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## DISTRIBUTION OF PULSATILLA GRANDIS WENDER. (RANUNCULACEAE) IN UKRAINE

*Pulsatilla grandis* Wender is included into the Red Data Book of Ukraine [13], Annex 1 of Bern Convention [4] Conservation status – LC. The results of phytocoenosis features of researching of growing *P. grandis* in different parts of natural habitat in Ukraine are presented. Database creation and primary studying of the received results were carried out by means of software Turboveg, analysis and classification – by means of software Juice 7.0. Syntaxonomical scheme was composed on the basis of «Syntaxonomy of vegetation of Ukraine», which was developed by W. Solomakha [26]. It is specified that on the major part of its natural habitat the grouping which includes *P. grandis* is mostly presented by the same or similar associations. There are three types of vegetation which include this species: meadow steppes and steppe meadows, petrophyte groupings and light thinned out forests. The descriptions prove that in Ukraine species belongs to different associations of Festuco-Brometea, Rhamno-Prunetea, Koelerio-Corynepherea, Vaccinio-Piceetea classes. According to the literature, *P. grandis* also found in Trifolio-Geranietea sanguinei, Quercetea pubescenti-petraeae classes. The natural habitat has undergone regressive changes. In other European countries this species occurs in four classes: Nardo-Callunetea, Festuco-Brometea, Trifolio-Geranietea sanguinei, Vaccinio-Piceetea. The growing areas of *P. grandis* near the eastern border of the natural habitat in Ukraine are sensitive to the impact of anthropogenic factors. The main reasons for the disappearance of species of natural flora Ukraine is natural and anthropic impact. Examples of human impact is tearing, digging, trampling plants, grazing, mowing, burning, building and expanding the boundaries of settlements. The natural impact is manifested in the low competitiveness of the type and long period of ontogenesis.

**Key words:** *Pulsatilla grandis* Wender., phytocoenosis, association, natural habitat, Ukraine.

**Purpose.** *Pulsatilla grandis* belongs to the genus *Pulsatilla*, family Ranunculaceae. The closest to *P. grandis* is *P. vulgaris*. The structure of *P. vulgaris* include european populations, known as *P. vulgaris* subsp. *grandis* and ukrainian populations described as *P. grandis* [31].

*P. grandis* – is the Central European Boreo-Meridional species, natural habitat of which covers moderate area of Northern Hemisphere (Europe). It is mainly concentrated in the Middle European flatland and is completely absent in the Southern Hemisphere [13]. This species occurs

in the countries of Central and Eastern Europe: Germany, Austria, Czech Republic, Slovenia, Hungary, Slovak Republic, Poland, Croatia, Bosnia and Herzegovina, Serbia, Romania, Moldova, Lithuania and Ukraine, where it reaches the eastern border of its distribution area [12, 34].

*P. grandis* is included into the Red Data Book of Ukraine [13], Annex 1 of Bern Convention [4] Conservation status – LC.

Literature data on *P. grandis* in Ukraine is mostly incomplete and fragmentary. Only a few works are devoted to morphology, Biology and taxonomy of species [2, 7, 19-21, 30, 33, 35-37].

The vegetation plays a very important role in differentiation of species spreading. For detailed studying of phytocoenosis of *P. grandis* we analyzed cover of its growing in different parts of natural habitat. The aim of the study is to analyze the habitat type in Ukraine. The main task – identifying phytocoenotic affinity *P. grandis* in different parts of the area and supplement knowledge on plant communities in which the studied species occurs.

**Methodology.** Phytocoenosis characteristic of *P. grandis* in different parts of natural habitat is carried out on the basis of own original phytosociological data and of dates from the collection of phytocoenosis characteristics presented by Ecology and Geobotany Departments of M.G. Kholodny Institute of Botany, NAS of Ukraine. Field researches were carried out during 2011-2018 years with the help of route method. Plant associations are adduced according to J. Braun-Blanquet [5] Database creation and primary studying of the received results were carried out by means of software Turboveg, analysis and classification – by means of software Juice 7.0. Syntaxonomical scheme was composed on the basis of «Syntaxonomy of vegetation of Ukraine», which was developed by W. Solomakha [26].

We used the herbarium materials from the KW, KWHU, KWHA, LW, LWD, LWKS, CHER, DSU, SOF, KXM, PTR, PDH Herbaria of Ukraine.

**Originality and practical value.** Results of the research proved that *P. grandis* is notable for its wide ecological amplitude in different parts of natural habitat. The species can be found in the conditions of arid climate of steppes, of meadow steppe areas, in light dry forests, on undergrowth, on forest edges. It happens to the black earth, gray and sod-podzolic soils.

According to «Ecoflora Ukraine» (Ekoflora of Ukraine 2004) and «Red Data Book of Ukraine» [13] *P. grandis* growing in communities 6 classes: *Festuco-Brometea* Br.-Bl. et R. TX. 1943 (*Festucetalia valesiacae*, *Festucion valesiacae*, *Cirsio-Brachipodion*, *Astragalo-Stipion*, *Stipo pulcherrimae-Festucetalia pallentis*, *Seslerio-Festucion glaucae*; *Brometalia*, *Mesobramion*), *Trifolio-Geranietea sanguinei* Th. Müller 1962 (*Origanetalia*, *Geranion sanguinei*), *Rhamno-Prunetea* Rivas Goday et Carb. 1961 (*Prunetalia spinosae*, *Prunion fruticosae*), *Sedo-Scleranthetea* Br.-Bl. **1935** (syn. *Koelerio-Corynephoretea*) (*Sedo-Scleranthetalia*; *Festuco-Sedetalia*), *Quercetea pubescenti-petraeae* Doing-Kraft ex Scamoni et Passarge 1959, *Vaccinio-Piceetea* Br.-Bl. 1939 (*Vaccinio-Piceetalia*, *Dicrano-Pinion*). As a result of own research species found in the classes – *Festuco-Brometea*, *Rhamno-Prunetea*,

*Vaccinio-Piceetea* and *Koelerio-Corynepforetea*. Although we do not deny the growth of the species in other classes of plant associations.

Comparison of the natural habitats of *P. grandis* in Ukraine proves their phytocoenosis propinquity. In outskirts of Horayivka village (Kamianets-Podilskyi Distr., Khmelnytskyi Reg.) and also near Mohyliv-Podilskyi (Vinnitsa Reg.) the species occurs on limestone hills with steppeness about 60-70°. The associations *Festuco valesiaca*-*Stipetum capillatae* Sill. 1937 (all. *Festucion valesiaca*) and ass. *Acini arvensis-Elytrigietum intermediae* (Kukovitsa et al. 1994) Kukovitsa in V.Sl. 1995 (all. *Cirsio-Brachypodium pinnati*, cl. *Festuco-Brometea*) grow in this habitat. In herbaceous layer *Stipa capillata* L., *Festuca valesiaca* Gaundin, *Sesleria heufleriana* Schur prevail. The natural habitats of the species are on the steppe calcipetrophyte areas, which are surrounded by bunchy steppe and forest-covered areas with *Pinus pallasiana* Aschers and remains of oak-hardbeam forest.

In Khmelnytskyi Reg., Kamianets-Podilskyi Distr., near Smotrych River *P. grandis* occurs on the upper terrace of Smotrych canyon with steppeness about 10-20° on the right bank of Smotrych River. It is a part of ass. *Brachypodio pinnati-Seslerietum* (Klika 1029) Toman 1976 (all. *Seslerio-Festucion glaucae*).

Our researching of the herbaceous layer of steppe associations near Zavoloka village (Storozhynets Distr., Chernivtsi Reg.) and Nastasijivka village (Mykolayiv Distr., Odessa Reg.) proves that the species belongs to ass. *Festuco valesiaca*-*Stipetum capillatae* Sill. 1937 (all. *Festucion valesiaca*) where the dominant species are *Stipa capillata* and *Festuca valesiaca*.

*P. grandis* belongs to association Dicrano-Pinetum Preising et Knapp ex Oberd. 1957 (all. Dicrano-Pinion Libb. 1933, cl. *Vaccinio-Piceetea*) and *Festuco valesiaca*-*Caricetum humilis* Klika (1931) 1936 (all. *Festucion valesiaca*, cl. *Festuco-Brometea*) near Pidlyssia village (Zolochiv Distr., Lviv Reg.) on Bila hill.

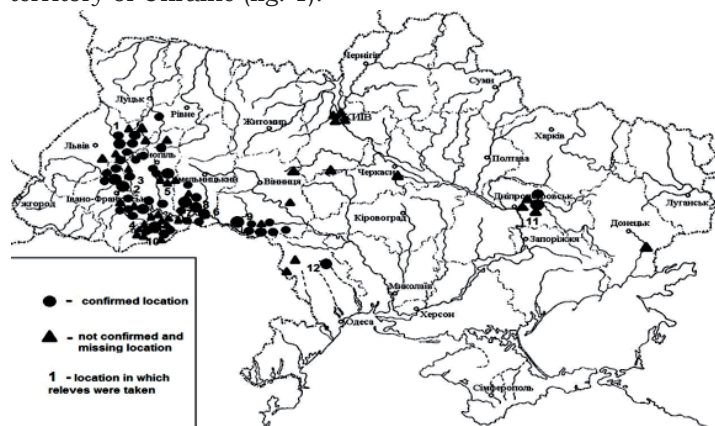
In «Kamin» hole (Ivano-Frankivsk Reg., Halytch Distr., outskirts of Mezhyhircsi village) *P. grandis* is included in ass. *Carici humilis-Brachypodietum pinnati* Soy (1942) 1947 and *Festuco valesiaca*-*Stipetum capillatae* Sill. 1937. The species is marked in poor soils with gypsum placers with general projective cover of about 80-100%.

In Ternopil Distr. *P. grandis* belongs to association of *Festucion valesiaca* alliance, where the dominants are *Festuca valesiaca*, *Anthericum ramosum* L., *Brachypodium pinnatum* (L.) Beauv., *Elytrigia intermedia* (Host) Nevski, *Elytrigia repens* (L.) Nevski, *Carex humilis* Leys., and in Holytskyi reserve (Berezhany Distr.) this species is one of the dominants. We found a small number of individuals of *P. grandis* in ass. *Prunetosae spinosae* R. Tx. 1952 (all. *Prunio fruticosae*, cl. *Rhamno-Prunetea*).

Populations of *P. grandis* near the eastern border of natural habitat in Ukraine are under the negative impact from anthropogenic factors and need to be preserved.

At present the localities of the *P. grandis* in vicinity of Kyiv (Koncha-Zaspa), Donetsk Regions (Mykolayivka village) and Cherkasy Regions are not confirmed. According to the original data and her-

baria we prepared the schematic map of *P. grandis* distribution on the territory of Ukraine (fig. 1).



**Fig. 1.** Distribution of *Pulsatilla grandis* Wender. in Ukraine

1 – Pidlyss’a village, Zolochiv Distr., Lviv Reg. on Bila hill; 2 – Mezhyhirtsy village, Halytch Distr., Ivano-Frankivsk Reg.; 3 – Meduha village, Halytch Distr., Ivano-Frankivsk Reg.; 4 – Probabyn village, Horodenca Distr., Ivano-Frankivsk Reg.; 5 – Holytskyi reserve, Ternopil Reg.; 6 – Horayivka village, Kamianets-Podilskyi Distr., Khmelnytskyi Reg.; 7- Smotrych River, Kamianets-Podilskyi Distr., Khmelnytskyi Reg.; 8 – Cytajgorod village, Kamianets-Podilskyi Distr., Khmelnytskyi Reg.; 9 – Nemiya village, Mohyliv-Podilskyi Distr., Vinnitsa Reg.; 10 – Zavo-loka village, Storozhynets Distr., Chernivtsi Reg.; 11 – Guards city, Dnipropetrovsk Reg.; 12 – Nastasijivka village, Mykolayiv Distr., Odessa Reg.

In comparing the results of own research on the distribution of species in Ukraine according to «Ecoflora Ukraine» [9] and «Red Data Book of Ukraine» [25], one could argue that the natural habitat has undergone regressive changes. Most localities have disappeared, there was a significant reduction of populations of *P. grandis*. The main reasons for the disappearance of species of natural flora Ukraine is natural and anthropic impact. Examples of human impact is tearing, digging, trampling plants, grazing, mowing, burning, building and expanding the boundaries of settlements. The natural impact is manifested in the low competitiveness of the type and long period of ontogenesis.

The most similar to Ukrainian locality of *P. grandis* is the natural habitat in neighboring western countries. Floristically and phytocenotically the association with *P. grandis* in Slovakia, Czech Republic, Slovenia, Hungary, Moldova and Romania is close to steep associations of Podillia upland in Ukraine.

In Germany *P. grandis* reaches the western border of natural habitat and is prevailing in semi-desert and steep associations of *Festuco-Brometea* class Br.-Bl. et R. Tx. in Br.-Bl. 1949 [17]. In Austria *P. grandis* belongs to associations of *Fumano-Stipetum eriocaulis* Wagner 1941 corr. Zólyomi 1966, *Scorzonero austriacae-Caricetum hu-*

*milis* Willner ass. nov. (all. *Seslerio-Festucion pallentis* Klika 1931 corr. Zólyomi 1966, cl. *Festuco-Brometea*) and *Polygalo-Brachypodietum pinnati* Wagner 1941 (all. *Cirsio-Brachypodion*, cl. *Festuco-Brometea*) [32].

In Serbia the species can be found on the forest lawns in associations of *Rusco-Quercu-Carpinetum* B. Jov. 1979 and in steep unions of *Festucion rupicolae* Pop 1968 [11]. In Poland *P. grandis* is spread on sandy or clay soils in associations of *Festuco-Brometea* class of sequence *Festuco-Sedetalia* Tx. 1950. In the north-eastern part of the country it is found in light pine forests in *Dicrano-Pinion* union (Libbert 1933) Matuszkiewicz 1962 (cl. *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl., Siss. et Vlieger 1939) [16]. A large population of *P. grandis* is found on the southern and northern exposed slopes around the peak and on the peak of Zebar Hill (860 m.a.s.l.) overlooking Vinodol valley in Croatia. Several dozens of individuals of *P. grandis* located in a number of isolated patches can be found within a radius of some 400 metres. They are distributed over two different types of grassland communities. One grassland type is classified as a Mediterranean-montane rocky pasture affected by succession (ass. *Carici-Centaureetum rupestris* Ht. 1931), while the other consists of abandoned pastures dominated by *Sesleria juncifolia* Host. (cl. *Festuco-Brometea*) [24].

In Czech Republic *P. grandis* grows on steep, meadow-steep areas, forest lawns, in light thinned forests. The species is included into 3 classes: *Nardo-Callunetea* Preising 1949, *Festuco-Brometea* and *Trifolio-Geranietea sanguinei* Th. Müller 1961. Around Prague city it is found in associations of union *Euphorbio-Callunion* Schubert 1960 (cl. *Nardo-Callunetea*) [22]. On Czech upland and near Elbe river *P. grandis* occurs in associations of union *Geranion sanguinei* R. Tx. in Th. Müller 1961 (cl. *Trifolio-Geranietea sanguinei*). On the east of Czech the phytocenosis role of *P. grandis* significantly increases. The species can be found mainly on the northern slopes of calcareous soils in Moravia in association of *Poo badensis-Festucetum pallentis* Klika 1931 corr. Zólyomi 1966 (cl. *Festuco-Brometea*). In Moravia *P. grandis* belongs to association of *Koelerio-Phleion phleoidis* Korneck 1974 alliance (cl. *Festuco-Brometea*) [1]. *P. grandis* is also one of the dominants of the union *Seslerio-Festucion glaucae* Klika 1931 em Kolbek 1983 and it is included into the association of union *Festucion valesiacae* Klika 1931, which is widespread on clay and limestone slopes in Central part of Czech, Moravia [22]. Similar associations can be marked on the western part of Ukraine.

In Slovakia Republic the species occurs on steep, meadow-steep slopes and, infrequently, on lawns in oak groves. *P. grandis* belongs to associations of *Seslerietum heuflerianae* Soó 1927 and *Saxifrago aizoi-Seslerietum calcariae* Klika 1941 (cl. *Festuco-Brometea*). Together with *P. grandis* in associations of union *Cirsio-Brachypodion pinnati* Hadač et Klika 1994 em Krausch 1961 such continental species as *Adonis vernalis* L., *Inula ensifolia* L., *Aster amellus* occur, they are widespread in the most Ukrainian associations with *P. grandis*. In Slovakia on the north-eastern slopes the species also grows in association of *Astero linosyris-Festucetum rupicolae* Maglocký in Chytrý et al. 1997 (cl. *Festuco-Brometea*) [28].

In Slovenia *P. grandis* occurs in such associations as *Festucion valesiaca*, *Cirsio-Brachypodium pinnati*, *Bromion erecti* Koch 1926, *Koelerio-Phleion phleoidis* Korneck 1974, *Asplenio-Festucion glaucae* Zólyomi 1936, *Scabioso hladnikiana-Caricetum humilis* Tomažič 1941 (nom. sin. *Bromo-Plantagnetum mediae* Horvat (1931) 1949) and *Onobrychido viciifoliae-Brometum* Müller 1966 (cl. *Festuco-Brometea*). In *Pulsatillo-Festucetum sulcatae* (Dostál 1933) Soó 1963 association it is one of the dominants [14, 15]. In Hungary the species is part of association of *Festucion valesiaca* union. *P. grandis* occurs in association as *Polygalo majori-Brachypodium pinnati* H. Wagner 1941 (cl. *Festuco-Brometea*). Fragments of steep associations with *P. grandis* were noticed on the lawns in oak groves [3, 27]. In the Western Carpathians and the northern Pannonian Basin (the south-eastern Czech Republic, north-eastern Austria, Slovakia and northern Hungary) *P. grandis* belongs to association of *Bromo pannonici-Festucion pallentis* Zólyomi 1966 and *Festuca valesiaca* alliance (cl. *Festuco-Brometea*) [8,10].

In Moldova *P. grandis* is the common species on the lawns in oak groves, rarely it belongs to steep associations of *Festuco-Brometea* class, where the most dominant plants are from the species of *Stipa* L. ra *Festuca* L. generation. Similar natural habitats of the species are also specific for Romania, where it is widespread in the meadow-steep areas and on forest lawns [6, 23]. *P. grandis* occurs in such associations as *Inulo ensifoliae-Peucedametum tauricae* Kovács 2009 (transitional association of *Geranion sanguinei* to *Festuco-Brometea* syntaxa) and *Cariceto humilis-Festucetum rupicolae* Soó 1947 corr. Kovács 2002 (cl. *Festuco-Brometea*) (Kovács 2008).

Comparison of the natural habitats of *P. grandis* in Ukraine and in other countries proves their phytocoenosis propinquity.

**Conclusion.** It is specified that on the major part of its natural habitat the grouping which includes *P. grandis* is mostly presented by the same or similar formations and associations. The above descriptions prove that in Ukraine species belongs to different associations of *Festuco-Brometea*, *Rhamno-Prunetea*, *Koelerio-Coryneporetea*, *Vaccinio-Piceetea* classes. According to the literature, *P. grandis* also found in *Trifolio-Geranietea sanguinei*, *Quercetea pubescenti-petraeae* classes. The natural habitat has undergone regressive changes. In other European countries this species occurs in four classes: *Nardo-Callunetea*, *Festuco-Brometea*, *Trifolio-Geranietea sanguinei*, *Vaccinio-Piceetea*. Most localities in Ukraine have disappeared, there was a significant reduction of populations of *P. grandis*. Places of *P. grandis* growing near the eastern border of natural habitat in Ukraine are less resistant to the impact from anthropogenic factors.

**Acknowledge.** Authors thanks Dr. Myroslav V. Shevera (M.H. Kholodny Institute of Botany, NAS of Ukraine) for help and discussing of results during prepared the manuscript of article, and MSc. Margarita V. Piatikh for correction of English translated.

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### **ПОШИРЕННЯ PULSATILLA GRANDIS WENDER. (RANUNCULACEAE) В УКРАЇНІ**

*Pulsatilla grandis* Wender внесена до Червоної книги України (Kahalo, Korotchenko & Lyubinska 2009) і Додаток 1 Бернської конвенції (Бернська конвенція 1979). Природоохоронний статус – LC. Представлено результати дослідження особливостей фітоценозів в яких зростає *P. grandis* в Україні. Результати фітоценологічного дослідження оброблені за допомогою програмного забезпечення *Turbovet* та *Luise 7.0*. Синтаксономічна схема була складена на основі «Синтаксономії рослинності України», яку розробив В. Соломаха (2008). Наведені нами описи доводять, що в Україні вид входить до різних асоціацій класів *Festuco-Brometea*, *Rhamno-Prunetea*, *Koelerio-Corynephoretea*, *Vaccinio-Piceetea*, а за літературними даними вид зростає у класах *Trifolio-Geranietea sanguinei*, *Quercetea pubescenti-petraeae*. В інших європейських країнах вид виявлено у класах *Nardo-Callunetea*, *Festuco-Brometea*, *Trifolio-Geranietea sanguinei*, *Vaccinio-Piceetea*.

**Ключові слова:** *Pulsatilla grandis* Wender, фітоценох, асоціація, патиприродні місця зростання, Україна.

Отримано: 16.10.2020