

Medical plants on the territory of Petrohan Training and Experimental Forest Range, Bulgaria

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Summary

Medicinal plants are an important component of local plant diversity. Their study is of high scientific and practical significance, related to the conservation and sustainable use of their resources. The present study presents results of the inventory of medicinal plants on the territory of the Petrohan Training and Experimental Forest Range (Western Stara Planina, Bulgaria). A total of 140 species of medicinal vascular plants belonging to 113 genera and 53 families were recorded. The systematic structure of the studied plants is characterized and the classification of plant species according to biological type, life form and geoelement is presented. The information on the usable parts of the medicinal plants and the biologically active substances contained as well as medicinal action are presented. Specifying species composition and resource status will contribute to assessment of medicinal plants as an ecosystem service offered by forest communities. A list of medicinal plants on the territory of the Petrohan Training and Experimental Forest Range is presented, too.

Key words

medicinal plants, systematics, floristic analyze, drugs, biologically active substances

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Introduction

Since ancient times people have been using many plants as medicine, food and spice. In recent years many biologically active substances (BAS) have been discovered and documented in plants (Nikolov, 2007). The knowledge of ingredients such as: alkaloids, glucosides, saponins, coumarins, essential oils and others is becoming more and more extensive due to the improvement of research methods. Medicinal plants occupy an increasingly important place in the treatment and prophylaxis of various diseases; either alone or as an additional means of conventional therapy (Nikolov, 2007).

Researches on medicinal plants in Bulgaria begin in 1944. Prof. P. Nikolov and A. Boichinov are the first pioneers in this field (Stoyanov, 1972). Later, a number of authors deal with the study of medicinal plants, giving information on the morphological characteristics of the species, distribution, usable part, time and method of gathering and drying, quality requirements, storage, content and use (Stoyanov, 1972, 1973; Ivanov et al., 1973; Petkov, 1982; Asenov, 1998; Bondev et al., 1983; Ganeva et al., 2006; Lyubenova et al., 2006; Ivanov, 2007; Ivanova, 2009; Kaniskov, 2011; Zahariev et al., 2016). Along with the beneficial properties of the plants, poisonous substances are studied as well (Vodenicharov and Petrov, 2001). The medicinal plants find their place in the education of specialists in pharmacy (Nikolov, 2007) and veterinary medicine (Radanova, 2011). Ecological characteristics of the species of medicinal plants in Bulgarian reserves were presented by Koev et al. (2014), different types of habitats by Nedelcheva and Pavlova (2006), species of Bulgarian medicinal dendroflora by Tashev and Tsavkov (2008) and of the whole Bulgarian medicinal flora by Vitkova and Tashev (2007) and Tashev (2017).

The opportunities for sustainable management of wild medicinal plants in Bulgaria, including these in national parks, are discussed in several plenary scientific publications: Hardalova et al. (1994), Evstatieva and Hardalova (2000), Gusev (2005), Evstatieva et al. (2007). These publications outline the basic requirements for the characterization and resource evaluation of wild growing medicinal plants in and outside protected areas (Vitkova and Delcheva, 2014).

Internationally, medicinal plants are also the subject of numerous studies. World Health Organization has developed series of monographs on selected medicinal plants, which aim to provide scientific information on the safety, efficacy, and quality control of widely used medicinal plants; provide models to assist Member States in developing their own monographs or formularies for these and other herbal medicines; and facilitate information exchange among Member States. Each monograph follows a standard format with information presented in two parts followed by a reference list. The first part presents pharmacopoeias summaries for quality assurance. The second part includes sections on medicinal uses, pharmacology, safety issues, and dosage forms (WHO, 1999).

Golovkin et al. (2001) developed monography containing information on more than 1500 biologically active substances of plant origin and their occurrence in 6500 plant species of higher plants from the whole world.

Medicinal and aromatic plants are offered in a wide variety of products on the market. However, utilization and commerce of wild plant resources should not be detrimental, but the increasing commercial collection, largely unmonitored trade, and habitat loss lead to an incomparably growing pressure on plant populations in the wild. In this relation Lange (2004) discusses geographical origin, wild-collection, trade volumes, threat factors, threatened species, conservation concepts and trade monitoring.

During floristic studies, medicinal and poisonous plants often receive special attention. For example during the floristic research of different habitat types of Plešivica hills, Croatia, 186 species were described as well as their life form, duration of life, phytogeographical elements, time of flowering (Purgar et al., 2017). Dihoru and Boruz (2014) discusses the main naturally occurring medicinal plants in Romania.

Kathe et al. (2003) reviewed medicinal and aromatic plants in Albania, Bosnia-Herzegovina, Bulgaria, Croatia and Romania. They studied their collection, trade, relevant legislation and the potential of use for financing nature conservation and protected areas.

In the present study, the territorial scope of the survey is the Petrohan Training and Experimental Forest Range (TEFR). It is a base for educational and research activities of the University of Forestry in Sofia. The study of the medicinal plants on the territory of the Range will contribute to highlighting an important way of use of plants to the students in the fields of Forestry, Ecology, Agronomy, Veterinary Medicine, Landscape Architecture, as well as to other visitors, demonstrating the richness, recognition and the benefits of the medicinal species located on the territory of the Range. Moreover, some of those plants are a livelihood for the local population.

Additional literature review on some medicinal plants can be found in Pavlov, Dimitrov (2003), Savev (2004) and Dimitrova (2015).

The purpose of the present study is to make a detailed inventory of the medicinal vascular plant species on the territory of the range and to provide information about their systematic structure, distribution by biological types, floristic elements as well as of the usable parts, content of BAS and their medicinal effects.

Material and methods

The studies were conducted in plant communities in the territory of Petrohan TEFR. It is located on the north-eastern slopes of Western Balkan Range, Bulgaria. Its total area is 7192 ha. The relief of the range is typically mountainous, steep, with deeply cut river valleys and steep minor ridges. The lowest point of the range is at an altitude of 350 m and the highest point is at an altitude of 1900 m. The high proportion of the forest area (88.5%) is located in the middle-mountain forest zone, containing beech and coniferous trees (600-1800 m) (Forest Management project, 2016). The region belongs to the temperate climatic zone. The soils are mainly Cambisols, CM (WRB, 2006).

Species identification was carried out according to the "Guide of Vascular Plants in Bulgaria" (Delipavlov et al., 2011) and Flora of Republic Bulgaria, vol. I-XI (Stoyanov et al., 1966; Jordanov,

1963, 1964, 1966, 1970, 1973, 1976, 1979; Velchev 1982, 1989; Kozuharov 1995; Peev 2012). The life forms were identified according to Raunkiaer (1934) and for floral elements the classification of Walter (Assyov and Petrova, 2012) was used.

The routing method was applied to the territories. The observations were made along different transects in the Petrohan TEFR (Figure 1).

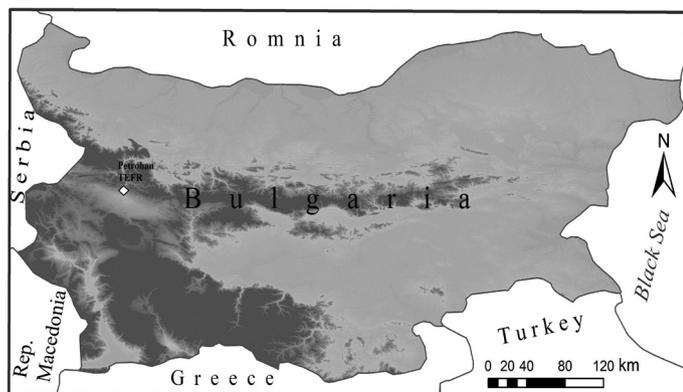


Figure 1. Object of investigation (The boundary is outlined on the base of SRTM digital elevation model (NASA JPL, 2013).

Results

As a result of the field surveys and the literature review conducted, 226 vascular plant species have been recorded on the territory of the Petrohan TEFR, of which 140 are listed in the Medicinal Plants Act (Sate Gazette, 2000; 2017). A list of the recorded medicinal plants is presented in Table 1.

The identified 140 vascular medicinal plant species belong to 113 genera and 53 families (Table 2). The established species constitute 3.5% of the Bulgarian flora.

The families Rosaceae (12 species), Lamiaceae (11 species),

Fabaceae (11 species) and Asteraceae (10 species) are presented with the largest number of species, which could be expected as these families are among the richest ones in the Bulgarian flora. *Sorbus* L., *Potentilla* L. and *Rubus* L. are among the richest genera in species in the family Rosaceae. From this family, *Crataegus monogyna* Jacq. and *Fragaria vesca* L. were found most frequently. From the family Lamiaceae, *Salvia glutinosa* L., *Clinopodium vulgare* L. and *Lamium purpureum* L. were the most frequent species. *Fabaceae* family was represented with 11 species from six genera on the investigated territory. *Vicia grandiflora* Scop., *Lathyrus pratensis* L. and *Trifolium pratense* L. are typical for the herbaceous communities. Other families, richer in species were Ranunculaceae (nine species) and Scrophulariaceae family (six species). *Anemone nemorosa* L. and *Veronica officinalis* L. were the most common from these two families, respectively. Most of the families were presented with one to two species, e.g. Hypolepidiaceae family (*Pteridium aquilinum* (L.) Kuhn.), Urticaceae family (*Urtica urens* L.), Valerianaceae family (*Valeriana officinalis* L.) and others.

The presence of species with any kind of restrictions for collection and use was low (4% of all medicinal plants). This category was presented by five plants. *Dryopteris filix-mas* (L.) Schott, *Lilium martagon* L., *Scilla bifolia* L. and *Orchis morio* L. and was included in Annex 4 of Biodiversity Act (2002, 2017). The species of this annex are under conservation and regulated use from natural populations. *Platanthera bifolia* (L.) L. C. Rich and *Orchis morio* L. are included in Annex 2 of Convention for international trade with endangered species of wild flora and fauna (CITES, 1973).

Despite of the presence of some anthropogenic pressure in the region due to gathering of mushrooms and other activities related with the logging, cuttings and nearness of settlements, ruderal species were relatively few: *Stellaria media* (L.) Vill., *Geum urbanum* L., *Capsella bursa-pastoris* (L.) Medic. and *Convolvulus arvensis* L. (Petrova and Vladimirov, 2002); 3% of obtained medicinal plants belong to the group of ruderal species.

Table 1. Medicinal plants on the territory of Petrohan TEFR, Bulgaria

Species	Drug	Content	Activity
<i>Abies alba</i> Mill.	young tips of branches, leaves, essential oil	vitamin C, maltol, lauricinic acid, antioxidative polyphenols, essential oils	anti-inflammatory; antioxidant
<i>Acer platanoides</i> L.	leaves, seeds, sap	tannins, sugars, fatty oil	in cases of kidney disease
<i>Achillea millefolium</i> L.*	aerial part	essential oil, achilein, tannins, resins	haemostatic, anti-inflammatory, carminative
<i>Actaea spicata</i> L.*	roots	benzoic acids, cardiogenic toxins, isoquinoline alkaloids magnoflorine, corytubrine; triterpene glycosides including actein, trans-aconic acid	sedative effect on cardiac muscle tissue, against rheumatism, inflammation, nerve diseases, lumbago, scrofula, chorea
<i>Alnus glutinosa</i> (L.) Gaertn.	fruits, leaves, bark	tannins, phenolic acids, triterpenes	antidiarrheal, astringent
<i>Alliaria petiolata</i> (Bieb.) Cavara et Grande.	leaves	glucosinolates, allylisothiosyanate	antiasmthic, antiseptic, vermifuge
<i>Allium ursinum</i> L.	bulbs, leaves	essential oil with vinyl sulphide, allicin	atherosclerosis, intestinal disorders
<i>Anemone nemorosa</i> L.*	arial part	saponin ranunculin, anthocyanins	soporific; in cases of insomnia, migraine, neurosis, hypotensive
<i>Anemone ranunculoides</i> L.*	arial part	saponin ranunculin, anthocyanins	soporific; in cases of insomnia, migraine, neurosis, hypotensive

Species	Drug	Content	Activity
<i>Anthoxanthum odoratum</i> L.	arial part	coumarins, essential oil, silicic acid	chest diseases; fodder
<i>Artemisia vulgaris</i> L.	arial part, roots	essential oil, lactones	appetite stimulant, sedative, haemostatic
<i>Arum maculatum</i> L.*	tubers	polyureas, flavonoids, coumarins	anti-inflammatory on the digestive tract
<i>Asarum europaeum</i> L.*	arial part, rhizomes	essential oil with azaron, alkaloids, mucous substances	expectorant, diuretic, sedative
<i>Astrantia major</i> L.*	rhizome with roots	amino acid, essential oil	diuretic, purgative
<i>Athyrium filix-femina</i> (L.) Roth *	rhizomes, leaves	thiaminase	vermifugal, diuretic
<i>Atropa bella-donna</i> L.*	leaves, roots	tropane alkaloids, atropine, coumarins	spasmolytic, mydriatic
<i>Bellis perennis</i> L.	flowers	saponins, mucuos, essential oil	antitussive; inflammatory skin diseases
<i>Briza media</i> L.	arial part	flavonoids, astragalin	holagogue, spasmolytic
<i>Calystegia sepium</i> (L.) R.Br.*	roots	alkaloids	antipyretic, hypotensive
<i>Capsella bursa-pastoris</i> (L.) Medic.	arial part	glucoside isopin, flavonoids, fruit and phenolic acids	urethonic, haemostatic
<i>Cardamine bulbifera</i> (L.) Crantz	rhizomes	—	treatment of: heart, stomach
<i>Carpinus betulus</i> L.	bark, leaves	tannins	anticancer effect
<i>Chamaecytisus supinus</i> (L.) Link *	arial part	alkaloids	blood purification, rheumatism
<i>Chamaespartium sagittale</i> (L.) P. Gibbs	arial part	—	against gout
<i>Chelidonium majus</i> L.*	arial part	alkaloids, helidonic acid	holagogue, spasmolytic
<i>Clematis vitalba</i> L.*	leaves, roots, flowers	essential oil, saponins, anemonine	against dermatitis
<i>Clematis recta</i> L.*	leaves	anemonine, protoanemonin, clematitol	bactericid, fungicid
<i>Clinopodium vulgare</i> L.	arial part	tannins, flavonoids, essential oils	vulnerary, antiviral, anti-inflammatory, early-healing
<i>Convolvulus arvensis</i> L.	arial part	glycoside resins, tannins, flavonoids	laxative, diuretic
<i>Cornus mas</i> L.	fruits	sugars, pectin, organic acids, vitamin C	astringent
<i>Corydalis bulbosa</i> (L.) DC.*	tubers	alkaloids	soporific, sedative
<i>Corydalis solida</i> (L.) Swartz.*	tubers	alkaloids	soporific, sedative
<i>Corylus avellana</i> L.	leaves, bark	flavons	coronarodilator
<i>Cotinus coggygria</i> Scop.	leaves	galatanines, essential oil	astringent, anti-inflammatory
<i>Crataegus monogyna</i> Jacq.	flowers with leaves, fruits	flavonoids, saponins	ischaemic heart disease
<i>Cruciata laevipes</i> Opiz.	leaves	asperulosid	anti-rheumatic
<i>Cichorium inthybus</i> L.	arial part, roots	inulin, glucosides - intibine, cychorin, resins, protein substances	appetite stimulant, facilitates digestion for liver and bile problems
<i>Digitalis grandiflora</i> Mill.*	leaves	glucoside digitoxin, saponins, flavonoids	diuretic, regulates the rhythm of the heart muscle
<i>Digitalis lanata</i> Ehrh.*	leaves	glucosides, saponins	for heart failure
<i>Dryopteris filix-mas</i> (L.) Schott*	rhizomes, leaves	crude phyllicin, crystalline substances, fatty oil	vermifuge
<i>Erodium cicutarium</i> (L.) L'Her.	arial part	tannins, flavone, vitamin C	haemostatic; forage
<i>Equisetum arvense</i> L.*	arial part	silicates, saponins, tannin	diuretic, haemostatic

Species	Drug	Content	Activity
<i>Equisetum sylvaticum</i> L.*	arial part	silicates, flavonoids, caffeic acid derivatives	—
<i>Evonymus europaeus</i> L.*	leaves, seeds	tannins, alkaloids, fats	antichelmintic
<i>Euphorbia amygdaloides</i> L.*	latex	rubber, resins, albumin, fats, refined oil	anti-rheumatic
<i>Fagus sylvatica</i> L.	bark, leaves, fruits	phenols, fatty acids, creosote	antiseptic, antifungal; anti-eczemic; in case of psoriasis
<i>Filipendula vulgaris</i> Moench.	flowers	phenolic glycosides, methyl salicylate	anti-rheumatic, diuretic
<i>Fragaria vesca</i> L.	fruits, leaves	pectins, sugars, vitamin C, flavonoids, anthocyanins, essential oil	diuretic, antiatherosclerotic
<i>Fraxinus excelsior</i> L.	bark, leaves	glucoside fraxin, tanning substances	antipyretic, laxative; fodder
<i>Fraxinus ornus</i> L.	sap, bark, leaves	coumarin derivatives, resins, mannit	astringent; forage
<i>Galium aparine</i> L.	arial part	glucoside asperlulaside, saponins, tannins	diuretic, laxative, analgetic
<i>Galium odoratum</i> (L) Scop.	arial part	coumarin, tannins, glucosides	sudorific, diuretic
<i>Geranium robertianum</i> L.	arial part, leaves, rhizomes	essential oil, tannins, flavonoids	hypotensive, sedative
<i>Geranium sanguineum</i> L.	arial part, leaves, rhizomes	essential oil, tannins, flavonoids	hypotensive, sedative
<i>Geum urbanum</i> L.	arial part, rhizomes	essential oil, tannins, flavonoids	anti-inflammatory, antidiarrheal
<i>Glechoma hederacea</i> L.	arial part	tanning substances, saponins	chronic bronchitis
<i>Gratiola officinalis</i> L.	arial part	glucosides, alkaloids, resins	laxative, diuretic
<i>Helleborus odoratus</i> Waldst. et Kit.*	rhizomes	glucosides, saponins, helebrin	cardiotonic
<i>Hypericum perforatum</i> L.*	arial part	hypericin, tannins, carotene, glucosides	regenerative, anti-inflammatory, against ulcerative disease
<i>Impatiens noli-tangere</i> L.	leaves	holine	antiseptic, diuretic, strongly emetic, laxative
<i>Isopyrum thalictroides</i> L.*	roots	quercetin, kaempferol, magnoflorine	antispasmodic, antioxidant
<i>Juglans regia</i> L.	fruits, bark, leaves	tannins, flavonoids, vitamin C, fatty oil	astringent, anti-inflammatory; dermatitis
<i>Knautia arvensis</i> (L.) Coult.	arial part	glucoside beta-sitosterol	antitumor; forage
<i>Lamium maculatum</i> L.	flowers	mucilages, tanning substances, saponins, histamine	antitussic, urinary, anti-inflammatory
<i>Lamium purpureum</i> L.	arial part	vitamins	anti-inflammatory, sedative
<i>Lathyrus niger</i> (L.) Bernh.	arial part	arbutin	antiseptic, diuretic
<i>Lathyrus pratensis</i> L.	arial part	ascorbic acid, saponins, bitter substances, flavonoids	expectorant; against upper respiratory tract irritation
<i>Lathyrus vernus</i> (L.) Bernh.	arial part, seeds	proteins, fats, cellulose	antirheumatic
<i>Leucanthemum vulgare</i> Lam.	arial part	scopoletin, umbelliferone	hypoglycaemic, depressant
<i>Leonurus cardiaca</i> L.*	arial part, leaves	alkaloids, tannins, saponins	sedative, anti-inflammatory, antiarrhythmic
<i>Lotus corniculatus</i> L.	arial part, fruits	flavonoids, cyanide compounds	spasmolytic, sedative; forage
<i>Lilium martagon</i> L.	bulbs	kaempferol	tonic for burns
<i>Lysimachia nummularia</i> L.	arial part	phenolic acids	antiscorbutic, mildly astringent, diuretic. vulnerary. An infusion is used to treat internal bleeding and diarrhoea
<i>Melittis melissophyllum</i> L.	flowers	oils, bitter substances, saponins	spasmolytic, diuretic

Species	Drug	Content	Activity
<i>Mentha longifolia</i> (L.) Hudson	arial part, leaves	peppermint oil, bitter substances	choleric, spasmolytic
<i>Mercurialis perennis</i> L.*	arial part	saponins, bitter substances, alkaloid mercuryline	laxative, anti-galactagogue
<i>Orchis morio</i> L.	tubers	mucus, starch, dextrin	anti-inflammatory
<i>Orthilia secunda</i> (L.) House	root	arbutin, gindarine, chimaphilin	analgetic, anti-cancer, anti-microbial, anti-inflammatory, diuretic
<i>Oxalis acetosella</i> L.	arial part, leaves	oxalates, flavonoids, vitamin C	normalizes the reduced acidity of the gastric juice, appetite stimulant
<i>Paris quadrifolia</i> L.*	rhizomes, fruits	saponins (paridin, paristyphnin, pennogenin), citric acid, paridol, ecdysterone	cardiac sedative; treatment of wounds
<i>Petasites hybridus</i> (L.) Gaertn.*	rhizome, roots, leaves	essential oil, tannins, inulin	spasmolytic
<i>Picea abies</i> (L.) Karst.	leaves	carotene, vitamin E, K, B, microelements, oils	for respiratory problems
<i>Pinus sylvestris</i> L.	young tips of branches	terpene oil, diterpenes	expectorant, antiseptic
<i>Plantago lanceolata</i> L.	arial part, leaves	mucus, aucubin, vitamin C, saponins	for wound healing, anti-inflammatory, analgesic; forage
<i>Plantago media</i> L.	arial part, leaves	polysaccharides, mucous substances, pectin	anti-inflammatory action
<i>Platanthera bifolia</i> (L.) L. C. Rich.	tubers	mucus, starch, dextrin	tonic, against ulcer, gastritis
<i>Polygonatum odoratum</i> (Mill.) Druce*	rhizomes	glucosides of convalarin	diuretic, against heart problems
<i>Polypodium vulgare</i> L.	rhizomes	essential oil, mucus and tanning substances	expectorant
<i>Populus tremula</i> L.	buds	glycosides, salicin, populin, essential oil, resins	astringent, diuretic, antiseptic
<i>Potentilla argentea</i> L.	rhizomes	tannins	haemostatic, diminishes uterine bleeding
<i>Potentilla reptans</i> L.	arial part, rhisomes	tannins, flavonoids, saponins	astringent, anti-inflammatory
<i>Prunella vulgaris</i> L.	arial part	tannins and bitter substances, potassium salts, fatty oils, waxes	painkiller, diuretic; in case of headache, stomach ache
<i>Pteridium aquilinum</i> (L.) Kuhn.*	rhizomes, leaves	pteridin	vermifuge; baths with decoction for skin rash
<i>Pulmonaria officinalis</i> L.	arial part	carotenes, rutin, tannins, resins	expectorant, anti-inflammatory, diuretic
<i>Quercus frainetto</i> Ten.	bark	tannins, flavonoids	astringent, anti-inflammatory, haemostatic
<i>Ranunculus ficaria</i> L.	leaves	essential oil, saponins, vitamin C	anti-inflammatory, painkiller; against hemorrhoids
<i>Ranunculus repens</i> L.*	arial part	glucoside ranunculine, anemonine	antibacterial, fungicidal, anti-rheumatic; in cases of gout, anemia
<i>Rubus caesius</i> L.	leaves, fruits	sugars, vitamin A, C, B, pectin substances	in case of bleeding gums
<i>Rubus hirtus</i> Waldst.et Kit.	roots, leaves, fruits	tannins, mucus, vitamin C, citric acid	astringent, anti-inflammatory
<i>Rubus idaeus</i> L.	leaves, fruits	flavons, vitamin C, tanning substances, sugars, slime substances	sudorific, astringent, anti-inflammatory
<i>Rumex alpinus</i> L.	root	anthroquinones, tannins, calcium oxalate	astringent
<i>Rumex acetosella</i> L.	arial part	oxalic acid, iron	forage
<i>Salvia glutinosa</i> L.	leaves	alkaloids, oleic acid	in case of: bile diseases, gastritis

Species	Drug	Content	Activity
<i>Sambucus ebulus</i> L.	roots, fruits, flowers	bitter substances, tanning substances, saponins, essential oil, cyanogenic glucoside	diuretic, antiseptic, expectorant
<i>Sambucus nigra</i> L.	flowers, fruits	flavonoids, triterpenes, essential oil, phenolic acids, vitamin C	sudorific, diuretic
<i>Sambucus racemosa</i> L.*	leaves, bark, fruits	beta-sitosterol, quercetin, betulinic acid	emetic, antidiarrheal, hemostatic: in cases of cold, cough, dermatological and gynecological disorders
<i>Sanicula europaea</i> L.	rhizomes, roots, arial part	triterpene saponins, phenolcarboxylic acids	haemostatic, astringent, antidiarrheal
<i>Sanguisorba minor</i> Scop.	rhizomes, roots	tannins, saponins	haemostatic, astringent, anti-inflammatory
<i>Scilla bifolia</i> L.	bulbs	scillarosides	—
<i>Scrophularia nodosa</i> L.*	rhizomes, roots, arial part	saponins, glycoside scrofularin, flavonoidysaccharides, coumarins	astringent, anti-inflammatory; in cases of skin rashes, rheumatic edema of the joints
<i>Senecio nemorensis</i> L.*	arial part	senecion, alkaloids, essential oils, cynarine	uretotoxic
<i>Solanum dulcamara</i> L.*	arial part	steroidal alkaloids, saponins	sudorific, anti-inflammatory
<i>Sorbus aucuparia</i> L.	fruits	sorbose, pectins, anthocyanins, vitamin C	anti-rheumatic, diuretic, astringent
<i>Sorbus torminalis</i> (L.) Crantz	fruits, leaves, flowers	sugars, starch, organic acids	antidiarrheal; in cases of cataracts
<i>Stachys sylvatica</i> L.	rhizomes, arial part	alkaloids, tannins, saponins, resins	regenerative, sedative
<i>Stellaria graminea</i> L.	arial part	polysaccharides, coumarins, triterpene saponins	—
<i>Stellaria media</i> (L.) Vill.	arial part	saponins, vitamin C, E, carotene	anti-inflammatory
<i>Syringa vulgaris</i> L.	leaves, flowers, buds	essential oils, sinigrin, phenoglucosides, phytoncides	diuretic action, anti-gout, rheumatism
<i>Tamus communis</i> L.*	rhizomes	starch, carotenoids	revulsive
<i>Taraxacum officinale</i> L.*	arial part, roots	triterpenes, sterols, rubber substances, carotenoids, inulin	holagogue, choleric
<i>Telekia speciosa</i> (Schreb.) Baumg.	rhizomes	telekin, inulin, alantolactone	antibacterial, antiseptic
<i>Tilia cordata</i> Mill.	flowers with bracts	essential oil, farnesol, mucous substances, carotenes	sudorific, anti-inflammatory
<i>Tilia platyphyllos</i> Scop.	flowers with bracts	essential oil, mucus, carotene	sudorific, anti-inflammatory
<i>Trifolium alpestre</i> L.	arial part	—	steam baths for back pain, bones
<i>Trifolium pratense</i> L.	flowers	tannins, flavonoids, glucosides	expectorant, diuretic
<i>Trifolium repens</i> L.	flowers	benzaldehyde, biochanine	forage; in case of cardiovascular problems
<i>Thymus serpyllum</i>	arial part	essential oil, tannins, flavonoids	expectorant, antibacterial, spasmolytic
<i>Tussilago farfara</i> L.	leaves	mucous substances, tusilagine, tannins, saponins, pigments	expectorant, antiseptic, anti-inflammatory
<i>Urtica urens</i> L.	arial part	carotene, iron salts, K, glucoside urticin	in case of skin itching
<i>Vaccinium myrtillus</i> L.	leaves, fruits	tannins, flavonoids, vitamin C	astringent, anti-inflammatory, hypoglycaemic
<i>Vaccinium vitis-idaea</i> L.	leaves, fruits	arbutin, tannins, flavonoids	diuretic, antiseptic, anti-inflammatory
<i>Valeriana officinalis</i> L.*	rhizomes, roots	valeropotriates, essential oil	sedative

Species	Drug	Content	Activity
<i>Veratrum lobelianum</i> Bernh.*	rhizomes, roots	alkaloids	hypotensive
<i>Veronica chamaedrys</i> L.	arial part	apigenin, aucubin	holagogue; in cases of, against inflammation of kidneys
<i>Veronica officinalis</i> L.	arial part	saponins, glucosides, tannins, vitamin A, C	broncholytic, anti-inflammatory
<i>Vicia cracca</i> L.	arial part	aminoacid canavaine, glicosides vicianine, vitamin C, P, flavonoids	galactogogue, antibacterial activity; forage
<i>Vicia grandiflora</i> Scop.	arial part	amino acids	forage
<i>Vincetoxicum hirsutaria</i> Medic.*	rhizomes, roots	saponin vincetoxin	spasmodic, holagogue
<i>Viola odorata</i> L.	rhizomes, roots, arial part, flowers	saponins, bitter substance, odoratin, mucus, essential oils	expectorant, slightly diuretic

- Note: data is missing

* - poisonous

According to their biological type, the medicinal plants could be classified into seven groups, two of them being transitional. The groups were as follows: trees – 16 species, trees or shrubs – 2 species, shrubs – 15 species, semi shrubs – 1 species, perennial herbaceous plants – 101 species, biannual-annual species – 2 species and annual – 3 species. The perennial herbaceous plants constituted the highest percentage (72%) and the semi shrubs the lowest (1%).

The distribution of species according to the life forms was as follows: Phanerophytes – 19%, Chamaephytes – 5%, Hemicriptophytes – 67%, Cryptophytes – 6%, Therophytes - Hemicriptophytes – 1%, Therophytes – 2%.

The analysis of the phytogeographical structure of the studied plants revealed 19 floristic elements. Geoelements of European origin prevailed with 54 species. Of these, 21 species were Euro-Asiatic elements, followed by the European Siberian elements – 17 species and European – 16 species. SubBoreal elements also had significant presence – 19 species (14%). There were many groups represented by one species (less than 1%), such as: Pontic-subMediterranean, Carpathian- Balkan, European-Mediterranean- centralAsiatic and others.

Different plant parts were in use as official drugs. The analysis of the medicinal plants on the territory of the Petrohan TEFR showed that aerial part (Herba) was used from most of the species – 50 species, followed by species whose leaves (Folia) were used – 35 species, rhizomes (Rhizoma) – 20 species, flowers (Flos) – 15 species, roots (Radix) – 13 species, bark (Cortex) – 7 species, tubers (Tubers) – 6 species, seeds (Semen) – 3 species. The flowers with bracts (Flores cum bractea) were used from a small number

of species – 2 species, tar (Pix) – 1 species, bulbs (Bulbs) – 1 species, young branch tips (Turiones) – 1 species.

Less common were species from which more than one plant part could be used as a drug, for example, *Clematis vitalba* L. – leaves, roots and flowers (Folia *Clematis vitalbae*, Radix *Clematis vitalbae*, Flores *Clematis vitalbae*).

Described medicinal plants contain active substances from different chemical groups (alkaloids, saponins, glycosides, tannins, mucous, vitamins, essential oils etc.), which means some of the plants have both medicinal and poisonous properties (31 plants of our list). These constituents in plants have different pharmacological effect. Drugs with diuretic effect are herb of *Equisetum arvense* L., inflorescence of *Sambucus nigra* L. as well as leaves of *Vaccinium vitis-idaea* L. Drugs with mucous that have an expectorant effect are the leaves of *Plantago lanceolata* L. The dried herb and inflorescences of *Achillea millefolium* L. and *Clinopodium vulgare* L. have anti-inflammatory action. The fruits of *Cornus mas* L. and the leaves of *Cotinus coggygria* Scop. have astringent effect, the rhizome of *Dryopteris filix-mas* (L.) Schott has vermifuge action, and this of *Helleborus odoratus* Waldst. et Kit. – cardio tonic. The root and rhizome of *Valeriana officinalis* L. and herbs of *Hypericum perforatum* L. have sedative effect.

Active substances of some plant species have multiple uses. Evident example for this is *Achillea millefolium* (Asteraceae). Herb of yarrow (*Herba Millefolii*) is an official digestive, but also used as a carminative, analgesic, antipyretic, diaphoretic, anti-hemorrhoidal, anti-inflammatory and anti-rheumatic healing remedy (Purgar et al., 2017).

Medicinal plants, which local people use for livelihood, are *Fragaria vesca* L., *Rubus idaeus* L., *Rubus caesius* L., *Sambucus nigra* L., *Vaccinium myrtillus* L., *Vaccinium vitis-idaea* L. So, their resources are not endangered.

Conclusion

The floristic composition at Petrohan TEFR, Bulgaria, showed a great number of medicinal and poisonous species. The list included 140 medicinal plant species, from which 31 species with the both - medicinal and poisonous properties. They belonged to different pharmacological groups and could be used to treat different diseases.

Table 2. Taxonomic structure of medicinal plants of Petrohan TEFR.

Division	Families	Genera	Species
<i>Polypodiophyta</i>	2	5	2
<i>Equisetophyta</i>	1	1	2
<i>Pinophyta</i>	3	3	3
<i>Magnoliophyta</i>	47	107	133
<i>Total</i>	53	113	140

The biological type ratio was typical for the zone of Middle-European deciduous forests. The hemicriptophytes were the prevailing group in the biological spectrum, which was normal under the continental climate of the region. A high diversity of floristic elements was established due to the peculiarities of Bulgarian flora, specific geographical position of the object and the diverse relief. The prevailing phytogeographical element in the studied flora was of European origin. The spectrum of used organs of medicinal plants showed the prevailing of above ground drugs.

The medicinal plants inventory in the area will be further developed with mapping of largest localities and assessment the resources state, which will contribute to the forest ecosystem services assessment and identifying measures for sustainable use of resources of medicinal plants and development of the region.

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