CONIFEROUS SPECIES – VITALITY AND DECORATIVE LEVEL IN GREEN AREAS OF PLOVDIV REGION

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Abstract

Results of the study on the use of coniferous species in the parks and gardens of the Plovdiv region are presented. There are included eight of the largest settlements in the region - Plovdiv, Pazardjik, Stamboliiski, Asenovgrad, Popovitsa, Hissar, Banya and Karlovo. There are 27 of the most common coniferous trees and shrubs in Bulgaria. According to a special methodology, the living and decorative level of these species was determined. Coniferous species were found to be the smaller part of the total number of plants invested in the parks and gardens of this part of the Thracian Plain. The vitality and decorativity of the majority of individuals is considered unsatisfactory. It is recommended to increase the percentage of use of conifers and shrubs using seedlings produced in nurseries in the same region. Restrict the use of the species Abies alba, Abies concolor, Pinus nigra, Metasequoia gliptostroboides. Expand the use of the species Cedrus, Chamaecyparis, Picea, Pinus, Cupressus, Juniperus.

Key words: *coniferous species, number of coniferous species, Plovdiv region, vitality level, decorative level*

1. INTRODUCTION

Conifers are a large group of resinous, cone-bearing trees and shrubs. According to the biological classification system, conifers comprise the order Coniferales of the Gymnosperms. Gymnosperms are woody plants that have naked seeds and do not produce flowers. There are seven families of conifers, which are sub-classified into 67 genera, and sub-classified further into over 600 living species. Conifers include the oldest and tallest trees. The oldest, the Bristlecone pine, can live to be nearly 5,000 years old. The tallest, the Coast redwood, grows to over 100 m high. Despite the fact that coniferous species are much smaller than the decidous species, some of them occupy big areas of land. All are terrestrial plants with a well-developed root system, and their stems are most often upright, slender and of varying sizes. The smallest shrubs are about 10 - 20 cm tall, and the largest trees reach a hundred meters high. Among them are the giants of the plant kingdom - the Californian mammoth tree, which reaches up to 120 m in height, and the California Sequoia, reaches to 100 - 112 m. Most conifer species are evergreen, meaning they retain most of their leaves throughout the year. However, a few genera, such as larch, are deciduous, meaning they shed all their leaves every autumn. Most evergreens shed leaves (or branches, in cedars) that grew two or more years earlier, so that newer branches are never bare of leaves. Most conifers have needle-like leaves such as the fir, pine, spruce and larch. Some, like cedar, cypress and juniper trees, have scale-like leaves and do not shed individual leaves, but shed short branches bearing one or more years growth. Coniferous crops are very useful and used in human life. Some of them have valuable wood and are used as a source of wood building material, resin and everything it receives. There are also a few species that contain human curative substances used not only in folk medicine but also in traditional medicine. These plants are a source of substances used in the perfumery industry. Products made from coniferous trees include paper, many kinds of lumber, furniture and anti-cancer drugs. In large part because of their usefulness, conifers are in danger. Exploitation, forest degradation and habitat destruction have placed 34 per cent of conifers under threat of extinction. Conifers create a healthy and favorable climate for humans thanks to their phytoncides. Conifers are popular ornamentals in parks, cemeteries, and other public places, as well as around private homes and gardens. Although few species are grown indoors as houseplants. They create the evergreen frame in landscape objects and the vast variety of shapes and varieties always keep the visitor's attention. The interest in conifers is now greater than ever and new varieties continue to appear.

Plovdiv is located in the central part of the Thracian Plain. The climate is moderate-continental with hot and dry summers and cold winters. Typical for the region's vegetation are decidous trees and shrubs. Therefore, the use of coniferous trees in the landscape sites in the region is limited and is accompanied by various problems. The most important practical difficulty is to choose the species that will maintain a satisfactory life and health status for an extended period of time.

The use of coniferous trees in the conditions of the Plovdiv region is limited and include only a set of several species. In the landscaping practice in Bulgaria there is an unwritten rule that about 30% of all vegetation used in a landscape site must be coniferous. It should not be approached so formally, each site should be examined individually, and the vegetation should be chosen according to the ecological situation. Unconditionally coniferous tree species bring diversity and make the site original and significantly different from the typical environment. However, account should be taken of the deterioration of the plant's vital and aesthetic performance in the growth and development process in the absence of appropriate conditions. That is why the widespread use of coniferous tree species in atypical areas should be done with care and attention.

2. MATERIAL AND METHODS

The Plovdiv region is in the central part of the Thracian Plain, which is characterized by deciduous forests. Most often in the landscape sites are used species that have been produced for years in nearby nurseries. The choice of these species is the result of routine action rather than the consideration of major environmental factors. In the present study, the green areas in 8 of the biggest settlements in the Plovdiv region were studied - Plovdiv, Pazardjik, Stamboliyski, Asenovgrad, Popovitsa, Hissar, Banya and Karlovo .

The number of coniferous species was determined by species belonging.

Vitality - this is the sum of different manifestations of the growth processes in individual specimens: visible slowing and stopping growth at the top of the plant or main branches (without mechanical damage); Yearly growth or length of shoots; Size; Color of the bark of the stem and of the shoots and others. Those with the lowest level of vitality have one or more of these manifestations, to a great extent.

Decorativity - this indicator is the result of the overall appearance, the habitat of the specimen. It includes a height-to-width ratio of the crown; Symmetry of the crown; Obstruction; Shape and color of the leaves; Coloring the leaves during vegetation; Autumn leaf coloring and more.

The assessment of the living and decorative level was determined on a scale of 1 to 5, assuming 1 - poor and 5 - excellent condition.

3. RESULTS AND DISCUSSION

The study of the availability of coniferous species used in the parks and gardens in the region of Plovdiv shows in the first place considerable diversity. More than 30 coniferous species, including 25 trees and only two shrubs species - Juniperus sabina and Taxus baccata, were surveyed over 30 public park and gardens in Plovdiv, Pazardjik, Stamboliyski, Asenovgrad, Popovitsa, Hissar, Banya and Karlovo.

There is a relatively high percentage of coniferous species in comparison with the total number of plant species in most of these green areas -38 % in Plovdiv; 29 % in Pazardzhik; 18 % in Stamboliiski; 32 % in Asenovgrad; 12 % in Popovitsa; 41 % in Hissar; 11 % in Banja and 28 % in Karlovo.

Table 1 shows that coniferous species of 13 genera and 27 species were used in the region of Plovdiv in the landscape sites. Some of the genera are represented by only one species, such as Psendotsuga menziesii; Sequoiadendron giganteum; Metasequoia glyptostroboides; Calocedrus decuorens; Chamaecyparis lawsoniana; Taxus baccata. Most Juniperus species - with 5 species - Juniperus communis; Juniperus Sabina; Juniperus exelsa; Juniperus virginiana; Juniperus chinensis, followed by

genus Pinus - 4 species - Pinus strobus; Pinus exelsa; Pinus silvestris; Pinus nigra. Thuja - are represented by 3 species; Thuja orientalis Thuja occdidentalis and Thuja plicata and Cedrus - Cedrus libani; Cedrus atllantica and Cedrus deodara, and with 2 species of the genera - Abies - Abies alba and Abies concolor; Picea - and Picea pungens and Cupressus - Cupressus sempervirens and Cupressus arizonica. The largest number of specimens is Juniperus - 25836, followed by the genus Thuja, Picea and Pinus - 10215, respectively; 9322; 7752 pcs. and 7495 pcs. Under number 1000 for the entire region are the Abies species; Psendotsuga; Sequoiadendron; Metasequoia; Calocedrus and Chamaecyparis. Surprisingly high is the number of specimens of Taxus baccata - 1433 pcs. taking into account its specific requirements to the environment - demanding for nutrients and soil and air humidity (Vakarelov, I. 2005). From the data on average for the settlements it is seen that with the greatest presence is Juniperus sabina - 2797,4 pcs. average for each settlement, which can be explained by the plant's inexpensiveness and resistance to air pollution (Bernatzky, D. 1989). With a relatively high number of individuals, the species of Thuja orientalis are present in the landscape sites - 778,4. and Picea abies - 652.3 pcs. With less than 100 pcs. in the settlement are the species Metasequoia glyptostroboides - 15; Abies concolor - 16,5 pcs. Calocedrus decurrens - 33,5; Juniperus chinensis - 49.3; Sequoiadendron giganteum - 54,5; Chamaecyparis lawsoniana - 65.8 pcs. and others.

Table 1. The number of the most frequent conifers in the biggest landscape objects of Plovdiv region, Bulgaria

№	Species / Places	Plovdiv	Pazardjik	Stamboliiski	Asenovgrad	Popovica	Hisar	Banja	Karlovo	Total	Mean
1.	Abies alba	187	78	24	93	37	168	63	21	671	83,9
2.	Abies concolor	57	18	8	12	-	23	4	10	132	16,5
3.	Psendotsuga menziesii	258	154	73	98	21	278	27	18	927	115,9
4.	Picea abies	1287	781	234	687	130	1045	297	757	5218	652,3
5.	Picea pungens	1193	548	178	734	94	1245	34	78	4104	513
6.	Cedrus libani	183	27	13	84	3	281	13	18	622	77,8
7.	Cedrus atllantica	848	358	183	468	77	748	134	311	3127	390.9
8.	Cedrus deodara	1140	401	212	634	107	1004	148	357	4003	500.4
9.	Pinus strobus	578	69	17	257	19	377	29	78	1424	178
10.	Pinus exelsa	611	173	57	227	63	418	13	44	1606	200.8
11.	Pinus silvestris	737	197	152	347	98	533	107	123	2294	286.8
12.	Pinus nigra	681	163	147	297	54	607	94	128	2171	271.4
13.	Sequoiadendron giganteum	147	57	7	43	1	181	-	14	436	54.5
14.	Metasequoia glyptostroboides	63	13	4	14	-	25	-	1	120	15.0
15.	Calocedrus decuorens	77	27	3	64	2	89	3	3	268	33.5
16.	Cupressus arizonica	743	437	258	456	13	507	73	183	2661	332.6
17.	Cupressus sempervirens	672	234	47	434	18	681	131	97	2314	289.3
18.	Chamaecyparis lawsoniana	197	63	26	85	6	143	3	3	526	65.8
19.	Thuja occidentalis	678	278	124	349	77	543	13	18	2080	260.0
20.	Thuja plicata	418	221	142	443	58	468	71	87	1908	238.5
21.	Thuja orientalis	1287	934	643	1137	354	1181	259	432	6227	778.4
22.	Juniperus communis	473	278	184	357	93	368	57	84	1894	236.8
23.	Juniperus sabina	12573	2183	954	1957	637	2304	837	934	22379	2797.4
24.	Juniperus exelsa	137	87	54	117	34	120	23	18	590	73.8
25.	Juniperus virginiana	148	75	37	103	41	109	67	19	579	72.4
26.	Juniperus chineusis	97	73	17	84	13	88	13	9	394	49.3
27.	Taxus baccata	348	234	137	278	17	259	77	83	1433	179.1

The tree species with the highest number of individuals were Thuja orientalis - 6227, followed by Picea abies - 5218 pcs. and Picea pungens - 4104 pcs. A great number of individuals also distinguish species of the genus Cedrus, Pinus and Cupressus.

As can be expected, from the bush species genus Juniperus has the largest presence - 22379 pcs. total for the eight settlements. The least represented in the surveyed region is Metasequoia glyptoboides - 120, followed by Abies concolor - 132.

Concerning the living level (Table 2), the data range from 1.3 to 1.5 for Abies alba; Abies concolor; Pinus nigra; Metasequoia glyptostoboides and Thuja orientalis to 2.5-3.5 for Juniperus virginiana; Cupressus sempervirens; Picea pungens; Cupressus arizonica; Juperus sabina; Cedrus deodara, Cedrus libani and Cedrus atllantica.

Table 2. The vitality level of the most frequent conifers in the biggest landscape objects of Plovdiv region, Bulgaria

№	Species / Places	Plovdiv	Pazardjik	Stamboliiski	Asenovgrad	Popovica	Hisar	Banja	Karlovo	Mean
1.	Abies alba	1.1	1.0	1.2	1.2	1.1	2.3	1.4	1.3	1.3
2.	Abies concolor	1.7	1.3	1.1	1.9	-	1.9	1.5	1.3	1.5
3.	Psendotsuga menziesii	1.9	1.7	1.3	2.1	1.4	2.4	1.3	1.1	1.6
4.	Picea abies	2.4	2.2	2.0	2.6	2.2	3.3	2.1	2.0	2.4
5.	Picea pungens	3.1	2.9	2.5	3.0	2.2	3.7	2.0	1.8	2.6
6.	Cedrus libani	4.0	3.6	3.0	4.0	2.7	4.1	2.6	2.3	3.3
7.	Cedrus atllantica	3.8	3.3	2.7	4.1	3.5	4.6	3.3	2.7	3.5
8.	Cedrus deodara	3.4	3.0	3.0	3.8	2.7	3.9	2.2	2.5	3.1
9.	Pinus strobus	2.4	1.9	1.3	2.7	2.7	2.9	1.7	1.3	2.1
10.	Pinus exelsa	1.9	2.1	1.7	2.0	1.3	2.9	1.7	1.6	1.9
11.	Pinus silvestris	2.1	1.7	1.1	2.0	1.3	2.5	1.1	1.0	1.6
12.	Pinus nigra	1.6	1.3	1.0	2.2	1.4	2.7	1.0	1.1	1.5
13.	Sequoiadendron giganteum	2.0	1.8	1.3	2.2	1.4	3.1	-	1.1	1.8
14.	Metasequoia glyptostroboides	1.1	1.5	1.1	1.9	-	2.1	-	1.2	1.5
15.	Calocedrus decuorens	2.8	2.0	1.8	3.0	1.6	3.2	1.7	1.6	2.2
16.	Cupressus arizonica	3.1	3.0	2.8	3.0	2.2	3.4	2.0	2.3	2.7
17.	Cupressus sempervirens	2.8	2.4	2.2	3.2	2.3	3.5	2.1	2.0	2.5
18.	Chamaecyparis lawsoniana	3.0	2.8	2.6	3.1	2.4	3.3	2.0	1.8	2.1
19.	Thuja occidentalis	1.8	1.4	1.2	1.7	1.0	2.0	1.8	1.5	1.6
20.	Thuja plicata	2.0	1.2	1.1	2.2	1.3	2.8	1.4	1.8	1.7
21.	Thuja orientalis	1.7	1.3	1.1	1.9	1.2	2.2	1.5	1.4	1.5
22.	Juniperus communis	1.8	1.6	1.4	2.0	1.5	2.3	1.3	1.2	1.6
23.	Juniperus sabina	3.2	3.0	2.7	3.82.1	2.5	3.9	2.3	2.0	2.9
24.	Juniperus exelsa	1.9	1.8	1.5	2.8	1.7	2.3	1.4	1.7	1.8
25.	Juniperus virginiana	2.6	2.0	2.1	2.2	2.0	3.1	2.7	2.3	2.5
26.	Juniperus chineusis	1.9	2.0	1.8	2.4	1.6	2.4	1.8	1.6	1.9
27.	Taxus baccata	1.7	1.4	1.5	2.9	1.7	2.9	1.5	1.8	1.8

The low living standard of some plants is probably due not only to the specific ecology of these species and the fact that they are forced to grow and develop under adverse conditions but also to the lack of adequate care during the growing season. Those species with a higher level of vitality might be called "urban-tolerant" (Carpenter P.L. et al. 1975). Differences in the level of vitality of Abies

concolor are equally low in both Plovdiv and Hissar. The same can be said for Thuja orientalis and Pinus nigra.

The decorative features of tree and shrub species are extremely important and decisive for their inclusion in landscapes. Coniferous species and their use are, in principle, a real challenge in the field of Bulgarian landscape architecture. These species exhibit their exceptional decorativity at higher altitudes, where humidity is higher and temperatures are lower (Ellenberg, H. (1973)). The use of coniferous species in an atypical environment creates a feeling of exotics and makes the atmosphere clearly different from the typical surroundings. However, it should be noted that this practice is characteristic not only for the Plovdiv region but also for the other regions of Bulgaria as well as for the neighboring countries. This leads to ever more uniform use of the same species and ultimately to uniformity and prosaicity. The level of decorativity of the species studied depends largely on their level of vitality (Table 3).

Table 3. The decorative level of the most frequent conifers in the biggest landscape objects of Plovdiv region, Bulgaria

№	Species / Places	Plovdiv	Pazardjik	Stamboliiski	Asenovgrad	Popovica	Hisar	Banja	Karlovo	Mean
1.	Abies alba	1.8	1.2	1.1	1.6	1.3	2.7	1.8	1.4	1.6
2.	Abies concolor	2.3	2.5	1.9	2.1	-	2.7	1.3	1.7	2.1
3.	Psendotsuga menziesii	2.6	2.0	1.3	2.2	1.9	2.5	1.8	1.7	2.0
4.	Picea abies	3.1	3.0	2.9	3.3	2.7	3.8	2.7	2.6	3.0
5.	Picea pungens	3.6	3.3	2.8	3.4	2.5	3.8	2.3	2.1	2.9
6.	Cedrus libani	4.1	3.8	3.0	4.0	3.1	4.2	3.0	2.7	2.7
7.	Cedrus atllantica	4.3	4.0	3.3	4.2	3.0	4.4	2.7	2.5	3.5
8.	Cedrus deodara	4.5	4.1	3.0	4.4	3.2	4.6	3.1	2.7	3.7
9.	Pinus strobus	3.4	2.9	2.3	3.3	2.6	3.7	2.7	2.3	2.9
10.	Pinus exelsa	3.3	3.1	2.3	3.0	2.1	3.5	2.7	2.5	3.1
11.	Pinus silvestris	2.9	2.7	2.0	2.8	2.0	3.1	2.1	2.0	2.5
12.	Pinus nigra	1.9	2.0	1.6	2.0	1.3	2.4	1.7	1.7	1.8
13.	Sequoiadendron giganteum	2.1	2.1	1.6	2.8	1.1	3.7	-	1.3	1.9
14.	Metasequoia glyptostroboides	1.9	1.6	1.5	2.9	-	3.4	-	1.7	2.2
15.	Calocedrus decuorens	3.3	2.9	2.5	3.8	2.2	3.9	2.0	1.8	2.8
16.	Cupressus arizonica	4.0	3.7	3.5	4.1	3.0	4.4	3.3	2.9	3.6
17.	Cupressus sempervirens	3.1	3.0	2.7	3.3	2.4	3.6	2.2	2.0	2.8
18.	Chamaecyparis lawsoniana	3.4	3.3	3.0	3.6	3.0	3.9	3.0	2.9	3.3
19.	Thuja occidentalis	2.6	2.2	2.0	2.5	1.7	2.8	1.6	1.3	2.1
20.	Thuja plicata	2.8	2.0	1.8	3.0	1.7	3.2	1.9	2.0	2.3
21.	Thuja orientalis	2.2	1.8	1.7	2.5	1.6	2.8	1.7	1.6	1.9
22.	Juniperus communis	3.0	2.9	1.9	3.2	1.7	3.3	1.5	1.4	2.4
23.	Juniperus sabina	4.3	4.0	3.8	4.4	3.6	4.5	2.9	3.0	3.8
24.	Juniperus exelsa	3.3	3.0	2.7	3.1	2.5	3.6	2.8	2.6	2.9
25.	Juniperus virginiana	3.8	3.0	3.0	3.6	2.7	3.6	2.3	2.8	3.1
26.	Juniperus chineusis	2.7	2.3	2.0	2.9	2.0	3.1	1.9	2.2	2.4
27.	Taxus baccata	2.3	2.2	1.9	3.4	2.4	3.8	2.1	2.3	2.6

The highest decorative qualities in the studied settlements are the representatives of the genus Cedrus, the genus Picea, the genus Juniperus and the genus Chamaecyparis, ranging from 2.9 to 3.7. Good values for this indicator are Picea abies; Cedrus libani; Pinus strobus; Pinus exelsa; Pinus silvestris;

Metasequoia glyptostroboides; Calocedrus decuorens; Cupressus sempervirens; Cupressus arizonica; Thuja occidentalis; Thuja plicata; Juniperus communis; Juniperus chineusis and Taxus baccata.With very low decorative features are the representatives of the genus Abies, genus Sequoiadendron, genus Metasequoia - from 1.6 to 1.9.

The settlements in Central Bulgaria are characterized by warm and dry summer and cold and windy winter. In the cultivation practice, species with a higher tolerance to the specified climatic conditions, propagated and grown in nurseries located in the same region should be used. Only then can we expect more functionality than these plants, as well as a higher vitality and decorative level.

4. CONCLUSIONS

Based on the presented results, we can draw the following conclusions:

1. Coniferous trees and shrubs are the smaller part of the total number of plants in the parks and gardens of the Plovdiv region. Their percentage ranges from 12 %in Popovica to 41% in Hissar. It is recommended to increase the percentage of conifers to improve the ecological and decorative effect of parks and gardens.
2. The most common coniferous species in the parks and gardens of the Plovdiv region are the following: Thuja orientalis, Picea abies, Picea pungens, Cedrus, Pinus, Cupressus, Juniperus.
3. The living status of the studied conifers is unsatisfactory. Species Abies alba, Abies concolor, Pinus nigra, Metasequoia gliptostroboides not to be used in landscape sites on the territory of the Plovdiv region or to use individuals propagated and raised in ornamental nurseries in the same region.
4. The ecological properties and the visual effect are directly related to the life status of the plants. It is recommended to extend the use of the following types: Cedrus, Chamaecyparis, Picea, Pinus, Cupressus, Juniperus.

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