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TAXONOMIC STRUCTURE AND SYSTEMATIZATION OF CONIFERS OF UKRAINIAN DENDROFLORA BASED ON MODERN TRENDS

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A new international classification of Gymnosperms is given in the publication. This classification was proposed at the beginning of the XXI century by the group of scientists based on DNA structure analysis, morphological, phylogenetical and other researches developed in compliance with APG-III system.

Key words: *coniferous, taxon, classification, structure, genus, species.*

At the beginning of the millennium a new systematization developed by scientists of the Royal Botanic Gardens, Kew (Great Britain), Missouri Botanical Garden (USA) and other researchers of the USA and Europe became popular. It is based on the DNA analysis and is commonly accepted under abbreviation APG (APG I-III). According to this systematization the conifers have somewhat different structure of placement and list of taxonomic units. [7-10,12]. This approach became popular among botanists despite having some controversial moments. The main advantage is absence of many synonyms, interspecific and intergenera hybrids that did not have features of intergenera systematic items.

The purpose of the survey was the analysis of taxonomic structure of the conifers presented on spoils and protected grounds on the territory of Ukraine and its changes according to the new global tendencies based on the molecular genetic analysis of plants.

Materials and methods of the survey. The objects of the survey were the representatives of the class *Pinopsida*, which naturally grow and are cultivated (on

spoils and protected grounds) on the territory of Ukraine. Catalogues and descriptions of collections of botanical garden establishments, taxonomic descriptions of forestries, catalogues of seed plots and garden centers of different regions of Ukraine, proper investigations and inventories were source materials for the paper. Leading scientists' the latest global publications dedicated to the classification of the conifers on the basis of molecular genetic analysis were studied; also the authors carried out the comparative analysis according to the classical systematics.

Survey results. According to the representations of the most widely used publications on dendroflora [1-4] of the end of the XX — the beginning of the XXI centuries all the taxons are placed under the systematic hierarchy presented in the papers of A. L. Takhtajan [6], A. Rehder [11] and other classical authors.

According to the literary data [2-5] under the classical system the conifers presented on the territory of Ukraine have the following taxonomic structure:

CLASS **PINOPSIDA**

ORDER TAXALES

FAMILE TAXACEAE

Genus *Taxus* L. (4 species та 1 nothospecies)

Genus *Torreya* Arn. (3 species)

FAMILE TAXODIACEAE

Genus *Sequoia* Endl. (1 species)

Genus *Sequoiadendron* Buchholz (1 species)

Genus *Taxodium* Rich. (2 species)

Genus *Cryptomeria* Don. (1 species)

Genus *Cunninghamia* R.Br. ex Rich. (1 species)

Genus *Metasequoia* Hu et Cheng (1 species)

FAMILE CEPHALOTAXACEAE

Genus *Cephalotaxus* Sieb. et Zucc. ex Endl.(1 species)

FAMILE ARAUCARIACEAE

Genus *Araucaria* Juss. (2 species)

ORDER PINALES

FAMILE PINACEAE

Genus *Abies* Mill.(17 species)

Genus *Pseudotsuga* Carr. (1 species)

Genus *Tsuga* Carr. (2 species)

Genus *Picea* Dietr. (19 species)

Genus *Larix* Mill. (7 species i
2 nothospecies)

Genus *Pseudolarix* Gord. (1 species)

Genus *Cedrus* Trew. (4 species)

Genus *Pinus* L. (58 species)

FAMILE CUPRESSACEAE

Genus *Juniperus* L. (22 species)

Genus *Calocedrus* Kurz. (2 species)

Genus *Cupressus* L. (11 species)

Genus *Chamaecyparis* Spach (species)

Genus *Thuja* L. (3 species)

Genus *Thujopsis* Sieb. et Zucc. (1 species)

Genus *Platycladus* Spach (1 species)

Genus M*icrobiota* Kom. (1 species)

Nothogenus × *Cupressocyparis* Dall. (2 nothospecies)

It was considered that on the spoil the group of the conifers accounted 6 families, about 27 genera, about 171 species and 5 nothospecies.

In accordance with new global tendencies [7-10, 12] as of 2013 the taxonomic structure of the conifers within the genera, which naturally grow and are cultivated in the conditions of spoils and protected grounds in different regions of Ukraine, had the following indicators (the table).

Quantitative structure and systematic location of some taxons of conifers that are cultivated or grow naturally in Ukraine.

Systematic items and their proper names	General quantity of existing species		Number of separate interspecific taxons discovered in Ukraine
	in the world	in Ukraine	
1	2	3	4
SUBCLASS PINIDAE Cronquist, Takht. et Zimmerm	682	171	
Order PINALES Gorozh.	252	111	
Family 1 *Pinaceae* Lindl.	252	102	
Genus *Cedrus* Trew.	4	4	Sp. – 4, subsp. – 1, cv. – 24
Genus *Pinus* L.	122	50	Sp. – 50, subsp. – 5, var. – 5, cv. – 15
Genus *Cathaya* Chug et Kuang	1	-	-
Genus *Picea* Dietr.	40	19	Sp. – 19, var. -1, cv. – 49
Genus *Pseudotsuga* Carr.	4	1	Sp. – 1, var. - 1 , cv. - 6
Genus *Larix* Mill.	14	8	Sp. – 8, cv. - 4
Genus *Pseudolarix* Gord.	1	1	Sp. - 1
Genus *Tsuga* Carr.	10	2	Sp. – 2, cv. - 3
Genus *Nototsuga* Hu ex C.N. Page	1	-	-
Genus *Keteleeria* Carriere	3	-	-
Genus *Abies* Mill.	52	17	Sp. – 17, var. – 1, cv. - 2
Family *2 Araucariaceae*	43	9	

Henkel et W.Hochstetter			
Genus *Araucaria* Juss.	20	6	Sp. - 6
Genus *Wollemia* W.G.Jones, K.D.Hill et J.M.Allen	1	1	Sp. - 1
Genus *Agathis* Salisb.	22	2	Sp.- 2
Family 3 *Podocarpaceae* Endl.	193	9	
Genus *Phyllocladus* Rich. et Mirb.	4	-	-
Genus *Lepidothamnus Phil.*	3	-	-
Genus *Prumnopitys* Phil.	9	1	Sp. - 1
Genus *Sundacarpus* (Buch. et Grey)Page	1	-	-
Genus *Halocarpus* Quinn	3	-	-
Genus *Parasitaxus* de Laub.	1	-	-
Genus *Lagarostrobus* Quinn	1	-	-
Genus *Manoao* Molloy.	1	-	-
Genus *Saxegothaea* Lindl.	1	-	-
Genus *Microcachrys* Hook.	1	-	-
Genus *Pherosphaera*	4	-	-

W.Archer			
Genus *Acmopyle* Pilg.	2	-	-
Genus *Dacrycarpus* de Laub.	9	-	-
Genus *Dacrydium Lamb.*	22	1	Sp. - 1
Genus *Falcatifolium* de Laud.	6	-	-
Genus *Retrophyllum* C.N.Neger	5	-	-
Genus *Nageia* Gaertn.	6	1	Sp. - 1
Genus *Afrocarpus* (J.Buchholz & N.E.Gray) C.N.Page	6	-	-
Genus *Podocarpus* L'Hér. ex Pers.	108	6	Sp. – 6, cv. - 1
Order CUPRESSALES Link	194	60	
Family 4 *Sciadopityaceae* Luerss.	1	-	-
Genus *Sciadopitys* Siebold et Zucc.	1	-	-
Family 5 *Cupressaceae* Gray	160	51	
Genus *Cunninghamia* R.Br. ex Rich.	2	1	Sp. - 1
Genus *Taiwania* Hayata	1	-	-
Genus *Athrotaxis* D.Don.	3	-	-

Genus *Metasequoia* Hu et W.C.Cheng	1	1	Sp. - 1
Genus *Sequoia* Endl.	1	1	Sp. – 1, cv. - 1
Genus *Sequoiadendron* Buchholz.	1	1	Sp. - 1
Genus *Cryptomeria* Don.	1	1	Sp. – 1, cv. - 4
Genus *Glyptostrobus* Endl.	1	-	-
Genus *Taxodium* Rich.	2	2	Sp. - 2
Genus *Papuacedrus* H.L.Li	1	-	-
Genus *Austrocedrus* Florin et Boutelje	1	-	-
Genus *Libocedrus* Endl.	5	-	-
Genus *Pilgerodendron* Florin.	1	-	-
Genus *Widdringtonia* Endl.	4	1	Sp. - 1
Genus *Diselma* Hook.	1	-	-
Genus *Fitzroya* Hook. ex Lindl.	1	-	-
Genus *Callitris* Vent.	16	-	-
Genus *Actinostrobus* Miq.	3	-	-
Genus *Neocallitropsis* Florin.	1	-	-
Genus *Thujopsis* Sieb.et Zucc.	1	1	Sp. – 1, cv. - 1
Genus *Thuja* L.	5	3	Sp. – 3, cv. - 60

Genus *Fokienia* Henry et Thomas	1	-	-
Genus *Chamaecyparis* Spach	6	3	Sp. – 3, cv. - 32
Genus *Cupressus* L.	21	13	Sp. – 13, subsp. – 1, cv. - 45
Genus *Juniperus* L.	71	18	Sp. – 18, var. – 3, cv. - 76
Genus *Calocedrus* Kurz.	4	2	Sp. - 2
Genus *Tetraclinis* Endl.	1	1	Sp. - 1
Genus *Platycladus* Spach	1	1	Sp. – 1, cv. - 9
Genus *Microbiota* Kom.	1	1	Sp. - 1
Family 6 Taxaceae Gray	33	9	
Genus *Austrotaxus* Compton	1	-	-
Genus *Pseudotaxus* Cheng	1	-	-
Genus *Taxus* L.	9	4	Sp. – 4, var. - 1 , cv. -28
Genus *Cephalotaxus* S. et Z. ex Endl.	9	2	Sp. - 2
Genus *Amentotaxus* Pilg.	6	-	
Genus *Torreya* Arn.	7	3	Sp. - 3
Families	6	5	
Genera	69	34	
Species	682	180	
Subspecies		7	
Sorts		12	

***** – absent; sp. – species, subsp. – subspecies; var. – sorts, cv. - cultivar

In such way so far the class of conifers *(Pinopsida)*, which exists in the world, is divided [7-10, 12] into 2 orders, 6 families, 69 genera and about 682 species.

There has been some changes within genera. In *Cedrus* genera subspecies *C.l. ssp. stenocoma (from the Pontic Mountains in Turkey)* was outlined from the base species *C. libani.* Number of species in *Larix* genera were significantly reduced. Genus *Nototsuga* (*N. longibracteata*) was outlined in *Araucariaceae* family. There is new monotypic *Wollemia* (*W. nobilis*) genus from Australia in *Araucariaceae* family, what actually became a sensation in the botanic world. A well-known *Chamaecyparis nootkatensis* species is transmitted to other genus - *Cupressus*.

Considering conifers grown in the open soil it is worth mentioning that according to our calculations introduction of at least 120-150 species in Ukraine, especially in southern and western regions, is possible. First of all it refers to *Pinaceae* family, including monotypic genera *Cathaya*, *Nototsuga*, *Keteleeria*. In the same family rather substantial introduction potential have species of genera *Pinus* (50 in Ukraine among 122 in the world), *Picea* (19 among 40), *Tsuga* (2 among 10), *Abies* (17 among 52), *Cupressus* (13 among 21), *Juniperus* (18 among 71).

In the review and analysis of wild and cultivated in Ukraine conifers a special attention should be paid to taxons that are interspecific and intergenus hybrids/ According to former practice such hybrids were marked with sign «×» and had a status of independent taxonomic units in the rank of species or genus. Such approach is rather disputable as hybrids do not have at least two basic criteria of species, namely they do not have outlined area and do not guarantee the transmission of inherited features to descendants. It is either hybrid (interspecific or intergenus) and is temporary interim taxon or set species (genus) which was created in the result of possible hybridization before known taxons. In the last case such new formations gain status of self-set taxonomic units.

To sum up it is possible to make up a **conclusion** that modern classification of the conifers based on the molecular analysis in a way differs from the classical one, which was used in the XX century and at the beginning of the XXI century.

It is well thought out, including the genetic point of view, and may be used as a source for preparation of catalogues, reference books and other publications in the future.

There are 2 orders, 5 families, 34 genera, about 180 species, 7 subspecies, 12 varieties and 360 cultivars of the conifers, which are cultivated both on spoils and protected grounds, in the dendroflora of Ukraine.

The viewpoint of the paper's authors concerning systematics and taxonomic structure of the conifers of Ukraine keeps the possibility for discussion and introducing more precise definitions of taxons.