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RESOURCE ASSESSMENT OF MEDICINAL PLANTS OF MEADOW ECOTOPS OF PEREYASLAV

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INTRODUCTION

Recently, the demand for the resource potential of medicinal plants of the natural flora is growing, since almost a third of the drugs of the pharmaceutical industry are obtained from plant raw materials. Since not all types of medicinal plants are cultivated by humans, and acclimatized and introduced species do not fully satisfy the needs of the pharmaceutical industry, harvesting raw materials in the natural environment is inevitable. But at the same time, another problem arises – increasing the anthropogenic load on natural populations of valuable raw plant species, the state of their resources will be in danger of depletion. And that is why there is an urgent need for systematic accounting of these resources within individual regions and the state as a whole, as provided for by the legislation of Ukraine; improvement of the methodical basis of accounting and monitoring of resources to increase the efficiency of such studies; study of regularities and peculiarities of the formation of resources of raw material species of plants to ensure their balanced use and preservation; starting the monitoring of resources of medicinal and food plant species to find out the dynamics of these resources under conditions of dosed anthropogenic load.

The flora of Pereyaslav region contains a significant number of valuable wild medicinal plants, in particular, their composition includes 582 species belonging to 106 families and 360 genera and constitutes 60.12% of the entire flora of the studied territory[1,2].

[1] Переяслав-Хмельницький. Природа: рослинний світ. Критичний інвентаризаційний анотований конспект флори та рослинності: судинні рослини, мохоподібні, лишайники, водорості / За редакцією В. П. Коцура, В. М. Джурана, М. М. Федорончука, М. В. Шевери. Корсунь-Шевченківський: ФОП Майданченко І. С., 2010. 163 с.

[2] Довгопола Л. І. Лікарські рослини природної флори Переяславщини. *Біорізноманіття, екологія та експериментальна біологія. Ботаніка*. 2020. Том 22, № 1. С. 27-36. doi: 10.34142/2708-5848.2020.22.1.03.

The analysis of literary sources showed that information on the state of resources of wild medicinal plants in Pereyaslav region is fragmentary and scattered and did not have a comprehensive approach to them[3].

The purpose of the work is to record the resources of certain species of potentially valuable medicinal plants of meadow phytocenoses.

Materials and methods. Resource studies were carried out during 2015–2020 on the territory of Pereyaslav region and are still being carried out. The object of research is medicinal plants of Pereyaslav region.

Pereyaslavshchyna is located in the east of the Kyiv region on the left bank of Ukraine, washed by the waters of the Kaniv reservoir. The territory of the district is 1456 km^2. It borders in the north and east with Baryshivskyi and Yagotynskyi districts of Kyiv region, in the south – with Drabivskyi and Zolotoniskyi districts of Cherkasy region. Pereyaslavshchyna is located in Livoberezhnodniprovsky geobotanical district[4,5] and the Livoberezhno-Dniprovskij forest-steppe physico-geographical province[6]. The district is located within the northeastern slope of the Ukrainian crystalline shield of the Dnieper-Donetsk depression. Three floodplain terraces of the Dnipro clearly stand out in the topography of the studied region. The Dnipro, Trubyzh, Alta, Supiy, Brovarka, and Karan rivers flow through the territory of the district. The average temperature in January is -6.5°C, in July – +20.1°C. Rainfall is about 500–600 mm per year[1]. The vegetation cover of the region was transformed as a result of the construction of the hydroelectric power plant on the Dnieper and the creation of the Kaniv reservoir.

The resources of certain raw material-important species of medicinal plants of meadow phytocenoses were studied by route, stationary and semi-stationary methods. Wild medicinal plants included species of official (official) and traditional folk medicine, as well as species of the natural flora of the Pereyaslav region, which are characterized by the presence of biologically active compounds that can potentially be used in phytotherapy according to V. Minarchenko and A. Grodzinsky[7].

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[3] Довгопола Л. І. Історія дослідження лікарських рослин Лівобережно-дніпровського геоботанічного округу. *Біологічні системи* : наук. журнал. Чернівці: Вид-во Чернівецького університету, 2013. Т 5. Вип. 3. С. 403–408.

[4] Геоботанічне районування Української РСР. Київ : Наукова думка, 1977. 303 с.

[5] Дідух Я. П., Шеляг-Сосонко Ю. Р. Геоботанічне районування України та суміжних територій. *Український ботанічний журнал*. 2003. Т. 60. № 1. С. 6-17.

[6] Національний атлас України / Голова ред. кол. Б. Є. Патон; гол. ред. Л .Г. Руденко. Київ : ДНВП «Картографія», 2007. 440 с.

[7] Мінарченко В. М. Лікарські судинні рослини України (медичне та ресурсне значення). Київ : Фітосоціоцентр, 2005. 324 с.

Generally accepted methods and techniques of flora analysis were used in the research process. Species of medicinal plants were determined according to the following publications: «Catalog of the Dendroflora of Ukraine»[8], «Medicinal vascular plants of Ukraine»[9], «Medicinal plants: encyclopedic reference», «Opredelitel vysshikh rastenii of Ukraine»[10]. In the work, the names of species and the volume of families are given under «Vascular plants of Ukraine. A nomenclatural checklist»[11].

The distribution of wild species of medicinal plants on the territory of Pereyaslav кegion was studied based on literature data, the results of original expedition research, and herbarium materials of the National Academy of Sciences of Ukraine M.G. Kholodny Institute of Botany (KW) and Hryhoriy Skovoroda University in Pereyaslav.

Determination of stocks of medicinal plants of the natural flora was carried out on recording plots measuring 1 m^2, on each of which the projective coverage of the species, the height and number of shoots were determined, as well as the raw material of the studied species was collected, then it was dried. Stocks of raw materials (biological and operational) were determined according to standard resource science methods. Stocks that are densely located and occupy an area of at least 0.5 ha were considered industrial stocks, non-industrial stocks of plants growing in dense thickets on an area of less than 0.5 ha or growing hfragmented or scattered[12].

1. The current state of medicinal plants of the natural flora of the meadow ecotopes of Pereyaslav

Our ecological and coenotic analysis of the flora of Pereyaslav region allowed us to identify 5 ecological and phytocoenotic groups of plants. They are dominated by forest (170 species), meadow (145), and meadow-steppe (114) species. The number of species of medicinal plants in synanthropic

[8] Кохно М.А. Каталог дендрофлори України. Київ: Фітосоціоцентр, 2001. 72 с.

[9] Лікарські рослини: Енциклопедичний довідник / Під ред. А. М. Гродзінського. Київ : в-во «Укр. Енциклопедія», Укр. вироб.-комерц. центр «Олімп», 1992. 544 с.

[10] Определитель высших растений Украины / Д. Н. Доброчаева, М. И. Котов, Ю. Н. Прокудин и др.; Редкол. : Ю. Н. Проскудин (отв. ред.) и др. Киев : Наукова думка, 1987. 548 с.

[11] Mosyakin S. L., Fedoronchuk M. M. Vascular plants of Ukraine. A nomenclatural checklist. Kiev : M.G. Kholodny Inst. of Botany NAS of Ukraine. 1999. 345 p.

[12] Мінарченко В. М. Ресурсознавство. Лікарські рослини : навчальний посібник. Київ : Фітосоціоцентр, 2014. 215 с.

phytocenoses is quite high – 95 species. The rest of the phytocenotic groups – medicinal species of plants of overmoistened ecotopes – 58 species.

The participation of wild medicinal plants of Pereyaslavshchyna in meadow phytocenoses ranks second (23%). The meadow type of floristic complexes in Pereyaslav is represented by floodplain meadows of the Dnipro, Supa, Trubezha, Alta, Brovarka rivers and a number of small rivers[13].

The largest areas (70-80%) are occupied by true meadows, represented by groups of the *Molinio-Arrhenatheretea* class. They are formed on flat elevations in floodplain areas and on the slopes of the left bank massif of the Dnipro river with moderate moisture. True meadow vegetation is represented by associations of *Fectucetum pratensis*, *Poetum pratensis*, *Anthoxantho-Agrostietum tenuis*. Meadow areas are an important resource base of medicinal plants, in particular: *Betonica officinalis*, *Ononis arvensis* L., *Filipendula vulgaris*, *Hypericum perforatum* L., *Thymus marshallianus* Willd, *Th. pallasianus*, *Rosa canina* L., etc. *Melilotus officinalis*, *Symphytum officinale* L., *Achillea submillefolium*, *Tanacetum vulgare*, *Cichorium intybus*, *Plantago major* L., etc. grow on areas with varying degrees of vegetation disturbance. Such species of wild medicinal plants as *Centaurium erythraea* Rafn, *Agrimonia eupatoria*, *Iris pseudacorus* L., *Symphytum officinale* L., *Oenanthe aquatica* are associated with wet floodplain meadows, although sometimes they also occur in dry meadows.

The share of wild medicinal plants in meadow-steppe phytocenoses of the flora of Pereyaslav region is 19.1% (114 species). Remains of natural meadow-steppe vegetation, which belongs to the classes *Fectucetea vaginateae* and *Fectuco-Brometeae*[14], were preserved only in small curtains among artificial plantations created on sand mounds near the Kaniv reservoir, as well as on the slopes of ravines and rivers valleys, on the slopes of the floodplain terraces of the Dnipro river (the village of Tsybli, the «Chicken's Neck» tract), the Trubyzh river (near the Museum of Folk Architecture and Life of the Middle Dnieper Region), the Supiy river (Kurgan, the outskirts of the village of Tashan), the outskirts of the village of Yerkivtsi, Divychki, Stovpyagi on the Pereyaslav-Kyiv highway, the «Three Brothers» mound, near St. Pereyaslavska, «Roblena Mogila» mountain,

[13] Довгопола Л. І. Лікарські рослини природної флори Переяславщини. *Біорізноманіття, екологія та експериментальна біологія. Ботаніка.* 2020. Том 22, № 1. С. 27–36. doi: 10.34142/2708-5848.2020.22.1.03.

[14] Переяслав-Хмельницький. Природа: рослинний світ. Критичний інвентаризаційний анотований конспект флори та рослинності: судинні рослини, мохоподібні, лишайники, водорості / За редакцією В. П. Коцура, В. М. Джурана, М. М. Федорончука, М. В. Шевери. Корсунь-Шевченківський : ФОП Майдаченко І. С., 2010. 163 с.

outskirts of the village. Travneve, the «Snake shaft» section along the Pereyaslav-Zolotonosha road – the complex natural monument «Dniprovo-Yanenkivskyi shaft», etc. Valuable medicinal plants include *Adonis vernalis*, *Verbascum densiflorum* Bertol., *Hypericum perforatum*, *Achillea submillefolium*, *Origanum vulgare* L., *Euphorbia stepposa* Zoz ex Prokh., *Hieracium pilosella* L., *Sedum acre* L., *Galium verum* L., *Plantago lanceolata* L., *Artemisia absinthium*, *Thymus pallasianus*, *Th. marshallianus*, *Astragalus dasyanthus*, *Salvia pratensis* L., *S. nemorosa* L., *Fragaria vesca*, *Trifolium pratense* L. and others [15].

2. Status of Achillea submillefolium resources Klok. et Krytzka

Achillea submillefolium **Klok. et Krytzka** – perennial herbaceous plant with a creeping, branched rhizome, hemicryptophyte, mesophyte, sciogeliophyte. It is found in dry and floodplain meadows, light sparse forests, forest glades, forest edges, near roads throughout the territory of Ukraine. At present, it is almost a synanthropic species.

A. submillefolium acts as an ingredient of meadow-steppe slightly disturbed habitats on meadows [16]. Its number in such areas is gradually decreasing due to the settlement of other species. More often, it grows scattered, occasionally forming sparse massifs. The plant is not demanding on moisture and richness of the soil.

A. submillefolium grows on poor, mesotrophic, even moistened slightly saline and salt marsh soils, withstanding pasture digression.

A. submillefolium is an ingredient of meadow and meadow-steppe communities, and also often acts as an edifier in the herbaceous temporary communities on disturbed lands[17].

On the territory of Pereyaslav region, *A. submillefolium* is usually found in meadows, as well as in lightly sodden areas, where it forms the most productive massifs, in particular: floodplain meadows of the Trubizh river

[15] Переяслав-Хмельницький. Природа: рослинний світ. Критичний інвентаризаційний анотований конспект флори та рослинності: судинні рослини, мохоподібні, лишайники, водорості / За редакцією В. П. Коцура, В. М. Джурана, М. М. Федорончука, М. В. Шевери. Корсунь-Шевченківський: ФОП Майданченко І. С., 2010. 163 с.

[16] Храбра С. З. Дикорослі лікарські рослини Тернопільської області (еколого–ценотичні особливості, ресурси та раціональне використання): автореф. дис. … кан. б. наук: 03.00.05 / Національного ботанічного саду імені М.М. Гришка НАН України. Київ. 2008. 22 с.

[17] Турубара О. В. Лікарські рослини Лівобережного Полісся: стан ресурсів, перспективи використання і охорона : автореф. дис. … кан. б. наук: 03.00.05 / Національного ботанічного саду імені М.М. Гришка НАН України. Київ. 2010. 22 с.

(university area), the outskirts of the village of Tashan (flood meadows of the Supii river), village Gaishyn, village Veselynivka (floodplains of the Trubizh and Brovarka rivers), village Khotsky (flood meadows of the Dnipro river) and others. Here it grows together with *Agrostis vinealis* Schreb., *Poa angustifolia* L., *Festuca pratensis* Huds., *Festuca rubra* L., *Alopecurus pratensis* L., *Potentilla argentea* L., *Calamagrostis epigeios* (L.) Roth, *Lotus arvensis* Pers., *Elytrigia repens* (L.) Nevski, *Plantago lanceolata* L., *Taraxatum officinale* Webb. Ex Wigg., *Dactylis glomerata* L., *Trifolium pretense* L., *Artemisia absinthium* L., *Berteroa incana* (L.) DC., *Daucus carota* L., *Pilosella officinarum* F. Schult. Et Soh. Beep. and other species.

According to our research, *Achillea submillefolium* in natural conditions does not form massifs on large areas, in most localities it occurs scattered or fragmented. Despite the fact that the area of these massifs is small (0.1–0.9 ha), it is possible to collect raw materials in these areas, because the stock density ranges from 60±7.2 to 390±11.2 g /m^2 in the freshly harvested state (Table 1).

Table 1

Achillea submillefolium resource inventory

Place of growth	Total area, ha	Yield of raw materials, g/m^2 in wet condition	Biological stock of air-dry raw materials, kg	Operating stock of air-dry raw materials, kg
Floodplain meadows of the Trubizh river	4,5	125±10,9	1284–1529	856–1019
Surroundings of the village Tashan, floodplains of the Supii river	2,0	130±9,7	602–699	401–466
Surroundings of the village Gaishyn floodplains of the Trubizh and Brovarka rivers	2,2	120±13,2	587–733	392–488
Surroundings of the village Veselinovka	1,5	390±11,2	1421–1505	947–1003
Surroundings of the village Khotsky, floodplain meadows of the Dnipro river	3,2	130±12,4	941–1139	627–759

Due to unpretentiousness to growing conditions and significant distribution in the region, *Achillea submillefolium* can be harvested in the amount of several tens of tons. Stocks of raw materials are large, and therefore the species does not require a strict limitation of harvesting volumes.

3. Status of Thymus serpyllum L.

***Thymus serpyllum* L.** – In the procurement practice of herbal medicinal raw materials, various species of the genus *Thymus* L. are collected under the common name. On the territory of Pereyaslav region, thymes are most often found: *Thymus serpyllum*, *Th. podolicus*, *Th. Marschallianus*, *Th. dimorphus*. Other species of thyme in our territory have a more limited distribution.

Th. serpyllum is a perennial creeping semi-shrub with numerous prostrate stems, chamephyte, mesophyte, heliophyte. On the territory of Pereyaslavshchyna *Th. serpyllum* grows mainly in dry and fresh pine forests, as well as in thinned oak-pine forests, in meadows, clearings, in young forest plantations, especially on sandy soils, pine terraces of the Dnipro river. It cannot develop in shaded areas, therefore, when growing, the crown falls out of the grass-shrub cover. It is resistant to lack of moisture, but good lighting is required for successful growth and reproduction[18].

Th. serpyllum is a pioneer species, populations of which can dominate in the overgrowth of sands and disturbed sandy soils in the early stages of the succession process. At later stages of succession, the productivity of *Th. serpyllum* is decreasing, therefore the amount of raw material reserves is unstable [19].

In conditions of fresh forests on sandy soils, *Th. serpyllum* forms strong vegetative and reproductive, more leafy shoots. However, in such conditions, the cenotic factor plays a major role. In the process of successions in the direction of the formation of the grass-herbaceous group *Th. serpyllum* loses its dominant position and can, in the absence of drastic ecological and cenotic changes, participate in the formation of the grass-shrub layer as an asectator for a long time. It is quite common to observe the release of *Th. serpyllum* on terrestrial meadows formed on watersheds, pine terraces. In such conditions, it can form more or less dense, small curtains on the entire territory of the site.

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[18] Мінарченко В. М. Атлас лікарських рослин України, (хорологія, ресурси та охорона). Київ : Фітосоціоцентр, 2002. 172 с.

[19] Глущенко Л. Особливості цвітіння та нектаропродуктивності видів роду *Thymus* L. (Lamiaceae Lindl.). *Український ботанічний журнал*. 1999. 56, № 4. С. 414–419.

Within the borders of Pereyaslav region, the main habitats of species of the genus *Thymus L*., which are valuable for raw materials, are confined to thyme-cereal communities of pine terraces on sod-slightly podzolic sandy soils. Also, *Th. serpyllum* grows in pine forests on sod-slightly podzolic sandy soils with a poorly developed humus horizon and a deep level of groundwater.

Table 2

Inventory list of *Thymus serpyllum* resources

Place of growth	Total area, ha	Yield of raw materials, g/m^2 in wet condition	Biological stock of air-dry raw materials, kg	Operating stock of air-dry raw materials, kg
Surroundings of the village Somkova valley, the edge of the pine forest. Studenivskogo forestry. (block 96)	1,1	59,8±12,5	156–239	104–159
Surroundings of the village October, the edge of a pine forest. Studenivskogo forestry. (block 92)	2,0	46,9±9,5	224–338	150–226
Surroundings of the village Little ones, on the slopes of the floodplain terrace of the Dnipro river	1,8	45,5±9,8	193–299	129–199
Surroundings of the village Tsybli, on the slopes of the floodplain terrace of the Dnipro river	1,7	59,6±12,5	240–368	160–245
with. Tashan, Tashanki hill	1,2	47,4±12,5	126–216	84–144
Surroundings of the village Stov'pyagi, on the slopes of the floodplain terrace of the Dnipro river	1,2	48,4±8,2	145–204	96–136
On the slopes of the floodplain terrace of the Trubizh River, (near the Museum of Folk Architecture and Life of the Middle Dnieper region)	2,0	57±9,8	283–401	189–267

The tree stand of such forests is formed by *Pinus silvestris* L. The understory is not developed. Grass-shrub cover with a total coverage of 65–70% consists mainly of *Th. serpyllum* (25–30%), *Festuca ovita* L., *Pilosella officinarum* F.W.Schultz & Sch.Bip., *Calamagostis epigeios* (L.) Roth, *Koeleria glauca* (Spreng.) DC., *Helichrysum arenarium* (L.) DG, *Sedum acre* L. and other species. Under the canopy of *P. silvestris*,

Th. serpyllum occurs occasionally, forming more or less clear curtains in places with thinned stands.

Most often, populations form clear curtains in well-lit places with a stock density of 5–6.5 g/m^2 (air-dry weight).

In the studied area, the average yield of raw materials is about 66.23±8.19 g/m^2. The most productive massifs of *Th. serpyllum* are listed in Table 2.

In the future, it is possible to foresee some reduction of raw material reserves due to certain exhaustion of the main massifs. This process is associated with increased cattle grazing on the grassy slopes, irrational harvesting of raw materials, when thyme grass is not cut, but pulled out by the roots, thus disrupting the turf and leaving the plants without the possibility of vegetative recovery. The growing recreational load on forest and grass communities also has a negative impact.

3.1. Status of Hypericum perforatum L.

***Hypericum perforatum* L.** – perennial herbaceous plant with weakly developed sparsely branched roots, hemicryptophyte, polycarpic, xeromesophyte, mesotron, heliophyte. It is found throughout the territory of Ukraine, with the exception of the alpine belt of the Carpathians, and very rarely in the south of the country[20].

In the conditions of Pereyaslavshchyna, *H. perforatum* is widely distributed. Prefers open, dry and lighted areas, slopes, bushes, forest glades, meadows, forest edges, can form productive massifs on weakly sod dry meadows in the absence of livestock grazing. Here it grows together with *Genista tinctoria* L., *Artemisia absintium* L., *Galium verum* L., *Elytrigia repens* L., *Euphorbia cyparissias* L., *Achillea millefolium* L., *Festuca pratensis* Huds, *Linaria vulgaris* L., etc.

H. perforatum is close to typical «pioneer» plants, in terms of its ability to actively settle in areas with disturbed cover under the influence of economic activity. It is not picky about the richness and moisture of the soil and is easy to grow, while it develops well and gives a large harvest.

It grows most massively (more than 20% coverage) on poor (89–100 degree of soil richness), moderately moistened (55–68 degree of moisture scale) soils[21].

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[20] Сивоглаз Л. М. Режим невиснажливого використання фіторесурсів *Hypericum perforatum* L. *Український ботанічний журнал*. 1999. 56, № 2. С. 166–169.

[21] Турубара О. В. Лікарські рослини Лівобережного Полісся: стан ресурсів, перспективи використання і охорона : автореф. дис. … кан. б. наук: 03.00.05 / Національного ботанічного саду імені М.М. Гришка НАН України. Київ. 2010. 22 с.

H. perforatum in the forest zone is a typical representative of herbaceous communities on mixed forest clearings, where it can form massifs with a projective cover of up to 50%, although it is a meadow-steppe species by its nature.

With the growth of tall grasses and shrubs, a decrease in light, and an increase in grass coverage, *H. perforatum* gradually falls out of the group, remaining in meadows, forest edges in small clusters or singly. The speed of such successions of *H. perforatum* populations is determined by the intensity of successive changes in the entire phytocenosis. Observations have shown that with a rapid increase in the density of the tree stand, the development of tall grass is inhibited, and this species persists for 6–7 years in such areas. With intensive growth of shrubs, it falls with the grass for 4–6 years. The productivity of *H. perforatum* populations in real meadows is low – its participation here is reduced, as a rule, to the level of an ingredient[22].

Significant reserves of *H. perforatum*, sufficient for harvesting, were found in the territory of Pereyaslav region: Pereyaslav city, «Kozynski Horby» tract, Studenkiv Forestry of the state enterprise «Pereyaslav-Khmelnytske Forestry» on fellings (quarters 20–26, 40–45, 60–63), «Chicken's throat» tract; Pereyaslav-Khmelnytskyi district, outskirts of the village Tsybli (slopes of the Dnipro river), village Khotskyi (slopes of the Dnipro river), village Students (from the forest); the vicinity of the village October (Table 3.).

The average productivity of *Hypericum perforatum* in the studied territory from 1 m^2 is 109.81±13.56 g of raw mass. It is necessary to note a certain natural lability of stocks of raw materials of this type. It forms highly productive massifs on fallows, eroded areas thanks to intensive self-sowing. In the absence of intense anthropogenic load, such massifs retain their raw material value for 6–7 years[23]. Mowing hay and grazing cattle to the same extent worsens the condition of its populations. On open areas with a thinned grassy cover, due to seed regeneration, it often forms well-defined compactions with a projective cover of up to 20–25%.

Taking into account the significant distribution *Hypericum perforatum* in all surveyed areas of Pereyaslav region, today there is no acute problem of the shortage of raw materials of this medicinal plant in the region, however, in order to prevent the depletion of the resource potential of *Hypericum perforatum*, the regulation of the annual volume of raw material harvesting

[22] Сивоглаз Л. М. Режим невиснажливого використання фіторесурсів *Hypericum perforatum* L. *Український ботанічний журнал*. 1999. 56, № 2. С. 166–169.

[23] Там само.

in Pereyaslav region as a whole should not exceed 5–7 tons. In addition, in order not to *Hypericum perforatum* thickets, it is recommended to harvest raw materials on one massif at intervals of 2 years[24].

Table 3

Inventory list of *Hypericum perforatum* resources

Place of growth	Total area, ha	Yield of raw materials, g/m^2 in wet condition	Biological stock of air-dry raw materials, kg	Operating stock of air-dry raw materials, kg
Pereyaslav, tract «Kozin hills»	2,8	100,19±6,3	605–686	403–457
Surroundings of the village Tsibli (slopes of the Dnipro river)	1,0	129,1±19,3	253–241	168–228
Surroundings of the village Khotskyi (slopes of the Dnipro river)	0,7	133±17,8	185–243	124–162
Studenki forestry on fellings (blocks 20-26, 40-45, 60-63)	1,3	112,5±7,24	315–358	210–239
Surroundings of the village Students, (laughter)	1,2	92,9±15,9	213–300	142–200
Tract «Chicken's throat»	0,8	107,2±13,8	172–223	115–148
Surroundings of the village October	4,7	93,8±14,6	856–1172	571–781

3.2. Status of *Helichrysum arenarium* (L.) Moench

***Helichrysum arenarium* (L.) Moench** – semi-rosette, taproot herbaceous monocarpic, oligomesotroph, xeromesophyte, heliophyte. Widespread throughout the territory of Ukraine in pine forests, on the sands of the second terraces and floodplains, steppe slopes, on outcrops, sometimes as a weed on light soils. It often forms thickets on treeless sands and in young pine plantations. In the studied territory, the species is

[24] Сивоглаз Л. М. Режим невиснажливого використання фіторесурсів *Hypericum perforatum* L. *Український ботанічний журнал*. 1999. 56, № 2. С. 166–169.

widespread mainly in dry pine forests, in meadows, in young pine plantations, in meadow-steppe areas[25].

H. arenarium grows on sandy soils. *H. arenarium* does not grow in sharply changing conditions of moisture. It is an indicator of dry and fresh forests, it is also found in fresh forests[26].

H. arenarium is a typical heliophyte. In shaded areas, more elongated reproductive shoots with a small number of flower baskets are formed. The plant does not tolerate complete darkness, therefore it is not found in pine forests (10–12 years old) with closed crowns. Here, first, a decrease in the number of reproductive, and then vegetative shoots is observed, which leads to the death of plants. Thus, *H. arenarium* in pine forests on sandy soil participates in the initial stages of successional processes.

H. arenarium cannot withstand competition and grows on poor, dry soils. On chernozems, it is suppressed by other plants and therefore most often grows near roads and paths, where the soil is more compacted, and the conditions for the growth of other species are not suitable. In plantings, when the pine crowns close and the light regime becomes unfavorable, *H. arenarium* gradually disappears.

With high abundance indicators, *H. arenarium* grows in young pine crops. When the canopy of the tree stand closes, the light regime becomes unfavorable for the species, its phytocenotic and ecological optimums are violated, the number of reproductive shoots decreases sharply, and the cypress is gradually displaced to the edges of the forest, meadows, and meadows, where it often dominates the grass layer for many years.

On drier sands, *H. arenarium* occurs in grass-herbaceous, sagebrush-herbaceous, and sagebrush-cereal communities, where it grows together with *Calamagrostia epigeios* (L.) Roth, *Agrostis alba* L., *Festuca ovina* L., *Festuca rubra* L., *Corynephorus canescens* (Bernh.) Beauv., *Koeleria glauca* (Spreng.) DC., *Achillea submillefolium* L., *Jasione Montana* L., *Pilosella officinarum* F. Schultz & Sch. Bip., *Berteroa incana* (L.) DC.

The identified valuable populations of the sand cypress are confined to sandy, lightly sodden soils with sufficient lighting in young pine plantations, forest edges (near the village of Khotchy, state organization «Forestry «Biloozerske», quarter 20–29; near the villages of Sosnova, Stokova, Zhovtneve of the Studenivsky State Forestry enterprise «Pereyaslav-

[25] Мінарченко В. М. Лікарські судинні рослини України (медичне та ресурсне значення). Київ: Фітосоціоцентр, 2005. 324 с.

[26] Храбра С. З. Дикорослі лікарські рослини Тернопільської області (еколого–ценотичні особливості, ресурси та раціональне використання) : автореф. дис. … кан. б. наук: 03.00.05 / Національного ботанічного саду імені М.М. Гришка НАН України. Київ. 2008. 22 с.

Khmelnytsk Forestry») and meadow-steppe areas (near the village of Zhovtneve, the slopes of the Dnipro river, the villages of Tsybli, Khotsky).

Within the borders of Pereyaslav region, *Helichrysum arenarium* grows scattered in lichen pine forests that occupy the upper parts of sandy hills, less often in flat, elevated places, which are characterized by dryness and poverty of sod-weakly podzolic sandy soils. The tree stand is formed by *Pynus silvestris*. The grass-shrub cover is very sparse and consists mainly of *Calamagrostia epigeios*, *Festuca ovina* L., *Thymus serpyllum*, with the participation of *Piosella officinarum*, *Solidago virgaurea* L., *Calluna vulgaris*, *Koeleria glauca* and other species.

Under the cover of closed pine forests, *H. arenarium* is occasionally found with a projective cover of 1–4%, the density is 0.8–1.6 g/m^2, and the productivity of coenopopulations is 8–16 kg/ha of raw inflorescences.

In open places and with thinned stands, *H. arenarium* grows massively, forming curtains on lightly sodden pine sands, mainly in meadows, glades, forest edges, along roads. *Hypericum perforatum*, *Piosella officinarum*, *Jasione montana*, *Berteroa incana* and other species often grow in groups together with cumin. Such massifs were investigated near the village of Khotchy, state organization «Forestry «Biloozerske», quarter 20–29; near the villages of Sosnova, Stokova, Zhovtneve Studenivsky Forestry of the state enterprise «Pereyaslav-Khmelnytsky Forestry».

The projective coverage of *H. arenarium* under such conditions is 10–15%, in some places reaching 20–25%, the height of the plants is 15–25 cm. The density of the stock of raw materials is on average 24–48 g/m^2 of raw inflorescences, and in some areas – 100–120 g/m^2.

Significant stocks of H. *arenarium* are concentrated in young pine forests on sandy soils. Under conditions of weak turfing in such plantings, the yield of *H. arenarium* raw material is 5–10 g/m^2. However, with the increase of shading, which occurs during the growth of the tree layer, *H. arenarium* gradually falls out with the grass, remaining in more illuminated places.

H. arenarium belongs to a group of species whose natural reserves in Ukraine are limited and the procurement of raw materials for the agricultural industry is subject to strict limitations[27].

The average yield of raw materials in the studied area is 61.33 ± 6.36 g/m^2, but *Helichrysum arenarium* does not form significant areas for harvesting, therefore it is impractical to collect plants within the Pereyaslav region.

[27] Мінарченко В. М. Лікарські судинні рослини України (медичне та ресурсне значення). Київ : Фітосоціоцентр, 2005. 324 с.

CONCLUSIONS

Thus, in the course of field research carried out in 2015–2020, an accounting of resources of wild raw medicinal plants of official medicine was carried out: *Achillea submillefolium* Klok. et Krytzka, *Hypericum perforatum* L., *Helichrysum arenarium* (L.) Moench, *Thymus serpyllum* L. and determined their raw material productivity (biological and operational reserves) in meadow ecotopes of Pereyaslav region. The location of the raw material massifs of the researched species of the specified territory was determined.

As a result of resource surveys of four types of medicinal plants of official medicine, it was established that stocks of *Achillea submillefolium* are significant and fully sufficient to meet the needs of the pharmaceutical industry; stocks of *Thymus serpyllum* and *Hypericum perforatum* are sufficient for industrial harvesting; *Helichrysum arenarium* stocks are insufficient and need to be limited.

SUMMARY

The article presents the results of the resource assessment and location of individual raw material species of medicinal plants of meadow and meadow-steppe phytocenoses of Pereyaslav region (Kyiv region, Boryspil district). It is established that the participation of wild medicinal plants of Pereyaslav region in meadow phytocenoses takes the second (145 species out of the total number – 582), and in meadow-steppe third (114 species) places. The meadow type of floristic complexes in the study area is represented by floodplain meadows of the Dnieper, Supa, Trubizh, Alta, Brovarka rivers, and a number of small rivers. They are presented in four types of formations: steppe, real, swampy and saline meadows.

During the field research conducted in 2015–2020, the resources of wild raw medicinal plants of official medicine were taken into account: *Achillea submillefolium* Klok. et Krytzka, *Hypericum perforatum* L., *Helichrysum arenarium* (L.) Moench, *Thymus serpyllum* L. and their raw material productivity (biological and operational reserves) in meadow and meadow-steppe ecotopes of Pereyaslav region was determined. The location of raw materials of the studied species of medicinal plants of the natural flora of the specified area is determined.

As a result of resource surveys, it was found that the stocks of *Achillea submillefolium* are significant and fully sufficient to meet the needs of the pharmaceutical industry; stocks of *Thymus serpyllum*, *Hypericum perforatum* are sufficient for industrial procurement; reserves of *Helichrysum arenarium* are insufficient and need to be limited.

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КОНСТРУКТИВНО-ГЕОГРАФІЧНІ ОСНОВИ РАЦІОНАЛЬНОГО ВИКОРИСТАННЯ Й ОХОРОНИ РЕСУРСІВ ВОДОЙМ ПОЛІССЯ УКРАЇНИ

Ільїна О. В.

ВСТУП

Головні тенденції сучасної цивілізації у ставленні до природних ресурсів, зокрема у ставленні до природних і штучних водойм, спрямовані на максимально ефективне, наперед плановане їх використання. У зв'язку з цим важливим завданням сучасної природничо-географічної науки став науковий прогноз найближчих і окремих змін водного середовища у процесі природного його розвитку в часі й просторі за участю спланованих і стихійних антропогенних впливів.