Conifers of flora of Japan at Peter the Great Botanic Garden

Firsov G.A.
Komarov Botanical Institute of the Russian Academy of Sciences, Saint Petersburg, Russia
gennady_firsov@mail.ru

Annotation. There are 24 species of conifers of flora of Japan cultivating at Peter the Great Botanic Garden (Saint-Petersburg, Russia). They are of 11 genera of 4 families. 10 species are endemics, and 10 species have common habitat with Russia. 20 species are represented by living form of a tree, and 4 species are shrubs. 16 species produce cones, and 1 species (*Pinus densiflora*) – episodical microstrobils only. *Pinus pumila* and *Picea jezoensis* were introduced into general cultivation by way of Peter the Great Botanic Garden. They have been known here since the first half of the XIX century. The introduction of a set of species at the second half of the XIX century was connected with C.I. Maximowicz. And at the beginning of the XXI century such warm loving conifers as *Cryptomeria japonica* have been involved in cultivation outdoor. In conditions of the warming of the climate the self-sowing of *Abies sachalinensis, Abies veitchii, Chamaecyparis pisifera* and *Taxus cuspidata* is observing in recent years.

Keywords*:* conifers, arboriculture, Japan, Saint-Petersburg, changes of climate

In the Peter the Great Botanical Garden BIN RAS, conifers of the flora of Japan appeared in the first half of the 19th century. *Pinus pumila* and *Picea jezoensis* were introduced here for the first time in world culture [1]. They were introduced from the Russian part of the range. Thus, *Picea jezoensis* was first mentioned by F.B. Fisher in 1852. In the second half of the 19th century the introduction of several Japanese species is associated with the name of K.I. Maksimovich. Many conifers were introduced in the 20th century. And even now, at the beginning of the 21st century, new species appear and successfully grow here, or those whose culture was considered impossible in the past (*Cryptomeria japonica*). Below is an annotated list of conifers grown in the arboretum of the BIN RAS.

***Abies firma* Siebold et Zucc. (Pinaceae) – Momi fir**

Large tree up to 40 m and more, with wide rigid needles up to 40 mm long. and cones up to 15 cm long. At plot number 99: plant from L.V. Orlova in 2017: Hungary, Budapest, Museum of Natural History, about 7 years old (germination year ~ 2010), planted in 2021, characterized by slow growth. At the age of ~ 11 years, it reached 55 cm in height, vegetative state. It has been known in the Garden since 1861 [2]. Repeatedly dropped out and again restored in the collection. Since the same 1861 it is considered introduced into Europe [3].

***Abies homolepis* Siebold et Zucc. – Nikko fir**

A large tree up to 40 m tall, with a trunk 1–1.5 m in diameter, with a regular conical or broadly pyramidal crown. Plot number 126: seeds from A.V. Kholopova from Germany, Hamburg Botanical Garden, seed-

lings 1999, planted in 2014. At the age of 22: 3.20 m in height, 3 cm in diameter, crown 2.5 x 2.6 m. At plot number 77, a younger specimen, from the nature of Japan, seeds from Lord Howick from the expedition of English botanists: Gumna Prefectura, Lake Ohnuma, Mt. Akagi, seedlings 2006, planting in 2019, vegetative state. Alpine view found in the south of the country (Honshu and Shikoku Islands) at altitudes up to 2000 m above sea level. Introduced in 1861 [3].

***Abies mariesii* Mast. – Maries' Fir**

A tree up to 25 m tall and a trunk up to 60 cm in diameter, with a smooth gray bark. Cones are very decorative, up to 10 cm long, purple before ripening. A young plant from Arboretum Mustila, Finland, Elimäki village, July 8, 2009, was brought by G.A. Firsov and A.V. Volchanskaya. There are also young seedlings in the nursery, also from Mustila Arboretum. Strongly freezes. In a vegetative state. Until 2009, it was not tested in the Garden before. Charles Maries was introduced to Europe around 1879 [3]. In nature, it grows in the mountains of Central Japan and Taiwan.

***Abies sachalinensis* F. Schmidt – Sakhalin fir**

Large tree up to 40 m tall, with a trunk up to 1 m in diameter, with a dense conical sharp crown. It grows on the insular part of the Russian Far East (Sakhalin and the Southern Kuriles) and in Northern Japan (Hokkaido). Usually, it is an admixture in mountain forests dominated by Yezo spruce *(Picea jezoensis)*; from sea level up to 800-1100 m; sometimes forms clear forests. There are 6 specimens in the Garden, the older one at plot 116: seedlings - 04/29/1960, planting - 05/19/1970 [4]. Fruiting, self-sowing was noted in 2020. It has been known in the Garden since 1889 (Svyazeva, 2005). In culture since 1878 [3].

***Abies veitchii* Lindl. – Veitch's fir**

It can reach more than 25 m in height, the trunk diameter is usually up to 70-80 cm. It grows in the mountains of Central Japan in the zone of 1300-2300 m; forms pure forests or mixed with spruce and hemlock species, other types of fir. There are 6 specimens in the Garden; older specimens at plots 36 and 107: seedlings - 05/04/1955 [4]. Fruiting, self-seeding (noted since 2014). In the Garden since 1887 [2]. Introduced to Europe in 1861 [5].

***Chamaecyparis obtusa* (Siebold et Zucc.) Endl. (Cupressaceae) – Hinoki cypress**

A tree up to 30 (-50) m in height and a trunk of 1.5–2 m in diameter, with a dense, wide-conical crown. Recorded in the Garden in 1870-1898 and 1949-1977 [2]. In the modern collection since 2009. At the age of 12, it is a 1.74 m tall tree. In 2018, seed production was observed for the first time. Originally from Japan and Taiwan, where it grows in the mountains at altitudes of 600-900 (up to 1500) m, adhering to the northern slopes and deep soils on granites. It grows best in areas with cool, humid summers and mild winters, on rich soils and in good lighting. Introduced to Europe in 1861 [3].

***Chamaecyparis pisifera* (Siebold et Zucc.) Endl. – Sawara cypress**

The tree is 25-30 (50) m in height, with a conical crown and horizontally spread branches, the trunk can reach 2 m in diameter. It has been known in the Garden since 1870 [2]. In the modern collection since 1953 [6]. Fruiting, grown from local seeds, self-sowing. Introduced to Europe from Japan by Siebold in 1860 [5].

***Cryptomeria japonica* (Thunb.ex L. f.) D. Don (Taxodiaceae) – Japanese cedar**

A tree with a conical crown. In Japan, by the age of 150 it reaches 45 m in height and a trunk diameter of 1–2 m, in culture it is usually much lower. In the Botanical Garden, BIN was planted once, in 1962, and froze out in the first winter [2]. Now it has been grown in the open field since 2009 from cuttings obtained from the BIN subtropical greenhouses. Reached 1.21 m in height, crown 0.75 x 0.85 m, single-trunk tree. In some winters, needles and ends of shoots freeze slightly. Forms cones (sporadically), the seeds ripened in 2015. In Europe since 1842 [3]. It is considered an important tree for forestry in its homeland. It is considered the national tree of Japan.

***Juniperus chinensis* L. (Cupressaceae) – Chinese juniper**

A tree, usually up to 8–10 (-25) m in height, with a conical crown formed by horizontal or ascending branches, sometimes an open or pressed shrub to the ground. There are 6 specimens in the Garden, seedlings - 1988, seeds from the Beijing Botanical Garden, China and from Salaspils Botanical Garden, Latvia. Bears fruit. It has been known here since 1892 [2]. Myanmar, China, Korea, Japan, Taiwan. It rises in the mountains up to 2700 m. It is a very variable species; within its wide range it has many forms. Introduced into culture before 1767 [5].

***Juniperus procumbens* (Siebold ex Endl.) Miq.**

Low-growing creeping bush with ascending tops of branches. It grows in the mountainous regions of Japan: Kyushu and Bonin islands. Presented at the Garden nursery, grown from cuttings, vegetative offspring, 2010. In a vegetative state. There is also his cultivar (cv. Nana) - grown since 2009 (cuttings from

Budapest, Hungary). Introduced to Europe in 1843 (to Denmark), to St. Petersburg - K.I. Maksimovich in 1864 [7].

***Juniperus rigida* Siebold et Zucc. – The Temple juniper**

The tree is up to 8-10 m in height, with a decorative columnar crown, sometimes open or flattened, very thorny shrub. Included in the delectus of seeds of the Botanical Garden of BIN for 1865: "Semina in Japonia a Tschonoskio legta" (seeds from Japan from Chonoski, assistant to K.I.Maksimovich). It has been reliably grown in the Garden in the open field since 1961; that specimen died in the abnormally harsh winter of 1986/87 [2]. There are 5 pieces in the modern collection, samples from K.G. Tkachenko and L.M. Pshennikova from the natural conditions of the Russian Far East, bears fruit since 2001, the first seed production in 2009, Russia; China, North Korea, Japan. On cliffs, rocky slopes and sandy terraces along the seaside. Introduced to Europe in 1861 [5].

***Juniperus sargentii* (A. Henry) Takeda ex Koidz.**

Creeping or spreading shrub up to 1.5 m in height and 2-3 m in latitude, with long main shoots and densely branching side branches, which, overlapping each other, form a dense, wide-open crown. There are 8 specimens in the Garden, seeds and cuttings from the Botanical Garden-Institute, Vladivostok. Fruiting, seed offspring are grown at the nursery. It was not tested here until 1987. In nature, it grows in Sakhalin and the Southern Kuriles, as well as in Japan and China, on coastal rocks and sands, rising into the mountains up to 600 m above sea level. Introduced into culture in Europe in 1892 [8].

***Larix kaempferi* (Lamb.) Carr. (Pinaceae) – Japanese larch or karamatsu**

The tree is up to 35 m in height and up to 100 cm in diameter, with a wide-cone-shaped crown formed by long, horizontally arranged branches. A group of three trees on plot 57 has been grown since 1863 thanks to seeds from K.I. Maksimovich from Japan (Svyazeva, 2005), one of them is atypical, probably of hybrid origin. Bears fruit. On site 60, seed offspring of the second generation are grown, seedlings - 2010. Volcanic mountain slopes of Honshu Island. It grows in the upper part of the forest belt, at altitudes of 1600-2700 m, along the slopes of mountains, in large clean stands, or in forests of Ayan spruce with an admixture of other species. In Europe since 1861 [5].

***Larix kamtschatica* (Rupr.) Carr. (L. kurilensis Mayr) – Kamchatka larch**

A tree up to 35 m in height, with a trunk up to 1.2 m in diameter, with a wide ovate-conical crown formed by very long, horizontally spaced branches. There are 6 specimens in the Garden. The origin of the older specimen in plot 107 is unknown, seedlings - 04/26/1956, sowing - 05/19/1970 (Golovach, 1980). Bears fruit. In the Garden until 1920 [2]. Introduced to Europe around 1888 [5].

***Picea glehnii* (F. Schmidt) Mast. (Pinaceae) – Sakhalin spruce or Glehn's spruce**

A tree of the first or second size (on Russian territory up to 19 m in height, in Japan – higher), with a dense cone-shaped crown, with a trunk with about 60-70 cm in diameter. Russian Far East: Sakhalin Island, South Kuriles; Japan (Hokkaido Island). It grows together with Sakhalin fir and Ayan spruce, in places it forms clean stands in wetlands. The oldest and largest tree grows in the nursery (plot number 82): seeds from nature from southern Sakhalin, Korsakovsky district, Muravyevskaya lowland, collected in 1953, shoots - 1955. Reached 22 m in height with a trunk diameter of 37 cm, forms the correct cone-shaped crown with a sharp top. Three other specimens (plot number 127) from the Garden expedition to the Kuril Islands, collected by G.A. Firsov and A.V. Kholopova: Kunashir Island, the outskirts of Yuzhnokurilsk, dark coniferous taiga along the Lechebny stream, dark coniferous taiga with thickets of bamboo, ~ 150 m below sea level. In October 1989. Fruiting since 1996, at the age of 41. In 2015, seed offspring were obtained for the first time [9]. In the collection of living plants of the Garden since 1892 [2]. Introduced to Europe in 1877 [3].

***Picea jezoensis* (Siebold et Zucc.) Carr. – Yezo spruce**

A tree up to 50 m in height, with a pyramidal or broad-conical crown. Russian Far East; China, north of the Korea Peninsula, Japan. One of the main types of dark coniferous taiga in the Far East, it grows on mountain slopes and plateaus, mainly above 500 m above sea level, reaching the upper border of the forest. Only 6 specimens. Two older trees in plots 90 and 116 represent the same specimen, seedlings - on June 14, 1954 (Golovach, 1980). Bears fruit. Introduced into culture by the Botanical Garden BIN. Here it was first noted by F.B. Fisher in 1852.

***Pinus densiflora* Siebold et Zucc. (Pinaceae) – Japanese red pine**

The tree is 20–35 m in height, with a trunk diameter of up to 80 cm, in young trees the crown is low-slung, with age - a characteristic umbrella-shaped or flat-irregular shape. One of the forest-forming species on the Korea Peninsula and in Japan (the islands of Honshu, Kyushu, Shikoku), from sea level to 2300 m. In Japan, it is cultivated as a bonsai tree, numerous garden forms have been developed. All 4 specimens are a sample from the Garden expedition to the Far East, seed collection in September 1997, on the Gamov Peninsula, Khasan District, Primorsky Territory, on rocks, 70 m below sea level, seedlings - 1998, seeding - 2007-

2011. One of two trees on plot number 139 (specimen number 52): commemorative planting of the writer A.G. Bitova October 2, 2007. This is also the largest tree. Introduced to Europe in 1852 [3].

***Pinus koraiensis* Siebold et Zucc. - Korean pine**

A tree up to 40 m in height and 1 (1.5) m in diameter, in culture it usually does not reach this size. Forms a wide-conical crown, loose, often multi-peaked. Russian Far East; China, Korea, Japan. On dry mountain slopes, ridges, along mountain rivers. Rarely forms pure stands, more often together with other coniferous and deciduous species. 7 specimens, all included in the book by A.G. Golovach [4] and represent one sample, sowing 01/09/1959, seedlings - 05/06/1959. Bears fruit. In culture since 1861 [3]. Since the same 1861, the first seeds from K.I. Maksimovich [2].

***Pinus parviflora* Siebold et Zucc. - Japanese white pine**

The tree is usually 15–20 m in height, the trunk often branches from the base, the crown is narrow cone-shaped in youth, later broad-cone-shaped, spreading. It originates from the mountainous regions of Japan, meeting almost from sea level to an altitude of 2500 m, also on the island of Utserie off the coast of Korea [8]. In the Botanical Garden, BIN has been known since 1939 [2] - it appeared for a short time and quickly dropped out. In the conditions of the modern climate, it is winter hardy, while small and in a vegetative state. A sample has been grown since 2009, seeds from Germany, the Hamburg Botanical Garden, sowing - 2018.The best specimen has reached 1.20 m in height, the crown is dense, almost to the ground, 1.1 x 0.7 m. In a vegetative state. Often bred in Japan as a dwarf potting plant. In Western Europe since 1861 [3].

***Pinus pumila* (Pall.) Regel - Siberian dwarf pine**

A large shrub up to 8 m in height, branches at the base of the trunks spread and then rise. Occasionally it has the shape of a small tree, 4-5 m in height. Has a wide range in Eastern Siberia and the Far East; outside Russia - in Mongolia, China, Korea, Japan. Forms large, difficult to pass thickets on mountain slopes, scree, sand. The branches lie under the snow for the winter, straighten out in the spring. There are 4 specimens in the Garden, older in plots 101 and 128: seeds in 1970 from the nature of Yakutia, Chulman village, Timpton forestry, seedlings – 1972, planted by M.M. Ignatenko 10.10.1980. Bears fruit. Introduced into culture by the Botanical Garden BIN [1] at the beginning of the 19th century.

***Taxus cuspidata* Siebold et Zucc. (Taxaceae) - Japanese yew**

In nature, a tree with discordant converging trunks can reach 22 m in height and 1.2 m in diameter, in worse and more severe conditions it takes a bushy or creeping shape. There are 19 specimens in the Garden. The oldest (a group of 3) grow in the nursery (plot number 82): from cuttings obtained from the arboretum of the Forestry Academy in 1941 [2]. Fruiting, self-sowing. It is known in the Garden until 1920. The Russian Far East, China, Korea, Japan. It was introduced to Europe by Robert Fortune in 1855 [3].

***Thuja standishii* (Gord.) Carr. (Cupressaceae) - Japanese thuja**

A tree up to 30 m in height, with outstretched or ascending branches forming a broad-conical crown. In the Botanical Garden BIN until 1891 [2], it froze out and recovered several times. The modern collection includes cuttings from 2009 by L.V. Orlovoy from Hungary, Arboretum Vacratot, sowing – 2018 At the age of 12 years: 1.35 m in height, crown 0.8 x 0.9 m. In a vegetative state. Central Japan, in the mountain forests of the islands of Honshu and Shikoku, at an altitude of 900-1800 m below sea level. Cultivated in Japan for centuries. It has been known in Europe since 1860 [3].

***Thujopsis dolabrata* (L. f.) Siebold et Zucc. (Cupressaceae) - Asunar/ Hiba arborvitae**

The tree is 15-30 m in height, in culture it is usually much shorter. There are 8 specimens in the Garden. Plots 99 and 56: cuttings from Ukraine, Botanical Garden of Kiev University, 1984. In plot 71, three specimens were transferred by adult plants from the BIN greenhouses. Bears fruit. It has been known in the Garden since 1886 [2]. In nature, it grows in humid forests (islands of Kyushu, Shikoku and the south of Honshu). The variegated form prevails in the culture, and not the typical one. Brought to Holland from Japan by Siebold in 1859 [5].

***Torreya nucifera* (L.) Siebold et Zucc. (Taxaceae) - kaya, Japanese torreya**

An evergreen tree up to 25 m in height with whorled, less often opposite branching and a dense, broad-conical crown, with a rather thick bark. In culture, it usually never reaches this size. One sample, plot number 127. Cuttings from G.A. Firsov and V.M. Reinwald from Germany, Hamburg Botanical Garden, 1993, sowing 2009 in a vegetative state. Bushy creeping tree, branches from the neck, but the leading stem is noticeably pronounced, 1.02 m in height, crown 2.0 x 2.2 m. Not tested in the Garden until 1993. In Europe since 1764 [3]. It comes from central and southern Japan, where it is often bred in temples and parks, and is prized for its wood and edible seeds.

Thus, 24 species of coniferous flora of Japan from 11 genera of 4 families are grown in the Botanical Garden of Peter the Great. Of these, 10 species are endemic, 10 species have a common area with Russia.

The life form of the tree is represented by 20 species, and 4 species are shrubs. Cones form 16 species, in 1 species (*Pinus densiflora*) episodic dusting was noted. *Pinus pumila* and *Picea jezoensis* were introduced into world culture by the Garden and have been known here since the first half of the 19th century. In the second half of the XIX century, the introduction of a number of species is associated with the name of K.I. Maksimovich. In the XXI century, thermophilic conifers such as *Cryptomeria japonica* appeared. In the context of climate warming in recent years, self-seeding of *Abies sachalinensis, Abies veitchii, Chamaecyparis pisifera, Taxus cuspidata* has been noted. There are large reserves for the further introduction of trees and shrubs from Japan to St. Petersburg.

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