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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				
Pinus sylvestris L.	P	T	Xm	Forest
The **Ephedraceae** Dumert. family				
Ephedra distachya L.	P	B	Xph	Steppe
The **Ranunculaceae** Juss. family				
Adonis wolgensis Steven	P	Sh-R	M	Steppe
Anemone sylvestris L.	P	L-R	M	Meadow
Pulsatilla patens (L.) Mill.	P	Sh-R	M	Steppe
Ranunculus polyanthemos L.	P	B-R	M	Meadow
Ranunculus polyrhizos Steph.	P	B-R	M	Steppe
Ranunculus repens L.	P	B-R	H	Meadow
Thalictrum minus L.	P	B-R	M	Meadow
Thalictrum simplex L.	P	B-R	M	Meadow
The **Betulaceae** S.F. Gray family				
Betula pendula Roth.	P	T	M	Forest
The **Caryophyllaceae** Juss. family				
Cerastium arvense L.	P	L-R	Xm	Meadow
Eremogone koriniana (Fisch. ex Fenzl)	P	S-R	Xph	Steppe
Eremogone longifolia (M.Bieb.) Fenzl	P	L-R	Xm	Meadow
Gypsophila altissima L.	P	S-R	Xm	Meadow
Gypsophila paniculata L.	P	S-R	Xm	Steppe
Otites wolgensis (Hornem.) Grossh.	A-B	S-R	Xm	Steppe
Silene nutans L.	P	L-R	M	Meadow
Stellaria graminea L.	P	L-R	M	Meadow

Continuation of table 1

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

Continuation of table 1

1	2	3	4	5

Continuation of table 1

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

Continuation of table 1

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

Continuation of table 1

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

End of table 1

1	2	3	4	5
The **Orchidaceae** Juss. family				
Dactylorhiza fuchsii (Druce) Soa	P	Tub-B	M	Forest
The **Convallariaceae** Horan. family				
Polygonatum odoratum (Mill.) Druc	P	L-R	M	Forest
The **Iridaceae** Juss. family				
Iris halophila Pall.	P	Sh-R	M	Meadow
The **Cyperaceae** Juss family				
Carex supina Willd. ex Wahlenb.	P	L-R	Xph	Steppe
The **Poaceae** Barnhart family				
Brachypodium pinnatum (L.) Beauv.	P	L-R	M	Forest
Bromopsis inermis (Leyss.) Holub	P	L-R	M	Meadow
Calamagrostis obtusata Trin.	P	L-R	M	Forest
Calamagrostis epigeios (L.) Roth	P	L-R	Xm	Meadow
Cleistogenes squarrosa (Trin.) Keng.	E	Br-R	Xm	Steppe
Elytrigia repens (L.) Nevski	P	L-R	M	Weed
Festuca valesiaca Gaudin	P	Sh-R	Xph	Steppe
Helictotrichon desertorum (Less.) Nevs	P	Sh-R	Xph	Steppe
Hordeum brevisubulatum (Trin.) Link	P	L-R	Xm	Meadow
*Koeleria cris*tata (L.) Pers.	P	L-R	Xph	Steppe
Leymus angustus (Trin.) Pilg	P	L-R	Xph	Steppe
Leymus paboanus (Claus) Pilg	P	L-R	Xph	Steppe
Melica nutans L.	P	L-R	M	Forest
Phleum phleoides (L.) H.Karst.	P	L-R	Xm	Steppe
*Poa angus*tifolia L.	P	L-R	Xm	Steppe
Poa palustris L.	P	L-R	M	Meadow
*Poa pratensi*s L.	P	L-R	M	Meadow
Stipa capillata L.	P	Sh-R	Xph	Steppe
Stipa lessingiana Trin. et Rupr.	P	Sh-R	Xph	Steppe
Stipa pennata L.	P	Sh-R	Xph	Steppe
Stipa zalesskii Wilensky	P	Sh-R	Xph	Steppe

*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 - Tuberous 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 - Xerome-sophytes, M - Mesophytes, H - Hygromosophytes).

Column 4 shows ecological and coenotic groups.

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	*Pulsatilla patens* 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
Asteraceae Bercht. et J. Presl	I	21/15	40/24	I	306/15
Poaceae Barnhart	II	14/10	21/12,5	III	132/7
Rosaceae Juss.	III	8/6	8/5	VIII	73/4
Fabaceae Lindl.	IV	8/6	8/5	II	145/7
Caryophyllaceae Juss.	V	6/4	6/3,5	VI	84/4
Ranunculaceae Juss.	VI	5/3,5	5/3	XII	59/3
Scrophulariaceae Juss.	VII	4/3	4/2	IX	69//3
Apiaceae Lindl.	VIII	6/6	6/3,5	VII	79/4
Brassicaceae Burnett	IX	5/5	5/3	IV	130/6
Lamiaceae 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 *Pulsatillla 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 *Pulsatillla 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-ценотикалық топтар.

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ЦЕНОФЛОРА *PULSATILA 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 коррелируют 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: *Pulsatila patens* s.l., ценопопуляция, Северный Казахстан, систематическая структура, эколого-ценотические группы.

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