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SHORT COMMUNICATION

Naturalization of *Pinus mugo* Turra (Pinaceae) in southeast Sakhalin, Russia

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ABSTRACT

The paper presents information about the discovery of *Pinus mugo* with trees of various ages on coastal terrace between the Igrivaya and Ostrovka rivers (46°25'25"N, 143°20'10"E; Tonino-Aniva Peninsula, Korsakov District). Unlike other pine species that come from outside the district that have been cultivated at different times on Sakhalin, *P. mugo* reproduces well naturally. The dispersal of this species may be confined exclusively to the habitats found on the coastal terrace of Aniva Bay on the Sea of Okhotsk.

Keywords: mountain pine, floristic record, alien species, introduced species, forest plantation, vacant niches

РЕЗЮМЕ

Корзников К.А. Натурализация *Pinus mugo* Turra (Pinaceae) на юго-востоке Сахалина, Россия. Приводится информация о находке разновозрастной популяции *Pinus mugo* на морской террасе побережья Анивского залива, между реками Игривая и Островка (46°25'25"N, 143°20'10"E; Тонино-Анивский полуостров, Корсаковский административный район). В отличие от других инорайоных видов сосен, культуры которых в разное время создавали на Сахалине, *P. mugo* хорошо возобновляется естественным образом. Дальнейшее расселение этого вида, возможно, будет приурочено исключительно к биотопам морских террас Анивского залива Охотского моря.

Ключевые слова: сосна горная, флористическая находка, чужеродный вид, интродуцент, лесные культуры, свободная экологическая ниша

During a botanical field work trip of 25.08.2015, in the Tonino-Aniva Peninsula coastal plain, between the Igrivaya and Ostrovka Rivers (46°25'25" N, 143°20'10" E) (Fig. 1), we found a various age population of pine that we identified as *Pinus mugo*. A comparison of the plant specimens we collected (Fig. 2) with those stored in the Moscow State University Herbarium (MW) confirmed that our identification was correct. The specimens were submitted to MW.

Species *P. mugo* is not included in the checklist of the vascular plants of Sakhalin (Barkalov & Taran 2004). Cultivated stands of *P. mugo* were not mentioned in the available Sakhalin forestry, geobotanical or flora documentation. *Pinus pumila* (Pall.) Regel is the only member of the genus *Pinus* native to the island.

The habitat of the mountain pine is a gently sloping coastal terrace facing west towards Aniva Bay on the Sea of Okhotsk, cut through and drained by small ravines. *P. mugo* forms open woodlands with a large number of young plants 3–4 m in height, 8–10 cm in diameter and smaller. Growth rings found in the tree cores showed that the trees of this size are up 20 years old. The pine naturalized out cultivated stands planted age of about 30 years, 7.5–8.5 m in height, 12–14 cm in diameter. The trees that had reached reproductive age all had produced a massive amount of seeds. We counted about 3000 trees of various ages on 17 hectares in marine terrace (Fig. 3).

Pinus mugo sometimes mixes with *Betula ermanii* Cham., *Picea jezoensis* (Siebold & Zucc.) Carrière, *Abies sachalinensis* F. Schmidt, *Larix cajanderi* Mayr *Acer mayrii* Schwer., *Betula ermanii* Cham., *Salix caprea* L. and *Pinus sylvestris* L. (the latter is naturalized from planting). The maximum height of the trees in surrounding forest stands does not exceed 10 m, and the most typical height is 7–8 m. Most trees have a flag-shaped crown. There are numerous *Hydrangea paniculata* Siebold shrubs, although this species doesn't form closed canopy. Occasionally there were *Vaccinium ovalifolium* Sm., *Menziesia pentandra* Maxim., *Juniperus sibirica* Burgsd. The dominant of herb layer cover consists of Lycopodiaceae and Ericaceae: *Lycopodium clavatum* L., *Diphasiastrum complanatum* (L.) Holub, *Lycopodium juniperoideum* Sw., *Vaccinium vitis-idaea* L., *V. praestans* Lamb. Commonly found plants are: *Osmundastrum asiaticum* (Fernald) Tagawa, *Chamaepericlymenum canadense* (L.) Asch. & Graebn., *Angelica genuflexa* Nutt. ex Torr. & A. Gray, *Bupleurum longiradiatum* Turcz., *Calamagrostis langsdorffii* (Link) Trin., *Artemisia* spp., and other species. Among the protected species are founded *Juniperus sargentii* (A.Henry) Takeda ex Koidz., *Aralia cordata* Thunb. and *Neottianthe cucullata* (L.) Schlechter. Adjacent to the surveyed area are cultivated stands of *Abies sachalinensis*.

Apparently, before the clear-cutting of the forest in the early 20th century, the vegetation between the rivers Igrivaya and Ostrovka consisted of dark coniferous forests

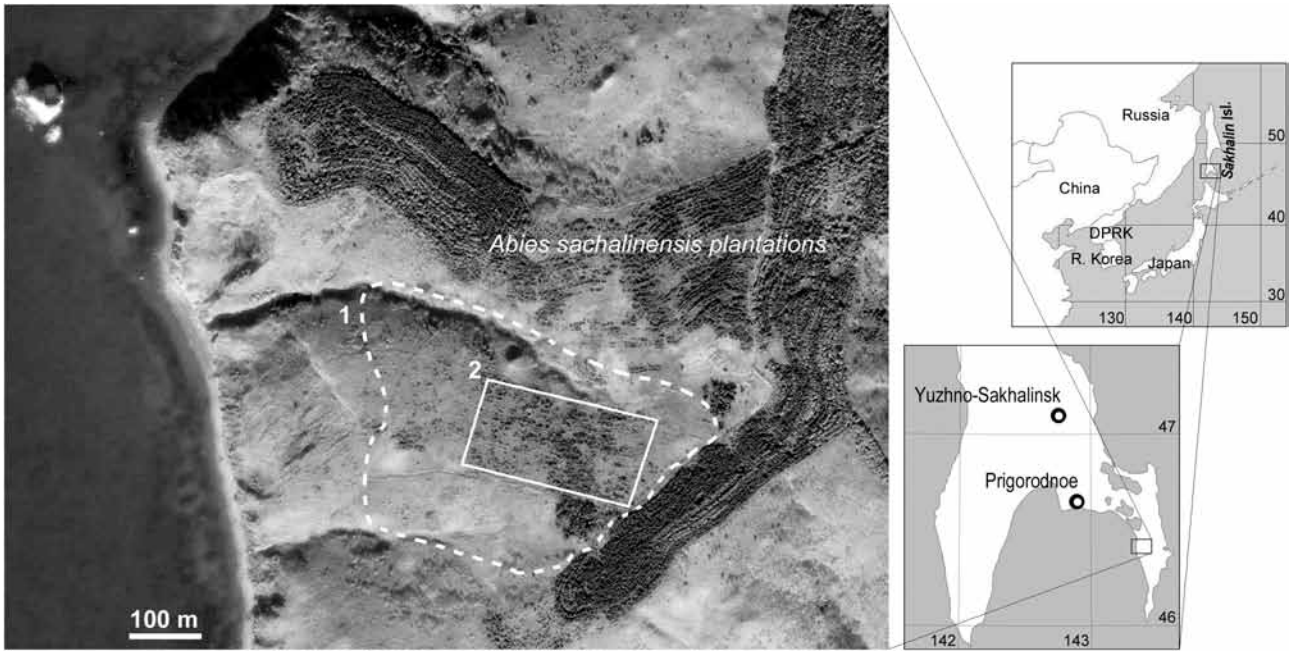

Figure 1 Location of mountain pine population found on Sakhalin Island: 1 – site with natural regeneration of *P. mugo* (17 ha, dashed line), 2 – *P. mugo* plantation (4 ha, solid line)

dominated by *A. sachalinensis*, with local areas showing a predominance of *Acer mayrii* and *Quercus crispula* in the presence of *Betula ermanii*. Today, the existing plant communities are long-term derivative stages of regenerative succession, which also contributed to the opening of an ecological niche for the mountain pine.

Also on October 2015, according to data from personal observation by Prof. Eryomin, we found the second place of cultivated stands of 40 years old *P. mugo* in an area of about 0.25 ha near the Prigorodnoe liquefied natural gas plant (46°37'29"N 142°51'12"E, Korsakov District).

The natural range of *P. mugo* is limited to the mountainous areas of Central and Southern Europe. It occurs usually in the sub-alpine zone above the timberline (1400–2700 m), but the species can grow at much lower altitudes (as low as 200 m) in frost hollows and peat bogs (Christensen 1987). The naturalization of *P. mugo* in European countries outside its natural range is summarized in a report by Jørgensen (2010). *P. mugo* now grows in Denmark, Norway, Sweden, and the Baltic States. In Russia, *P. mugo* in cultivated stands can reach Leningrad Province (Maleev 1949). There are unique cases of naturalization in Moscow Province (Syreyshchikov 1927). In North America (specifically in Ontario, Canada) it has been observed entering into natural plant communities in dry, rocky, and sandy habitats (Catling 2005). The introduction of *P. mugo* into natural communities may lead to a decrease in plant species diversity (Catling

Figure 2 Herbarium specimen of *Pinus mugo* in MW

Figure 3 *Pinus mugo* from study site: a – 20-year-old treelet with reproductive organs; b – one of the *P. mugo* clusters, October 2015

2005, Zeidler et al. 2012) and the restructuring of the functional relationships in ecosystems (Kašák et al. 2015).

USSR forestry workers experimented with the introduction of *P. mugo* in southern Sakhalin in 1970–1980s. It should be noted that Japanese botanists created plantations of East Asian representatives of the Pinaceae from outside Sakhalin on the island in the first half of the 20th century with both very successful (*Larix kaempferi* (Lamb.) Carrière) and not very successful (*P. densiflora* Siebold & Zucc., *P. thunbergii* Parl.) results. That said, there are stands of trees, *P. densiflora*, *P. thunbergii*, and *Chamecyparis pisifera* (Siebold & Zucc.) Endl. planted over 80 years ago in southern Sakhalin towns that are presently in good condition. *Cryptomeria japonica* was cultivated by Japanese foresters, and the trees were quite successful in the vicinity of Shebunino, a village in the far southwest of Sakhalin (Voroshilova 1978), but were cut down. In post WWII times, foresters started creating forest plantations of *P. sylvestris* L. and *P. koraensis* Siebold & Zucc. (Vlasova et al. 2010), although attempts at their introduction were made before 1945 (Smirnov 2013). In southeast and central Sakhalin there are known plantings of *P. banksiana* Lamb. (Barkalov & Taran 2004). This species is used in a limited way in Yuzhno-Sakhalinsk landscaping.

While it has been said that the natural population regeneration of any pine species originating outside Sakhalin is weak or non-existent, and they have no prospects for natural reproduction (Smirnov 2013), this is not the case for the mountain pine. The discovery of a self-sustaining *P. mugo* population with trees of various ages indicates the possibility of the successful existence of this species, at least in the habitats found on the coastal terrace of southeast Sakhalin.

The mountain pine can be used in landscaping cities in the south of Sakhalin, and it is an alternative to *P. pumila* in green building. The possibility for *P. mugo* to be used to stabilize sandy slopes in erosion control measures and for the restoration of sand pits (etc.) requires more detailed research.

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