Foeniculum vulgare</i> Mill.	koper włoski	Fr	fresh, decoction, as tea	diuretic (2)	2
<i>Levisticum officinale</i> W.D.J.Koch	lubczyk ogrodowy	Ba, Fr, Lf	decoction (used in blends)	diuretic (cystitis, dysuria) (7), antiseptic (2)	7
<i>Petroselinum crispum</i> (Mill.) Fuss	pietruszka zwyczajna	WP	fresh, decoction, infusion	diuretic (ischuria, cystitis, urinary stones, edema) (23), spasmolytic (5), antiseptic (2)	23
<i>Pimpinella saxifraga</i> L.	biedrzeniec mniejszy	AP, Ro	decoction (used in blends)	diuretic (2)	2
Araliaceae					
<i>Hedera helix</i> L.	bluszcz pospolity	Lf	infusion	anti-inflammatory (kidney stones) (1)	1
Aristolochiaceae					
<i>Asarum europaeum</i> L.	kopytnik pospolity	Rz	decoction	analgesic (cystitis, edema); decoction (1)	1
Asparagaceae					
<i>Asparagus officinalis</i> L.	szparag lekarski	Rz	decoction	diuretic (urinary stones) (4)	4
<i>Convallaria majalis</i> L.	konwalia majowa	AP	decoction, infusion	diuretic (1)	1
<i>Maianthemum bifolium</i> (L.) F.W.Schmidt	konwalijka dwulistna	AP	infusion	diuretic (1)	1

^a Number of informants who cited the properties are indicated in the brackets. Sometimes rural informants only knew the name of the plant used, but did not know its properties.

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Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
Berberidaceae					
<i>Berberis vulgaris</i> L.	berberyś	Fr	infusion (used in blends)	diuretic (3)	3
Betulaceae					
<i>Betula pendula</i> Roth	brzoza brodawkowata	Lf	infusion, as tea, ethanolic extract	diuretic (cystitis, urinary stones) (19), antiseptic (2), anti-inflammatory (prostatitis) (5), analgesic (1)	19
<i>Betula pubescens</i> Ehrh.	brzoza omszona	Lf	infusion	diuretic and anti-inflammatory, (cystitis) (2)	3
Boraginaceae					
<i>Borago officinalis</i> L.	ogórecznik lekarski	AP	decoction (used in blends)	diuretic (4)	4
<i>Pulmonaria officinalis</i> L. s. str.	miodunka plamista	AP	decoction (used in blends)	diuretic (2)	2
Brassicaceae					
<i>Capsella bursa-pastoris</i> (L.) Medik.	tasznik pospolity	AP	infusion (used in blends)	(hematuria) (1)	1
<i>Raphanus raphanistrum</i> subsp. <i>sativus</i> (L.) Domin	rzodkiew świrzepa	Ro	fresh	diuretic (bladder diseases) (1)	1
Cannabaceae					
<i>Humulus lupulus</i> L.	chmiel zwyczajny	Fl	decoction	diuretic (cystitis) (3)	3
Caryophyllaceae					

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Plant parts: AP, aerial parts; Ba, bark; Fl, flower; FS, flowering shoots; Fr, fruit; In, inflorescence; JB, juniper berry; LS, leaf stalk; Lf, leaf; Rz, rhizome; Ro, root; Se, seed; Sp, spores; WP, whole plant;

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Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
<i>Herniaria glabra</i> L.	połonicznik nagi	AP	decoction, infusion (used in blends), ethanolic extract	diuretic (12), spasmolytic and antiseptic (6)	13
<i>Herniaria hirsuta</i>	połonicznik kosmaty	AP	decoction (used in blends)	diuretic, spasmolytic (1)	1
<i>Saponaria officinalis</i> L.	mydlnica lekarska	Ro	decoction (used in blends)	diuretic (4)	4
<i>Silene vulgaris</i> (Moench) Garcke	lepnica rozdęta	Lf, Fl	infusion	diuretic (ischuria) (5)	5
<i>Stellaria media</i> (L.) Vill.	gwiazdnica pospolita	AP	infusion (used in blends)	diuretic and anti-inflammatory (urethritis, cystitis) (2)	2
Compositae					
<i>Achillea millefolium</i> L.	krwawnik pospolity	AP	infusion	analgesic (bladder and kidney diseases) (4)	4
<i>Arctium lappa</i> L.	łopian większy	Ro	decoction (used in blends), ethanolic extract, oil	diuretic (20), anti-inflammatory (BPH) (1), antiseptic (1)	20
<i>Artemisia vulgaris</i> L.	bylica pospolita	AP	decoction	diuretic (2)	3
<i>Bellis perennis</i> L.	stokrotka pospolita	AP	infusion, as tea	diuretic (urinary stones) (4)	5
<i>Bidens tripartita</i> L.	uczep trójlistkowy	AP	infusion	diuretic (ischuria, urinary stones) (7)	8
<i>Calendula officinalis</i> L.	nagietek lekarski	In	decoction, infusion	spasmolytic and anti-inflammatory (7)	7

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Plant parts: AP, aerial parts; Ba, bark; Fl, flower; FS, flowering shoots; Fr, fruit; In, inflorescence; JB, juniper berry; LS, leaf stalk; Lf, leaf; Rz, rhizome; Ro, root; Se, seed; Sp, spores; WP, whole plant;

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Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
<i>Carlina acaulis</i> L.	dziewięćsił bezłodygowy	Ro	decoction	diuretic and anti-inflammatory (ischuria, urethritis, cystitis) (1)	1
<i>Centaurea benedicta</i> (L.) L.	drapacz lekarski	AP	infusion (used in blends)	diuretic (4)	5
<i>Chamaemelum nobile</i> (L.) All.	rumian szlachetny	In	infusion	spasmolytic (2), diuretic (2), anti-inflammatory (1)	3
<i>Cichorium intybus</i> L.	cykoria podróżnik	Ro	decoction (used in blends)	diuretic (ischuria) (4)	4
<i>Cirsium oleraceum</i> (L.) Scop.	ostrożeń warzywny	WP	decoction	diuretic (1)	1
<i>Cyanus segetum</i> Hill	chaber bławatek	Fl	infusion, as tea	diuretic (kidney/bladder diseases) (15)	15
<i>Helichrysum arenarium</i> (L.) Moench	kocanka piaskowa	In	decoction, infusion	spasmolytic (1), diuretic (4), anti-inflammatory (3)	4
<i>Inula helenium</i> L.	oman	Ro	decoction	diuretic (7)	7
<i>Matricaria chamomilla</i> L.	rumianek pospolity	In	infusion, as tea	anti-inflammatory (nephritis, urethritis, cystitis) (22), antiseptic (3)	22
<i>Onopordum acanthium</i> L.	popłoch pospolity	Lf	infusion (used in blends)	anti-inflammatory (inflammation of the urinary tract) (6)	6
<i>Solidago virgaurea</i> L.	nawłoć pospolita	FS	decoction (used in blends)	diuretic and anti-inflammatory (kidney stones, inflammation of the urinary tract) (21)	21

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Plant parts: AP, aerial parts; Ba, bark; Fl, flower; FS, flowering shoots; Fr, fruit; In, inflorescence; JB, juniper berry; LS, leaf stalk; Lf, leaf; Rz, rhizome; Ro, root; Se, seed; Sp, spores; WP, whole plant;

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Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
<i>Taraxacum campylodes</i> G.E.Haglund	mniszek lekarski	Ro	decoction	diuretic (edema) (5)	5
Cucurbitaceae					
<i>Bryonia alba</i> L.	przestęp biały	Ro	decoction	diuretic (edema) (1)	1
Cupressaceae					
<i>Juniperus communis</i> L.	jałowiec pospolity	JB	decoction, infusion, ethanolic extract	diuretic (urinary diseases, hematuria, edema) (22), antiseptic (4)	22
Equisetaceae					
<i>Equisetum arvense</i> L.	skrzyp polny	AP	decoction, dry powder	diuretic (kidney stones, urine retention) 16	19
Ericaceae					
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	mącznica lekarska	Lf	decoction	antiseptic (kidney stones, inflammation of the urinary tract) (23)	23
<i>Calluna vulgaris</i> (L.) Hull	wrzos zwyczajny	Fl	decoction, infusion	antiseptic and diuretic (11), anti-inflammatory (5)	16
<i>Chimaphila umbellata</i> (L.) Nutt.	pomocnik baldaszkowaty	AP	infusion	diuretic (inflammation of the urinary trac) (5)	5
<i>Vaccinium microcarpum</i> (Turcz. ex Rupr.) Schmalh.	żurawina drobnoowocowa	Fr	decoction, infusion, juice	diuretic and antiseptic (9)	14
<i>Vaccinium myrtillus</i> L.	borówka czarna	Lf, Fr	decoction, fresh fruit	diuretic (12)	12

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Plant parts: AP, aerial parts; Ba, bark; Fl, flower; FS, flowering shoots; Fr, fruit; In, inflorescence; JB, juniper berry; LS, leaf stalk; Lf, leaf; Rz, rhizome; Ro, root; Se, seed; Sp, spores; WP, whole plant;

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Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
<i>Vaccinium vitis-idaea</i> L.	borówka brusznica	Lf, Fr	decoction, fruit juice	diuretic and antiseptic (kidney stones, inflammation of the urinary tract) (14)	17
Fabaceae					
<i>Ononis spinosa</i> L.	wilżyna ciernista	Ro	decoction (used in blends)	diuretic (inflammation of the urinary tract, urinary stones) (11), antiseptic (2), BPH (2)	15
Fagaceae					
<i>Quercus robur</i> L.	dąb szypułkowy	Ba	decoction (used in blends)	anti-inflammatory (urethritis, cystitis) (6)	6
Grossulariaceae					
<i>Ribes nigrum</i> L.	porzeczka czarna	AP, Fr	infusion, juice, as tea	diuretic and anti- inflammatory (kidney stones, cystitis, kidney diseases) (4)	4
Hypericaceae					
<i>Hypericum perforatum</i> L.	dziurawiec zwyczajny	AP	decoction, infusion, as tea	diuretic (kidney diseases) (2)	2
Lamiaceae					
<i>Elsholtzia ciliata</i> (Thunb.) Hyl.	marzymiąta grzebieniasta	AP	infusion (used in blends)	diuretic (ischuria) (1)	1
<i>Hyssopus officinalis</i> L.	hyzop lekarski	AP	decoction (used in blends)	diuretic (1)	1
<i>Lamium album</i> L.	jasnota biała	Fl	infusion (used in blends)	anti-inflammatory (urethritis, cystitis) (3)	3

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Plant parts: AP, aerial parts; Ba, bark; Fl, flower; FS, flowering shoots; Fr, fruit; In, inflorescence; JB, juniper berry; LS, leaf stalk; Lf, leaf; Rz, rhizome; Ro, root; Se, seed; Sp, spores; WP, whole plant;

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Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
<i>Rosmarinus officinalis</i> L.	rozmaryn lekarski	Lf	decoction	spasmolytic and diuretic (5)	6
Leguminosae					
<i>Anthyllis vulneraria</i> L.	przelot pospolity	Fl	decoction, infusion (used in blends)	" blood cleansing" (1)	2
<i>Cytisus scoparius</i> (L.) Link	żarnowiec miotlasty	AP	decoction (used in blends)	diuretic (edema) (1)	2
<i>Genista tinctoria</i> L.	janowiec barwierski	FS	infusion (used in blends)	diuretic (kidney diseases and edema, bladder stones) (11)	11
<i>Glycyrrhiza glabra</i> L.	lukrecja gładka	Ro	decoction, infusion (used in blends)	diuretic (kidney diseases) (3)	4
<i>Ononis spinosa</i> L.	wilżyna ciernista	Ro	decoction (used in blends)	diuretic (kidney/bladder stones) (10)	14
<i>Phaseolus vulgaris</i> L.	fasola zwyczajna	husk	cold water extract	diuretic and antiurolithiatic (7)	9
<i>Robinia pseudoacacia</i> L.	robinia akacjowa	Fl	decoction	diuretic (1)	1
<i>Trifolium arvense</i> L.	koniczyna polna	AP	infusion	diuretic (edema) (1)	1
<i>Trigonella caerulea</i> (L.) Ser.	kozieradka błękitna	AP	infusion	diuretic (5)	6
Lycopodiaceae					
<i>Lycopodium clavatum</i> L.	widłak goździsty	Sp	aqueous suspension	diuretic (cystitis, bladder/kidney stones) (8)	10
Malvaceae					

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<i>Tilia platyphyllos</i> Scop.	lipa szerokolistna	Fl, Lf	infusion, as tea	diuretic (bladder and kidney diseases) (2)	3
Oleaceae					
<i>Fraxinus excelsior</i> L.	jesion wyniosły	Ba, Lf	decoction, infusion	diuretic, anti-inflammatory (urethritis, cystitis) (1)	1
Onagraceae					
<i>Epilobium angustifolium</i> L.	wierzbówka kiprzyca	AP	infusion	anti-inflammatory (BPH) (11)	12
<i>Epilobium parviflorum</i> Schreb.	wierzbownica drobnokwiatowa	AP	infusion	anti-inflammatory (BPH) (11)	12
Papaveraceae					
<i>Chelidonium majus</i> L.	glistnik jaskólcze ziele	WP	infusion	spasmolytic (6) diuretic (edema) (3)	6
<i>Fumaria officinalis</i> L.	dymnica pospolita	AP	infusion (used in blends)	diuretic (bladder diseases) (3)	3
Plantaginaceae					
<i>Linaria vulgaris</i> Mill.	lnica pospolita	AP	decoction, infusion (used in blends)	diuretic (2)	2
<i>Plantago lanceolata</i> L.	babka lancetowata	AP	infusion, ethanolic extract	anti-inflammatory (cystitis) (6)	7
<i>Plantago major</i> L.	babka zwyczajna	AP, Lf	infusion	diuretic (urological diseases) (4)	7
<i>Veronica officinalis</i> L.	przetacznik leśny	AP	decoction (used in blends)	diuretic (6)	6

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If the plant is used only in mixtures, it is written in brackets - (used in blends).

Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
Poaceae					
<i>Briza media</i> L.	drążczka średnia	AP	infusion	diuretic (bladder pain) (1)	1
<i>Elymus repens</i> (L.) Gould	perz właściwy	Rz	decoction, infusion	diuretic (edema, urinary stones) (21), fungistatic (1)	23
<i>Zea mays</i> L.	kukurydza zwyczajna	stigma	infusion	diuretic (15), anti-inflammatory (1), antiurolithiatic (4)	17
Polygonaceae					
<i>Persicaria hydropiper</i> (L.) Delarbre	rdest ostrogorzki	AP	decoction (used in blends)	diuretic (11), antiseptic (3)	18
<i>Polygonum aviculare</i> L.	rdest ptasi	AP	infusion (used in blends)	diuretic (edema, kidney diseases/stones, cystitis) (15)	17
<i>Polygonum bistorta</i> L.	rdest wężownik	AP	infusion (used in blends)	diuretic (3), anti-inflammatory (urethritis, cystitis, hematuria) (3)	3
<i>Rumex acetosa</i> L.	szczaw zwyczajny	Lf	infusion	diuretic (6)	6
Polypodiaceae					
<i>Polypodium vulgare</i> L.	paprotka zwyczajna	Rz	infusion	diuretic (kidney diseases) (1)	1
Primulaceae					
<i>Adonis vernalis</i> L.	miłek wiosenny	AP	infusion (used in blends)	diuretic (2)	2
<i>Anagallis arvensis</i> L.	kurzyślad polny	AP	infusion	diuretic (kidney stones) (3)	3

^a Number of informants who cited the properties are indicated in the brackets. Sometimes rural informants only knew the name of the plant used, but did not know its properties.

Plant parts: AP, aerial parts; Ba, bark; Fl, flower; FS, flowering shoots; Fr, fruit; In, inflorescence; JB, juniper berry; LS, leaf stalk; Lf, leaf; Rz, rhizome; Ro, root; Se, seed; Sp, spores; WP, whole plant;

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Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
Ranunculaceae					
<i>Nigella sativa</i> L.	czarnuszka siewna	Se	infusion	diuretic, anti-inflammatory (urethritis, cystitis) (2)	2
Rhamnaceae					
<i>Frangula alnus</i> Mill.	kruszyna pospolita	Ba	decoction	diuretic, anti-inflammatory (urethritis, cystitis) (2)	3
Rosaceae					
<i>Agrimonia eupatoria</i> L.	rzepik pospolity	AP	decoction (used in blends)	diuretic (7)	7
<i>Crataegus laevigata</i> (Poir.) DC.	głóg dwuszyjkowy	Fr	decoction (used in blends)	spasmolytic and diuretic (5)	5
<i>Filipendula ulmaria</i> (L.) Maxim.	wiązówka błotna	Fl	infusion	diuretic, anti-inflammatory (urethritis, cystitis) (2)	2
<i>Fragaria vesca</i> L.	poziomka pospolita	AP, Fr	decoction, as tea	diuretic (kidney/bladder stones) (4)	4
<i>Potentilla anserina</i> L.	pięciornik gęsi	AP	infusion	anti-inflammatory, diuretic (edema) (4)	7
<i>Prunus avium</i> (L.) L.	wiśnia ptasia	LS	infusion (used in blends)	diuretic (urinary stones) (1)	1
<i>Prunus spinosa</i> L.	śliwa tarnina	Fl	decoction, infusion, as tea	diuretic, anti-inflammatory (ischuria, urinary tract infections) (2)	2
<i>Rosa canina</i> L.	róża dzika	Fr, Se	decoction, as tea	diuretic (kidney stones) (3)	3

^a Number of informants who cited the properties are indicated in the brackets. Sometimes rural informants only knew the name of the plant used, but did not know its properties.

Plant parts: AP, aerial parts; Ba, bark; Fl, flower; FS, flowering shoots; Fr, fruit; In, inflorescence; JB, juniper berry; LS, leaf stalk; Lf, leaf; Rz, rhizome; Ro, root; Se, seed; Sp, spores; WP, whole plant;

If the plant is used only in mixtures, it is written in brackets - (used in blends).

Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
<i>Rubus caesius</i> L.	jeżyna popielica	Ro	decoction	diuretic (1)	1
<i>Sanguisorba officinalis</i> L.	krwiściąg lekarski	Rz, Ro	decoction, wine extract	antihaemorrhagic (hematuria) (2)	2
<i>Sorbus aucuparia</i> L.	jarząb pospolity	Fr, Fl	infusion, jam	diuretic (urinary stones) (2)	2
Rubiaceae					
<i>Asperula odorata</i> (<i>Galium odoratum</i>)	marzanka wonna	AP	infusion (used in blends)	antiurolithiatic (3)	5
<i>Galium aparine</i> L.	przytulia czepna	AP	decoction, infusion	diuretic (kidney stones) (5)	8
<i>Galium odoratum</i> (L.) Scop.	przytulia wonna	AP	decoction, infusion	diuretic, spasmolytic (5)	8
<i>Rubia tinctorum</i> L.	marzana barwierska	AP, Rz	ethanolic extract, dry powder	antiurolithiatic, spasmolytic, antiseptic (3)	8
Rutaceae					
<i>Ruta graveolens</i> L.	ruta zwyczajna	Lf	infusion	diuretic (edema) (1)	2
Salicaceae					
<i>Populus nigra</i> L.	topola czarna	Ge	decoction	diuretic (2)	3
<i>Salix alba</i> L.	wierzba biała	Ba	decoction	diuretic and analgesic (urinary stones) (13)	17
Urticaceae					
<i>Urtica dioica</i> L.	pokrzywa zwyczajna	WP	infusion, as tea, juice, fresh	diuretic (urinary stones, cystitis) (23)	23
<i>Urtica urens</i> L.	pokrzywa żegawka	WP	infusion, as tea	diuretic (19)	19

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If the plant is used only in mixtures, it is written in brackets - (used in blends).

Species full name by family	Polish name	Parts used	Method of preparation	Properties ^a	No of citations
Verbenaceae					
<i>Verbena officinalis</i> L.	werbena pospolita	Lf	infusion (used in blends)	diuretic (urinary stones, nephritis, cystitis) (7)	9
Violaceae					
<i>Viola tricolor</i> L.	fiołek trójbarwny	AP	infusion, as tea	diuretic and anti-inflammatory (cystitis) (23)	23

^a Number of informants who cited the properties are indicated in the brackets. Sometimes rural informants only knew the name of the plant used, but did not know its properties.

Plant parts: AP, aerial parts; Ba, bark; Fl, flower; FS, flowering shoots; Fr, fruit; In, inflorescence; JB, juniper berry; LS, leaf stalk; Lf, leaf; Rz, rhizome; Ro, root; Se, seed; Sp, spores; WP, whole plant;

If the plant is used only in mixtures, it is written in brackets - (used in blends).

Table 2
Most common urological diseases diagnosed and treated by traditional healers in Podkarpackie Voivodeship

Disease(s)	Percent (%)
Urinary tract infections (UTI; total)	62.7
• asymptomatic bacteriuria	2.1
• urethritis	16.5
• cystitis	37.8
• prostatitis	6.3
Urolithiasis (total)	10.5
• with UTI	8.4
Benign prostatic hyperplasia (total)	26.8
• with UTI	7.8

Figures

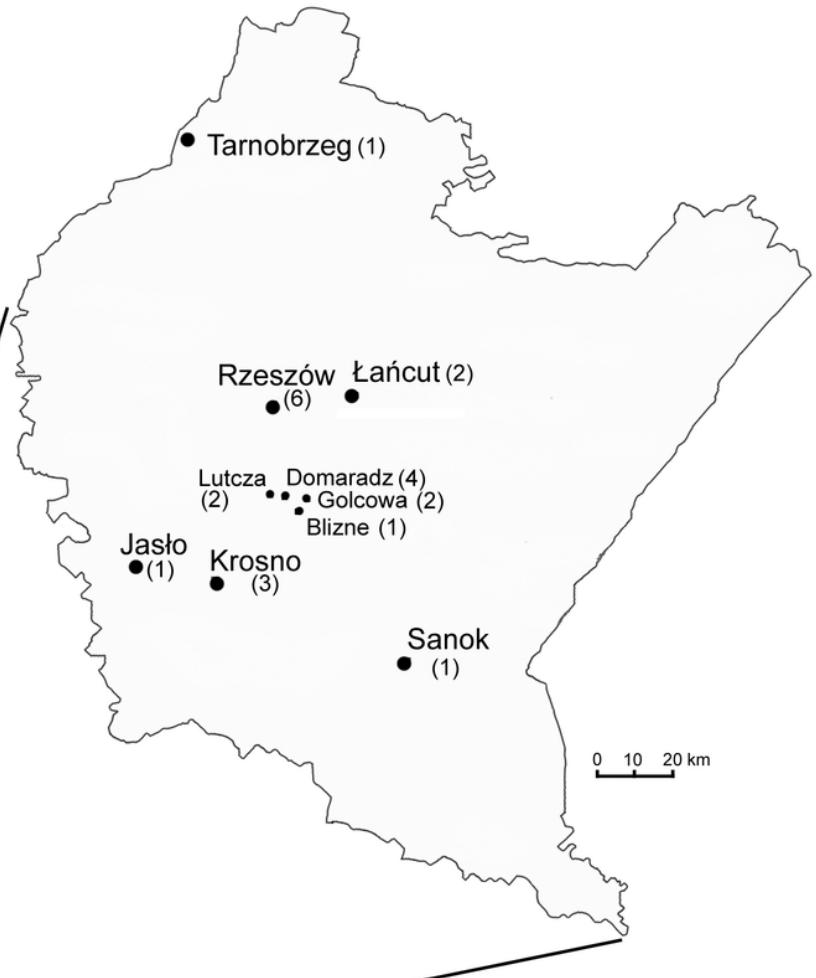


Figure 1

Map of Europe showing the location of Poland and places in Podkarpackie Voivodeship visited during research. The numbers in brackets indicate the number of informers from a given city who took part in the survey. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.