

## VITAL STRUCTURE OF CENOPOPULATIONS OF *POTENTILLA ALBA* L. (ROSACEAE) AT THE SOUTHERN OPILLIA

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*It is presented results of individuals vitality research and the vital structure of *Potentilla alba* L. (Rosaceae) cenopopulations at the Opillia. It is investigated 15 cenopopulations according to Yu. A. Zlobin. It is established that the vital status of individuals and the vital structure of *P. alba* cenopopulations vary depending on the ecological-cenotic conditions. In most cenopopulations, there are individuals of all classes of vitality, but in the correlation between classes there are significant differences. Cenopopulations belong to three vital types, however, prosperous types prevail. The predominance of vitality highest class individuals and high values of the quality index are characteristic for cenopopulations that grow at the mesophytic and steppe meadows and meadow steppes, at podzolic chernozems with a capacity 45-60 cm, formed at the slabs or sloping parts of the slopes – in formations groups of *Brizietia mediae* and *Brachypodieta pinnati*. Equilibrium cenopopulations with superiority of vitality higher or middle-class individuals are presented at the meadow steppes formed at relatively steep slopes – in formations groups of *Cariceta humilis* and *Seslerieta heufleranae*, as well as associations of *Brachypodietum (pinnati) festucosum* (valesiaca). Depressive type with minimum values of the quality index and advantage vitality lower class individuals includes the cenopopulation in the formation groups of *Elytrigietia intermediae*, which are characterized by a high density of dominant species and the plentiful flora composition. The same indicators are typical for the cenopopulation in association groups of *Festucetum (valesiaca) stiposum (pennatae)*, which grows at a steep slope of a hill with shallow black soil and scattered gipsoandardites.*

*Keywords: *Potentilla alba* L., Opillia, vitality of individuals, vitality structure of cenopopulations*

**Introduction.** *Potentilla alba* L. – the middle-eastern European species, which grows in light pine and oak forests, in shrubs, at deforestation, lawns, meadows, outskirts, grass slopes. In Ukraine, the species is widespread in Polesia, in the forest-steppe and, occasionally, in the foothills of the Carpathians (Cvelev, 2001; Chopik, 1983). At Opillia *P. alba* for the most part, grows at the open slopes of the northern, western, rarely southern exposure hills, covered with meadow steppes and steppe meadows, occasionally also at mezophytic meadows, outskirts, in woodland.

*P. alba* recently acquired a significant popularity of the medicinal plant, what led to the mass harvesting of rhizomes. In this regard, it is necessary to investigate the state of populations of *P. alba* in different ecological-cenotic conditions of Opillia. One of the most reliable estimates of population stability can be obtained by researching their vital structure (Zhilyaev, 2005; Zlobin, 1983 and 2013). Because of the vital structure of *P. alba* cenopopulations at the South Opillia have not been studied yet, this is exactly the goal of proposed work.

**Materials and methods.** The research was conducted during 2012-2017 in the Galitsky, Rogatyn, Tlumatsky and Tysmenitsky districts of the Ivano-Frankivsk region. In terms of physical-geographic zoning, the territory belongs to the Roztotsk-Opilsky hillhorn area of the East European

plain country Broad-leaved forest zone Western Ukrainian region; in terms of geobotanical zoning – to the Opilsky-Kremenets district of beech, hornbeam and oak forests, genuine, steppe meadows and meadow steppes of the European Broad-leaved forest area Central European province (Mirkin, 2001).

According to the floristic zoning of Volyn-Podillya proposed by B. V. Zaverukha (1985), the territory belongs to the European region Central European province Lublin-Volyn-Podilsky subprovince Roztotsk-Opilsky-Podilsky county Opillia district.

The research area covers two natural areas of Opillia: Burshtynsky and Bystrzyca-Tlumacky (Gerenchuk, 1973).

The research objects are the cenopopulations (CP) of *P. alba* (Smirnova, 1976). Their vital structure was studied by method of Yu. A. Zlobin (1989; 2013). Individuals (overhead shoots) of *P. alba* are selected as the account units (Zlobin, 1983 and 2013, Smirnova, 1976). For the conduct of morphometric measurements, according to the random principle, 25 individuals were selected in each cenopopulation (Shmidt, 1984). In this case, non-destructive methods were used (Panchenko, 2007), therefore the morphometric feature, measurement of which does not require plants cutting or digging (height of the highest flowering shoal) was selected.

The set of individuals in all cenopopulations was divided into three classes of vitality, the extremes of which were determined by the method proposed by Yu. A. Zlobin (1989; 2013). After that, the relative frequencies of different classes individuals were established in each cenopopulation, the quality index (Q) of the cenopopulations and their type was determined.

Geobotanical descriptions were carried out according to the traditional method at the test areas 10 x 10 m<sup>2</sup> (Yunatov, 1964). Groups classification was carried out according to the dominant principle (Shelyag-Sosonko, 1991).

There was selected 15 cenopopulations of *P. alba* for research, detected in the following localities:

- 1 – natural boundary Ostrivets, 2,5 km northeast of the Galitsky district Meducha village; area at the plakore; steppe meadow, group association of *Brachypodietum (pinnati) purum*; projective coverage (PC) of *P. alba* is 60%;
- 2 – natural boundary Simlin, 3 km northeast of the Galitsky district Meducha village; northwest slope of the hill; steppe meadow, group formation of *Elytrigietum (intermediae) purum*; PC of *P. alba* is 35%;
- 3 – natural boundary Mount Casova, surroundings of the Galitsky district Bovshiv village (Galician National Nature Park), the northern slope of the hill; steppe meadow, group formation of *Brachypodietum (pinnati) brizidosum (mediae)*; PC of *P. alba* – 45%;
- 4 – natural boundary Stone, 1 km north of the Galitsky district Mezhighirsi village (Galician National Nature Park), northwest slope of the hill; meadow steppe, group association of *Caricetum (humilis) anthericosum (ramosi)*; PC of *P. alba* – 60%;
- 5 – natural boundary Shchovby, 1 km northeast of the Galitsky district Podillya village, northwest slope of the hill; meadow steppe, group association of *Brachypodietum (pinnati) anthericosum (ramosi)*; PC of *P. alba* – 80%;
- 6 – natural boundary Brucheva, 2 km north of the Galitsky district Khokhonov village (Galician National Nature Park), the northern slope of the hill; meadow steppe, group association of *Seslerietum (heufleranae) brachypodiosum (pinnati)*; PC of *P. alba* – 50%;
- 7 – a complex nature monument of the local value Big Goldie, surroundings of the Rogatinsky district Luchyntsi village; southwest slope of the hill; meadow steppe, group association of *Elytrigietum (intermediae) purum*; PC of *P. alba* – 25%;
- 8 – natural boundary Vertebista near Rogatinsky district Yunashkiv village; the lower part of the hill southwest slope; meadow steppe, group association of *Brachypodietum (pinnati) festucosum (valesiacaе)*; PC of *P. alba* – 60%;
- 9 – natural boundary Mount Hrebtova; 2 km west of the Rogatinsky district Sarniki village; northwest slope of the hill; meadow steppe, group association of *Brachypodietum (pinnati) stiposum (pennatae)*; PC of *P. alba* – 70%;
- 10 – natural boundary Mount Lysa, 1 km east of the Rogatinsky district Uizd village; the lower part of the hill northwest slope; meadow steppe, group association of *Elytrigietum (intermediae) brachypodiosum (pinnati)*; PC of *P. alba* – 10-30% (there are numerous digging traces of *P. alba* rhizomes);
- 11 – natural boundary Zdymyr, 2 km northeast of the Tysmenytsia district Pidluzhzhya village, mesophytic hay meadow near the forest, group association of *Brizietum (mediae) cynosurosium (cristati)*; PC of *P. alba* – 60%;
- 12 – natural boundary Pidgory, 1.5 km southwest of the Tysmenytsia district Uzin village; the lower part of the hill southwest slope; soil cover - low-power, with dispersion of hypsonadrids; meadow steppe, group association of *Festucetum (valesiacaе) stiposum (pennatae)*; PC of *P. alba* – 30%;
- 13 – natural boundary Gorody, eastern outskirts of Tysmenytsia city; mesophytic hay meadow near the forest, group association of *Brizietum (mediae) agrostidosum (tenuis)*; PC of *P. alba* – 70%;
- 14 – natural boundary Homa Mount, surroundings of the Tlumach district Oleshiv village, south-east slope of the hill; soil cover - low-power, with limestone spreading; group association of *Seslerietum (heufleranae) festucosum (valesiacaе)*; PC of *P. alba* – 45%.
- 15 – natural boundary Hump between Zagirya and Bratyshiv village of Tlumach district; hill top; woodland forest grouping of *Carpineto (betuli) – Quercetum (roboris) caricosum (pilosae)*; PC of *P. alba* – 55%.

**Results and discussion.** In most of *P. alba* investigated cenopopulations there are individuals of all vitality classes, but there are significant differences between classes (table 1). The predominance of the highest-class *a* individuals proportion is characteristic for eight CP: 1, 3, 4, 5, 8, 9, 11, 13. The largest proportion of individuals in this class, with the absence of vitality lower class *c* individuals, is characteristic for CP 11 and 13, which are part of the mesophytic steppes at the flattened areas. Other coenopopulations – components of meadow steppes or steppe meadows, namely, formation groups of *Brachypodieta pinnati* (CP 1, 5, 9) or *Cariceta humilis* (CP 4), confined to slopes of moderate steepness or patches with a top layer of soil with power 45-60 sm.

Vitality spectra and types of *Potentilla alba* L. cenopopulations at Opillia

№	Name of the natural boundary	Particles of vitality different classes individuals			Type of cenopopulation	Value of the cenopopulation quality index (Q)
		<i>a</i>	<i>b</i>	<i>c</i>		
1	Ostrivets	0,68	0,22	0,1	Prosperous	0,45
2	Simlin	0,16	0,32	0,52	Depressive	0,24
3	Mount Casova	0,48	0,31	0,21	Prosperous	0,39
4	Stone	0,52	0,17	0,31	Equilibrium	0,34
5	Shchovby	0,56	0,32	0,12	Prosperous	0,44
6	Brucheva	0,28	0,37	0,35	Equilibrium	0,33
7	Big Goldie	0	0,42	0,58	Depressive	0,21
8	Vertebista	0,38	0,3	0,32	Equilibrium	0,34
9	Mount Hrebtova	0,64	0,22	0,14	Prosperous	0,43
10	Mount Lysa	0	0,38	0,62	Equilibrium	0,19
11	Zdymyr	0,76	0,24	0	Prosperous	0,5
12	Pidgory	0,18	0,26	0,56	Depressive	0,22
13	Gorody	0,68	0,32	0	Prosperous	0,5
14	Homa Mount	0,22	0,42	0,36	Equilibrium	0,32
15	Hump	0,28	0,5	0,22	Prosperous	0,39

Prevalence of class *b* individuals is observed in three CP: 6, 14 and 15. The first two CP are part of *Seslerieta heufleranae* group formation, the third – to the *Carpineto betuli* – *Querceta roboris* forest grouping formation.

For the four CP is characteristic the predominance of vitality lowest class *c* individuals: 2, 7, 10, 12, at the same time in the CP 7 and 10, there are absolutely no individual of classes *a*. These two CP, as well as CP 2, are part of the *Elytrigieta intermediae* group formation, and CP 12 – to grouping formation of *Festucetum (valesiacaе) stiposum (pennatae)*.

The investigated cenopopulations belong to three vital types. In particular, seven CP (1, 3, 5, 9, 11, 13, 15) – prosperous; CP 4, 6, 8 and 14 – equilibrium, and four others (2, 7, 10 and 12) – depressive.

The quality index of cenopopulations is of highest importance at mesophytic meadows – in the natural boundaries Simlin and Gorody (CP 11 and 13), and the lowest one – in the natural boundary Mount Lysa (CP 10).

An analysis of ecological-cenotic conditions has shown that the predominance of vitality highest class (*a*) individuals and high values of the quality index are characteristic for cenopopulations of *P. alba*, growing at mesophytic, steppe meadows and meadow steppes, in formations groups of *Brizieta mediae* and *Brachypodieta pinnati* – at podzolic chernozem with power 45-60 sm, formed at plaque or flat parts of slopes.

Equilibrium CP with the prevalence of class *a* or *b* individuals are presented at meadow steppes, formed at relatively steep slopes – in formations

groups of *Cariceta humilis* and *Seslerieta heufleranae*, as well as associations of *Brachypodietum (pinnati) festucosum (valesiacaе)*.

Depressive type with the minimum values of the quality index and superiority of the vitality lowest class individuals includes cenopopulations in the formation groups of *Elytrigieta intermediae*, which are characterized by a high density of dominant species and the plentiful flora composition. The same indicators are marked by the cenopopulation in association groups of *Festucetum (valesiacaе) stiposum (pennatae)*, which grows at a steep slope of a hill with shallow black soil and scattered gipsoandardites.

The highest projective coverage of *P. alba* (60-80%) are characteristic for mesophytic, steppe meadows and meadow steppes at plains and shallow slopes – in formations groups of *Brizieta mediae*, *Brachypodieta pinnati* and *Cariceta humilis*. Instead, in the formation groups of *Elytrigieta intermediae* and associations of *Festucetum (valesiacaе) stiposum (pennatae)* the projective cover of the species acquires the minimum values (20-30%).

**Conclusions.** Life state of individuals, vitality structure and density of *P. alba* cenopopulations vary depending on the ecological-cenotic conditions. Ecological and cenotic optimum species in the natural habitats of Opillia are realized in conditions of moderate humidification at the mesophytic, steppe meadows, meadow steppes, as well as in the woodlands – at plakors and shallow slopes of hills with soil cover capacity 45-60 sm. Most often *P. alba* was found in formation groups of *Brachypodieta pinnati*.

At insufficiently damp steep southern slopes of hills with low-strength soils the species is absent or represented by depressed populations with low density. Depressive populations with low projective coverage of *P. alba* individuals also are characteristic for groups with dense herbage.

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## ВІТАЛІТЕТНА СТРУКТУРА ЦЕНОПОПУЛЯЦІЙ *POTENTILLA ALBA* L. (ROSACEAE) НА ПІВДЕННОМУ ОПІЛЛІ

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Представлені результати дослідження віталітету особин і віталітетної структури ценопопуляцій *Potentilla alba* L. (Rosaceae) на Опіллі. Досліджено 15 ценопопуляцій за методикою Ю.А. Злобіна. Встановлено, що життєвий стан особин і віталітетна структура ценопопуляцій *P. alba* змінюються в залежності від еколого-ценотичних умов. У більшості ценопопуляцій наявні особини всіх класів віталітету, але у співвідношенні між класами спостерігаються суттєві відмінності. Ценопопуляції належать до трьох віталітетних типів, проте переважають процвітаючі.

Переважаання рамет вищого класу віталітету та високі значення індексу якості характерні для ценопопуляцій, що ростуть на мезофітних та остепнених луках і лучних степах, на опідзолених чорноземах потужністю 45-60 см, сформованих на плакорах чи пологіх частинах схилів – в угрупованнях формацій *Brizieta mediae* та *Brachypodieta pinnati*.

Рівноважні ценопопуляції з перевагою особин вищого чи середнього класів віталітету представлені на лучних степах, сформованих на порівняно крутих схилах – в угрупованнях формацій *Cariceta humilis* і *Seslerieta heufleranae*, а також асоціації *Brachypodietum (pinnati) festucosum (valesiacaе)*.

До депресивного типу з мінімальними значеннями індексу якості та перевагою рамет нижчого класу віталітету належать ценопопуляції в угрупованнях формації *Elytrigietal intermediae*, які відзначаються високою щільністю домінантного виду та бідністю флористичного складу. Такі ж показники притаманні ценопопуляції в угрупованні асоціації *Festucetum (valesiacaе) stiposum (pennatae)*, яка росте на крутому схилі пагорба з малопотужним чорноземом та розсипами гіпсоангідритів.

Ключові слова: *Potentilla alba* L., Опілля, виживаність, віталітетна структура ценопопуляцій

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