

POLYVARIATION OF THE GENUS *THUJA* L. MEMBERS IN THE CULTURAL FITOLANDSCAPES OF VOLYN-PODILLIA

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The taxonomical review of the genus Thuja of cultural fitolandscapes Volyn-Podillia has been carried out. The morphological and bioecological characteristics of the species Th. occidentalis, Th. plicata, Th. koraiensis, Th. standishii, Th. sutchuensis have been given and the habitat of the oldest taxons of Volyn-Podillia has been pointed. Polyvariation of the form content of Th. occidentalis, Th. plicata has been investigated and its classification has been held.

The problem of range and quality optimization of tree and bush plants which are used in planting, is being actual. A considerable role in forming of cultural fitolandscapes is traditionally taken by plants-introducents, the use of which promotes the planting ornamental value [8]. And ornamental forms of introduced tree plants have a large value for the creation of highly artistic landscape gardening constructions. The use of the genus *Thuja* L. members is quite promising, because they inherent wide polymorphism, which is showed in the variety of crown forms and sizes, shoots structure, pine-needle colouring, silhouettes' picturesqueness and makes them quite valuable material for planting. Except of it, the use of coniferous plants in planting is often complicated by high sensitiveness to the row of contaminants, which is determined mainly by considerable pine-needle life-span. However the genus *Thuja* members differ in considerable firmness to technogenic contamination, as they do not only own high ornamental qualities but they are also able to resist the action of toxic gases as compared with other coniferous plants [2].

A lot of scientists were engaged in the study of the genus *Thuja* form content in Ukraine [4, 5, 9, 10]. Working out the research results enabled us to find out the introducents' taxonomical information content and analyse the features of their use in landscape gardening construction. We have used the system of form content classification of multivalent kinds in the given researches from R.V. Karmazin's scientific work [5]. The kinds and forms which were introduced in Volyn-Podillia in the period of 2000-2010, and in particular those which grow in single copies aren't paid attention to.

Therefore the purpose of our scientific researches was the study of the form content, bioecological and morphological characteristics of the probed kinds in the conditions of Volyn-Podillia for their maintainance, reproduction and subsequent mass use in landscape gardening construction.

Methods of researches. For the characteristics of the form content of the Volyn-Podillia probed types R.V. Karmazin's classification was used [5], namely, A. Juvenile forms – with needles of conifer (juvenile); B. Transitive forms – with

needles of intermediate type (or a plant has needles of both types); B. With a scale-like needles, that is with needles of old plants. The supergroup B is subdivided into three groups: I. Growth – forms with deviations in growth size (of old plants), crown form, character of shoots branching of different order, shoots morphology. II. Colour-growth – forms with the signs of growth group, but besides they have deviation in needle or shoot colouring or tint which can be permanent (constant) or seasonal (changeable). III. Colour – forms with deviation only in needle or shoot colouring. The presence of growth signs of the first and second groups allowed R. V. Karmazin to subdivide them into three subgroups of growth: 1 – normal growth, 2 – average height and 3 – low height, each of which, in its turn, is subdivided into variation: a) deviation in crown form: columnar, pyramidal, spherical; b) deviation in crown form and shoot or needle structure or branching type: weeping, outstretched.

Research results. The object of our research is genus *Thuja* (*Thuja*). It belongs to the subfamily *Thuja* (*Thujoideae*), family of Cypress (*Cupressaceae*), order of Pine (*Pinales*), class Conifers (*Pinopsida*), subdivision Coniferous (*Pinaceae*), division of Gymnosperms (*Pinophyta*). It is the most numerous genus of the family *Cupressaceae* in form content. It is represented by monoecious evergreen trees growing from 8 to 60 m tall with a scale-like bark and short outstretched or directed up branches that form a pyramidal crown. Leaves are cross-conjugate, scale-like, flowers are monoecious, stamens are ovate ones with 6-12 pair-opposite stamens, cones are ovate-oblong or ovate, 8-12 scales are with a rib or tubercle on the top, though 2 or 3 middle pairs are fruit-bearing, 2 or 3 thin, flat seeds with two lateral narrow porches are under every scale, 2 seed-lobes. The genus includes 5 species, 2 of which grow in North America, others grow in China, Korea and Japan, which form pure and mixed plantations in the native country [1, 6, 7]. 5 species grow in Volyn-Podillia, 2 species (*Th. occidentalis*, *Th. plicata*) are widely cultivated, and 3 species (*Th. koraiensis*, *Th. standishii*, *Th. sutchuensis*) grow in the collection planting of botanical gardens.

Th. occidentalis is slow-growing, not requiring fertility of soil, relatively requiring moisture, optional oread, gas-resistant. In the conditions of Volyn-Podillia it maintains winters without damages, growing mainly to a height of 10-12 metres tall and with a 0.4 metres trunk diameter at the age of 38. 3 specimens of *Th. occidentalis* grow to a height of 5 metres tall at the age of 115-125 one at a time on a steep slope near the pond in the Mykhaylivsk park of the Khmelnytsk region. 5 multitrunked specimens of *Th. occidentalis* grow to a height of 7 metres tall at the same age in Golozubynetsk park of the Khmelnytsk region. Within the limits of natural habitat in the east of North America, *Th. occidentalis* is monotypic, it's polymorphic in the culture, more than 120 ornamental forms [6,7], which differ by the crown shape (columnar, pyramidal, spherical, pillow-like, oval), structure of shoots (pectinate, threadlike), needle and shoot colouring, are known (white-tipped, golden-tipped, yellow, chlorine, rifle-green, blue-green) [3]. *Th. occidentalis* is represented by 41 ornamental forms in the territory of Volyn-Podillia.

`Alba`. The tree has got white-tipped shoot, especially bright in new plants. At the age of 10 it grows to a height of 1,5-2 metres tall (B, III). *`Albovariegata`*. The tree with pied golden-yellow needles grows to a height of 2 metres tall at the age of 10 (B, III). *`Aurea`*. The tree with golden-yellow needles grows to a height of 2 metres tall at the age of 10 (B, III). *`Aureospicata`*. Tree with a wide-conical crown, hard shoots, bright rifle-green needles, or golden needles on young shoots grows to a height of 3 metres tall at the age of 10 (B, III). *`Aureovariegata`*. Wide bushy skittle-like sapling with golden pied needles grows to a height of 0,8-1 metre tall at the age of 10 (B, III). *`Bodmeri`*. Small skittle-like sapling with triquetrous or tetrahedral shoots and rifle-green needles grows to a height of 70-90 centimetres tall at the age of 10 (B, I, 2, b). *`Columna`*. Tree with a narrow columnar crown, fan-shaped sprigs and bright rifle-green needles grows to a height of 3 metres tall at the age of 10 (B, I, 1, a). *`Compacta`*. Small skittle-like sapling with bright green needles grows to a height of a metre tall at the age of 10 (B, I, 2, a). *`Cristata`*. A pillow-like bush with short shoots, directed up to the top and green needles grows to a height of 40 centimetres tall at the age of 10 (B, I, 3, b). *`Danica`*. Midget rounded bush with straight short thick branches and chlorine needles with a bronze tint in winter grows to a height of 30-40 centimetres tall at the age of 10 (B, I, 3, a). *`Douglasii Pyramidalis`*. It's a sapling or a high bush with a dense pyramidal crown and thick branches, naked-out on tips and similar to the fern leaves, with a bright green pine-needle. It grows to a height of 3 metres tall at the age of 10 (B, I, 1, a). *`Elegantissima`*. It's a columnar tree with bright green needles. It grows to a height of 3 metres tall at the age of 10 (B, I, 1, a). *`Ellwangeriana`*. It's a wide skittle-like bush with partly needle-shaped new and scale-like rifle-green needles in the crown's lower part. It grows to a height of 0,8 metre tall at the age of 10 (B). *`Ellwangeriana Aurea`*. It's a bush with golden bronze and partly needle-shaped needles in the crown's lower part. It was derived as a result of *Thuja occidentalis* 'Ellwangeriana' mutation (B). *`Ericoides`*. It's a rounded or wide skittle-like bush or a small sapling with soft green or brown in autumn and winter needle-shaped needles. It can be multiplied by grafting of one-year seedlings of basic species. It grows to a height of 1-1,5 metre tall at the age of 10 (A). *`Fastigiata`*. It's a wide skittle-like tree with directed straight branches, partly recurved down sprigs. Needles are mat, green. It grows to a height of 3 metres tall at the age of 10 (B, I, 1, a). *`Filiformis`*. It's a tree with midget, rounded to wide skittle-like form. Branches are threadlike, straight and hanging down. Needles are chlorine, with a dark tint in winter. It grows to a height of 1,5-2 metres tall at the age of 10 (B, I, 3, b). *`Globosa`*. It's a midget bush with a spherical crown, straight, even branches. Needles are green with a grey tint in winter. It grows to a height of 1-1,5 metre tall. Old plants lose a serried spherical form (B, I, 3, a). *`Globosa Nana`*. It's an undersized spherical bush with a chlorine needles with a grey tint in winter. It grows to a height of 0,8 metre tall at the age of 10 (B, I, 3, a). *`Holmstrup`*. It's a dense undersized even skittle-like bush with very beautiful, green needles which remains the same in winter (B, I, 3, a). *`Hosseri`*. A midget bush of a spherical form with rifle-green needles grows to a height of 0,5 metre tall and with a 0.4 metre trunk diameter at the age of 10 (B, I, 3, a). *`Hoveyi`*. It's an original bush

with a characteristic dense jug-like crown and bright-green needles. Older individuals can become deformed, mainly by snow. It resembles *Thuja orientalis*. It grows to a height of 1,5 metre tall at the age of 10 (B, I, 3, b). *Little Gem*. It's a midget flat-rounded form with thin, straight raised branches, distorted sprigs, rifle-green or brown in winter needles. It grows to a height of 0,3 metre tall at the age of 10 (B, I, 3, b). *Lutea*. It's a tree with a narrow pyramidal crown, yellow brown branches, golden-yellow or light sulphur low sprigs and needles (B, II, 1, a). *Lutescens*. It's a tree with a thick wide pyramidal crown and pale yellowish green needles. It grows to a height of 2 metres tall at the age of 10 (B, II, 3, a). *Ohlendorffii*. It's an uneven sapling with long straight branches and branchy ends. Young leaves on the shoot ends are cross-opposite, subulate, russet, scale-like, four-row. It has got an interesting, original form. It grows to a height of 0,75-1 metre tall at the age of 10 (B). *Plicata*. A rounded bush with fan-shaped plicate branches resembles *Thuja plicata*, but differs from it by trailing branches of a wrong form. (B, I, 3, b). *Pyramidalis*. It's a cone-shaped tree with bright rifle-green needles (B, I, 1, a). *Recurvata*. It's a midget spherical thick bush with green shoots arcuated in the tips (B, I, 3, b). *Recurva Nana*. It's a midget bush with involute apexes of shoots and green needles which have a brown tint in winter (B, I, 3, b). *Rosenthalii*. It's evenly columnar sapling with glittering rifle-green needles. Branches are dense, even, straight (B, I, 2, a). *Semperaurea*. It's a wide skittle-like form, densely covered with branches. Branches and sprigs are rough, shining, the tips of shoots are golden-yellow or yellow brown in winter (B, III). *Smaragd*. It's a skittle-like friable-branched sapling with branches placed in a vertical plane. Needles are rifle-green in summer and winter. It grows to a height of 1,7 metre tall at the age of 10 (B, I, 2, b). *Spiralis*. It's a narrow skittle-like sapling with short involute branches, placed spirally and pteridophytess sprigs. Needles are blue-green. It grows to a height of 1 metre tall at the age of 10 (B, I, 2, b). *Teddy*. It's a new midget spherical form of *Thuja occidentalis*. Branches are thin, placed densely. Needles are chlorine in summer and brown green in winter. It is easily deformed by snow. It grows to a height of 0,5 metre tall at the age of 10 (A). *Umbraculifera*. It's a midget rounded bush with a umbellate dense crown, rounded slightly trailing branches. Needles are thin, green, as if covered with blue hoarfrost. It grows to a height of 0,8 metre tall at the age of 10 (B, I, 3, b). *Variiegata*. It's a tree with white spotted branches which have got more or less permanent saturated sulphur colouring (B, III). *Vervaeneana*. It's a narrow skittle-like tree with a dense crown. Needles are chlorine or golden bronze in winter (B, II, 1, a). *Wagneriana*. It's a tree with an egg-shaped or conically egg-shaped crown. Branches are directed up or slightly trailing, easily damaged by snow in winter. Needles are rifle-green with a grey and blue tint or ore one in winter. It grows to a height of 1,5 metre tall at the age of 10 (B, II, 2, b). *Wareana*. It's a wide skittle-like tree with fan-shaped branches and chlorine needles. It grows to a height of 2 metres tall at the age of 10 (B, I, 1, b). *Woodwardii*. It's a midget dense circle-like bush with direct branches and rifle-green needles. It grows to a height of 0,4 metre tall at the age of 10 (B, I, 3, a).

Consequently, the supergroup A (juvenile forms, needles of conifer) is represented by 2 forms, the supergroup B (transitive forms, different needles) is represented by 3 forms, the supergroup B (with needles of adult plant, scale-like) is represented by 36 forms. Among the plants of the supergroup B there are 25 forms of the growth group (I), 4 forms of the colour-growth group (II) and 7 forms of the colour group (III). Among the forms of *Thuja occidentalis* of the growth and colour-growth groups there are 8 high growth forms (normal growth), 8 middle growth (slow growth), 13 undersized (nanism) and 15 forms which have a rejection of crown form and 14 forms which have a rejection of crown form, branching, escapes and pine-needle structures.

Th. koraiensis is slow-growing, not requiring soil fertility, relatively requiring moisture, an optional oread, relatively gas-resistant, in severe winters one-year shoots are frosted over partly. In Volyn-Podillia it grows in the botanical garden of National Forestry and Wood Technology University of Ukraine (Lviv), where it grows to a height of 2 metres tall at the age of 20.

Th. plicata is slow-growing if it is new, later it becomes fast-growing, requiring soil fertility, moisture, oread, gas-resistant and winter-resistant. In the Volyn-Podillia conditions it grows to a height of 15 metres tall at the age of 40. By the crown structure it is distinguished as a columnar and trailing form; by growth character it is distinguished as low height; by colouring of needles it's bright-green, white-striped, golden-pied [3].

Such ornamental forms grow on the Volyn-Podillia territory: *`Aurescens`*. A form is the same, as of a genus, but the tips of young shoots are sulphur (B, III). *`Semperaurea`*. It has got a wide skittle-like form, densely covered with branches which are stuck out from a barrel, the tips of shoots are golden-yellow or yellow brown in winter. It grows to a height of 2 metres tall at the age of 10 (B, III). *`Variegata`*. It's a midget rounded bush with bright white pied needles (B, III). *`Zebrina`*. It's a wide skittle-like and fast-growing tree. The tips of old trees are trailing slightly. Needles are green with golden-yellow strips. It grows to a height of 2,5 metres tall at the age of 10 (B, III).

Consequently, *Th. plicata* is represented by 4 forms of the supergroup V, colour group.

Th. standishii is slow-growing, relatively requiring soil fertility, moisture, oread, relatively gas-resistant and winter-resistant. In Volyn-Podillia it grows in the botanical garden of National Forestry and Wood Technology University of Ukraine (Lviv) at the age of 15-20, growing to a height of 2 metres tall and in the Kremenets botanical garden.

Th. sutchuensis is slow-growing, slightly requiring soil fertility, relatively requiring moisture, optional oread, relatively gas-resistant. In the conditions of the probed region in winter one-year shoots are frosted over partly. In Volyn-Podillia it grows in the botanical garden of National Forestry and Wood Technology University of Ukraine (Lviv) at the age of 15-20, growing to a height of 2 metres tall and in the Kremenets botanical garden.

Conclusions. The genus *Thuja* in Volyn-Podillia is represented by 5 species which have 45 forms. The classification of the genus form content made grounds

to assert that the supergroup A (juvenile forms, needles of conifer) is represented by 2 taxons (4,4%), the supergroup B (transitive forms, needles of intermediate type) is represented by 3 taxons (6,7%), the supergroup B (scale-like needles) is represented by 40 taxons (88,9%). The growth group includes 25 forms (62,5%), colour-growth group includes 4 forms (10%), colour group includes 11 forms (27,5%). There are 8 forms of large growth (27,6%), 7 – of average height (24,1%), 14 – of low height (48,3%). There are 15 forms with deviation in crown shape (51,7%), 14 forms with deviation in crown shape and structure of shoots (48,3%).

Summarizing the above given materials about investigating the genus and form-content of *Thuja* species, we can suppose that in the conditions of culture genetic potential of genus *Thuja* can be revealed in the direction of external changing of plants' life form. Therefore, enrichment of species' form content of the genus by the introduction and usage of rapid reproduction methods is suggested to be promising and practical in landscape gardening construction.

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