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PATHOLOGICAL CONDITION OF INTRODUCED CONIFERS (GENERA *ABIES*, *PICEA*, *PINUS* AND *PSEUDOTSUGA*) IN FORESTS OF LITHUANIA

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Tree condition of *Abies*, *Picea*, *Pinus* and *Pseudotsuga* genera was studied in the forests of six forest enterprises and twelve forest districts in the south -western and western Lithuania in 2003–2007. According to our studies, the most perspective species for growing in these parts of Lithuania could be considered *Pinus contorta* and *Pseudotsuga menziesii*. Acclimatization success of other tree species: *Abies alba, A. sibirica, A. concolor; Pinus banksiana, P. peuce, P. strobus; Picea glauca, P. pungens; Pseudotsuga caesia* – is restricted by biotic (disease pathogens and pests) and abiotic (edaphic and climatic conditions) factors.

Key words: introduction, conifers, diseases, pests, condition.

It has been studied about growing introduced trees in forests and other related problems since the 19th century [19, 27, 29]. Earlier (15th century) introduced trees were an important component of estates, but later they were more grown in town parks [33]. They occupied prevailing positions in towns and settlements; rather frequently they occurred in the plantations of roadsides, homesteads and even fields. If assortment of tree species is properly chosen the positive features of them such as: exotic and decorative appearance, specific resistance against adverse edaphic and other conditions, reveals in urban territories sufficiently well. The most important aspect of some introduced plants comparing to local species is higher or complete immunity to local plant pests and diseases [30, 31].

However, if landscape design and park specialists are satisfied with the mentioned features of woody introducents, then foresters, seeking to establish productive, resistant and producing high-quality timber stands of introduced plants, tend to be more careful. In this case the relation between forests introducents and harmful organisms plays a very important role.

Pathogens can restrict the spreayng of several introduced species producing economically valuable timber very effectively [1].

Introduction of perspective species is determined by species evolution, biological and economic value of under natural growth conditions, adaptation to new site conditions and climate, amplitude of species adaptability, species genetic diversity which is proportional to the native range and geographical latitude [22]. The evaluation of introduced trees is carried out by the method of experimental plantations which are established in different habitats and natural regions.

Some of the first introducents which were started growing in Lithuanian forests in the 19th century are different *Larix* species originated from geographically different regions [2]. It

is thought that practically important also can be some *Abies*, *Picea*, *Pinus*, *Pseudotsuga* species. In Lithuania about 20 species of *Pinus*, and – 20 *Picea* were introduced, however, only some of them in forests [3].

The condition of woody introducents in Lithuanian forests is studied insufficiently. Introduced trees which grow in parks and green town areas are described, their condition is assessed [7], while in the forests only trees of local coniferous species have been studied until now [16, 17, 28].

The aim of the work is to assess the sanitary state of introduced trees species in Lithuanian forests and to ascertain the most important damage sources in stands.

The condition of introduced conifers was assessed in 2003–2005 in stands of twelve forest districts of six forest enterprises in the western and south-western Lithuania.

The trees were described according to G. Krűssmann [10] and M. Navasaitis [15], methods the taxonomy of plants compiled by M. Navasaitis [15] was applied.

Describing precise growing places, forest district, area, species composition were recorded.

The pathological condition of trees (not less than 50 trees in the account) was assessed based on methodic by A. Žiogas [24], R. Ozolinčius [17], A. Juodvalkis and A. Vasiliauskas [9] as well as methodic used in the Forest Protection Manual [25] and applied in our studies. Tree condition was assessed in 5 grade scale (table 1).

Mean damage grade was calculated for the studied trees of each tree species based on modified and used in agriculture and forestry methodic [9, 23] according to the formulae:

$V = \sum(n \cdot b)/N$, when

V – mean damage grade,

$\sum(n \cdot b)$ – number of plants damaged to the same grade as well as product sum of it and the grade,

N – number of checked plants.

Pathogens were identified according to disease symptoms, cultural and morphological traits of distinguished microorganisms, based on the descriptors [1, 5, 14, 18, 32]. Pests were described according to [5, 6, 12, 20, 31].

During the studies, the most attention was paid to the condition of the most widespread in Lithuanian forests plants of four genera of introduced coniferous species: *Abies*, *Pinus*, *Picea* and *Pseudotsuga*.

Table 1

Tree condition assessment scale

Degree of tree condition	Signs of damage	Grades
Relatively healthy	No signs of damage, crown characteristic of the species, trees have no signs of weakening	1
Weakened	Trees with slight openness of the crown, reduced increment, up to 1/3 of needles are damaged. Individual branches are dry. Small patches of the trunk and branches are dead	2
Weak	Open crown. Strongly reduced or absent increment. Up to 2/3 of needles, branches are damaged or dead. Tree tops are dead. Large damaged areas on the trunk	3
Drying	Strong openness of the crown, light green, yellowing and falling needles. 2/3 of the needles are damaged. Dry tops of trees. There are signs of stem pest attack	4
Freshly dead trees	Trees which died in recent year. Needles are dry and remain on trees or have fallen down. Bark beetles have already left or are staying in the wood	5

***Abies* Mill.**

A. alba Mill., A. concolor Gord. et Glend) Lindl. ex Hildebr. and A. sibirica Ledeb

The data in table 2 show that the condition of *Abies concolor* (V is from 3,28±0,05 to 3,35±0,05) is worst. The majority of trees are strongly weakened, about 30% – drying out. Bad pathological condition is typical for *A. sibirica* and *A. alba* (average grade – 2.88–3.02). An exception is *A. alba* plantings in Kuro forest district, which, are very young comparing to other plants (15 years).

Abies trees of all species growing in Alytus, Vaišvydava and Kuras forest districts are damaged by *Aphrastasia pectinatae* (Cholodkovsky, 1888), (*Hemiptera, Adelgidae*) the abundance depends on localization and trees age. *A. pectinatae* cause mass defoliation, heavily worsen the condition of the whole plant, while 30–40-year-old trees are sentenced to death (table 2).

It was recorded in Vaišvydava on *Abies concolor* and *A. sibirica* forest district a large outbreak of *Dreyfusia piceae* (Ratzeburg, 1844), (*Hemiptera*, *Adelgidae*) which occupied the whole stand. Damaged *Abies* are characterized by abundant defoliation and branches drying. Larvae feeding on the bark of *Abies* damage the cambium and lead to the formation of large necrotic areas. Splits and cup-shakes appear on the bark. In 6–8 years trees damaged by the pest die [6].

All the data show that because of the damage caused by this pest *Abies* are non-perspective introducents in our forests. In some places better solution is to try growing a slightly more resistant to *Abies nordmanniana* (Steven) Spach needle pest (*Dreyfusia piceae*) [8].

***Picea* A. Dietr.**

P. pungens Engelm and P. glauca (Moench) Voss ex C. A. Schenck

Both *Picea* species trees were observed in Alytus and Šilėnai forest districts where they

Table 2

Condition of *Abies* in Lithuania in 2003–2007

Forest district (Forest enterprise)	Species	Year	Number of trees by the degree of damage						Average grade of damage
			Total	1	2	3	4	5	
Kuras (Dubrava)	*Abies alba*	2003	276	170	76	20	10	0	1,53±0,02
		2004		167	88	10	11	0	1,51±0,02
		2005		171	79	16	10	0	1,51±0,02
		2007		171	79	16	10	0	1,51±0,02
Šilėnai (Dubrava)	*Abies alba*	2003	263	0	62	180	20	1	2,85±0,01
		2004	262	0	58	180	23	1	2,87±0,01
		2005	261	0	60	168	32	1	2,90±0,01
		2007	260	0	60	166	32	2	2,90±0,01
Vaišvydava (Dubrava)	*Abies alba*	2003	261	0	57	169	33	2	2,92±0,01
		2004	259	0	55	171	32	1	2,92±0,01
		2005	258	0	55	174	29	0	2,90±0,00
		2007	258	0	55	174	28	1	2,90±0,01
Alytus (Alytus)	*Abies concolor*	2003	74	0	4	47	20	3	3,30±0,04
		2004	71	0	3	47	19	2	3,28±0,05
		2005	69	0	1	45	23	0	3,32±0,05
		2007	69	0	1	44	23	1	3,35±0,05
Vaišvydava (Dubrava)	*Abies sibirica*	2003	213	0	20	172	20	1	3,01±0,01
		2004	212	0	17	175	19	1	3,02±0,01
		2005	211	0	14	169	27	1	3,07±0,02
		2007	210	0	13	168	27	2	3,09±0,02

grow together (80% of the *P. pungens*). In Šilėnai forest district the same sites also contain *Abies* and other local tree species. In Birštonas forest district grow only individual trees of the *P. pungens*. On all growth sites *P. pungens* are damaged by *Oligonychus unnunguis* Jackobi, 1905, (*Acari*, *Tetranychidae*) especially heavily in Alytus forest district where young trees grow poorly in an open area. In Šilėnai forest district *Picea* trees are older and more damaged by stem pests. In all the places increment is low, while defoliation is high (table 3).

The worst condition of *Picea pungens* trees is in Alytus and Šilėnai forest areas (V – 3,20 and 3,00). About 30% in Alytus forest district and 15% in Šilėnai forest district are damaged by *Dendroctonus micans* Kug. (*Scolytidae* (*Ipidae*) *Coleoptera*). 60–70% of the trees is strongly damaged or dried out.

Pseudotsuga Carrière

***P. caesia* (Schwer.) Flous, *P. menziesii* (Mirb.) Franco and *P. menziesii* var. *glauca* (Beissn.) Franco**

In all forest districts, where *Pseudotsuga* are grown, remains only a small portion of healthy trees, while the average damage grade is rather high (from 2,14 to 3,28) (table 4).

Due to inappropriate ecological conditions (too heavy soil, high density) trees are being weakened. The crowns are open also due to damages by *Phaeocryptopus gaeumannii* (Rohde) Petrak and *Rhabdoclinae pseudotsugae* Sydow needle casts. Following infection by *Phaeocryptopus gaeumannii Pseudotsuga* cast their needles in 1–3 years. Manifestation of the disease and its spreading rate depends on the general condition of plants: it may become an epidemic if trees are weak [1]. In all observed places trees of all *Pseudotsuga* species and varieties were damaged by this pathogen (the damage comprised 3–4 grades in Vaišvydava forest district, while in other forest districts the condition was slightly better).

Rhabdoclinae pseudotsugae of *Pseudotsuga* doesn't appear every year it spreads in spring when there is more precipitation [21]. It is possible that due to *Rhabdoclinae pseudotsugae Pseudotsuga* in Vaišvydava forest district pertain rather open crowns. Although during 2003–2007 disease pathogens were detected (up to 2 grades) and the needles during recent years stayed almost undamaged, however, 3–4 years ago defoliation was extremely intensive. *Pseudotsuga* of different varieties resist to this pathogen differently: less resistant – *P. caesia* and *P. menziesii* var. *glauca,* more resistant – *P. menziesii* [1, 13].

Table 3

Condition of the *Picea pungens* in Lithuania in 2003–2007

Forest district (Forest enterprise)	Year	Number of trees by the degree of damage						Average grade of damage
		Total	1	2	3	4	5	
Alytus (Alytus)	2003	168	0	20	102	38	8	3,20±0,02
	2004	160	0	19	96	43	2	3,18±0,02
	2005	158	0	18	95	42	3	3,19±0,02
	2007	155	0	18	93	41	3	3,19±0,02
Birštonas (Alytus)	2003	74	0	51	20	3	0	2,35±0,05
	2004		0	48	23	3	0	2,39±0,05
	2005		0	50	22	2	0	2,35±0,05
	2007		0	49	23	2	0	2,36±0,05
Šilėnai (Dubrava)	2003	307	0	15	280	10	2	3,00±0,01
	2004	305	0	21	274	7	3	2,97±0,01
	2005	302	0	25	268	5	4	2,96±0,01
	2007	298	0	21	268	6	2	2,36±0,01

Table 4

Condition of *Pseudotsuga* in Lithuania in 2003–2007

Forest district (Forest enterprise)	Year	Number of trees by the degree of damage						Average grade of damage
		Total	1	2	3	4	5	
Alytus (Alytus)	2003	160	0	10	96	48	6	3,31±0,02
	2004	154	0	9	100	44	2	3,25±0,02
	2005	152	0	8	99	44	1	3,25±0,02
	2007	151	0	8	95	47	1	3,27±0,02
Birštonas (Alytus)	2003	87	0	19	40	28	0	3,10±0,04
	2004		0	18	42	27	0	3,10±0,04
	2005		0	19	41	27	0	3,09±0,04
	2007		0	19	40	28	0	3,10±0,04
Kuras (Dubrava)	2003	191	3	88	60	39	1	2,72±0,02
	2004	190	2	89	66	33	0	2,68±0,02
	2005	190	2	89	64	33	2	2,71±0,02
	2007	188	1	91	64	31	1	2,68±0,02
Norkaičiai (Šilutė)	2003	364	30	260	54	20	0	2,18±0,01
	2004		30	274	49	11	0	2,11±0,01
	2005		29	270	52	13	0	2,13±0,01
	2007		29	268	54	13	0	2,14±0,01

The age of *Pseudotsuga* needles in their natural growth sites comprises 6–8 years [4]. During the years of mass infestation, *Phaeocryptopus gaeumannii* (Rohde) Petrak and *Rhabdoclinae pseudotsugae* Sydow caused long-term losses and weaken trees not only during disease years.

In some neighbor states of Poland, *Pseudotsuga* woolly aphid *Gilletteella cooleyi* (Gillete, 1907), (*Hemiptera*, *Adelgidae*) [11] is detected, which should be considered a potentially dangerous pest.

In Kaliningrad region there are *Pseudotsuga* stands which at the age of 59 years reach 30 m in height and 53 cm in diameter, producing 900 m^3ha^{-1}, while at the age of 76 years – 34 m; 48 cm; 1050 m^3/ha respectively. In Alytus *Pseudotsuga* seed orchard grows both species (*P. caesia* and *P. menziesii*) as well as trees of the *P. menziesii* var. *glauca* grow. It was found that in this place the *P. menziesii* grows best, followed by *P. caesia*, while the *P. menziesii* var. *glauca* grows poorest. *Pseudotsuga* (especially the *P. menziesii*) should be grown in the coastal forest plantations of Lithuania, mixing them with *Picea*, which would protect trees against more considerable windbreaks.

***Pinus* L.**

***P. banksiana* Lamb.**

Pinus banksiana in good condition were not found in any of the forest districts (V from 3,03 to 3,21). Everywhere trees had thin, crooked and branchy stems (table 5).

Disease pathogens or pests were not detected on the *Pinus*. Most likely their condition was bad due to unfavorable for them edaphic and climatic conditions. After World War II it was attempted to plant this *Pinus* in many places in Lithuania, however, it turned out to be unsuitable for growing in the forest, because it grows rather slowly and its wood is of low value.

***P. contorta* Douglas ex Loudon**

Main damages - yellowing of needles and dead branches (table 6).

About 30% of yellowing needles contain the carposomes of *Lophodermium seditiosum* Minter, Staley & Millar. The outbreak of this *Pinus* pest is found in Jūrė forest district.

Table 5

Condition of the *Pinus banksiana* in Lithuania in 2003–2007

Forest district (Forest enterprise)	Year	Number of trees by the degree of damage						Average grade of damage
		Total	1	2	3	4	5	
Ežerėlis (Dubrava)	2003	500	0	40	340	100	20	3,20±0,01
	2004	480	0	30	350	95	5	3,16±0,01
	2005	475	0	26	340	94	15	3,21±0,01
	2007	460	0	25	335	90	10	3,18±0,01
Kuras (Dubrava)	2003	100	0	5	80	14	1	3,11±0,03
	2004	99	0	5	78	14	2	3,13±0,03
	2005	97	0	5	78	13	1	3,10±0,03
	2007	96	0	5	75	14	2	3,14±0,03
Vaišvydava (Dubrava)	2003	300	0	20	240	31	9	3,10±0,01
	2004	291	0	18	246	19	8	3,06±0,01
	2005	287	0	18	248	15	6	3,03±0,01
	2007	281	0	15	248	11	7	3,06±0,01

In all observed *P. contorta* growth sites 3% of the *Pinus* were damaged by *Melampsora pinitorqua* (D By) Rostr. Trunks and branches of different thickness were deformed. This disease caused damage on many *Pinus* species, but among our observed ones *P. contorta* was the most damaged. Literature sources point that the most attackable is local *Pinus* species – *P. sylvestris* L. [14], but we have detected only individual damaged trees of *P. sylvestris*, while damages in the stand of *P. contorta*, which is located in Višakio Rūda forest district, comprised 15%. Our studies were carried out in forests, while about the spread of *Melampsora pinitorqua* in nurseries we have no data.

In Ežerėlis forest district *Pinus* are planted rather densely, they have many dead branches. On the sites of *P. contorta* no trees with the signs of *Heterobasidion annosum* (Fr.) Bref were found. It is possible that *Pinus* of this species are more resistant to the parasitic fungus, which causes great damage to the *Pinus* of local species.

***P. peuce* Griseb**

A small stand of this *Pinus* has been established in Kazlų Rūda forest district. *Pinus* grow very unevenly: about 60% are sufficiently fast growing and good condition, while the rest grow poorly. Most probably, *Pinus* of this species in Lithuania should be grown for decorative purposes, but not as stands in the forests.

***P. strobus* L.**

There are no major stands of this *Pinus* species in Lithuania. The reason of this is the spreading of fungal pathogen – *Cronartium ribicola* J. C. Fischer in all growth sites of *P. strobus*. We observed *P. strobus* in Kuras and Norkaičiai forest districts. Their condition in these places differs – in Kuras forest district *Pinus* are damaged by *Cronartium ribicola* and their V is from 3,30±0,04 to 3,38±0,05 (table 7).

Damaged *Pinus* were not observed in Norkaičiai forest district, where the stand of *P. strobus* was established 130 years ago. Here *Pinus* grow in a mixed stand with *Fagus sylvatica* L. There could be several reasons of the good trees condition: 1) the most irresistible to *Cronartium ribicola* are 20–30-year-old trees. Part of trees of this age could have died, while the rest were growing further; 2) when the *Pinus* were young, *Cronartium ribicola* might have not been present in Lithuania yet. It is believed that this disease was detected around 1905 [29].

Although in the western and south-western part of Lithuania conditions for most of the introducents should be rather favorable [34], the condition of introduced in the forests coniferous trees varies.

Table 6

Condition of *Pinus contorta* in Lithuania in 2003–2007

Forest district (Forest enterprise)	Year	Number of trees by the degree of damage						Average grade of damage
		Total	1	2	3	4	5	
Ąžuolų Būda (Kazlų Rūda)	2003	50	11	23	10	6	0	2,22±0,07
	2004		13	20	10	7	0	2,22±0,07
	2005		12	24	9	5	0	2,14±0,07
	2007		11	25	9	5	0	2,16±0,07
Ežerėlis (Dubrava)	2003	100	0	11	41	40	8	3,45±0,03
	2004	92	0	8	45	32	7	3,41±0,04
	2005	85	0	6	43	30	6	3,42±0,04
	2007	79	0	3	40	29	7	3,51±0,04
Jūrė (Kazlų Rūda)	2003	50	29	17	4	0	0	1,5±0,09
	2004		28	16	3	3	0	1,62±0,09
	2005		28	15	6	1	0	1,6±0,09
	2007		29	15	5	1	0	1,56±0,09
Višakio Rūda (Kazlų Rūda)	2003	50	17	17	10	3	3	2,16±0,07
	2004	47	15	17	9	3	3	2,19±0,08
	2005	44	15	17	8	1	3	2,10±0,09
	2007	41	14	15	8	1	3	2,12±0,09

Species diversity of the pests and diseases of trees-introducents, their abundance, distribution and harmfulness in different stands observably differs and depends on many factors. Their harmfulness to a great extent depends on how well ecological requirements of the species coincide with the conditions of growth site.

Many harmful agents (pests and diseases) of introducents are imported as well as the plants themselves. Very often they concentrate locally, therefore, the character of damages becomes chronic and it is necessary to give up the idea of using valuable tree species on a wider scale. Growing of most *Abies* species in the forests becomes impossible due to the spreading of *Aphrastasia pectinatae* and *Dreifusia piceae*, while *Pinus strobus* – due to *Cronartium ribicola*.

The diversity of harmful agents and their damage depends also on the age of stands. The resistance of old trees usually decreases, although some diseases are characteristic of young and middle-aged trees. Damage caused to young trees heavily weakens them and their condition get worse during whole ontogenesis. *Rhabdochinae pseudotsugae* of *Pseudotsuga* repeated every several years opens their crowns for a long time. Damages caused by shoot

Table 7

Condition of *Pinus strobus* in Lithuania in 2003–2007

Forest district (Forest enterprise)	Year	Number of trees by the degree of damage						Average grade of damage
		Total	1	2	3	4	5	
Kuras (Dubrava)	2003	80	0	3	50	22	5	3,36±0,04
	2004	75	0	4	55	15	6	3,30±0,04
	2005	69	0	3	42	19	3	3,32±0,05
	2007	66	0	3	53	20	4	3,38±0,05
Norkaičiai (Šilutė)	2003	60	50	10	0	0	0	1,17±0,09
	2004		55	5	0	0	0	1,08±0,09
	2005		54	6	0	0	0	1,1±0,09
	2007		52	8	0	0	0	1,13±0,09

distortion remain on the stems and branches of *Pinus* life long. Meanwhile, stem pests and other secondary pests and diseases are more characteristic of old trees their damage depends on various unfavorable conditions.

General stand resistance to harmful agents depends on stand composition. In this respect mixed stands are more resistant, because some pests (*Aphrastasia pectinatae* and *Dreifusia piceae*) due to a restricted mobility can not cover long distances. In mixed stands conditions are usually more favorable to beneficial organisms. Besides, introducents most often increase the resistance of a mixed stand, because they are often rather resistant to local pathogens.

A large number of harmful organisms of introduced trees are also introduced, i.e. they came to Lithuania from different geographical regions, got well acclimatized and caused great damage. Thus introduction of plants, planting of new stands should be carried out very carefully, using only healthy plants. Studies on the condition of introduced plants should be carried out permanently, because their condition is changing: there appear and spread new harmful pests. Pathogen *Rhabdoclinae pseudotsugae* was detected in Lithuania in 1975 [26], *Dreifusia piceae* – in 1992 [8].

The level of damage greatly depends on sanitary-hygienic and silvicultural measures (thinning, pruning and elimination of the outbreaks of pathogens, protection against forest animals, pests and diseases).

Conclusions

1. *Pseudotsuga menziesii* should be grown in the Lithuanian coastline, where milder climate is more suitable for the species. It is best to grow it in mixed *Pseudotsuga menziesii* – *Picea* plantations.
2. *Pinus contorta* can be planted in Lithuania, especially in areas unsuitable for farming, because it is resistant to *Heterobasidion annosum*.
3. All the studied *Abies* species, *Pinus banksiana*, *P. peuce* and *P. strobus*, *Picea glauca* and *P. pungens* due to the adverse effect of biotic and abiotic factors under the conditions of Lithuania are not perspective for planting in the forest.
4. In Lithuania forests most important pests and disease agent of introduced coniferous are: *Aphrastasia pectinatae*, *Dreifusia piceae*, and *Cronartium ribicola.*

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ФІТОПАТОЛОГІЧНИЙ СТАН ІНТРОДУКЦІЙНИХ ХВОЙНИХ (*ABIES*, *PICEA*, *PINUS* AND *PSEUDOTSUGA*) У ЛІСАХ ЗАХІДНОЇ ТА ПІВДЕННО-ЗАХІДНОЇ ЧАСТИН ЛИТВИ

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У лісах західної і південно-західної частин Литви на території дванадцяти лісництв шістьох лісгоспів в 2003–2005 рр. досліджено стан інтродукційних хвойних *Abies*, *Picea*, *Pinus* і *Pseudotsuga.* На основі одержаних даних перспективними породами для вирощування лісів у згаданих частинах Литви є *Pinus contorta* і *Pseudotsuga menziesii*. Інші інтродукційні породи: *Abies alba, A. sibirica, A. concolor; Pinus banksiana, P. peuce, P. strobus; Picea glauca, P. pungens*; *Pseudotsuga caesia,* – через вплив абіотичних (едафічних, кліматичних) і біотичних (шкідники, хвороби) факторів для вирощування лісів не рекомендуються.

Ключові слова: інтродукція, хвойні, хвороби, шкідники, стан.

ФИТОПАТОЛОГИЧЕСКОЕ СОСТОЯНИЕ ИНТРОДУЦИРОВАННЫХ ХВОЙНЫХ В ЛЕСАХ ЗАПАДНОЙ И ЮГО-ЗАПАДНОЙ ЧАСТЕЙ ЛИТВЫ

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В юго-западной и западной частях Литвы, в лесах двенадцати лесничеств шести лесхозов в 2003–2007 г. исследовано состояние интродуцированных хвойных *Abies, Picea, Pinus* и *Pseudotsuga.* На основе полученных данных перспективными породами для лесовыращивания в упомянутых частях Литвы являются *Pinus contorta и Pseudotsuga menziesii*. Другие интродуцированные породы: *Abies alba, A. sibirica, A. concolor; Pinus banksiana, P. peuce, P. strobus; Picea glauca, P. pungens*; *Pseudotsuga caesia* – из-за влияния абиотических (эдафических, климатических) и биотических (вредители, болезни) факторов для лесоразведения не рекомендуются.

Ключевые слова: интродукция, хвойные, болезни, вредители, состояние.

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