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ВЕСТНИК

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NAS RK is pleased to announce that Bulletin of NAS RK scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of Bulletin of NAS RK in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential multidiscipline content to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы "ҚР ҰҒА Хабаршысы" ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Web of Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабаршысының Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді мультидисциплинарлы контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Вестник НАН РК» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Вестника НАН РК в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному мультидисциплинарному контенту для нашего сообщества.

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**COENOFLORA *PULSATILLA PATENS* (L.) MILL. s.l.
IN NORTHERN KAZAKHSTAN**

Abstract. The current article presents the results of the study made on *Pulsatilla patens* (L.) Mill. s.l. coenoflora of Northern Kazakhstan. The materials have been obtained in the course of field research considering the literary data. The list of pulsatilla flora discovered in Northern Kazakhstan is based on detailed route studies. The coenoflora of *Pulsatilla patens* (L.) Mill. s.l. in Northern Kazakhstan includes 168 species belonging to 42 families and 141 genera. The leading families are *Asteraceae*, *Poaceae*, *Rosaceae*, *Fabaceae*, *Caryophyllaceae*, *Ranunculaceae*. The largest number of species refers to perennial species (150), annuals and biennials make up 15 species, ephemera - 3 species. Among the life forms, there are mainly long-rooted (70) and stem-rooted (36) species. The coenoflora has a steppe character with a small number of forest floristic elements correlating with ecological conditions of the rocky (and partly sparsely forest) habitats where the populations are formed. The eco-biological analysis confirmed a meadow-steppe character of coenoflora. Anthropogenic breach of coenoflora is expressed in a rather large number of weed species (18 species - 11%).

Key words: *Pulsatilla patens* s.l., coenopopulation, Northern Kazakhstan, systematic structure, ecological and coenotic groups.

Introduction. *Pulsatilla patens* s. str. is a forest-steppe species widespread in Eastern Europe, Western Siberia, Central and Northern Kazakhstan, Altai and Tarbagatai [1, 2]. The species is included into the Red Book of Kazakhstan (2014) [3].

Systematic position of *Pulsatilla patens* s.l. is extremely complicated. This species is not mentioned in Siberian flora, instead, there is *Pulsatilla flavescens* (Zuss.) Juz. [4]. According to the current studies, that name is a later ononym, and therefore a denotation of Kazakhstan and Siberian species as "*Pulsatilla flavescens*" is illegal [2, 5]. *Pulsatilla uralensis* (Zamels)Tzvel (= *Pulsatilla flavescens* (Zuss.) Juz.) is employed to denote yellow flowered pulsatilla. According to our observations, there are no "pure" populations of *Pulsatilla patens* in Northern Kazakhstan. Instead, in the area, we most likely have complex hybrid races between the European *Pulsatilla patens*, the Ural-Kazakhstan *Pulsatilla uralensis*, and the East European-Asian *P. multifida* (G. Pritz.) Juz. In this research we are investigating the diversity of the *Pulsatilla* races in Northern Kazakhstan within the framework of a polytypic species *Pulsatilla patens* s.l.

In the absence of clear morphological species, especially for rare and endangered species, coenotic environment is very important, on the one hand, it can indicate an ecological difference between individual populations and, on the other, can identify any threats to the existence of a species. There were conducted no special works on the study of *Pulsatilla patens* s.l. in northern Kazakhstan.

Material and research methods. The research was carried out on the territory of Pavlodar and Akmola regions. For the floristic description were chosen the areas with a high density of *Pulsatilla patens* s.l. All in all were examined 13 population loci: Akmola region, the vicinity of Yereymentau, Mount Yereymentau, a hillside, 29 IV 2018; Akmola region, the territory of "Burabay" State National Natural Park (SNNP), the vicinity of Catharkol, gravel hillsides 03 V 2018; the vicinity of Akylbay, a feather-grass steppe, 04 V 2018; Akylbay forestry, a pine-birch forest, near Svetly lake, 15 V 2013;

Borovsky forestry, quarter 96, in bushes, a rocky slope, 04 V 2012; Zolotoborsky forestry, quarter 26, a pitch-dark pine forest, 3 VI 2011; Katarkol forestry, quarter 11, a forest edge, 03 VI 2011; Mirny forestry, quarter 74, pine-birch forest, 05 VI 2011; quarter 73, a pine forest 05 VI 2011; quarter 14, a hillside 05 VI 2011; Barmashinsky forestry, quarter 134, a forest edge, 08 VI 2011; Pavlodar region, the vicinity of Bayanaul, a meadow between the rocks 28 IV 2018; the Bayanaul Mountains, Mount Auliet, a slope, 26.V.2007.

The habitats of *Pulsatilla patens* s.l. are confined to the steep hill slopes, as well as to the pitch-dark and stony pine forests [6, 7].

For analysis of the coenoflora life forms, we employed the approaches of Serebryakov I.G. (1962) [8]. Evaluation of species in their relation to moisture was carried out according to the ecological scale of Shennikov A.P. (1950) [9]. To process floristic descriptions we used an IBIS program developed by Zverev A.A. (1998, 2007) [10, 11].

The volume of families is given according to Cherepanov S.K. (1995) considering modern data [12]. The families of flowering plants are arranged according to the system of Takhtajyan A.L. [13]. The species in genera and the genera in families are arranged in an alphabetical order.

Results and discussion. The coenoflora of *Pulsatilla patens* s.l. includes 168 species belonging to 42 families and 141 genera (table 1).

Table 1 – Composition of *Pulsatilla patens* s.l. coenoflora

Plant species	1*	2	3	4
1	2	3	4	5
The Pinaceae Spreng. ex Rudolphi family				
<i>Pinus sylvestris</i> L.	P	T	Xm	Forest
The Ephedraceae Dumert. family				
<i>Ephedra distachya</i> L.	P	B	Xph	Steppe
The Ranunculaceae Juss. family				
<i>Adonis wolgensis</i> Steven	P	Sh-R	M	Steppe
<i>Anemone sylvestris</i> L.	P	L-R	M	Meadow
<i>Pulsatilla patens</i> (L.) Mill.	P	Sh-R	M	Steppe
<i>Ranunculus polyanthemus</i> L.	P	B-R	M	Meadow
<i>Ranunculus polyrhizos</i> Steph.	P	B-R	M	Steppe
<i>Ranunculus repens</i> L.	P	B-R	H	Meadow
<i>Thalictrum minus</i> L.	P	B-R	M	Meadow
<i>Thalictrum simplex</i> L.	P	B-R	M	Meadow
The Betulaceae S.F. Gray family				
<i>Betula pendula</i> Roth.	P	T	M	Forest
The Caryophyllaceae Juss. family				
<i>Cerastium arvense</i> L.	P	L-R	Xm	Meadow
<i>Eremogone koriniana</i> (Fisch. ex Fenzl)	P	S-R	Xph	Steppe
<i>Eremogone longifolia</i> (M.Bieb.) Fenzl	P	L-R	Xm	Meadow
<i>Gypsophila altissima</i> L.	P	S-R	Xm	Meadow
<i>Gypsophila paniculata</i> L.	P	S-R	Xm	Steppe
<i>Otitis wolgensis</i> (Hornem.) Grossh.	A-B	S-R	Xm	Steppe
<i>Silene nutans</i> L.	P	L-R	M	Meadow
<i>Stellaria graminea</i> L.	P	L-R	M	Meadow

Continuation of table 1				
1	2	3	4	5
The Chenopodiaceae Vent family				
<i>Axyris amaranthoides</i> L.	A-B	S-R	Xph	Weed
<i>Chenopodium album</i> L.	A-B	S-R	Xm	Weed
The Polygonaceae Juss. family				
<i>Fallopia convolvulus</i> (L.) A.Love	A-B	S-R	M	Weed
The Limoniaceae Ser. family				
<i>Limonium gmelinii</i> (Willd.) Kuntze	P	Sh-R	Xm	Steppe
The Vacciniaceae S.F. Gray family				
<i>Vaccinium vitis-idaea</i> L.	P	Sh	Xm	Forest
The Pyrolaceae Dumort family				
<i>Chimaphila umbellata</i> (L.) W.P.C.B	P	Sh	Xm	Forest
<i>Orthilia secunda</i> (L.) House	P	Sh	Xm	Forest
<i>Pyrola minor</i> L.	P	Sh	Xm	Forest
The Primulaceae Batsch ex Borkh. family				
<i>Androsace septentrionalis</i> L.	E	S-R	M	Forest
<i>Primula longiscapa</i> Ledeb.	P	B-R	M	Meadow
The Limoniaceae Ser. family				
<i>Limonium gmelinii</i> (Willd.) Kuntze	P	Sh-R	Xm	Steppe
The Brassicaceae Burnett family				
<i>Descurainia sophia</i> (L.) Webb ex	A-B	S-R	M	Weed
<i>Draba nemorosa</i> L.	E	S-R	M	Steppe
<i>Clausia aprica</i> (Stephan) Ko	P	L-R	Xph	Steppe
<i>Odontarrhena tortuosa</i> (Waldst. et Kit. ex Willd.) C.A. Mey.	P	Sh	Xph	Steppe
<i>Turritis glabra</i> L.	A-B	S-R	M	Meadow
The Violaceae Batsch family				
<i>Viola rupestris</i> F.W.Schmidt	P	Sh-R	M	Forest
The Crassulaceae J. St.-Hil. family				
<i>Sedum hybridum</i> L.	P	L-R	M	Steppe
<i>Sedum telephium</i> L.	P	L-R	M	Meadow
The Urticaceae Juss. family				
<i>Urtica dioica</i> L.	P	L-R	M	Weed
The Euphorbiaceae Juss. family				
<i>Euphorbia subcordata</i> C.A.Mey.	P	L-R	Xm	Meadow
The Rosaceae Juss. family				
<i>Cerasus fruticosa</i> Pall.	P	B	Xm	Steppe
<i>Cotoneaster melanocarpus</i> Fisch. ex Bl	P	B	Xm	Steppe
<i>Filipendula ulmaria</i> (L.) Maxim.	P	Tub	M	Meadow
<i>Filipendula vulgaris</i> Moench	P	Tub	Xm	Steppe
<i>Fragaria vesca</i> L.	P	L-R	M	Forest
<i>Fragaria viridis</i> (Duchesne) Weston	P	L-R	Xm	Meadow

Continuation of table 1				
1	2	3	4	5
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1	2	3	4	5
<i>Pentophylloides parvifolia</i> (Fischer ex Lehm.) Sójak	P	B	Xm	Steppe
<i>Potentilla argentea</i> L.	P	S-R	Xph	Steppe
<i>Potentilla bifurca</i> L.	P	L-R	Xm	Steppe
<i>Potentilla canescens</i> Besser	P	Sh-R	Xm	Steppe
<i>Potentilla humifusa</i> Willd. ex Schldl.	P	Sh-R	Xm	Steppe
<i>Rosa acicularis</i> Lindl.	P	B	Xm	Steppe
<i>Rosa majalis</i> Herrm.	P	B	Xm	Forest
<i>Rubus saxatilis</i> L.	P	L-R	M	Forest
<i>Spiraea hypericifolia</i> L.	P	B	Xm	Steppe
The Onagraceae Juss. family				
<i>Chamaenerion angustifolium</i> (L.) Scop.	P	L-R	M	Forest
The Fabaceae Lindl. family				
<i>Astragalus danicus</i> Retz.	P	L-R	M	Meadow
<i>Caragana frutex</i> (L.) K.Koch	P	B	Xm	Steppe
<i>Glycyrrhiza uralensis</i> Fisch.	P	L-R	M	Steppe
<i>Lathyrus pisiformis</i> L.	P	S-R	M	Forest
<i>Lathyrus pratensis</i> L.	P	L-R	M	Meadow
<i>Lupinaster pentaphyllus</i> Moench	P	L-R	Xm	Forest
<i>Medicago falcata</i> L.	P	S-R	Xm	Steppe
<i>Melilotus officinalis</i> (L.) Pall.	A-B	S-R	Xm	Weed
<i>Vicia cracca</i> L.	P	L-R	M	Weed
The Polygalaceae Hoffmanns. et Link family				
<i>Polygala comosa</i> Schkuhr	P	S-R	M	Meadow
The Geraniaceae Juss. family				
<i>Geranium albiflorum</i> Ledeb.	P	Sh-R	M	Forest
<i>Geranium pratense</i> L.	P	Sh-R	M	Meadow
The Valerianaceae Batsch family				
<i>Valeriana tuberosa</i> L.	P	Tub	M	Steppe
The Dipsacaceae Juss. family				
<i>Scabiosa isetensis</i> L.	P	L-R	Xm	Steppe
The Fabaceae Lindl. family				
<i>Cenolophium denudatum</i> (Fisch. ex Hornem.) Tutin	P	S-R	M	Meadow
<i>Conioselinum tataricum</i> Hoffm.	P	S-R	M	Meadow
<i>Heracleum sibiricum</i> L.	P	S-R	M	Forest
<i>Kadenia dubia</i> (Schkuhr) Lavrova & V.N.Tikhom.	P	S-R	M	Forest
<i>Seseli ledebourii</i> G.Don	P	Sh-R	Xm	Steppe
<i>Seseli libanotis</i> (L.) W.D.J.Koch	P	S-R	M	Meadow
<i>Xanthoselinum alsaticum</i> (L.) Schur	P	Sh-R	M	Meadow

Continuation of table 1				
1	2	3	4	5
The Plantaginaceae Juss. family				
<i>Plantago media</i> L.	P	Br-R	Xm	Meadow
<i>Plantago urvillei</i> Opiz	P	Br-R	M	Meadow
The Campanulaceae Juss. family				
<i>Campanula wolgensis</i> P.A.Smirn.	P	S-R	M	Forest
The Asteraceae Bercht. et J. Presl family				
<i>Achillea asiatica</i> Serg.	P	L-R	Xm	Meadow
<i>Achillea millefolium</i> L.	P	L-R	M	Meadow
<i>Achillea nobilis</i> L.	A-B	Br-R	Xm	Steppe
<i>Achillea setacea</i> Waldst. & Kit.	P	L-R	Xm	Steppe
<i>Antennaria dioica</i> (L.) Gaertn.	P	L-R	Xph	Forest
<i>Aster alpinus</i> L.	P	L-R	Xm	Steppe
<i>Artemisia absinthium</i> L.	P	Sh-R	Xm	Weed
<i>Artemisia armeniaca</i> Lam.	P	L-R	Xm	Meadow
<i>Artemisia austriaca</i> Jacq.	P	L-R	Xm	Steppe
<i>Artemisia campestris</i> L.	P	S-R	Xm	Steppe
<i>Artemisia frigida</i> Willd.	P	Sh	Xm	Steppe
<i>Artemisia glauca</i> Pall. ex Wil	P	L-R	Xm	Meadow
<i>Artemisia latifolia</i> Ledeb.	P	L-R	M	Meadow
<i>Artemisia macrantha</i> Ledeb.	P	L-R	M	Forest
<i>Artemisia marschalliana</i> Spreng.	P	S-R	Xph	Steppe
<i>Artemisia pontica</i> L.	P	L-R	Xph	Steppe
<i>Artemisia rupestris</i> L.	P	L-R	M	Meadow
<i>Artemisia scoparia</i> Waldst. et Kit.	A-B	S-R	Xph	Weed
<i>Artemisia sericea</i> Weber ex Ste	P	L-R	Xm	Steppe
<i>Carduus crispus</i> L.	A-B	S-R	Xm	Weed
<i>Carduus nutans</i> L.	A-B	S-R	Xm	Weed
<i>Cirsium incanum</i> (S.G.Gmel.)	P	L-R	Xm	Weed
<i>Cirsium setosum</i> (Willd.) Bes	P	L-R	Xm	Weed
<i>Cirsium vulgare</i> (Savi) Ten.	A-B	S-R	Xph	Weed
<i>Conyza canadensis</i> (L.) Cronqis	A-B	S-R	Xm	Weed
<i>Echinops ritro</i> L.	P	S-R	Xph	Steppe
<i>Galatella angustissima</i> (Tausch) Novopokr.	P	L-R	Xm	Steppe
<i>Crinitaria tatarica</i> (Less.) Czer.	P	L-R	Xm	Steppe
<i>Helichrysum arenarium</i> (L.) Moench	P	L-R	Xph	Steppe
<i>Hieracium umbellatum</i> L.	P	Br-R	Xm	Forest
<i>Hieracium virosus</i> Pall.	P	Br-R	Xm	Steppe
<i>Inula salicina</i> L.	P	L-R	M	Meadow
<i>Jacobaea vulgaris</i> Gaertn.	A-B	S-R	Xm	Weed
<i>Pilosella echioides</i> (Lumn.) F.Sc	P	Br-R	Xph	Steppe

Continuation of table 1				
1	2	3	4	5
<i>Scorzonera purpurea</i> L.	P	S-R	Xm	Steppe
<i>Serratula coronata</i> L.	P	L-R	M	Meadow
<i>Solidago virgaurea</i> L.	P	Sh-R	M	Forest
<i>Tanacetum vulgare</i> L.	P	L-R	M	Meadow
<i>Taraxacum officinale</i> F.H.Wigg.	A-B	S-R	M	Weed
<i>Trommsdorffia maculata</i> (L.) Bernh.	P	S-R	Xm	Meadow
The Rosaceae Juss. family				
<i>Galium boreale</i> L.	P	L-R	M	Forest
<i>Galium verum</i> L.	P	Sh-R	Xm	Steppe
The Gentianaceae Juss. family				
<i>Gentiana fetisovii</i> Regel. et Winkl.	P	L-R	M	Meadow
The Boraginaceae Juss. family				
<i>Onosma simplicissima</i> L.	P	L-R	Xm	Steppe
<i>Onosma transrhyrnensis</i> Klok. ex M. Pop.	P	S-R	Xph	Steppe
The Scrophulariaceae Juss. family				
<i>Linaria vulgaris</i> Mill.	P	L-R	M	Weed
<i>Odontites vulgaris</i> Moench	A-B	S-R	Xm	Meadow
<i>Pedicularis dasystachys</i> Schrenk	P	Br-R	Xm	Steppe
<i>Veronica incana</i> L.	P	L-R	Xph	Steppe
<i>Veronica krylovii</i> Schischk.	P	S-R	M	Meadow
<i>Veronica longifolia</i> L.	P	L-R	M	Meadow
<i>Veronica spicata</i> L.	P	L-R	Xm	Steppe
<i>Veronica spuria</i> L.	P	L-R	Xm	Steppe
The Orobanchaceae Vent. family				
<i>Orobanche caesia</i> Reichenb.	P	P	M	Steppe
<i>Orostachys spinosa</i> (L.) Sweet	P	P	M	Steppe
The Lamiaceae Martinov family				
<i>Dracocephalum ruyschiana</i> L.	P	L-R	Xm	Meadow
<i>Phlomis tuberosa</i> (L.) Moench	P	Tub	Xm	Steppe
<i>Thymus marschallianus</i> Willd.	P	L-R	Xm	Steppe
<i>Thymus serpyllum</i> L.	P	L-R	Xm	Steppe
The Rosaceae Juss. family				
<i>Gagea granulosa</i> Turcz.	P	Tub-B	M	Steppe
<i>Tulipa patens</i> C.Agardh ex Schult. & Schult. f.	P	Tub-B	M	Steppe
The Alliaceae Borkh. family				
<i>Allium hymenorhizum</i> Ledeb	P	Tub-B	M	Meadow
<i>Allium globosum</i> M.Bieb. ex Redoute	P	Tub-B	Xm	Steppe
<i>Allium rubens</i> Schrad. ex Willd.	P	Tub-B	Xm	Steppe
The Asparagaceae Juss. family				
<i>Asparagus officinalis</i> L.	P	L-R	M	Meadow

End of table 1				
1	2	3	4	5
The Orchidaceae Juss. family				
<i>Dactylorhiza fuchsii</i> (Druce) Soa	P	Tub-B	M	Forest
The Convallariaceae Horan. family				
<i>Polygonatum odoratum</i> (Mill.) Druc	P	L-R	M	Forest
The Iridaceae Juss. family				
<i>Iris halophila</i> Pall.	P	Sh-R	M	Meadow
The Cyperaceae Juss family				
<i>Carex supina</i> Willd. ex Wahlenb.	P	L-R	Xph	Steppe
The Poaceae Barnhart family				
<i>Brachypodium pinnatum</i> (L.) Beauv.	P	L-R	M	Forest
<i>Bromopsis inermis</i> (Leys.) Holub	P	L-R	M	Meadow
<i>Calamagrostis obtusata</i> Trin.	P	L-R	M	Forest
<i>Calamagrostis epigeios</i> (L.) Roth	P	L-R	Xm	Meadow
<i>Cleistogenes squarrosa</i> (Trin.) Keng.	E	Br-R	Xm	Steppe
<i>Elytrigia repens</i> (L.) Nevski	P	L-R	M	Weed
<i>Festuca valesiaca</i> Gaudin	P	Sh-R	Xph	Steppe
<i>Helictotrichon desertorum</i> (Less.) Nevs	P	Sh-R	Xph	Steppe
<i>Hordeum brevisubulatum</i> (Trin.) Link	P	L-R	Xm	Meadow
<i>Koeleria cristata</i> (L.) Pers.	P	L-R	Xph	Steppe
<i>Leymus angustus</i> (Trin.) Pilg	P	L-R	Xph	Steppe
<i>Leymus paboanus</i> (Claus) Pilg	P	L-R	Xph	Steppe
<i>Melica nutans</i> L.	P	L-R	M	Forest
<i>Phleum phleoides</i> (L.) H.Karst.	P	L-R	Xm	Steppe
<i>Poa angustifolia</i> L.	P	L-R	Xm	Steppe
<i>Poa palustris</i> L.	P	L-R	M	Meadow
<i>Poa pratensis</i> L.	P	L-R	M	Meadow
<i>Stipa capillata</i> L.	P	Sh-R	Xph	Steppe
<i>Stipa lessingiana</i> Trin. et Rupr.	P	Sh-R	Xph	Steppe
<i>Stipa pennata</i> L.	P	Sh-R	Xph	Steppe
<i>Stipa zaleskii</i> Wilensky	P	Sh-R	Xph	Steppe
<p>*Column 1 shows the longevity of species (P - Perennials, A-B - Long-vegetating annual-biennial plants, E - Ephemera). Column 2 shows life forms (T - Trees, B - Bushes, Sh - Shrubs, L-R - Long-rooted grasses, Sh-R - Short-rooted grasses, Tub - Tuberos grasses, Tub-B - Tuber-bulbous grasses, S-R - Stem-rooted grasses, Br-R - Brush-rooted grasses; Parasites). Column 3 shows ecological groups in relation to moisture supply of the habitats (Xph - Xerophytes, Xm - Xeromesophytes, M - Mesophytes, H - Hygromosophytes). Column 4 shows ecological and coenotic groups.</p>				

The share of 10 leading families comprises 117 species, which makes 70% of the total coenoflora composition. The *Asteraceae*, *Poaceae*, and *Rosaceae* families are the richest in species composition (Table 2). The leading genera are *Artemisia* (13), *Veronica* (5), *Achillea*, *Potentilla*, and *Stipa* (4 species each).

Table 2 – Leading families of *Pulsatilla patens* s.l. coenoflora according to the number of species

Family	<i>Pulsatilla patens</i> s.l. coenoflora			Flora of the Kazakh Uplands (KU) (Kupriyanov, 2017)	
	place according to the number of species	number of genera / % of the total	number of species / % of the total	place according to the number of species	number of species / % of the total
<i>Asteraceae</i> Bercht. et J. Presl	I	21/15	40/24	I	306/15
<i>Poaceae</i> Barnhart	II	14/10	21/12,5	III	132/7
<i>Rosaceae</i> Juss.	III	8/6	8/5	VIII	73/4
<i>Fabaceae</i> Lindl.	IV	8/6	8/5	II	145/7
<i>Caryophyllaceae</i> Juss.	V	6/4	6/3,5	VI	84/4
<i>Ranunculaceae</i> Juss.	VI	5/3,5	5/3	XII	59/3
<i>Scrophulariaceae</i> Juss.	VII	4/3	4/2	IX	69/3
<i>Apiaceae</i> Lindl.	VIII	6/6	6/3,5	VII	79/4
<i>Brassicaceae</i> Burnett	IX	5/5	5/3	IV	130/6
<i>Lamiaceae</i> Martinov	X	3/3	4/2	XI	65/3
Total		80/57	107/64		1142/57

Compared to the Kazakh Upland's flora [14], the third place in terms of the number of species is occupied by *Rosaceae*, which takes 8th place in the KU flora. The ten leading families are *Ranunculaceae* and *Lamiaceae*, which are beyond the top ten leading families in the KU territory. The *Brassicaceae* family has dropped from place IV to IX. The floras of Eastern Europe have a tendency for lowering the status of *Fabaceae* and raising the status of *Rosaceae* [15]. These peculiarities of the coenoflora correlate well with the ecological conditions of stony (and partly sparse forest) habitats in which populations of *Pulsatilla patens* s.l. are formed with greater resistance to unfavorable growing conditions.

In the *Asteraceae* family there were found 13 species of the *Artemisia* genus. Among them, a major part of the species belongs to the steppe and meadow ones, which indicates a meadow-steppe character of the *Pulsatilla patens* s.l. coenoflora. The presence of *Pyrolaceae* species (*Chimaphila umbellata*, *Orthilia secunda*, *Pyrola minor*), which are part of a relict complex of the pine forests, indicates a forest character of the coenoflora [6].

The largest amount of species refers to perennial species (150), annuals and biennials make up 15 species, ephemera 3 species. Among the life forms, there are mainly long-rooted (70) and stem-rooted (36) species. A meadow-steppe character of the coenoflora emphasizes almost the same number of mesophytes and xeromesophytes (71 and 70 species respectively) as well as the presence of xerophytes (26 species) and the almost complete absence of more hygrophilous species. Among coenotic groups, there dominate steppe species (73 species, or 43%), then meadow ones (49 species, or 29%), forest ones (28 species, or 17%), and weedy (18 species, or 11%). The presence of a relatively large proportion of weed species indicates a significant anthropogenic breach in the habitats due to cattle pastures, recreation, partly steppe and forest fires.

Conclusion. Coenoflora of *Pulsatilla patens* s.l. includes 168 species belonging to 42 families and 141 genera. The leading families are *Asteraceae*, *Poaceae*, *Rosaceae*, *Fabaceae*, *Caryophyllaceae*, *Ranunculaceae*. The characteristics of coenoflora correlate well with the ecological conditions of rocky (and partly sparse forest) habitats where the populations of *Pulsatilla patens* s.l. are formed. Eco-biological analysis confirmed a meadow-steppe character of the coenoflora with a little presence of forest species. Anthropogenic breach of coenoflora is expressed in a rather large amount of weed species (18 species, or 11%).

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СОЛТҮСТІК ҚАЗАҚСТАНДАҒЫ *PULSATILLA PATENS* (L.) MILL. s.l. ЦЕНОФЛОРАСЫ

Аннотация. Мақалада Солтүстік Қазақстандағы *Pulsatilla patens* (L.) Mill. s.l.) ценофлорасын зерттеу нәтижелері келтірілген. Материалдар далалық зерттеулер нәтижесінде алынды, әдеби мәліметтер ескерілді. Нақтылы-маршрутты зерттеулер негізінде Солтүстік Қазақстандағы ашық құндызшөп флорасының тізімі келтіріледі.

Солтүстік Қазақстанның *Pulsatilla patens* (L.) Mill. s.l. ценофлорасында 42 тұқымдасқа және 141 туысқа жататын 168 түрі бар. Негізгі тұқымдастары: *Asteraceae*, *Poaceae*, *Rosaceae*, *Fabaceae*, *Caryophyllaceae*, *Ranunculaceae*.

Түрлердің ең көп саны көпжылдық түрлерге жатады (150), бір-екі жылдықтар 15 түрді, эфемерлер 3 түрді құрайды. Өмірлік формалар арасында ең көбі ұзын тамырлы (70) және тамыр сабақты (36) түрлері бар. Ценофлора орман флористикалық элементтердің аз мөлшері бар далалық сипаттағы және популяциялар қалыптасатын тасты (ал ішінара кесілген орман) мекендейтін жерлердің экологиялық жағдайларымен үйлеседі. Экобиологиялық талдау нәтижесінде ценофлораның шалғындық-дала сипаты расталды. Ценофлораның антропогендік бұзылуы арамшөптердің (18 түрі немесе 11%) өте көптігінен көрінеді.

Түйін сөздер: *Pulsatilla patens* (L.) Mill., ценопопуляция, Солтүстік Қазақстан, систематикалық құрылым, экология-ценодикалық топтар.

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ЦЕНОФЛОРА *PULSATILLA PATENS* (L.) MILL. s.l. В СЕВЕРНОМ КАЗАХСТАНЕ

Аннотация. В статье приведены результаты изучения ценофлоры *Pulsatilla patens* (L.) Mill. s.l. в Северном Казахстане. Материалы получены в результате полевых исследований, учтены литературные данные. На основании детально-маршрутных исследований приводится список флоры прострела раскрытого в Северном Казахстане. Ценофлора *Pulsatilla patens* (L.) Mill. s.l. в Северном Казахстане насчитывает 168 видов, принадлежащих к 42 семействам и 141 родам. Ведущими семействами являются: *Asteraceae*, *Poaceae*, *Rosaceae*, *Fabaceae*, *Caryophyllaceae*, *Ranunculaceae*. Наибольшее количество видов относится к многолетним видам (150), одно-двулетники составляют 15 видов, эфемеры – 3 вида. Среди жизненных форм более всего длиннокорневищных (70) и стержнекорневых (36) видов. Ценофлора имеет степной характер с небольшим количеством лесных флористических элементов и коррелирует с экологическими условиями каменистых (а отчасти разреженно лесных) местообитаний, в которых формируются популяции. Экобиологический анализ подтвердил лугово-степной характер ценофлоры. Антропогенная нарушенность ценофлоры выражается в довольно большом количестве сорных видов (18 видов или 11%).

Ключевые слова: *Pulsatilla patens* s.l., ценопопуляция, Северный Казахстан, систематическая структура, эколого-ценоотические группы.

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