

Two standard flora of the lower reaches of the Lena River, as an indicator of the territory's biodiversity

Evgenii Nikolin^{1,2*}, and *Irina Yakshina*²

¹Institute for Biological Problems of Cryolithozone SB RAS, 677980 Yakutsk, Russia

²State Nature Reserve Ust-Lensky, 678400 Tiksi, Republic of Sakha (Yakutia), Russia

Abstract. The standard flora method established the diversity of vascular plants in two areas of the lower reaches of the Lena River (North-East Asia), which is estimated at 232 (216 species, 1 notospecies, 11 subspecies and 4 varieties) – 241 (228 species, 11 subspecies and 2 varieties) taxon/km².

The problem of obtaining comparable quantitative data on the diversity of vascular plants per unit area has already been covered by us in the collection BIO Web of Conferences [1]. In this case, information is provided about two new sites studied in the volume of standard flora. Both sites are located in the right-bank part of the lower reaches of the Lena River, about 20 km downstream from the island of Tit-Ary, within the northern spurs of the Kharaulakh ridge. The landscape of the studied area is mountainous-tundra, with altitudes up to 300 m. Among the predominant tundra vegetation, there are small fragments of tree and shrub communities. According to the standard flora method, the area of each plot is 1 km². One of the sections (SF 1) covers the estuary part of the right tributary of the Lena River – the Chinke River, the other (SF 2) – the estuary part of the Lena tributary similar in volume to the catchment area – the Sobol-Yuryage River. Since the distance between the mouths of these rivers is small, about 1 km, the northwest corner of SF 1 and the southwest corner of SF 2 are combined at the same coordinate point.

The angular boundaries of the standard floras were highlighted in the coordinates: SF 1: extreme north-western point – 72°07'27.47" N, 126°58'43.95" E – the bank of the Lena River below the mouth of the Chinke River; extreme north-eastern point – 72°07'27.98" N, 127°00'31.03" E – western exposure mountain slope in the Chinke and Sobol-Yuryage interfluve; extreme south-western point – 72°06'55.24" N, 126°58'46.29" E – the bank of the Lena River above the mouth of the Chinke River; extreme south-eastern point – 72°06'55.60" N, 127°00'28.91" E – mountain slope in the area between the Chinka and Lena rivers.

SF 2: extreme southwestern point – 72°07'27.47" N, 126°58'43.95" E – the bank of the Lena River in the Chinke and Sobol-Yuryage interfluve; extreme south-eastern point – 72°07'34.92" N, 127°00'26.14" E – western exposure mountain slope in the Chinke and Sobol-Yuryage interfluve; extreme north-western point – 72°08'00.37" N, 126°58'19.98" E

* Corresponding author: enikolin@yandex.ru

– the bank of the Lena River below the mouth of the Sobol-Yuryage river; extreme north-eastern point – 72°08'07.26" N, 127°00'04.79" E – the slope of the mountain in the interfluvium of Sobol-Yuryage and Lena.

List of species marked in the standard flora of Chinke and Sobol-Yuryage

(numbers in parentheses indicate the corresponding numbers of the standard flora)

Fam. Cystopteridaceae (Payer) Schmakov: *Cystopteris dickieana* R. Sims (2); *C. fragilis* (L.) Bernh. (2).

Fam. Woodsiaceae (Diels) Herter: *Woodsia glabella* R. Br. (2).

Fam. Equisetaceae Rich.: *Equisetum arvense* L. (1, 2); *E. palustre* L. (1, 2); *E. scirpoides* (1, 2); *E. variegatum* Schleich. ex Web. et Mohr (1, 2).

Fam. Huperziaceae Rothm.: *Huperzia arctica* (Tolm.) Sipliv. (2).

Fam. Pinaceae Spreng. ex Rudolphi: *Larix dahurica* Turcz. subsp. *cajanderi* (Mayr) Dyl. (1).

Fam. Poaceae Barnh.: *Alopecurus alpinus* Smith. (1, 2); *Arctagrostis arundinacea* (Trin.) Beal. (1); *A. latifolia* (R. Br.) Griseb. (1, 2); *Arctophila fulva* (Trin.) Anderss. (1, 2); *Bromopsis sibirica* (Drob.) Peschkova (1, 2); *Calamagrostis holmii* Lange (1, 2); *C. langsdorffii* (Link) Trin. (1, 2); *C. lapponica* (Wahlenb.) C. Hartm. (1); *C. neglecta* (Ehrh.) Gaertn., Mey. et Schreb.: a. subsp. *groenlandica* (Schrank) Matuszk. (1, 2); 6. subsp. *neglecta* (1, 2); *Deschampsia borealis* (Trautv.) Roshev. (1, 2); *D. glauca* C. Hartm. (2); *D. obensis* Roshev. (1, 2); *D. submutica* (Trautv.) Nikiforova (1, 2); *D. sukatschewii* (Popl.) Roshev.; *D. × vodopjanoviae* Nikiforova (1, 2); *Dupontia fisheri* subsp. *pelligera* (Rupr.) Tzvelev (1, 2); *D. psilosantha* Rupr. (1, 2); *Elymus subfibrosus* (Tzvelev) Tzvelev (1, 2); *Festuca auriculata* Drob. (1, 2); *F. edlundiae* S. G. Aiken (1); *F. rubra* L.: a. subsp. *arctica* (Hackel) Govor. (1, 2); 6. subsp. *rubra* (1, 2); *Hierochloa alpina* (Sw.) Roem. et Schult. (1, 2); *H. pauciflora* R. Br. (1); *Hyalopoa lanatiflora* (Roshev.) Tzvel. (1); *Koeleria asiatica* Domin (1, 2); *Leymus interior* (Hult.) Tzvel. (1, 2); *Poa alpigena* (Blytt) Lindm.: a. subsp. *alpigena* (1, 2); 6. subsp. *colpodea* (Th. Fries) Jurtzev et Petrovsky (1, 2); *P. arctica* R. Br. (1, 2); *P. attenuata* Trin. (2); *P. bryophila* Trin. (1, 2); *P. filiculmis* Roshev. (1); *P. glauca* Vahl (1, 2); *P. pratensis* L. s.str. (1); *Trisetum molle* Kunth (1); *T. sibiricum* Rupr. subsp. *litorale* Rupr. ex Roshev. (1, 2); *T. spicatum* (L.) K. Richt. (1, 2).

Fam. Cyperaceae Juss.: *Carex aquatilis* Wahlenb.: a. subsp. *aquatilis* (1, 2); 6. subsp. *stans* (Drej.) Hult. (1, 2); *C. bigelowii* Torr. ex Schwein.: a. subsp. *arctisibirica* (Jurtz.) A. et D. Love (1, 2); 6. subsp. *ensifolia* (Turcz. ex Gorodk.) Holub (1, 2); 8. subsp. *rigidioides* (Gorodk.) Egor. (1); *C. capillaris* L. (1, 2); *C. fuscicula* V. Krecz. ex Egor (1); *C. ledebouriana* C. A. Mey. ex Trev. (2); *C. melanocarpa* Cham. ex Trautv. (1); *C. rariflora* (Wahlenb.) Smith. (1); *C. rupestris* All. (1, 2); *C. vaginata* Tausch. subsp. *quasivaginata* (C. B. Clarke) Malyshev (1); *Eriophorum angustifolium* Honck. (1, 2); *E. scheuchzeri* Hoppe (1, 2); *E. tolmatchevii* Novoselova (2); *E. vaginatum* L. (1, 2); *Kobresia filifolia* (Turcz.) Clarke (1, 2); *K. myosuroides* (Vill.) Fiori (1, 2); *K. sibirica* (Turcz. ex Ledeb.) Boeck. (1, 2); *K. simpliciuscula* (Wahlenb.) Mackenz. subsp. *subholarctica* Egor. (1).

Fam. Juncaceae Juss.: *Juncus biglumis* L. (1, 2); *J. castaneus* Smith (2); *Luzula confusa* Lindeb. (1, 2); *L. multiflora* (Ehrh. et Retz.) Lej. s.l. (1, 2); *L. nivalis* (Laest.) Spreng. (1, 2); *L. tundricola* Gorodk. ex V. Vassil. (1, 2).

Fam. Melanthiaceae Batsch ex Borch.: *Tofieldia coccinea* Richards. (1, 2); *Veratrum oxysepalum* Turcz. (1, 2); *Zigadenus sibiricus* (L.) A. Gray (2).

Fam. Liliaceae Juss.: *Lloydia serotina* (L.) Reichenb. (1, 2).

Fam. Orchidaceae Juss.: *Coeloglossum viride* (L.) C. Hartm. (1, 2).

Fam. Salicaceae Mirb.: *Salix abscondita* Laksch. (1); *S. alaxensis* Coville (1, 2); *S. arctica* Pall. (1, 2); *S. berberifolia* Pall.: a. subsp. *berberifolia* (2); 6). subsp. *fimbriata* A. Skvorts. (2); b). subsp. *tschuktschorum* (A. Skvorts.) Kuv. (2); *S. boganidensis* Trautv. (2); *S. dasyclados* Wimm. (1); *S. fuscescens* Andersson (1, 2); *S. glauca* L. (1, 2); *S. hastata* L. (1, 2); *S. lanata* L. (1, 2); *S. polaris* Wahlenb. (1, 2); *S. pulchra* Cham. (1, 2); *S. recurvigemmis* A. K. Skvortsov (1, 2); *S. reptans* Rurp. (1, 2); *S. reticulata* L. (1, 2); *S. saxatilis* Turcz. ex Ledeb. (1, 2); *S. sphenophylla* A. K. Skvortsov (1, 2); *S. udensis* Trautv. et C. A. Mey. (2).

Fam. Betulaceae S. F. Gray: *Betula divaricata* Ledeb. (2); *B. nana* L. subsp. *exilis* (Sukacz.) Hult. (1, 2); *Duschekia fruticosa* (Rupr.) Pouzar (1, 2).

Fam. Polygonaceae Juss.: *Acetosa lapponica* (Hiit.) Holub (1, 2); *A. pseudoxyria* (Tolm.) Tzvel. (1, 2); *A. thyriflora* (Fingerh.) A. L. ve et D. L. ve (1); *Aconogonon ocreatum* (L.) Hara (1, 2); *A. tripterocarpum* (A. Gray) Hara (1, 2); *Bistorta plumosa* (Small) D. Love (1, 2); *B. vivipara* (L.) Delabre (1, 2); *Oxyria digyna* (L.) Hill (1, 2); *Rumex arcticus* Trautv. (1); *R. sibiricus* Hult. (1).

Fam. Portulacaceae Juss.: *Claytonia arctica* Adams (1, 2).

Fam. Caryophyllaceae Juss.: *Cerastium beeringianum* Cham. et Schldt.: a. subsp. *beeringianum* (2); 6). subsp. *bialynickii* (Tolm.) Tolm.; *C. jenisejense* Hult. (1, 2); *Dianthus repens* Willd. (1, 2); *Eremogone formosa* (Fisch. ex Ser.) Fenzl (1, 2); *Gastrolychnis affinis* (Vahl ex Fries) Tolm. et Kozhan. (1, 2); *G. uniflora* (Ledeb.) Tzvel. (1, 2); *Minuartia arctica* (Stev. ex Ser.) Graebn. (1, 2); *M. macrocarpa* (Pursh) Ostenf. (1, 2); *M. rubella* (Wahlenb.) Hiern; *M. verna* (L.) Hiern (1, 2); *Sagina nodosa* (L.) Fenzl (1, 2); *Silene chamarensis* Turcz. subsp. *paucifolia* (Ledeb.) Kuvaev (1, 2); *Stellaria ciliatosepala* Trautv. (1, 2); *S. crassifolia* Ehrh. (1, 2); *S. dahurica* Willd. ex D. F. K. Schldt. (1); *S. edwardsii* R. Br. ex Rich. (1, 2); *S. longifolia* Muehl. ex Willd. (1); *S. palustris* Retz. (1); *S. peduncularis* Bunge. (1); *Wilhelmsia physodes* (Fisch. ex Ser.) McNeill (1, 2).

Fam. Ranunculaceae Juss.: *Anemonidium richardsonii* (Hook.) Starodub. (1, 2); *Caltha arctica* R. Br. (1, 2); *C. palustris* L.: a. subsp. *membranacea* (Turcz.) Hult. (1); 6). subsp. *palustris* (2); *Coptidium lapponicum* (L.) Tzvelev (1, 2); *Delphinium chamissonis* G. Pritzel (1, 2); *D. ochotense* Nevski (1, 2); *Pulsatilla angustifolia* Turcz. (2); *Ranunculus gmelinii* DC. (2); *R. hyperboreus* Rottb. (2); *R. monophyllus* Ovcz. (2); *R. nivalis* L. (1, 2); *R. pedatifidus* Smith. s.l. (2); *R. propinquus* C. A. Mey. (1, 2); *R. pygmaeus* Wahlenb. (2); *R. turneri* Greene: a. subsp. *jacuticus* (Ovcz.) Tolm. (1, 2); 6). subsp. *turneri* (1); *Trollius sibiricus* Schipcz. (2).

Fam. Papaveraceae Juss.: *Papaver angustifolium* Tolm. (1); *P. czechanowskii* Tolm. (1); *P. lapponicum* (Tolm.) Nordh. subsp. *orientale* Tolm. (1, 2); *P. leucotrichum* Tolm. (1, 2); *P. minutiflorum* Tolm. (1); *P. nudicaule* L. subsp. *commune* Turcz. var. *riparia* Petrovsky (1); *P. paucistaminum* Tolm. et Petrovsky (1, 2); *P. pulvinatum* Tolm.: a. subsp. *lenaense* Tolm. (1, 2); 6). subsp. *pulvinatum* (1).

Fam. Fumariaceae Marquis: *Corydalis arctica* M. Pop. (1, 2).

Fam. Cruciferae Juss.: *Arabidopsis septentrionalis* (N. Busch) V. I. Dorof. (1, 2); *A. umbrosa* (Turcz. ex Steud.) V. I. Dorof. (2); *Cardamine bellidifolia* L. (1); *C. microphylla* Adams (1, 2); *C. nymanii* Gand. (1, 2); *C. prorepens* Fisch. (1, 2); *Cochlearia arctica* Schlecht. (1); *C. groenlandica* L. (1, 2); *Descurainia sophioides* (Fisch. ex Hook.) O.E. Schulz (1, 2); *Dichasanthus humilis* (C. A. Mey.) Soják (1, 2); *Dimorphostemon pinnatifidus* (Willd.) H. L. Yang (1); *Draba alpina* L. (1, 2); *D. cinerea* Adams (1, 2); *D. fladnizensis* Wulf. (1, 2); *D. hirta* L. (1); *D. juvenilis* Kom. (1, 2); *D. metaarctica* Petrovsky (1); *D. nivalis* Lilyebl. (1); *D. pauciflora* R. Br. (1, 2); *D. pilosa* DC. (1); *D. subcapitata* Simm. (1, 2); *Erysimum pallasii* (Pursch) Fernald. (1, 2); *Eutrema edwardsii* R. Br. (1, 2); *Parrya nudicaulis* (L.) Regel (1, 2); *Rorippa palustris* (L.) Bess. (1); *Sphaerorrhiza trifida* (Poir.) A. P. Khokhr. (1, 2).

Fam. Crassulaceae J. St.-Hil.: *Rhodiola rosea* L. subsp. *borealis* (Boriss.) Khokhr. et Kuvaev. (1, 2).

Fam. Saxifragaceae Juss.: *Chrysosplenium alternifolium* L. subsp. *sibiricum* (Ser. ex DC.) Hult. (1, 2); *Saxifraga bronchialis* L. (1, 2); *S. cernua* L. (1, 2); *S. foliolosa* R. Br. (1); *S. hieracifolia* Waldst. et Kit. (1, 2); *S. hirculus* L. (1, 2); *S. hyperborea* R. Br. (2); *S. nelsoniana* D. Don (1, 2); *S. nivalis* L.: a). var. *nivalis* (2); б). var. *tenuis* Wahlenb. (2); *S. oppositifolia* (2); *S. setigera* Pursh (1, 2); *S. spinulosa* Adams (1, 2).

Fam. Parnassiaceae Martinov: *Parnassia kotzebuei* Cham. et Schlecht. (2); *P. palustris* L. subsp. *neogaea* (Fern.) Hulten (2).

Fam. Grossulariaceae DC.: *Ribes triste* Pall. (1, 2).

Fam. Rosaceae Juss.: *Acomastylis glacialis* (Adams) Khokhr. (1); *Comarum palustre* L. (1, 2); *Dryas punctata* Juz. (1, 2); *Potentilla hyparctica* Malte (1); *P. nivea* L. s.l. (1, 2); *P. stipularis* L. (1, 2); *P. uniflora* Ledeb. (1, 2); *Rubus chamaemorus* L. (1, 2); *Sanguisorba officinalis* L. var. *polygama* (Nyl.) Serg. (1, 2).

Fam. Fabaceae Lindl.: *Astragalus alpinus* L. (1, 2); *A. frigidus* (L.) A. Gray (1, 2); *A. norvegicus* Grauer (1, 2); *A. tugarinovii* N. Basil. (2); *A. umbellatus* Bunge (1, 2); *Hedysarum arcticum* B. Fedtsch. (1, 2); *Oxytropis adamsiana* (Trautv.) Jurtz. (1, 2); *O. nigrescens* (Pall.) Fisch. (1, 2); *O. sordida* (Willd.) Pers. s.l. (1, 2).

Fam. Empetraceae Hook. et Lindl.: *Empetrum nigrum* L. s.l. (1, 2).

Fam. Violaceae Batsch: *Viola biflora* L. (1, 2).

Fam. Onaragaceae Juss.: *Chamaenerion latifolium* (L.) Th. Fries et Lange (1, 2); *Epilobium davuricum* Fisch. ex Hornem. (2); *E. palustre* L. (1, 2).

Fam. Hippuridaceae Vest.: *Hippuris* × *lanceolata* Retz. (2).

Fam. Umbelliferae Juss.: *Angelica decurrens* (Ledeb.) B. Fedtsch. (1); *Conioselinum tataricum* Hoffm. (1); *Pachypleurum alpinum* Ledeb. (1, 2); *Phlojodicarpus villosus* (Turcz. ex Fisch. et C. A. Mey.) Ledeb. (1).

Fam. Pyrolaceae Dumort.: *Pyrola rotundifolia* L. s.l. (1, 2).

Fam. Ericaceae Juss.: *Arctous alpina* (L.) Niedenzu (1, 2); *Cassiope tetragona* (L.) D. Don (1, 2); *Ledum palustre* L.: a). subsp. *decumbens* (Ait.) Hult. (1, 2); б). var. *angustum* N. Busch. (1, 2); в). var. *dilatatum* Wahlenb. (1, 2); *Rhododendron adamsii* Rehder (1, 2); *Vaccinium uliginosum* L.: a). subsp. *microphyllum* (Lange) Tolm. (1, 2); б). subsp. *uliginosum* (1); *V. vitis-idaea* L.: a). subsp. *minus* (Lodd.) Hult. (1, 2); б). subsp. *vitis-idaea* (1, 2).

Fam. Diapensiaceae Lindl.: *Diapensia obovata* (Fr. Schmidt) Nakai (1, 2).

Fam. Primulaceae Batsch ex Bork.: *Androsace bungeana* Schischk. et Bobr. (1, 2); *A. septentrionalis* L. (1, 2); *Primula matthioli* (L.) V. A. Richt. subsp. *sibirica* (Andrz. ex Besser) Kovt. (2).

Fam. Limoniaceae Ser.: *Armeria scabra* Pall. ex Schult. (1, 2).

Fam. Gentianaceae Juss.: *Comastoma tenellum* (Rottb.) Toyokuni (1, 2).

Fam. Polemoniaceae Juss.: *Polemonium acutiflorum* Willd. ex Roem. et Schult. (1, 2).

Fam. Boraginaceae Juss.: *Eritrichium villosum* (Ledeb.) Bunge (1, 2); *Myosotis asiatica* (Vestergren) Schischk. et Serg. (1, 2); *M. suaveolens* Waldst. et Kit. s.l. (1, 2).

Fam. Lamiaceae Martinov: *Thymus extremus* Klokov (1, 2); *T. reverdattoanus* Serg. (1, 2).

Fam. Scrophulariaceae Juss.: *Castilleja arctica* Kryl. et Serg. (2); *Lagotis minor* (Willd.) Standl. (1, 2); *Pedicularis alopecuroides* Adams (1); *P. amoena* Adams ex Stev. (1, 2); *P. capitata* Adams (1, 2); *P. lapponica* L. (1, 2); *P. oederi* Vahl (1, 2); *P. sceptrum-carolinum* L. (1, 2); *P. sudetica* Willd. s.l. (1, 2); *P. tristis* L. (2); *P. verticillata* L. (1, 2).

Fam. Rubiaceae Juss.: *Galium densiflorum* Ledeb. (2); *G. trifidum* L. (1).

Fam. Adoxaceae E. Mey.: *Adoxa moschatellina* L. (1, 2).

Fam. Valerianaceae Batsch: *Valeriana capitata* Pall. ex Link. (1, 2).

Fam. Campanulaceae Juss.: *Campanula rotundifolia* L. (1, 2).

Fam. Asteraceae Bercht. et G. Presl.: *Antennaria villifera* Boriss. (2); *Arnica iljinii* (Maguire) Iljin (1, 2); *Artemisia arctisibirica* Korobkov (1, 2); *A. furcata* Bieb. (1, 2); *A. lagopus* Fisch. ex Bess. subsp. *abbreviata* Krasch. ex Korobkov (1, 2); *A. tilesii* Ledeb. (1, 2); *Chrysanthemum zawadskii* (Herb.) Tzvel. subsp. *peleiolepis* (Trautv.) Zuev (1, 2); *Crepis chrysantha* (Ledeb.) Turcz. subsp. *minor* (Ledeb.) Lomonosova (1, 2); *C. nana* Richards. (1, 2); *Packera heterophylla* (Fisch.) E. Wiebe (1, 2); *Petasites frigidus* (L.) Fries (1, 2); *P. glacialis* (Ledeb.) Polun. (1); *P. sibiricus* (J. F. Gmel.) Dingwall. (2); *Saussurea alpina* (L.) DC. (1, 2); *S. tilesii* (Ledeb.) Ledeb. (1, 2); *Tanacetum bipinnatum* (L.) Sch. Bip. (1, 2); *Taraxacum arcticum* (Trautv.) Dahlst. (1); *T. macilentum* Dahlst. (1, 2); *T. stepanovae* Worosch. (1, 2); *Tephrosia integrifolia* (L.) Holub (2); *Tripleurospermum hookeri* Sch. Bip. (1).

The diversity of vascular plants of SF 1 is estimated at 228 species, 11 subspecies and 2 varieties (a total of 241 taxa / km²); in SF 2 – 216 species, 1 notospecies, 11 subspecies and 4 varieties (total 232 taxa / km²). These are quite high indicators, more typical for the islands of the Lena River in the middle taiga subzone of the Boreal region (Haryyalah Island – 228 taxa / km²). The quantitative indicators of the standard Chinke and Sobol-Yuryage floras are similar in value, but differ somewhat in species composition. Common to both standard floras are 176 species, 9 subspecies and 2 varieties. The specificity of the standard Chinke flora is formed by 52 species and 2 subspecies (a total of 54 taxa), and in Sobol-Yuryage – 40 species, 1 notospecies, 2 subspecies and 1 variety (a total of 44 taxa).

References

1. E. Nikolin, BIO Web of Conferences **16** (2019)