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SPECIES DIVERSITY OF RARE AND DISAPPEARING SPECIES OF PLANTS REPRESENTING *ORCHIDACEAE* JUSS FAMILY ON THE TERRITORY OF TURKA DISTRICT

Abstract. Species diversity rare and endangered species of the Orchidaceae Juss. family on the territory of Turka district has been studied. The species diversity of five species of plants of the Orchidaceae Juss. family, which were found in the study area: Cephalanthera longifolia L., Orchis purpurea Huds., Listera ovata L., Dactylorhiza fuchsii, Platanthera bifolia L., were met singly, occurred on close inspection. It was found that the identified species of the Orchid Juss. The family had insignificant distribution and abundance of growth, which was due to the features of their development, environmental conditions, and anthropogenic pressure. In general, there are insignificant resources of rare and endangered species with the threat of extinction of their natural populations within the Turka district.

Key words: Red Book, Orchidaceae Juss. family, species, abundance, natural conditions, Turka district.

INTRODUCTION

Plants are an important component and the main resource of our planet. The functioning of the biosphere depends on them. Prolonged human economic activity has led to radical changes in the plant world, including the decline in the number and extinction of many plant species. Special attention should be paid to the species protected at the national level and listed in the Red Book of Ukraine [9; 17].

Rare and endangered plants are widespread throughout Ukraine and in the Lviv region as well. The species richness of the flora within the Lviv region is explained by the diversity of its landscapes, which is why the attention of scientists is constantly focused on the study and distribution of rare and endangered species. Observations of their species diversity and place of growth are carried out. In 2011, the popular science publication "Rare and endangered plant species of Lviv region" was published [19]. As a result of numerous studies, updated data on the activity of species were obtained. In 2014, researchers O.O. Kahalo and N.M. Sychak reviewed the list of endangered plant species requiring protection in the Lviv region. Based on their many years of research, they proposed a new list of vascular plants requiring protection in the Lviv region (146 species included in the Red Book of Ukraine) [7].

In 2015, the author's team of scientists led by L. Tasienkevych supplemented and presented the characteristics of endangered and rare species of plants of the Red Book of Ukraine growing in the Lviv region. The description of each species was carried out according to a scheme similar to the characteristics of Red Book plants [12].

Rare and endangered plant species of the family Orchidaceae Juss require special attention. Family Orchidaceae Juss. is one of the largest families of angiosperms monocotyledonous perennial terrestrial herbaceous plants [20]. Its representatives are distributed around the globe. The center of orchids genus and species diversity is tropical America, where there are up to 306 genera, which unite 8266 species [18].

Species of the family Orchidaceae Juss. are gradually disappearing in many localities due to the vulnerability of their habitat to anthropogenic changes, direct extinction by man, as well as a complex and long-life cycle. This alarming trend is the basis for studying the distribution, structure, and dynamics of populations to assess their condition and develop ways of conservation.

Study of the Orchidaceae Juss. family representatives within modern Ukraine last more than 200 years and are closely linked with the history of flora research on its territory. Orchids systematic composition and number of species have changed with the development of taxonomic studies. The first generalized information of the family Orchidaceae Juss. in Ukraine included 53 species belonging to 23 genera. Thus, the scientist Sobko described 70 species of orchids belonging to 28 genera in the flora of Ukraine [13]. The third edition of the Red Book of Ukraine (2009) lists 68 species of 29 genera, which indicates the rarity and uniqueness of this family [17; 18]. According to research by M.B. Haponenko, the modern flora of the family Orchidaceae Juss. in Ukraine has 71 species and 27 genera [2].

Study of the Orchidaceae Juss. family structure and its species composition are active in many countries. According to the latest classification, the orchid flora of Ukraine belongs to the division Magnoliophyta, class Liliopsida, subclass Liliidae, genus Asparagales, family Orchidaceae Juss., which includes two subfamilies (Cypripedioideae and Epidendroideae), 6 tribes (Orpriae, 11 subspecies, 27 genera, 74 species, and 19 subspecies. Until recently, there are changes in the classification of the family Orchidaceae Juss., and the authors' views on the volume of individual taxa often differ significantly [2].

Western Ukraine is one of the richest regions of Ukraine in the number of taxa and known habitats of the Orchidaceae Juss family. Here are the boundaries of the habitats for 22 species of this family. For a long time, relatively little changed natural phytocenoses were preserved in large areas. But insufficient attention to orchids in recent decades has led to the destruction of habitats of many species and the reduction of representative areas for the creation of protected areas [4].

The most thorough research on species composition of the Orchidaceae Juss. family in Western Ukraine was carried out by scientist M. Zapulsky. The scientist studied 62 species of the Orchidaceae Juss. family, which belong to 24 genera. The scientist showed that a large number of representatives were characterized by the genera Dactylorhiza (21.1%), Orchis (15.4%), Epipactis (9.6%), less – the genera Sephalanthera and Gymnadenia (5.8%), Listera (3 species), Platanthera (8 species), and Spiranthes (7 species). However, 16 genera of the family Orchidaceae Juss. (Anacamptis, Coeloglossuw, Corallorhiza, Epipogium, Goodyera, Hasmarbya, Herminium, Liparís, Malaxis, Neottía, Neottianthe, Nigritella, Ophrys, Pseudorchis, Traunsteinera) are represented by one species [5; 6].

3098 orchid species are registered in the western region of Ukraine. Most of them are located in Lviv (29.9%), Zakarpattia (20.0%), Ivano-Frankivsk (19.4%), Volyn (16.0%) and Chernivtsi (11.4%) oblasts. Orchidaceae species are components of more than 40 formations and 220 associations. The richest species composition of orchid is for forest groups (Fageta sylvaticae, Querceta roboris), meadows (Festuceta rubrae, F. pratensis, Nardeta strictae), and meadow-steppe groups (Brach and pod and eta pinnati, Cariceta humllis). Orchids do not play a significant phytocenotic role, they are indigenous assectators [5].

Representatives of the Orchidaceae Juss. family in western regions of Ukraine have coenopopulations with a low number of individuals (51.2% of species), much less with high – 25.0% and medium – 9.6%. Urbanization is an important factor in the destruction of orchids. Over the last 150 years, the species composition of Orchidaceae in Lviv has decreased by 62.8% due to significant urban changes. The highest rates of this process were observed for the first half of the XX century (50.0%) [6].

All members of the Orchidaceae Juss. family growing in Western Ukraine are polycarpic herbs. Scientists have identified a significant morphological diversity of species in this family [5; 11].

Today orchids are in the stage of active evolution, which is confirmed by the structure of the generative organ [1]. Vegetative organs are less variable, their structure characterizes the adaptation of plants to climatic, edaphic, and phytocenotic conditions of existence, which was formed in the process of evolution. Under natural conditions, orchids are capable of vegetative and seed reproduction, but it is not enough for the restoration of natural reproduction populations due to their bioecological characteristics. Most species are rare and endangered [20].

Orchid flowers are of irregular shape, six-membered, consisting of petals, sepals, and lips, are united in inflorescences (top or side bouquet). The stamen grows in with the pistil, lumps of glued pollen are on the stamen top. Most orchids have only one stamen, some species have two. Pollen grows in pollen lump. After pollination, the ovary develops into a capsule. Fruit is a dry capsule of various shapes and sizes with leaves; it ripens from 2 to 12 months. The capsule contains several million dusty seeds spread by wind. Orchids do not have double fertilization; multicellular endosperm is formed only in a third of the studied species up to 2-10 nuclei. In most cases, the primary nucleus of the endosperm degenerates without further division and is absorbed by the embryo [13].

Orchids are pollinated by insects (bees, beetles, flies, butterflies), and sometimes birds (hummingbirds, honeybees, nectaries). The insect usually sits on the lip of the flower and collects nectar, polynya sticks to its body. On the second flower, the pollen falls on the receptacles – self-pollination is eliminated. Orchids bloom more often in the dry season, some species for 2-3 months. Different species of orchids bloom at different times and are therefore protected from natural hybridization [8].

The rarity of orchids, the reduction of their number is due to the influence of natural factors (absence in the biotope of fungi-mycorrhizal and specific pollinating insects), and anthropogenic activity [22]. The main anthropogenic factors influencing the extinction of orchids are unauthorized uncontrolled deforestation, burning of dry grass in spring, which leads to forest fires, excessive use of hayfields and pastures, drainage of wet meadows and swamps [3, 8]. That is why the protection and conservation of plant resources of the Orchidaceae Juss. family requires their comprehensive study and inexhaustible and proper use.

It should be noted that all species of the Orchidaceae Juss. family, which occur in the Lviv region, including Turka district, are included in the list of European and International Red List of rare and endangered plants [7]. These species require constant monitoring of the population status to preserve their habitats.

Our research aimed to establish the species diversity and distribution of rare and endangered plants of the Orchidaceae Juss. family on the territory of Turka district.

MATERIALS AND METHODS

Determination of the species composition for the family Orchidaceae Juss. on the territory of Turka district was carried out by the route method. The routes passed through the outskirts of the villages of Nizhniy Turiv, Nyzhne, Verkhne, Borynya, Nyzhnia Yablunka, which are located in the lower mountain belt of the Carpathians. The research routes passed through the territories of Borynsya, Yablunka, and Verkhne forestries. It should be noted that part of the regional landscape park "Nadsyansky" is located on the territory of Yablunka forestry.

Fieldwork was performed during May-August 2020–2021. Identification of plant species was carried out according to generally accepted methods, herbarium material, and specified by determinants of higher plants [17; 20; 21]. The vegetation of different landscapes (meadow, shrub, forest) was examined. To determine the abundance, which permits to determine the degree of participation for individuals of the species in the cenosis, a rough method of direct accounting according to O. Drude was used.

RESULTS OF THE RESEARCH AND ITS DISCUSSION

Turka district is located in the Stryj-Syansk Verkhovyna physical-geographical district in the southwest of the Lviv region among the Carpathian landscapes. Its territory covers the mouths of the rivers Stryy, San, Dniester, and the southern part of the Ukrainian Carpathians. Turka district borders with the Transcarpathian region in the south, and with Poland in the west. The length from north to south is 47 km, and 19 km from west to east. The territory of this region covers 1193 km^2, which is 5.5% of the whole territory of the Lviv region.

The region is dominated by mountainous terrain, which is represented by ridges dissected by the rivers Yablunka and Stryy at altitudes from 500 to 1400 m. Skole Beskydy, Verkhovyna Turianska, the highest peak of Lviv region – Mount Pikuy (1408 m), Verkhovyna watershed are located here [16].

The soil cover of the Turka district was formed in rather difficult conditions of the geological structure, climatic regimes, under the influence of autochthonous vegetation of mountain relief. Soils differ in geological structure. Brown forest and sod-brown soils prevail within the district. They are common soils of the Ukrainian Carpathians, which are found in different thermal zones of the mountainous part of the Lviv region, and their properties have insignificant differences.

According to the climatic zoning of the Carpathian Mountains, the territory of Turka district belongs to temperate, cool, and moderately cold thermal zones. The relief of mountainous areas and radiation and circulation cycles are the reason for the formation of temperate-continental climate, which is characterized by mild winters, not hot summers, warm autumns. Humidification mode is mostly excessive. The amount of precipitation depends on the absolute heights of the terrain, as well as the prevailing winds and the exposure of the slopes [16].

Features of the formation of phytocenoses in the Turka district are defined by the relief, geographical location, and climatic conditions. The territory of the region is located in the mountains. That is why there is vertical zoning in the distribution of plant species diversity.

In ancient times, the territory of the Turka district was covered with mixed forests. Today, natural vegetation is preserved only in the east and south of the region, where the highest and steepest mountain ranges in the region are located. A large number of species came from the north, south, the mountains of Central Europe, and the steppes of the East. Picea abies L., Vaccinium vitis-idaea L., Oxalis acetosella L. moved from the north, Fagus sylvatica, Abies alba Mill, Acer pseudoplatanus moved from the west; Juniperus comunicum. etc. moved from the south. There are now more than 2,000 species growing in the area, many of which are relict and endemic plants [16].

In the lower mountain belt of Turka district, hornbeam-beech and beech-hornbeam forests, where grow such species of trees as Fagus sylvatica L., Carpinus betulus L., Betula verrucosa Ehrh., Populus tremula L. are spread. Shrub vegetation grows, which is found on edges, forest glades, on unforested slopes above streams. These are Sambucus nigra L., Gretaegus oxyacanta L., Sorbus aucupaia L., Viburnus opulus L., Corylus avellana L., Rubus ideus L., Prunus spinosa L., Rosa canina. Many medicinal plants are widespread among herbaceous representatives: Sumphytum cordatum Waldst et Kit. ex Willd, Asperula odorata L., Campanula patula L., Drypteris filix mas L., Viola canina L., Arcticum lappa L., Urtica diorica L., Fragaria veska L., Oxalis acetosella l., Mentha piperata L., Chelidonium majus L., Lamium alba L., Centaurea phrygia L. [16].

The upper mountain forest belt is represented by Fagus sylvatica (Libohory forestry). Herbaceous plants are rare, the most common are Oxalis acetosella, Asperula odorata, Dentaria bulbifera [16].

In general, the vegetation cover of Turka district is located according to the vertical zonation: from coniferous-deciduous forests, floodplain meadows, and river valleys to subalpine meadows of the Watershed Range. The main forest crop, which occupies the largest areas in the region is Picea abies L. Large areas are occupied by Abies alba Mill, which is quite common in forests, but

rarely forms homogeneous habitats. Fagus sylvatica is the third most widespread forest-forming species in the region. It grows the most in Libokhor forestry – 49.2% of its square, 12.9% in Yasenitsia forestry, and 11.4% in Rozluky forestry.

The landscape and natural geographical diversity of the Turka district have led to the creation of a significant number of nature reserve fund objects on its territory. Here are located such nature reserves as Skole Beskydy National Nature Park, Boykivshchyna National Nature Park, Nadsyansky Regional Landscape Park, Rozluch Landscape Reserve, landscape reserve of state importance "Pikuy", protected tracts of local significance "Yalyna", "Krasne", "Sygla", the general zoological reserve of local significance "Libohorivsky" [16].

During the research conducted based on the collected material, we found five species of rare and endangered species of the Orchidaceae Juss. family, which were found in the study area: Cephalanthera longifolia L., Orchis purpurea Huds., Listera ovata L., Dactylorhiza fuchsii, Platanthera bifolia L.

Cephalanthera longifolia L. is a perennial herbaceous plant of the Orchidaceae Juss family. The stem is 20-50 cm high, densely covered with leaves. Leaves are linear-lanceolate, with well-marked parallel strong veins, arranged in two rows. The inflorescence is dense. The flowers are milky white, directed at an angle. The outer leaves of the perianth are almost twice as long as the lip, which is golden yellow at the top and densely covered with very small papillae. Seeds are small, brown.

The plant blooms during May. The species is listed in the Red Book of Ukraine. The conservation status of the species is rare. As a result of our research, several generative individuals of middle age have been identified. Cephalanthera longifolia L. was found singly in the territory of Borynya forestry (on the roadsides of forest roads, in mixed forests, on the edges, at meadows).

Orchis purpurea Huds. is a perennial herbaceous plant with underground elongated ovoid tubers of the Orchidaceae Juss family. The stem is straight height 30-70cm. Leaves are oblong, acute, elliptical-lanceolate, shiny above, pale below, the upper leaf is curled around the stem. The flowers are fragrant, bisexual, irregular, in a dense spike, the lip is light pink with dark purple dots. Fruit is the capsule. It blooms in May-June. The species is listed in the Red Book. The conservation status of the species is vulnerable.

Lonely individuals of Orchis purpurea Huds. are met on the territory of Yablunka forestry (on the edges, on the roadsides of forest roads). Orchis purpurea plants grew on the slope of the south-eastern exposition. According to morphometric features, individuals of low vitality were in young and middle age.

Listera ovata L. is an herbaceous plant with a short creeping rhizome of the Orchidaceae Juss family. The stem at the base has two broad oval-shaped opposite leaves, which are placed almost horizontally. An elongated multi-flowered inflorescence is at the end of the stem.

The flowers are collected in a multi-flowered raceme, small, greenish-yellowish, form a lot of nectar. The shape of the flowers resembles falling drops. Fruit is the capsule. In rainy weather, only 10% of flowers can bear fruit. The plant is propagated mainly by seeds (very small) and vegetatively. The species is listed in the Red Book of Ukraine. This is one of the most common Red Book plants in Ukraine. The conservation status of the species is not evaluated.

Plants were rare during the research in the territory of the Verkhnensky forestry (in moist coniferous and mixed forests, in swampy places), there were single groups of 1–5 plants.

Dactylorhiza fuchsii is a perennial herbaceous plant of Orchidaceae Juss family 20–50 cm heigh. Tubers are 2–4-bladed. The leaves are more clustered at the bottom of the stem, ovate-long, spotted, higher on the plant are smaller. The inflorescence is spike-shaped, many-flowered. The lip is deeply three-lobed, the middle blade is longer than the lateral ones. It blooms in June-July. The plant is propagated by seeds. The species is listed in the Red Book of Ukraine. The conservation status of the species is not evaluated.

Plants were rare on the territory of Borynya forestry (on the glades of mixed forests, on the edges, on the side of the forest road). Populations were represented by several middle-aged generative individuals. The reasons for the change in numbers are the destruction of plants for bouquets, grazing cattle, digging tubers as medicinal raw materials.

Platanthera bifolia L. is a perennial herbaceous plant of the Orchidaceae Juss family, 20 to 50 cm high. Tubers are whole, oval. The species has two undivided tuberous roots. Every year one tuber of a plant dies, and a new tuber grows in its place the next year. The stem is tall, slender. The plant has only 4-6 leaves, of which the lower 2 are large, elliptical, almost opposite. The species name indicates a characteristic feature – two leaves are well visible (in most individuals). The inflorescence is a racemose, raised on a long peduncle. The flowers are greenish-white or white, fragrant.

The fruit of the species is a multi-seeded capsule with small seeds looking like dust. The plant blooms in June and May and bears fruit in August. Seedlings develop in the soil for 2–4 years, the first flowering in individuals occurs at 11 years, and the plant can live up to 27 years in general. Platanthera bifolia L. is listed in the Red Book of Ukraine. The conservation status of the species is not evaluated.

The plants were scattered on the territory of Borynya, Yablunka, Verkhnenske forestries (on the edges, among bushes, on light areas of beech forest). The spatial structure is characterized by a single placement of individuals.

By conservation status established species following Art. 13 of the Law of Ukraine "On the Red Book of Ukraine", are divided into the following categories: rare, vulnerable, and not evaluated (Table 1).

Table 1. Species diversity and distribution of the Orchidaceae family plants on the territory of Turka district

No.	The Latin name of the species	Abundance of growth	Conservation status of the species
1	Cephalanthera longifolia L.	Un (unicum)	Rare
2	Orchis purpurea Huds.	Un (unicum)	Vulnerable
3	Listera ovata L.	Sol (solitaries)	Not evaluated
4	Dactylorhiza fuchsii	Sol (solitaries)	Not evaluated
5	Platanthera bifolia L.	Sol (solitaries)	Not evaluated

Characterizing the abundance of plants by the scale of numbers in the phytocenosis, it was found that all identified species can be divided into two groups by distribution: Sol (solitaries) – plants found singly, occurred after closer inspection and Un (unicum) <1% – one plant per research area. Field studies have shown that certain species grew rarely, in fragments, were insignificant.

The main factors influencing the number of rare and endangered plants are their plucking (for bouquets, medicinal raw materials) and degradation of habitats (excessive grazing, mowing, burning grass, forestry). In recent decades, there has been an increase in anthropogenic pressures in the highlands, including the growth of mountain and green tourism, which leads to the collection and trampling of rare plants by tourists and locals. At the same time, special destruction occurs in populations of medicinal and ornamental species, including many endangered and rare plants.

CONCLUSIONS

During the research conducted based on the collected material, we found five species of rare and endangered species of the Orchidaceae Juss. family, which were found in the Turka district territory: Cephalanthera longifolia L., Orchis purpurea Huds., Listera ovata L., Dactylorhiza fuchsii, Platanthera bifolia L.

Field studies have shown that certain species grew sparsely, in fragments, and on the scale of numbers in the phytocenosis were characterized as single plants occurring after the close inspection. Orchid Juss. family plants found in the study area indicate their low prevalence and abundant growth, which is due to the features of their development, environmental conditions, and anthropogenic pressure. There are insignificant resources of rare and endangered species with the threat of extinction of their natural populations within the Turka district.

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АНОТАЦІЯ

ВИДОВА РІЗНОМАНІТНІСТЬ РІДКІСНИХ І ЗНИКАЮЧИХ РОСЛИН РОДИНИ *ORCHIDACEAE* JUSS. НА ТЕРИТОРІЇ ТУРКІВЩИНИ

Видове багатство флори Львівської області представлене різноманітністю її ланшафтів. Зважаючи на поширеність видів увага науковців звернена на вивчення рідкісних і зникаючих видів. При цьому особливої уваги заслуговують рідкісні і зникаючі види рослин родини *Orchidaceae* Juss. Представники родини *Orchidaceae* Juss. поступово зникають у численних популяціях. Причинами цього явища є безпосереднє винищування людиною, вразливість до антропогенних змін середовища існування, а також складний життєвий цикл. Згадана тенденція є підставою для вивчення поширення, структури й динаміки популяцій.

Всі види родини *Orchidaceae* Juss., які трапляються на території Львівщини, зокрема і Турківщини, включені до переліку Європейського та Міжнародного Червоного списків рідкісних та зникаючих рослин. Ці види потребують постійного моніторингу стану популяцій з метою збереження їх оселищ.

Метою наших досліджень було встановити видову різноманітність та поширення представників родини *Orchidaceae* Juss. на території Турківщини.

Визначення видового складу представників родини *Orchidaceae* Juss. на території Турківщини проводили маршрутним методом. Маршрути пролягали через околиці сіл Нижній Турів, Нижнє, Верхнє, Бориня, Нижня Яблунька, які розміщені у нижньому гірському поясі Карпат. Території досліджень охоплювали Боринське, Яблунське та Верхненське лісництва.

Польові роботи виконувались протягом травня-серпня 2020–2021 рр. Ідентифікацію видів рослин здійснювали за загальноприйнятими методами, гербарним матеріалом і уточнювали за визначниками вищих рослин. Нами обстежувалась рослинність різних ландшафтів (лучна, чагарникова, лісова). Для визначення рясності, за якою можна визначити ступінь участі особин виду в ценозі, ми використовували окомірний метод прямого обліку О. Друде.

Під час проведених досліджень на підставі зібраного матеріалу нами встановлено місцезростання п'яти видів родини *Orchidaceae* Juss., зокрема: *Cephalanthera longifolia L., Orchis purpurea Huds., Listera ovata L., Dactylorhiza fuchsii, Platanthera bifolia L.*

Польові дослідження показали, що визначені види зростали рідко, фрагментарно і за шкалою чисельності у фітоценозі характеризувались як рослини, що зустрічаються поодиноко, трапляються при ретельному огляді. Виявлені на території дослідження рослини родини Orchidacea Juss. свідчать про їх незначне поширення та рясність зростання, що пов'язано із особливостями їх розвитку, умовами навколишнього середовища та антропогенним навантаженням.

Основними факторами, які впливають на чисельність рідкісних і зникаючих рослин, є їх зривання (на букети, заготівля лікарської сировини) та деградація місцезростань (надмірне випасання, викошування, випалювання трави, проведення лісогосподарських робіт). За природоохоронним статусом визначені види розподілені за такими категоріями: рідкісні, вразливі та неоцінені.

Отже, у межах Турківщини є незначні ресурси рідкісних і зникаючих видів родини *Orchidaceae* Juss. із загрозою знищення їх природних популяцій.