

DISTRIBUTION OF MEDICINAL PLANTS IN CONIFEROUS HABITATS OF VITOSHA NATURE PARK

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ABSTRACT. Coniferous forests occupy one of the essential parts of the Vitosha Nature Park territory. Three coniferous habitat types corresponded to A Classification of Palaearctic Habitats are studied: Moeso-Macedonian spruce forests (42.2413), Native spruce plantations (83.3111) and Native pine plantations (83.3112). This study presents data of biodiversity and distribution of medicinal plants in it. As a result from the investigation are identified 108 medicinal plant species from 46 families. Twelve of them are with conservation significance. The families Rosaceae, Asteraceae and Lamiaceae are represented by the largest number of species.

The biological type, the life form, the relation to the humidity, the floristic elements and the conservational status of the identified medicinal species are specified. The quantitative participation of the species in each habitat types is pointed out. Some of their population state are commented and the anthropogenic influence is reported.

The present data will contribute to a future monitoring study of the medicinal plants in this protected territory. The results and conclusions of this study could be utilized for their rational use and conservation.

KEY WORDS: Nature Park Vitosha, coniferous habitats, distribution, biodiversity, medicinal plants

INTRODUCTION

The protected areas in Bulgaria including the nature parks are particularly important areas for the real protection of the medicinal plants genetic fund in the natural habitats (Hardalova & all, 1994). An important issue for this protection is the investigation and situating of their populations. Situated in the close vicinity of the capital city the Park is actively used for recreation and tourism. These intrusions continuously threaten the biodiversity of Vitosha Mountain, which important part is medicinal plants.

Forests are main component (60%) in the nature complex of Vitosha Nature Park and they determine its importance to a great degree. The coniferous forests occupy 39% of its forested area. This study was aimed at establishing the diversity, distribution and natural resources of medicinal plants in the main coniferous habitats of Nature Park Vitosha, as well as reporting the population states of the protected medicinal plants and anthropogenic influence on them.

The review of botanical researches in Mt Vitosha shows the absence of the scientific works on the medicinal plants. Although there are literary data on the distribution of number of medicinal species in the coniferous forests of Mt Vitosha. Kitanov (1943) established *Lycopodium clavatum* L. between spruce trees around Tintiava chalet. Investigating pine forests in Tzarkva hill Kouzmanov (1961) reported some medicinal plants like *Arctostaphylos uva-ursi*, *Vaccinium myrtillus*, *Vaccinium vitis-idaea* etc. In the composition of the spruce forests protected in Bistrishko Branishte Reserve are established 26 species medicinal plants, between them are *Sorbus aucuparia*, *Galium odoratum*, *Corylus avellana*, *Angelica pancicii*, *Vaccinium myrtillus* etc. (Stoyanov, 1939, Doikov, 1974, Bondev & all, 1983). Kitanov & Penev (1963) reported 1542 species vascular plants in Mt Vitosha. In the forest communities the authors found 151 species, 52 of them are medicinal species – *Juniperus communis*, *Betula pendula*, *Actaea spicata*, *Oxalis acetosella*, *Vaccinium vitis-idaea*, *Vaccinium myrtillus* etc. are between species mentioned for the coniferous forests of the mountain. Herbariological data based on the Herbarium collections SOM and SO shows presence of number of medicinal species in the coniferous forests of Mt Vitosha, such as *Actaea spicata*, *Asarum europaeum*, *Asplenium trichomanes*, *Daphne mezereum*, *Dryopteris filix-mas*, *Gentiana asclepiadea* etc.

THE STUDY AREA

Vitosha Nature Park (fig. 1) covers the territory of the homonymous mountain in the centre of the southwestern part of Bulgaria and represents a part of the Plansko-Zavalska mountain range (Nikolov & Iordanova, 1997). It occupies an area of 26 606 ha and it has an average altitude of 1500 m. The mountain is divided into four parts according to the valleys of the rivers Vladayska, Dalboka, Kourtova and Matnitsa, and the course of the river flows.

The core of the mountain consists of massive syenite pluton covered from Higher-Cretaceous igneous rocks – andesites, diorites etc. In some places in the northern and western part of mountain's periphery exist conglomerates and sandstones and in the southern and southeastern outskirts – limestones and dolomites (Nikolov & Iordanova, 1997).

The mountain falls into the Moderate-continental climatic zone (Velev, 2002).

In terms of the type of river regime it is situated in the hydrological zone with snow-and-rain regime (Iordanova 2002).

According to soil regionalization of Bulgaria, Mt Vitosha belongs to the Vitoshko-Srednogorska soil province of the Mediterranean soil zone. Brown mountain-forest soils are the main soil type in the mountain (under *Fagus sylvatica*

L., *Pinus sylvestris* L., *Abies alba* Mill., *Picea abies* (L.) Karst., *Pinus peuce* Griseb. and under mixed beech-coniferous forests). On the higher altitudes are presented dark-colored mountain-forest soil type too (mainly under *Picea abies* and *Pinus peuce*) (Ninov, 2002).

In terms of the geobotanical regionalization of the country (Bondev, 2002) Mt Vitosha stands as a separate Vitosha region of the Vitosha district, which falls into the Illyrian (Balkan) phytogeographical province of the European broadleaved forest zone.

Data on the vegetation of Mt Vitosha are detected mainly in older scientific works related to the study area (Georgiev, 1928; Stefanov, 1939; Yordanov, 1977), but also in the more recent literary sources (Baev & Matev, 1985; Nikolov & Iordanova, 1997; Apostolova & Meshinev, 2002 etc.). Coniferous forests of Mt Vitosha have been investigated by Petkov (1920), Zaharieva (1940) etc.

Mt Vitosha is characterized with all vegetation belts of the Bulgarian mountains excepted the alpine one (Velchev, 2002). According to the author there are xerothermic oak belt, belt of hornbeam-durmast oak forests, beech belt, belt of coniferous forests and subalpine belt.

Nature *Picea abies* (L.) Karst. communities compose the coniferous belt (between average altitudes of 1500 m and 1900 m). They outline the upper forest boundary in Vitosha Nature Park. This belt was destroyed in the southern part of the mountain excepted small patches in its southeastern slopes. *Pinus sylvestris* can be seen in the most cases in plantations. The nature forests of *Pinus sylvestris* occupy a small surface (0,04% of the Park territory) and have not been included in this study. In the past *Pinus peuce* Griseb. was part of the natural coniferous forests in the higher plases of Mt Vitosha. At present it takes part in the natural spruce forests with single trees and only occasionally can be seen *Pinus peuce* plantations.

MATERIAL AND METHODS

The study was carried out in the April 2003 – October 2004 period. Transect method was used for the resarch. Terrains in the 850 m to 1870 m altitude interval were explored. A 1:25 000 topographic map and a map of Mt Vitosha habitats were employed.

The species under study were chosen accordingly National strategy for biological diversity protection (Hardalova and all, 1994). The taxonomy and biological types are given according to Kozhuharov, ed. (1992). The floristic elements are determined after Dimitrov, ed. (2001). The life form of each species is given according to Raunkiaer (1934). Relation of species to humidity follows Bondev (1995). Anthropophytes are given after Stefanov & Kitanov (1962).

Conservation status of the medicinal plants is accordingly Biodiversity Law (2002), Order № Rd– 173/03.02.2005 of the Ministry of Environment and Waters (group I – protected and prohibited for gathering, group II – with restrictive regime of gathering), Red Data Book of Bulgaria (Velchev, 1984).

Three habitat types have been studied coverig a surface of 20,2% from the Park area or 5518 ha. Their names and codes correspond to A Classification of Palaeartic

Habitats (1996). This are Moeso-Macedonian spruce forests (42.2413), Native spruce plantations (83.3111) and Native pine plantations (83.3112). Moeso-Macedonian spruce forests are included in Biodiversity Law (Annex № 1) as priority for protection habitat type, and also in Annex I of Resolution № 4 of Bern Convention (1996).

The state and regeneration capacities of some populations were studied by specifying their acreage, spatial and age structure and abundance of specimens. In each habitat type were located sample plots covering an average of 5% of its surface area. The total number of sample plots was 240. Their size depends on the relief and was an average at 1 ha. To illustrate the quantity representation of each medicinal species in the separate habitat type was employed an abundance relative scale including degrees: 1 – single specimens, 2- dozens of specimens, 3 – hundreds of specimens, 4- thousands of specimens. The last two degrees define good and very good biological resources. In some species that formed clone polpulations was counted the number of vegetative branchings and respectively the generative shoots. The abundance as well as the frequency of each medicinal species in the framework of the separate habitat type is pointed out in Table 1.

RESULTS AND DISCUSSION

As a result of the investigation 108 medicinal plants species from 46 families are identified in the coniferous habitats of Vitosha Nature Park (Table 1). Twelve of them (11%) are of conservation importance. The following families are represented by the largest numer of species: Rosaceae (15), Asteraceae (12) and Lamiaceae (7).

The distribution of the medicinal species in terms of their biological type, life form, relation to the humidity and floristic elements is expressed on the figures 2 – 5. According these characterizations are prevailing perennials (fig. 2) – 69%, hemicryptophytes (fig. 3) – 64% and mesophytes (fig. 4) – 59%. The preponderand floristic elements are of north origin, as can be seen on figure 5 (subBoreal, Boreal, Euro-Asiatis and Euro-Siberian) – 55% while these with mediterranean distribution (Euro-Mediterranean, Euro-subMediterranean, subMediterranean, Mediterranean-centralAsiatic, subMediterranean-Pontic and Ponto-Mediterranean) compose 19%. This, as well as the prevalence of hemicryptophytes in the study area is owing to moderate-continental mountainous climatic conditions in this area (Grouev & Kouzmanov, 1994, Pavlov, 1995). The predominance of mesophytes results from the ecological and the phytocenotic characteristics of the communities of *Picea abies*, *Pinus sylvestris*, *P. peuce* and *P. nigra*.

A big part of established medicinal plants are antropophytes (52%). The longlasting vigorous anthropogenic influence over the mountain vegetation on the one side and the transiency in the investigated areas on the other (enlighted slots, vicinity to other habitat types etc.) are the cause of the existance of many untypical species in the coniferous forests pointed out in Table 1.

The various habitats determine the diferences between medicinal species composition as well as their natural resources.

In the territory of Nature Park Vitosha **Moeso-Macedonian spruce forests (42.2413)**, formed by *Picea abies*, occupy 1436 ha (5,2% from the Park area). They outline the upper forest boundary in Mt Vitosha – at average altitude of 1800 m, over which the spruce trees are sparse, in groups or single. The location of this forests is secondary fragmented. Two big compact spots are formed – in the western (between Chernata skala peak and Ostritsa peak, on the upper part of the river Vladayska basin) and in the eastern part of the mountain (Bistrishka river basin, where the forests are included in Bistrishko Branishte Reserve). Their distribution is limited in the northern mountain part – on the upper stream of Dragalevska and Boyanska rivers. Spruce forests are almost missing in the southern part of Mt Vitosha. The investigated plots are situated between altitudes of 1250 to 1900 m.

Accompanying *Picea abies* species in the observed forests are tree species *Pinus sylvestris*, *Fagus sylvatica*, *Salix capraea* L., *Abies alba* Mill., *Pinus peuce* etc. Besides medicinal species pointed out in the Table 1 among the most often founded species in the herbal and shrubby layer are *Ribes petraeum* Wulf., *Lonicera nigra* L., *Sambucus racemosa* L., *Bruckenthalia spiculifolia* Rchb., *Cystopteris fragilis* (L.) Bernh., *Polystichum lonchitis* (L.) Roth, *Poa nemoralis* L., *Luzula luzuloides* (Lam.) Dandy, *Luzula sylvatica* (Huds.) Gand. etc. During the investigation of 91 plots in the Moeso-Macedonian spruce forests we established 55 species medicinal plants from 28 families (51% from all established medicinal species in the coniferous forests of Nature Park Vitosha). In terms of their biological type and life form the ratio of the species is similar to that for the forest habitats in Mt Vitosha as all (figs. 2 & 3). According to their relation to the humidity (fig. 4) the share of the mesophytes increase (67%) to the detriment of the share of the xerophytes (5%), which is due to the bigger soil and air moisture in the spruce habitats. As regards floristic elements (fig. 5) the share of those with northern origin (63%) is bigger than that with southern one (10%), which can be explained with a boreal character of the spruce communities. In the observed habitat the share of the antropophytes is comparatively smallest (44%). This could be attributed to the fact that Bistrishko Branishte Reserve preserves considerable part of the *Picea abies* communities since 1934.

The species with conservation significance among the established medicinal plants in the Moeso-Macedonian spruce forests are five, such as *Angelica pancicii*, *Arctostaphylos uva-ursi* and *Asarum europaeum* (protected and prohibited for gathering), *Alchemilla vulgaris complex* and *Galium odoratum* (with restrictive regime of gathering). *Angelica pancicii* and *Arctostaphylos uva-ursi* are included in the Red Data Book as rare species.

According to the distribution of the medicinal plants in the observed forests four groups of species are designated:

- 1 group (fined in over 50% of the investigated plots) – 4 species: *Vaccinium myrtillus*, *Rubus idaeus*, *Gentiana asclepiadea* and *Caltha palustris*
- 2 group (from 35% to 50%) – 9 species: *Dryopteris filix-mas*, *Vaccinium vitis-idaea*, *Oxalis acetosella*, *Tussilago farfara*, *Epilobium angustifolium*,

Sorbus aucuparia, *Hypericum perforatum*, as well as the conservation significant *Angelica pancicii* and *Alchemilla vulgaris complex*

- 3 group (from 20% to 35%) – 13 species, among them *Galium odoratum*
- 4 group (to 20%) – 29 species

Vaccinium myrtillus has the biggest biological resources in the investigated plots. Stefanov (1934) noted this species as a participant in the spruce forests along with nine other species medicinal plants as *Vaccinium vitis-idaea*, *Arctostaphylos uva-ursi*, *Rubus idaeus*, *Gentiana asclepiadea* etc. *Vaccinium myrtillus* is presented in all studied plots in Bistrishko Branishte Reserve, which can be explained with the main role of the association *Piceetum myrtillosum* in its vegetation cover (Bondev & all, 1983). As a whole the species is found in 89% of the studied plots in the spruce forests of Vitosha Nature Park between average altitudes of 1250 m to 1850 m. The average projective covering of *Vaccinium myrtillus* in those plots is 40% as it is facilitated by rather open canopy of the forests as it is under Piperkata peak, in the south of Edelvais chalet, round the Yavorova Poljana locality etc. In mentioned localities is detected a good fructification of *Vaccinium myrtillus*, but as a whole it is comparatively poor in the observed habitat type. The incorrect harvesting of the fruits by the tourists (by uprooting etc.) could be a real threat for its development.

As a strongly competitive species *Rubus idaeus* can be found in the sparse parts of the forest. The bigger locations are found along the road from Filharmoniatata chalet to Zvezditsa chalet, around Ostritsa chalet etc. In few places appears as a undergrowth – in the north of Planinarsks Pesen chalet, around Tintiava chalet etc.

Besides *Vaccinium myrtillus* other typical accompanying species of *Picea abies* as *Gentiana asclepiadea*, *Dryopteris filix-mas*, *Vaccinium vitis-idaea*, *Sorbus aucuparia* and *Oxalis acetosella* are found more often and with higher abundance in the spruce forests of Bistrishko Branishte Reserve rather than out of its territory. In the same time an opposite tendency is observed for the species connected with a human activities – *Artemisia vulgaris*, *Taraxacum officinale*, *Tussilago farfara*, *Plantago major*, *Rumex alpinus*, *Urtica dioica* etc., which are presented with higher frequency and abundance in the explored plots outside the Reserve.

Mesophytic element *Gentiana asclepiadea* is often found as a participant in the observed communities in Mt Vitosha but with comparatively low abundance. In the investigated plots the average projective covering of the species is 5%.

The distribution of *Caltha palustris* in the spruce habitats is connected with places with abundant humidity, with forest marshlands and streams. Their drainage due to a human intervention could affect negatively the development of this hygromesophytic species.

Among the medicinal species fall under the second group of distribution in Moeso-Macedonian spruce forests of Mt Vitosha with the biggest resources are distinguished *Dryopteris filix-mas* and *Vaccinium vitis-idaea*. Owing to appropriate edaphic and climatic conditions in the observed habitat type the first one has found suitable environment for its development and takes part in the herbal layer with an average projective covering of 30%. *Vaccinium vitis-idaea* is to be found in the spruce communities over an altitude of 1550 m, but it occupies more significant areas

on stony and rocky meadows near to upper forest boundary, as it is the western slope of Goliam Koupen peak, the northern slope of Ostritsa peak etc.

Along the glens, in damp and sparsely forest localities are to be found *Alchemilla vulgaris complex* and *Epilobium angustifolium*. The latter is a ruderal plant and its spread in the spruce forests often is connected with mounds and clear-cuttings along the forest paths, where it forms spots with different sizes.

Although with low abundance *Hypericum perforatum* and *Tussilago farfara* are to be found comparatively often in the observed habitat. The distribution of the second species is due to active human impact in the investigated areas.

Sorbus aucuparia is to be found mixed to the tree layer – individual or as small groups under Piperkata peak, around Tintiava chalet, along the bank of Bistrishka river in the lower part of The Reserve etc. A location on an area of 0,05 ha and big density of *Sorbus aucuparia* is reported in the north of Ostritsa chalet at an altitude of 1600 m.

The scyophytic element *Oxalis acetosella* is to be found as a participant in the observed spruce forests mainly along the streams and beside forest peatbogs. In the localities with rather large canopy closure its projective covering reaches 20%.

The conservation significant *Angelica panicii* is reported in 36 sample plots in the framework of Moeso-Macedonian spruce forests of Vitosha Nature Park on total area of about 1 ha and an average abundance 0,01 specimens/m². The bigger localities of the species are situated outside the territory of Bistrishko Branishte Reserve (in Trendafila locality, around Koumata chalet etc.), nearby major touristic sites therefore a strong control of the populations' state has to be ensured.

Galium odoratum, *Geranium macrorrhizum*, *Sanicula europaea*, *Daphne mezereum* and *Veronica officinalis* are often met shade-loving mesophytes among the species in the third group of distribution in the observed habitat. The first one is distinguished with the biggest resources. Even low, the presence of species such as *Urtica dioica*, *Plantago major* and *Rumex alpinus* is due to anthropogenic impact on the vegetation in the spruce forests.

In the fourth group of distribution are included more than a half medicinal plants (53%) established in Moeso-Macedonian spruce forests of Mt Vitosha, of conservation significance among them are *Asarum europaeum* and *Arctostaphylos uva-ursi*.

On a western slope of Goliam Koupen peak in a sparse *Picea abies* forest is found location of *Arctostaphylos uva-ursi*. It covers an area of 0,005 ha at an altitude of 1850 m. The projective covering of the species is 60%. Most specimens are juvenile and are not fruit-bearing. Accompanying species are *Vaccinium vitis-idaea*, *Vaccinium myrtillus*, *Juniperus sibirica*, *Bruckenthalia spiculifolia*, *Sesleria comosa* etc. The location is situated in the territory of Bistrishko Branishte Reserve and is not affected of human activity. *Asarum europaeum* is found in two locations on the banks of Bistrishka river. The first one appears at an altitude about 1350 m below the Reserve boundary and covers an area of 0,2 ha in ample numbers. The second one is situated in the Reserve at an altitude of 1500 m and here this species is presented with single specimens.

The coniferous plantations occupy a big part (75%) from all the coniferous forests of Vitosha Nature Park. The native coniferous plantations belong to following two forest habitat types.

European fir, spruce and larch plantations (83.3111) occupy 591 ha (2,2%) of the Park territory. *Picea abies* plantations form 98% of this habitat and according Srefanov (1939) the species is the most suitable for a forestation in the higher parts of Mt Vitosha. A major part of the spruce plantations is located on an altitude over 1400 m mainly in the northern and eastern part of Mt Vitosha. In that plantations are studied 31 sample plots at altitudes from 900 m to 1750 m and are found 52 species medicinal plants from 29 families (48% from all reported medicinal species in the coniferous forests of Nature Park Vitosha). In respect to biological type, life form, relation to the humidity and floristic elements the species ratio do not differ significantly from that in Moeso-Macedonian spruce forests. This is due to similar ecological and climatic conditions in both habitat types. In both cases edificatory species is *Picea abies* and that explains the big share of common medicinal species between them – 57% (while the share of common medicinal species between spruce plantations and pine plantations is 47%). A half of established medicinal plants (50%) in the spruce forests are anthropophytes.

Three species are of conservation importance: *Angelica pancicii* and *Valeriana officinalis* – prohibited for gathering, and *Galium odoratum* – with restrictive regime of gathering.

According to the distribution of the medicinal plants in the observed forests four groups of species are designated:

- 1 group (fined in over 50% of the studied plots) – *Rubus idaeus*
- 2 group (from 35% to 50%) – 3 species: *Corylus avellana*, *Betula pendula* and *Fragaria vesca*
- 3 group (from 20% to 35%) – 9 species, among them *Angelica pancicii*
- 4 group (to 20%) – 39 species

The investigation shows that *Rubus idaeus* is with the most significant resources in the spruce plantations of Nature Park Vitosha. The biggest locations are reported in Zlatni mostove locality and around Koumata chalet. In the first one it forms undergrowth in the spruce plantations while in the second one it finds conditions of growth along the forest path. Only *Rubus idaeus* occurred in more than 50% of the studied plots and the biggest part (75%) of medicinal species are found up to 20% of them. The spruce plantations are with closer canopy than nature spruce communities in Mt Vitosha. This explains the above result as well as the fact that the most medicinal plants, which are common for both habitats, are characterized with lower frequency and abundance in the spruce plantations. This concerns particularly for *Vaccinium myrtillus*, *Gentiana aclepiadea* and *Caltha palustris*, for which this indexes drop sharply, and also for *Rubus idaeus*, *Dryopteris filix-mas*, *Epilobium angustifolium*, *Sorbus aucuparia*, put under restrictive regime of gathering *Galium odoratum* etc.

Compare to the nature spruce forests the presence of *Fragaria vesca*, *Oxalis acetosella*, *Sanicula europaea*, *Pulmonaria officinalis*, *Geranium robertianum*

(which are mostly sciophytes) remains almost the same as well as the presence of the ruderal species *Artemisia vulgaris*, *Urtica dioica*, *Plantago major*, *Rumex alpinus*. The conservative significant *Angelica pancicii* is with equally good presence in both habitat types. The biggest location of it in the spruce plantations are situated on the right banks of Vladayska river at an altitude of 1600 m (0,08 ha and abundance 0,9 generative specimens/m²) as well as on the west of Bor chalet at an altitude of 1650 m (0,12 ha and abundance 0,8 generative specimens/m²). In both regions is noted vigorous touristic spate.

In comparison with nature spruce forests in the *Picea abies* plantations very few species medicinal plants enhance their presence. Among that plants are *Corylus avellana*, *Betula pendula*, *Helleborus odoratus*, *Pteridium aquilinum*, whose abundance is bigger mainly in the sparsed parts of the forest.

Among the medicinal species that could be found in the *Picea abies* plantations and those missing in the nature spruce forests is the prohibited for gathering *Valeriana officinalis*. The location is situated in the northeast of the Dendrarium entrance at an altitude of 1200 m alongside the motor road to Kopitoto peak – one of the most animated roads in the north part of the mountain. There are reported 19 generative and 35 juvenile specimens on the area of 0,1 ha.

European pine plantations (83.3112) occupy 3491 ha (12,8%) of the territory of Nature Park Vitosha. *Pinus sylvestris* plantations represent the biggest part of them (2513 ha – 12,5%). *Pinus sylvestris* is the main species in the coniferous plantations of the Park, which mainly replace destroyed primary vegetation of *Quercus* spp. and *Fagus sylvatica*. *Pinus nigra* forms plantations on a total area of 885 ha (0,3%) and *Pinus peuce* plantations are the most limited – 93 ha (0,03%). The investigated plots are located between altitudes of 950 m and 1870 m in the *Pinus sylvestris* and *Pinus nigra* plantations, and between altitudes of 1500 m and 1850 m in the *Pinus peuce* plantations. During the investigation in 117 plots, located mainly (90%) in *Pinus sylvestris* plantations, are found 97 species medicinal plants from 45 families (89% from all established medicinal species in the coniferous forests of Nature Park Vitosha). Almost the half of the found species medicinal plants (47%) are reported in both the previous habitats types too. Besides those pointed out in Table 1 medicinal species here are also often presented *Calamagrostis arundinacea* (L.) Roth., *Dactylis glomerata* L., *Festuca heterophylla* Lam., *Trifolium alpestre* L., *Aremonia agrimonoides* L., *Euphorbia cyparissias* L., *Chamaecytisus hirsutus* (L.) Link, *Scrophularia nodosa* L., *Senecio nemorensis* L., *Stachys sylvatica* L. etc.

In terms of biological type, life form, relation to the humidity and floristic elements the species ratio is identical to the shown for the forests habitats in Mt Vitosha as all (figs. 2 – 5). The species with conservation significance are ten: *Angelica pancicii*, *Asplenium trichomanes* and *Asarum europaeum* – prohibited for gathering; *Carlina acanthifolia*, *Berberis vulgaris*, *Betonica officinalis*, *Sedum acre*, *Primula veris*, *Alchemilla vulgaris complex* and *Galium odoratum* – with restrictive regime of gathering.

According to the distribution of the medicinal plants in the observed forests four groups of species are designated:

- 1 group (found in over 50% of the studied plots) – *Pinus sylvestris*
- 2 group (from 35% to 50%) – 2 species: *Fragaria vescai* and *Corylus avellana*
- 3 group (from 20% to 35%) – 16 species, among them *Galium odoratum*
- 4 group (to 20%) – 78 species

The resources of *Pinus sylvestris* in the observed habitat type can be defined as very good. Besides extensive plantations created in all the parts of Mt. Vitosha, Scots pine occurs individually or as groups in *Pinus peuce* and in *Pinus nigra* plantations.

In the most cases the sunlight under the *Pinus sylvestris* forests canopy is sufficient for the growth of comparatively abundant, including medicinal species, herbal layer.

In the sparsed *Pinus sylvestris* plantations *Fragaria vesca* finds appropriate conditions for development. Its very good resources are recorded on the northern slope of Tsarkva hill, on the slopes over Rudartsy village, in the Borachevitsa locality etc.

Corylus avellana is found individually or in small groups in the observed habitats. It forms well-developed undergrowth in open canopy of the *Pinus sylvestris* plantations as it is in Katounishte locality, Goly Rid locality over Vladaya village etc., for what probably due to the richest and well-moistured soils in this regions.

Among the medicinal species that fall under the third group of distribution in the observed plantations with biggest biological resources we can note *Geum urbanum*, *Pteridium aquilinum* and *Helleborus odorus*. The frequent presence of *Geum urbanum* is mostly connected with human activities in the explored regions. The larger resources are observed in vicinity of the villages, by forests buildings etc. *Pteridium aquilinum* is dominant species in the herbal layer mainly on the steep areas – over Zheleznitsa village, on the south slope of Tsarkva hill, in the southeast of Katounishte locality etc. *Helleborus odorus* is found as a participant in *Pinus sylvestris* plantations with an average projective coverage of 10%, while in *Pinus peuce* plantations is not found yet.

Betula pendula, *Clinopodium vulgare* and *Teucrium chamaedrys* are found with good resources in the observed habitat. The biggest resources of *Betula pendula* are established in the east part of Mt Vitosha – in Brezite locality, on the lower part of the valley of Bistrishka river, on Tsarkva hill etc. The other two species find appropriate conditions to develop on the dry slopes in sparsed *Pinus sylvestris* plantations, but *Teucrium chamaedrys* is distinguished with better resources. Comparatively frequent, but with low abundance are found *Astragalus glycyphyllos*, *Hypericum perforatum* and *Crataegus monogyna*.

The distribution of the mesophytic species in the observed habitat as *Geranium robertianum*, *Dryopteris filix-mas*, *Galium odoratum*, *Pulmonaria officinalis*, *Sanicula europaea* is connected with their specific ecological requirements. They occupy big areas in wet localities, along the streams and river valleys (of the rivers Bistrishka, Matnitsa etc.) where their resources are assessed as very good.

In the *Pinus* spp. plantation as well as in the both previous habitat types the fourth group of distribution comprises the biggest part of the established medicinal

species (80%). Excepting *Galium odoratum* it includes all the conservation significant medicinal species recorded here. Among them the most often found are *Angelica pancicii* and *Alchemilla vulgaris complex*. The latter is presented with single specimens alongside forest paths. *Angelica pancicii* is established in small groups covering total area of about 0,6 ha as a component of riverside communities mainly in *Pinus peuce* plantations – in the north of Koumata chalet, in Balabana locality, around Borova Gora chalet etc. There are recorded 0,02 specimens/m². The remaining protected medicinal species are detected with very low presence – in single localities with few specimens in *Pinus sylvestris* plantations (*Berberis vulgaris* – on Tsarkva hill, *Betonica officinalis* – over Zheleznitsa village, *Primula veris* – in Shevovitsa locality, *Carlina acanthifolia* – in the south of Chuipetlovo village, *Sedum acre* – in the south of Marchaevo village) or more seldom in *Pinus nigra* plantations (*Berberis vulgaris* – in Krasto locality over Bosnek village, *Primula veris* – in Shevovitsa locality). The exception is *Asarum europaeum* – a location on the area of 0,1 ha is found on the banks of Bistrishka river at an altitude of 1150 m. The projective covering of the species is 15%, the spatial structure is mosaic.

The investigated plots in *Pinus peuce* plantations are characterized with comparatively poor herbal layer. The higher altitudes and moderate amounts of moisture in the localities determine frequently presence of *Vaccinium myrtillus*, *Rubus idaeus*, *Dryopteris filix-mas*, *Gentiana asclepiadea* and *Epilobium angustifolium*. With the biggest biological resources are distinguished *Vaccinium myrtillus* and *Rubus idaeus*.

CONCLUSION

The coniferous forests of Nature Park Vitosha are of great importance for the protection of the genetic fund of medicinal species and at the same time give opportunity for sustainable use of their resources.

We found a great diversity of medicinal plants in the observed habitats – 108 species from 46 families. Twelve of them (11%) are with conservation significance.

More than a half of the identified medicinal species (54%) is related to the three of the observed habitats. The most widespread are *Dryopteris filix-mas*, *Pinus sylvestris*, *Betula pendula*, *Corylus avellana*, *Gentiana asclepiadea*, *Epilobium angustifolium*, *Vaccinium myrtillus*, *Caltha palustris*, *Fragaria vesca* and *Rubus idaeus*. With the greatest resources are distinguished *Rubus idaeus*, *Vaccinium myrtillus*, *Fragaria vesca*, *Corylus avellana*, *Epilobium angustifolium*, *Pinus sylvestris*, *Dryopteris filix-mas* and *Pteridium aquilinum*. Only in the Meso-Macedonian spruce forests are found 5% of the established medicinal species, included protected by the Biodiversity law *Arctostaphylos uva-ursi*. Only in the *Picea abies* plantation are reported 4% of the species under study, among them is prohibited for gathering *Valeriana officinalis*. Only in the *Pinus* spp. plantations are observed 36% of the medicinal species. Among them are the species with conservation importance *Berberis vulgaris*, *Sedum acre*, *Betonica officinalis*, *Carlina acanthifolia*, *Primula veris* and *Asplenium trichomanes*.

A considerable part (79%) of the medicinal species is established comparatively rarely (up to 20% of the investigated plots) as the quantitative participation of the most of them is not big. All the conservation significant medicinal species belong to the above mentioned part except *Galium odoratum* and *Angelica pancicii*.

Considering the four geographic parts of Mt Vitosha, the greatest number of medicinal plants is identified in the eastern part (80%) which is due to the protection of the great part of the spruce forests in Bistrishko Branishte Reserve. The least quantity (22%) of the medicinal species is found in the southern part of the mountain because of the lack of coniferous belt in that part and the presence only of patches of *Pinus sylvestris* and *Pinus nigra* plantations.

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Taxa	Biological type	Life form	Relation to humidity	Floristic element	Conservation status	Mountain part	42.2413 Moeso-Macedonian spruce forests		83.3111 European spruce plantations		83.3112 European pine plantations	
							Frequency %	Abundance	Frequency %	Abundance	Frequency %	Abundance
Div. Equisetophyta												
Fam. Equisetaceae												
<i>Equisetum arvense</i> L.*	p	Cr	hgm	Boreal		EW					5	2
Div. Polypodiophyta												
Fam. Aspidiaceae												
<i>Dryopteris filix-mas</i> (L.) Schott.	p	H	m	Boreal		EW N	50	4	31	4	35	3
Fam. Aspleniaceae												
<i>Asplenium trichomanes</i> L.	p	H	m	Kos	I	E					1	1
Fam. Athiriaceae												
<i>Athirium filix-femina</i> (L.) Roth.	p	H	m	Boreal		EW N	17	3	8	3	5	2
Fam. Hypolepidaceae												
<i>Pteridium aquilinum</i> (L.) Kuhn.*	p	H	m	Kos		EW N	11	3	23	3	27	4
Fam. Polypodiaceae												
<i>Polypodium vulgare</i> L.	p	H	m	Kos		EW N			15	2	11	3
Div. Pinophyta												
Fam. Cupressaceae												
<i>Juniperus communis</i> L.	sh	Ph	m	subBoreal		E					11	3
Fam. Pinaceae												
<i>Pinus sylvestris</i> L.	t	Ph	mx	subBoreal		EW NS	11	2	8	2	81	4
Div. Magnoliophyta												
Fam. Apiaceae												
<i>Angelica pancicii</i> Vand.	p	H	hgm	Bal	I	EW N	39	3	31	3	14	2
<i>Eryngium campestre</i> L.*	p	H	xm	Pont-Med		ES					5	2
<i>Heracleum sibiricum</i> L.*	b	H	m	Euro-As		EW N	11	2	15	2	11	2
<i>Sanicula europaea</i> L.	p	H	m	Boreal		EN	22	3	15	3	22	3
Fam. Apocynaceae												
<i>Vinca herbaceae</i> L.	p	Ch	xm	Euro-subMed		E					1	2
Fam. Araceae												
<i>Arum maculatum</i> L.	p	Cr	m	Eur		N			8	2		
Fam. Araliaceae												
<i>Hedera helix</i> L.*	sh	Ph	m	Euro-As		N					3	3
Fam. Aristolochiaceae												
<i>Asarum europaeum</i> L.	p	H	m	Euro-As	I	EN	11	2			5	3
Fam. Asclepiadaceae												
<i>Vincetoxicum hirundinaria</i> Medic.*	p	H	xm	Euro-Sib		E					3	2
Fam. Asteraceae												
<i>Achillea millefolium complex</i> *	p	H	mx			EW NS	6	2	15	3	16	3
<i>Anthemis tinctoria</i> L.*	p	H	x	Euro-As		W					5	2
<i>Artemisia vulgaris</i> L.*	p	H	m	Boreal		WN	6	2	8	2	8	3
<i>Carlina acanthifolia</i> All.	b	H	x	subMed-Pont	II	WS					1	2
<i>Cichorium intybus</i> L.*	p	H	m	Euro-Sib		NS			8	2	3	2
<i>Hieracium pilosella</i> L.	p	H	x	subPont		EW N	6	2			5	2
<i>Petasites hybridus</i> (L.) Gaertn.	p	H	hgm	Eur		E	17	2				

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Solidago virga-aurea</i> L.*	p	H	m	Boreal		EN					3	2
<i>Tanacetum vulgare</i> L.	p	H	m	Euro-As		WN	6	2	8	2		
<i>Taraxacum officinale</i> Web.*	p	H	m	Kos		EW N	6	2			14	3
<i>Telekia speciosa</i> (Schreb.) Baumg.	p	H	hgm	subBoreal		EN			8	2	3	2
<i>Tussilago farfara</i> L.*	p	H	m	Euro-As		EW N	44	3	23	2	16	3
Fam. Berberidaceae												
<i>Berberis vulgaris</i> L.	sh	Ph	x	Euro-Med	II	ES					2	2
Fam. Betulaceae												
<i>Betula pendula</i> Roth.	t	Ph	m	Euro-Sib		EWNS	11	2	38	3	35	3
<i>Corylus avellana</i> L.	sh-t	Ph	m	Med-Cas		EW N	22	2	46	3	41	3
Fam. Boraginaceae												
<i>Pulmonaria officinalis</i> L.	p	Cr	m	Euro-subMed		EW N	11	3	15	2	27	3
Fam. Caprifoliaceae												
<i>Sambucus ebulus</i> L.*	p	H	m	Euro-subMed		E					3	3
<i>Sambucus nigra</i> L.*	t-sh	Ph	m	Euro-subMed		E					3	3
Fam. Caryophyllaceae												
<i>Stellaria media</i> (L.) Vill.*	b	Th	m	Kos		E					8	3
Fam. Convolvulaceae												
<i>Convolvulus arvensis</i> L.*	p	H	x	Kos		W					3	3
Fam. Cornaceae												
<i>Cornus mas</i> L.	t-sh	Ph	m	subMed		EW					5	2
Fam. Crassulaceae												
<i>Sedum acre</i> L.	p	H	x	Euro-Med	II	W					1	2
<i>Sedum maximum</i> (L.) Suter	p	H	xm	subBoreal		N					3	2
Fam. Ericaceae												
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	sh	Ch	xm	Boreal	I;Rd;Bdl	E	1	2				
<i>Vaccinium myrtillus</i> L.	sh	Ch	mx	Boreal		EW N	89	4	15	3	22	3
<i>Vaccinium vitis-idaea</i> L.	sh	Ch	xm	Boreal		EW N	39	4			5	3
Fam. Fabaceae												
<i>Astragalus glycyphyllos</i> L.*	p	H	m	Pont		EWS	1	1			22	3
<i>Genista tinctoria</i> complex	sh	Ch	m	Euro-Sib		E					3	2
<i>Melilotus alba</i> Med.*	a	Th	m	subBoreal		N			8	1		
<i>Ononis arvensis</i> L.*	p	H	m	Pont		WS					5	3
<i>Robinia pseudoacacia</i> L.*	t	Ph	x	Am		E					5	3
Fam. Gentianaceae												
<i>Gentiana asclepiadea</i> L.	p	H	m	Eur		EW N	61	3	8	2	14	3
<i>Gentiana cruciata</i> L.	p	H	xm	Euro-Sib		S					3	2
Fam. Geraniaceae												
<i>Geranium macrorrhizum</i> L.*	p	H	m	Euro-Med		EN	28	3			16	3
<i>Geranium robertianum</i> L.*	a-b	Th	m	subBoreal		EW N	6	2	8	2	30	4
<i>Geranium sanguineum</i> L.*	p	H	xm	subPont		EW N			8	1	8	2
Fam. Hypericaceae												
<i>Hypericum perforatum</i> L.*	p	H	xm	Kos		EWNS	39	3	8	2	22	2
Fam. Lamiaceae												
<i>Betonica officinalis</i> L.*	p	H	m	Euro-Sib	II	E					1	1
<i>Clinopodium vulgare</i> L.*	p	H	m	subBoreal		EWNS	11	3	8	2	30	3
<i>Galeopsis tetrachit</i> L.*	a	Th	m	Euro-As		EN	6	2				
<i>Mentha spicata</i> complex*	p	H	m			WNS			8	3	5	3
<i>Origanum vulgare</i> L.	p	H	mx	Euro-As		E					8	2
<i>Teucrium chamaedrys</i> L.*	p	H	xm	Euro-As		EWS					22	4
<i>Thymus sp. diversa</i>	p	H	x			EWNS	17	2			19	4

1	2	3	4	5	6	7	8	9	10	11	12	13
Fam. Liliaceae												
<i>Polygonatum odoratum</i> (Mill.) Druce	p	Cr	mx	Euro-As		N			8	2		
<i>Veratrum lobelianum</i> Bernh.*	p	Cr	m	Euro-As		E W N	33	2	8	1	5	2
Fam. Oleaceae												
<i>Fraxinus ornus</i> L.	sh-t	Ph	x	subMed		E W					8	2
<i>Ligustrum vulgare</i> L.*	sh	Ph	x	Euro-subMed		E W N					11	3
Fam. Onagraceae												
<i>Epilobium angustifolium</i> L.*	p	H	m	subBoreal		E W N	44	3	31	4	16	3
Fam. Oxalidaceae												
<i>Oxalis acetosella</i> L.	p	H	hgm	subBoreal		E W N	50	3	35	3	11	2
Fam. Plantaginaceae												
<i>Plantago lanceolata</i> L.	p	H	m	Euro-As		E W					8	2
<i>Plantago major</i> L.*	p	H	m	Boreal		E W N	28	2	31	2	24	2
Fam. Polygalaceae												
<i>Polygala major</i> Jacq.*	p	H	xm	Euro-Sib		W N	6	2			5	2
Fam. Polygonaceae												
<i>Bistorta major</i> S. Gray	p	H	m	Euro-As		E N	1	1				
<i>Rumex acetosa</i> L.*	p	H	m	Boreal		E W N S	22	2	8	2	5	2
<i>Rumex acetosella</i> L.	p	H	mx	Euro-subMed		W					3	2
<i>Rumex alpinus</i> L.*	p	H	m	Alp-Carp-Bal		E W N	22	1	15	2	3	2
Fam. Primulaceae												
<i>Primula veris</i> L.*	p	H	m	subMed	II	E S					5	3
Fam. Ranunculaceae												
<i>Actaea spicata</i> L.	p	H	m	Euro-Sib		E	11	3			3	2
<i>Caltha palustris</i> L.	p	H	hgm	Eur		E W N	56	3	23	2	3	2
<i>Clematis vitalba</i> L.*	sh	Ph	xm	Eur		E W					16	3
<i>Helleborus odoratus</i> W. et K.	p	Cr	m	Euro-subMed		E W N S	6	2	31	3	27	4
<i>Hepatica nobilis</i> Mill.	p	Cr	m	Eur		E					3	3
Fam. Rosaceae												
<i>Agrimonia eupatoria</i> L.*	p	H	m	Euro-Med		E W S					11	2
<i>Alchemilla vulgaris</i> complex	p	H	m		II	E W N S	39	3			16	3
<i>Crataegus monogyna</i> Jacq.*	sh-t	Ph	mx	subBoreal		E W N			8	2	24	2
<i>Filipendula ulmaria</i> (L.) Maxim.	p	H	hgm	subBoreal		W N	11	3				
<i>Filipendula vulgaris</i> Moenh.*	p	H	xm	Euro-Med		W					3	2
<i>Fragaria vesca</i> L.*	p	H	m	subBoreal		E W N S	28	3	38	3	47	4
<i>Geum urbanum</i> L.*	p	H	xm	Boreal		E W N S					32	4
<i>Potentilla argentea</i> L.*	p	H	m	subPont		E W			8	1	11	3
<i>Potentilla erecta</i> (L.) Rausch.*	p	H	m	subBoreal		E W N	17	3	8	2	3	2
<i>Potentilla reptans</i> L.*	p	H	m	Kos		E W					8	3
<i>Rosa canina</i> complex*	sh	Ph	x			E W N S			8	2	16	2
<i>Rubus caesius</i> L.*	sh	Ph	m	Euro-As		E W N	11	3	8	2	19	3
<i>Rubus idaeus</i> L.*	sh	Ph	mx	subBoreal		E W N	83	4	62	4	30	3
<i>Sanguisorba officinalis</i> L.	p	H	m	subBoreal		E N					1	1
<i>Sorbus aucuparia</i> L.	sh	Ph	m	subBoreal		E W N	44	3	15	2	16	2
Fam. Rubiaceae												
<i>Galium aparine</i> L.*	a	Th	mx	Euro-As		E N			8	2	1	2
<i>Galium odoratum</i> (L.) Scop.	p	H	m	Euro-As	II	E W N	33	4	8	2	24	3
<i>Galium verum</i> L.	p	H	xm	Euro-As		E W N	17	2	8	2	3	2
Fam. Salicaceae												
<i>Populus tremula</i> L.	t	Ph	m	subBoreal		E W N	6	2	23	2	5	3
Fam. Scrophulariaceae												

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Digitalis grandiflora</i> Mill.	p	H		Eur		E W N	6	2	8	1	11	2
<i>Digitalis lanata</i> Ehrh.*	p	H	xm	BalDac		E					1	2
<i>Verbascum thapsiforme</i> Schrad.*	b	H	x	subMed		E W N	11	2				
<i>Veronica officinalis</i> L.*	p	H	m	Euro-Sib		E W N	33	3	8	2	11	3
Fam. Thymeleaceae												
<i>Daphne mezereum</i> L.	sh	Ph	m	Euro-Sib		E W N	28	3	15	2	1	1
Fam. Tiliaceae												
<i>Tilia cordata</i> Mill.	t	Ph	m	Eur		W					3	2
Fam. Urticaceae												
<i>Urtica dioica</i> L.*	p	H	m	Kos		E W N	22	3	15	3	5	3
Fam. Valerianaceae												
<i>Valeriana officinalis</i> L.	p	H	xm	Euro-As	I	N			8	2		
Fam. Violaceae												
<i>Viola tricolor</i> L.*	a-b	Th	m	Euro-As		S					3	2

Biological type: t - tree, sh - shrub, p - perennials, b - biennials, a - annuals; **Life form:** H - hemicyptophytes, Ch - chamaephytes, Ph - phanerophytes, Th - therophytes, Cr - cryptophytes; **Relation to humidity:** m - mesophytes, x - xerophytes, xm - xeromesophytes, mx - mesoxerophytes, hg - hygrophytes, hgm - hygromesophytes; **Floristic elements:** Eur - European, Med - Mediterranean, Sib - Siberian, Bal - Balcan, Kos - Cosmopolitan, As - Asiatic, cAs - centralAsiatic, Alp - Alpine, Carp - Carpathian, Pont - Pontic, Dac - Dacian, Am - American; **Conservation status:** Bdl - Biodiversity Law, Rb - Red Data Book of PR Bulgaria, I - prohibited for gathering, II - with restrictive regime of gathering, III - widespread; **Mountain part:** N - northern, E - eastern, S - southern, W - western; * - anthropophytes

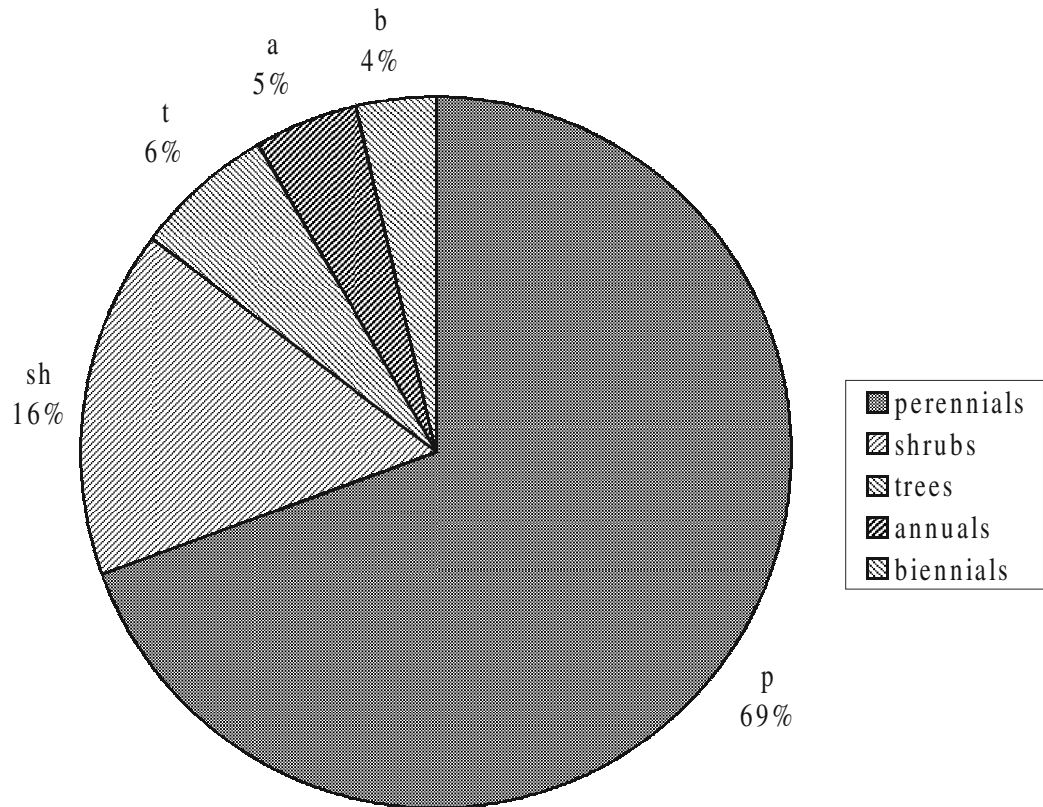


Fig. 2. Proportion of the medicinal species according to the biological type

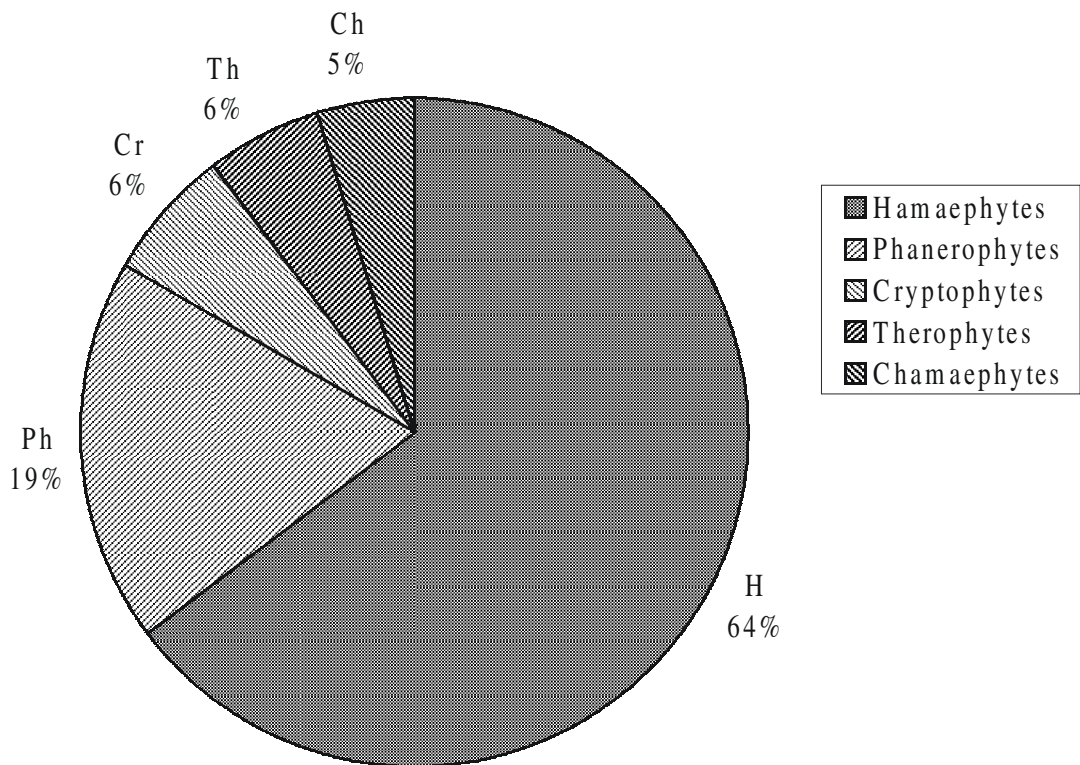


Fig. 3. Proportion of the medicinal species according to the life for m

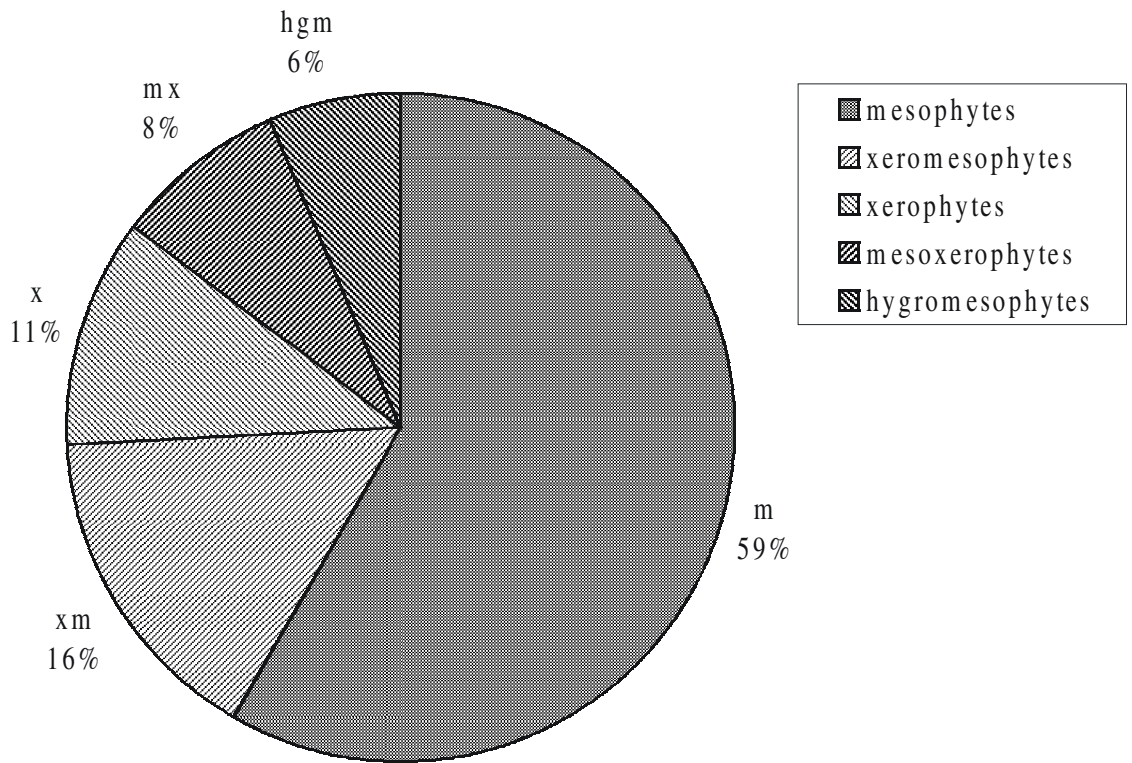


Fig. 4. Proportion of the medicinal species according to the relation to humidity

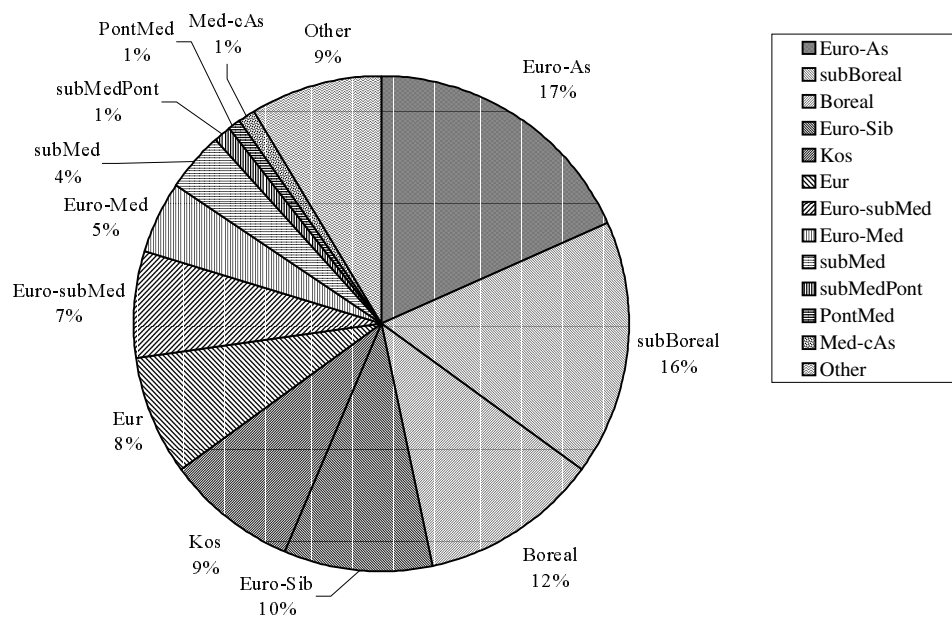


Fig. 5. Distribution of the floristic elements