

УДК 502.172:633.2 (477)

## ECOLOGICAL AND CEONOTIC CHARACTERISTICS OF *SCHOENUS FERRUGINUS* L. POPULATION ON THE TERRITORY OF «KEMPA» BOTANICAL RESERVE

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На території ботанічного заказника місцевого значення «Кемпа» досліджено популяцію *Schoenus ferrugineus* L. Для визначення структури популяції було оцінено морфометричні ознаки та еколого-ценотичні особливості умов місцезростання за едафічними та кліматичними чинниками (методом синфітоіндикації). Встановлено, що популяція *S. ferrugineus* за віталітетним спектром є процвітаючою.

**Ключові слова:** *Schoenus ferrugineus* L., популяція, водно-болотні угіддя.

Population studies within the reserved areas play an essential role for biodiversity conservation [1, 3, 5, 7, 11–15]. Investigation at the population level can not only assess the environmental conditions of habitats, identify nature of variability, dependence between intra-population variability and adaptation potential, but also establish theoretical and practical basis for the protection of rare species [8, 9]. An important objective of preserving phytodiversity condition of wetlands is the identification and assessment of cenopopulations of rare plant species as indicators of natural ecosystems [1, 3, 10].

The «Kempa» botanical reserve of local importance is located in the village Smilno, Brodivskyi district, Lviv region established in 1984 with an area of 10 hectares in order to protect the unique in Ukraine habitat of rare species *Spiranthes amoena* (Bieb.). There is a valuable lowland grass-sedge marsh, where growing species are listed in the Red Book of Ukraine and rare groups are listed in the Green Book of Ukraine at the Reserve territory [6, 13]. In this context it should be highlighted a representative of the family *Cyperaceae* Juss., *Schoenus ferrugineus* L. [2, 11, 13]. Natural habitat for *S. ferrugineus* are Central Europe, the Scandinavian peninsula, very rare – Mediterranean [14, 15]. In Ukraine this species extends within Volyn hill (Loess Plateau), Podolian Upland (West),

Small Polissia, Roztochchya, thus within the Volyn, Rivne, Lviv, Ternopil and Khmelnytsky regions [6]. A literary analysis shows that phytocoenoses *Schoenus ferrugineus* L. perform soil-retaining, water security and turf true meaning [1–3, 5–7, 10–15]. Among Ukrainian scientists there should be especially noted works by Ye. Bradis, A. Barbarych, and T. Andriyenko who have held a number of geo-botanical descriptions as well as suggestions for reducing human impacts on wetlands and particularly rare species of flora and fauna. However, comprehensive ecological and coenotic studies over the *Schoenus a ferrugineus* L. population has not been performed fully yet, as well as structural and functional properties of its adaptations and complex of relevant environmental factors have not been established.

*Schoenus ferrugineus* L. – a perennial plant with 15–30 cm of height. Inflorescences 7–12 2–8 mm capitates consisting of 2–3 reddish-brown spikelets at the base with two grooved at floral leaves, the lower of which is slightly longer than inflorescence. Leaves are less than half (1/3) of the stem [2, 11, 13]. In Ukraine known populations are not numerous and occupy small areas of eutrophic wetlands, mainly formed on carbonate rocks [1–3]. The literature review also shows that many well-known species habitats have disappeared at the end of the last century, due to the holding of large scale meliorative drainage works. Among the groups that survived dominate

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transformed where *Schoenus ferrugineus* L. co-dominates with *Phragmites australis* (Cav.) Trin. ex Steud. and *Molinia caerulea* L., bog-meadow and meadow species are also heavily involved [1–3, 11, 13]. Moreover, I. Danylyk has noticed the emergence of new *S. ferrugineus* habitats, at the secondary wetland and heavily drained areas [3].

However, regardless of experience, in modern terms of ecological and coenotic peculiarities of the *Schoenus ferrugineus* L. coenotic population on the territory of protected areas, and the degree of anthropogenic transformation conditions of habitats over rare species have been investigated in an insufficient measure. Therefore, the aim of work was to establish eco-coenotic peculiarities of the *S. ferrugineus* natural populations on the territory of «Kempa» botanical reserve of local importance.

#### MATERIALS AND METHODS

A number of morphometric traits have been investigated to clarify the populations structure (Tab. 1).

Within the population on the basis of undamaged there were investigated 50 individuals in 11 times repetition of each feature on two sites that differ by level of humidification: 1) 250–70 m – in low relief

area, more hydrated with water level up to 30 cm; 2) 100–100 m – on the increase, less hydrated, the water level is up to 10 cm. Population of the species is represented by 475 measurements of each trait that ensures reliability of results. Also, for a more detailed description of the generative organs there has been calculated the density inflorescence index (P). Biometric research results have been analyzed and calculated by means of the Statistic Ph 6.0 and Microsoft Excel application programs. Assessment of vitality status of the *Schoenus ferrugineus* L. coenotic population has been conducted by generally accepted method [8, 9]. The assessment of habitat conditions has been conducted by edaphic and climatic factors [4].

#### RESULTS AND DISCUSSION

When examining the territory of «Kempa» botanical reserve of local importance we have found the *Schoenus ferrugineus* L. habitat. Land plot area, that group occupies covers 250 m<sup>2</sup>. The soil is calcareous, highly humidified. During periods of prolonged rainfall, a layer forms of thickness at 5–15 cm due to the meliorative canals on the surface. Sedge marsh, which was formed on the lawn in the pine forest within the «Kempa» botanical

Table 1

Investigated morphometric features of *Schoenus ferrugineus* L.

| No. | Morphometric characteristics    | Reference designation |
|-----|---------------------------------|-----------------------|
| 1   | generative shoot length (cm)    | L                     |
| 2   | inflorescence length (cm)       | L <sub>I</sub>        |
| 3   | atfloral sheet length (cm)      | L <sub>b</sub>        |
| 4   | spine length (cm)               | L <sub>a</sub>        |
| 5   | the first spikelet length (cm)  | L <sub>1s</sub>       |
| 6   | the second spikelet length (cm) | L <sub>2s</sub>       |
| 7   | the third spikelet length (cm)  | L <sub>3s</sub>       |
| 8   | number of spikelets             | N <sub>s</sub>        |
| 9   | stem diameter (cm)              | d                     |
| 10  | leaf length (cm)                | L <sub>l</sub>        |
| 11  | leaf width (cm)                 | W <sub>l</sub>        |
| 12  | inflorescence density           | P                     |

reserve, is characterized by tree-shrub layer that is formed by several species of willows (*Salix myrtilloides* L., *Salix cinerea* L., *Salix pentandra* L., *Salix caprea* L.), *Alnus glutinosa* (L.) Gaerth. Mill. Vegetation, with a total estimated cover up to 90% is formed by two tiers. In the top grass tier of the height up to 1.5 m, dominate *Phragmites australis* (Cav.) Trin. ex Steud. (with projective cover of 10–40%), *Molinia caerulea* (L.) Moench (15–40%), *Cladium mariscus* (L.) Poht (up to 20%), *Juncus effuses* L. (1–2%). The total projective cover of the lower tier of grass up to 60 cm, makes up 50%. A significant part in the formation of groups take *Schoenus ferrugineus* L., *Carex dioica* L., *Carex davalliana* Smith, *Eryophorum polystachion* L., *Potentilla erecta* L. – from 5 to 40% of projective cover.

The species composition of cenoses formed by *Schoenus ferrugineus* L., involves from 6 to 29 species where significant proportion accounts for members of the *Cyperaceae* family, which are typical for wetland cenoses. In the composition of the investigated groups there has been noticed several species that are indicators of calcareous wetlands, namely: *Schoenus ferrugineus* L., *Carex dioica* L., *Carex davalliana* Smith, *Carex flava* L., *Cladium mariscus* (L.) Poht. The performed Syntaxonomical groups analysis allows one to classify it to the *Scheuchzerio-Caricetea nigrae* class, *Caricion davallianae* union as well as *Schoenium ferruginei* association.

In general, investigated *Schoenus ferrugineus* L. habitat places are characterized by low content of carbonates and meet envi-

ronmental group which withstand insignificant content of carbonates in the soil (CaO, MgO within the limits of 0.5–1.5%), salts (150–200 mg/l) and nitrogen (0.2–0.3%) in soil, and slightly acidic pH (5.5–6.5). Among the climatic factors it has been set a correlative connection between thermo-regime and ombro-regime with edaphic factors.

According to biomorphological analysis the length of generative shoots exceeds average size indicated by other authors (Barbarych, Bradis, 1977; Wheeler, Brookes, Smit, 1983, Hajkova, 2011) on 9–20 cm the length of inflorescences is up to 0.1–1.2 cm. (Tab. 2). The coefficient of variation for morphological and metric parameters of coenotical population in all areas varies from 6–24%. The most changing were leaf width (24%), the length of spine (20%) and the number of spikelets (11%). The lowest amplitude of variability is characterized at the length of floral leaf (6%).

To establish a connection between the investigated characteristics it has been also calculated the correlation coefficient (Tab. 3). A statistically significant correlation between morphometric features has been found: by inflorescence, spine as well as spikelets lengths. Whereas, for the number of spikelets signs and leaflets length the correlation has not been installed with any of morphometric parameters. That demonstrates features of the *Schoenus ferrugineus* L. coenotic populations adaptation to the environmental conditions of the swamp.

Based on morphological traits investigated, we have also examined the vitality status

Table 2

**The value of morphometric traits of the *Schoenus ferrugineus* L. coenotical population for «Kempa» botanocal reserve of local importance**

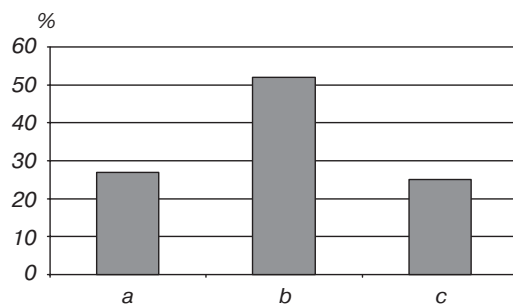
| Statistical characteristics  | Morphometric parameters |                |                |                |                 |                 |                 |                |      |                |                |      |
|------------------------------|-------------------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|----------------|------|----------------|----------------|------|
|                              | L                       | L <sub>a</sub> | L <sub>l</sub> | L <sub>b</sub> | L <sub>1s</sub> | L <sub>2s</sub> | L <sub>3s</sub> | N <sub>s</sub> | d    | L <sub>l</sub> | W <sub>l</sub> | P    |
| The arithmetic average       | 41.0                    | 0.81           | 1.74           | 1.01           | 0.99            | 0.88            | 0.8             | 2.7            | 0.19 | 23.2           | 0.38           | 1.3  |
| Standard deviation           | 2.51                    | 0.16           | 0.19           | 0.06           | 0.07            | 0.08            | 0.08            | 0.29           | 0.02 | 4.1            | 0.08           | 0.2  |
| The coefficient of variation | 6.1                     | 19.7           | 10.9           | 5.94           | 7.07            | 9.09            | 10.0            | 10.7           | 10.5 | 19.0           | 23.5           | 15.1 |

Table 3

**Averaging correlation communications between morphometric characteristics of the *Schoenus ferrugineus* L. cenopopulations («Kempa»)**

|                       |          |             |             |           |             |             |            |           |          |           |
|-----------------------|----------|-------------|-------------|-----------|-------------|-------------|------------|-----------|----------|-----------|
| <b>L</b>              |          |             |             |           |             |             |            |           |          |           |
| <b>L<sub>a</sub></b>  | 0.25     |             |             |           |             |             |            |           |          |           |
| <b>L<sub>l</sub></b>  | 0.38     | <b>0.96</b> |             |           |             |             |            |           |          |           |
| <b>L<sub>b</sub></b>  | 0.43     | 0.35        | <b>0.52</b> |           |             |             |            |           |          |           |
| <b>L<sub>1s</sub></b> | -0.04    | 0.46        | 0.47        | 0.19      |             |             |            |           |          |           |
| <b>L<sub>2s</sub></b> | -0.10    | <b>0.57</b> | 0.55        | 0.25      | <b>0.63</b> |             |            |           |          |           |
| <b>L<sub>3s</sub></b> | 0.14     | 0.38        | 0.47        | 0.52      | <b>0.56</b> | <b>0.60</b> |            |           |          |           |
| <b>N<sub>s</sub></b>  | -0.08    | -0.04       | -0.12       | 0.04      | 0.10        | 0.20        | 0.01       |           |          |           |
| <b>d</b>              | 0.23     | 0.45        | 0.48        | 0.35      | 0.30        | 0.50        | 0.18       | -0.01     |          |           |
| <b>L<sub>l</sub></b>  | -0.22    | -0.65       | -0.23       | -0.11     | -0.71       | -0.65       | 0.11       | -0.01     |          |           |
| <b>W<sub>l</sub></b>  | 0.01     | 0.09        | -0.13       | -0.34     | -0.54       | -0.23       | -0.11      | -0.01     | 0.23     | 0.12      |
|                       | <b>L</b> | <b>La</b>   | <b>LI</b>   | <b>Lb</b> | <b>L1s</b>  | <b>L2s</b>  | <b>L3s</b> | <b>Ns</b> | <b>d</b> | <b>LI</b> |

of the *Schoenus ferrugineus* L. populations. Vitality is not always related to weight, since dispersed type of distribution in communities is optimal for some species [8, 9]. The same trend can be typical for rare species. To construct the size spectrum it has been used length of generative shoot, inflorescence and spikelet. The result of analysis of vitality has shown that the studied populations are characterized by a smaller proportion of small (*c*) and slightly larger (*a*) species, and significantly greater proportion of medium-sized species (*a*), which testament to its thriving spectrum (Figure).



Vitality spectrum of *Schoenus ferrugineus* L. populations on the territory of «Kempa» botanocal reserve of local importance

### CONCLUSIONS

The conducted analysis has shown that investigated *Schoenus ferrugineus* L. population is developing in weakly acidic, enriched with salts, relatively poor regarding soil mineral nitrogen, presence of some meadow species indicates a slight transformation of coenosis on both sites. Wide fluctuations in amplitude of variability of morphometric traits on the *Schoenus ferrugineus* L. population on various sites that differ by moisture level, indicates a high level of adaptation of populations to the terms of the natural environment. Moreover, it was found that the greater number of correlation communications between investigated morphometric characteristics, the more equilibrium and prosperous is coenotic population. This peculiarity can be explained by phenotypic and morphological characteristics of species.

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UDC 631.526.4/53.01:633.16

## BARLEY GENOTYPES IDENTIFICATION OF SEED PROLAMINE BY ELECTROPHORETIC SPECTRUM

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*Наведено результати досліджень з вивчення компонентного складу гордеїнів у сортів ячменю ярого. Для ідентифікації та визначення чистоти сорту за електрофоретичними спектрами застосовували аналіз блоків локусів Hrd A, Hrd B та Hrd F, що є найбільш поліморфними та детально вивченими. На основі отриманих даних створено каталог, що налічує 91 сорт ячменю, використання якого в дослідженнях надасть можливість визначити сортову чистоту партій зерна, здійснювати ідентифікацію генотипів сортів ячменю та використовувати дослідження електрофоретичних спектрів гордеїнів як додатковий вид аналізу для проведення кваліфікаційної експертизи.*

**Ключові слова:** запасні білки, гордеїни, електрофоретичні спектри, сортова чистота.

Barley is one of the major crops in Ukraine. It is used for food, feed and process needs. Breeding and seed production of barley aimed at creating not only high grades, but also their maintaining.

At present, during the qualifying examination for the divergence, homogeneity and stability (DHS) for the variety registration description of identification characteristics though the visual assessment method is used, which depends on the type and display of studied parameters. However, the most of

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