ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

YEW BERRY IN DENDROCENOSES OF NORTH OSSETIA.

Bazaev AB[1]*, Gryazkin AV[2], Khetagurov Kh M[1], Gutal MM[3], and Nikolaev IA[4].

[1]Candidate of biological sciences, associate professor, Gorsky State Agrarian University, Russian Federation, Vladikavkaz,
[2]Doctor of biological Sciences, Professor, St. Petersburg State Forestry University named after S.M. Kirov. Russia, St. Petersburg
[3]Candidate of biological Sciences, associate Professor. University of East Sarajevo Federation of Bosnia and Herzegovina.
[4]North Ossetian State University by Khetagurov, Russian Federation, Vladikavkaz,

ABSTRACT

The peculiarities of natural regeneration, the structure of dendrocenoses with the participation of berry yew, the taxation characteristics of forest stands, the composition and condition of the lower tiers of vegetation were studied in 12 tracts in North Ossetia. In most cases, there are less than 200 trees in places of compact growth of yew. In all cases, yew berry grows under the canopy of stands, in the second tier. In the first tier of tree stands, beech dominates most often; hornbeam, elm, alder, and very rarely linden, maple, and oak are found as small admixtures. The average height of yew trees varies greatly, from 4 to 9 m, and the average diameter of the trunks also varies from 7 to 19 cm. The yew wood reserves vary considerably from 3 to 46 m3 / ha. In most of the objects, the proportion of damaged yew trees exceeds 20%. Due to its high shade tolerance, the yew has a dense, dense crown. The number of branches per 1 running meter reaches 11 pieces. The biometric characteristics of the needles differ significantly. The mass of 100 needles ranges from 1.67 to 2.35 g. The natural renewal of yew is unsatisfactory, the number of undergrowth in 10 cases out of 12 is less than 1 thousand / ha. Small undergrowth of yew, which is 2-11 years old, prevails. More than 67% of the undergrowth is considered viable. The most common eastern beech (Fagus orientalisLipsky.), Berry yew (Taxusbaccata L.), common hornbeam, (Carpinusbetulus L.), elm (Ulmusscabra Mill.), Black alder (Alnusglutinosa L. Gaertn) The underbrush includes 7 species, the number of underbrush growing together with yew, is less than 300 units per ha: black elderberry (Sambucusnigra L.), Caucasian blueberry (Vaccinium arctostaphylos L.), barberry (Berberis vulgaris L.), cornel (Cornus mas L.), viburnum (Virburnum lantana L.), hazelnut (Corylusavelana L.) and euonymus (Euonymus europaea L.). Live ground cover under the canopy of trees of the first and second tiers is very poor and is represented by a small number of species (no more than 16). The projective cover of all species in the herbage on the tracts is 5-18%. The predominant species, satellites of the yew, are the crow's eye (Paris quadrifoliaBieb.), the blackberry (RobushirtusWaldstet Kit.), The fern (Dryopterisfilix-mas L. Schott.), Oxalis (Oxalis acetosella L.), Lathraea(Lathraeasquamaria L.) - characteristic representatives of the flora of the Caucasus. The most common soils in places of natural growth of the yew berry are brown forest podzolic soils. The humus content in them reaches 7% or more. Less often, yew grows on the residual-carbonate mountain-forest brown soil.

Keywords: forest resources, yew berry, forest stand, seed productivity, productivity.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Rational use of forest resources, their systematization and evaluation is the most important element of sustainable development. This is noted not only at symposiums, conferences and meetings, but also in the main documents on the development of the forest complex in many countries of the world. The resolution of the UN Conference on Environment and Development contains materials on the problem of the sustainable development of mountain areas, which indicates their importance for the sustainable development of not only individual countries, but also the entire world economy [Forest Development Strategy of the Russian Federation until 2030 ..., 2018; EU 2015; Non-wood news, 2006; Global Forest Resources Assessment ..., 2001; United Nations Conference on the Environment ..., 1992; World Forestry Congress ..., 2003; Farris, Filigheddu, 2008; Nygren, 2006; Leuthold, 1980].

The Caucasus region is a special territory that has unique natural landscapes, reflecting the special structure and specificity of mountain ecosystems. Such ecosystems fulfill both a biospheric and a socio-economic role [Voskoboinikova, 2016; Bityukov et al., 2011; Gabeev, 2011; Balov, 2005; Adiniaev, Jeriyev, 2001; Koval, Bityukov, 2000; Gordienko, Solntsev, 1999; Budun, 1994; Altukhov, Litvinskaya, 1989].

Promoting plantings with yew berry in the mountain forests of North Ossetia, identifying features of the structure of phytocenoses, studying the renewable potential are the most important stages of research associated with this relict species listed in the Red Book of the Russian Federation.

The yew berry Taxusbaccata L. is one of the most shade-tolerant species in the forest fund of our country. There are few publications on this type in scientific literature. Information concerning the genus Taxus and the yew berry is available in the works of domestic and foreign researchers [Bazaev et al., 2016; Bazaev, Gryazkin, 2016; Arbuzov, Kazmin, 1992; Kuliev, Tumbatov, 1985; Komarnitsky et al., 1962; Schirone et al., 2010; Farris, Filigheddu, 2008; Wyka et al., 2008; Thomas, Polwart, 2003; García et al., 2000].

Many researchers [Semagina, 1983; Makhatadze, 1960; Dhar et al., 2006; García et al., 2000; Hulme, 1996] have studied the natural regeneration of the yew berry. The properties of wood, the structure of stands and the natural renewal of yew in some tracts of North Ossetia were studied by us (Bazaev et al., 2016; Bazaev, Gryazkin, 2016; Gryazkin, Bazaev, 2011). According to some authors, self-renewal of yew in most cases is unsatisfactory (Arbuzov, Kazmin, 1992; Semagina, 1983; Ruguzov, 1972; Dhar A, Ruprecht H, Klumpp R, Vacik H., 2006).

An analysis of the available literature suggests that there is no complete data on the distribution of berry yew in the Caucasus, and the structure of mountain biogeocenoses, including phytocenoses involving yew in their composition, has been studied very superficially (Bazayev et al., 2016; Bazayev, Gryazkin, 2016; 2010; Gabeev, 2011; Khetagurov et al., 2018).

The purpose of the research is to study the structure of forest phytocenoses with the participation of yew in their composition and to assess the renewable potential of the yew berry in the conditions of the North Caucasus.

OBJECTS AND METHODS

The study of the structure of forest stands with the participation of yew in their composition was carried out on the northern macroslopes of the Greater Caucasus in beech forests at an altitude of 700 to 1100 m above sea level.

The methodological basis for the study of phytocenoses is the method of test plots and route studies.

General characteristics of phytocenoses on the objects of study are presented in Table 1.

ISSN: 0975-8585

Table 1: General characteristics of the objects of study

Object number and name of the tract	Height above sea level, m	Total slope exposure	Slope steepness	Forest area with yew, ha	Type of growing conditions
1. Lindenspire	650	C3	40°	2	D_3
2. Mayramadag	700	C3	45°	27	D_3
3. Ursdon	700	C, C3	60°	11	D_3
4. Fassalugardan	700	C, C3, 3	50°	8	D_3
5. The basin of the river Ahshkadon, North Ossetian State Reserve	700	C3	40°	1	D_2
6. The basin of the Tsakhsadykomdon River, North Ossetian State Reserve	800	C3	30	2	D_2
7. Reserve "Tseysky"	800	C3	35°	7	D_2
8. Souadag	900	C, C3	60°	0,5	D_2
9. Zhazhdzhin	900	C3	40°	2	D_3
10. The basin of the river Ahshkadon	950	C3, 3	25°	2	D_3
11. At the village of Zintsar, North Ossetian State Reserve	1000	3	30°	3	D_2
12. Zilahar	1100	C, C3	40°	3	D_3

General characteristics of the objects of study on tracts show that the distribution range of yew is highly fragmented, it has been preserved on steep slopes, in small areas in hard-to-reach mountainous areas of Alanya. Yew groves have been preserved on the territory of the Vladikavkaz, Suburban, Suadag, Alagir, and Irafsky forestry enterprises, as well as on the territory of the North Ossetian State Reserve and the Tseysky federal complex reserve.

Trial areas were laid on different elements of the relief. Taxation of stands as a whole was carried out according to generally accepted methods. The composition of the tiers was calculated by the ratio of the areas of sections of tree species at chest height. Forest type is determined by V.N. Sukachev, type of conditions of the place of growth - according to P.S. Pogrebnyak.

All studied phytocenoses by typology V.N. Sukachev belong to the forest type forb (D_2 – D_3). The exception is the stand with a predominance of the hornbeam in the first tier, the type of forest is a complex gooseberry (D_3).

The age structure of the studied stands is the imprint of previous logging. Due to the prevalence of clear-cuttings up to the 60s of the last century, the age structure of the formed stands can be considered conditionally of the same age. The average age of forest stands on the studied objects is from 60 to 90 years.

The closure of the canopy is determined using the kronomerof S.V. Belov, and the refreshment with TKA-Lux luxmeter. The measurements were carried out simultaneously in 150-200 points on each trial plot.

Selective statistical method was used in the study of the lower tiers of vegetation. A number of changes were made to the generally accepted method for accounting for undergrowth in accordance with the RF patent No. 2084129 (Gryazkin, 1997). Regardless of the species composition of the grass-shrub layer, the thickness of undergrowth and underbrush, their height and condition, in all cases laid at least 30 circular areas of 10 m^2 each.

ISSN: 0975-8585

A soil profile was laid in each tract, with a description of the morphological characteristics of the horizons and the selection of soil samples for analysis. Chemical analysis of samples was carried out according to generally accepted methods in the agrochemical laboratory of Gorsky State Agronomic University.

THE RESULTS AND DISCUSSION

In the Republic of North Ossetia-Alania, there is a total of no more than 100 hectares of stands with the participation of yew berry. They are scattered over a large area in a narrow strip of width up to 10 km in the mountains of the Wooded and Piedmont Mountains. Yew is found in single trees, groups, clumps and small arrays. It grows mainly under the canopy of tree stands due to its shade tolerance.

Regardless of the height above sea level, the first tier of stands is mainly represented by beech. There are elm, hornbeam and linden most often as an impurity (from 10 to 20%) in the upper tier of the stands. Sessile oak, gray alder, Norway maple and common ash are found sporadically.

Forest stand The upper tier of tree stands is characterized by a large variety of taxation indicators (Table 2). The range of variation of the average height of the first tier is 13-27 m, diameter - 19-50 cm. Differences in age of trees and stands are more pronounced than the height and diameter of the trunks. The main reason for this differentiation is the peculiarities of the growing conditions and the consequences of unsystematic logging. The height of tree stands is minimal on steep slopes and on the ridges of spurs of ridges, the age is often the maximum, and the average diameter is often even greater than that of tree stands that grow down the slope. In relief depressions, the average height of the upper tier and the average diameter of the beech trunks reach maximum values. At the same time, the age of forest stands can differ significantly, depending on the age and intensity of economic impact.

Table 2: Taxation characteristics of tree stands of the upper tier

Object number	Composition	Average height, m	Average diameter, cm	Number of trees, unit / ha	Stock, m^3 / ha	Crown closeness,%
1	100Bq,Hornbeam, linden	19	20	318	103	81
2	70Bq, 20 elm 10 hornbeam, linden, gray alder	27	45	171	334	86
3	100Bq	26	50	80	192	58
4	80Bq 20 hornbeam	24	25	174	105	70
5	90Bq 10 hornbeam	20	21	202	72	76
6	80Bq 20 hornbeam	22	26	111	70	68
7	100Bq. hornbeam, linden	22	40	75	108	62
8	100Bq	14	20	398	75	87
9	80Bq 20 linden, hornbeam	18	21	292	82	75
10	100Bq	22	28	92	65	69
11	70 hornbeam 20 linden 10 Norway maple, Sessile oak	13	19	467	85	88
12	100Bq hornbeam	20	31	159	119	78

In all investigated tracts, berry yew grows in the second tier. The main taxation indicators of the tier differ significantly by tracts (Table 3).

ISSN: 0975-8585

Table 3: Taxation characteristics of the second tier with the participation of yew

Object number	Average height, m	Average diameter, cm	Absolute completeness, m^2 / ha	Density, unit / ha	Stock, m^3 / ha	The proportion of damaged yew trees,%
1	5,0	8,2	1,4	201	5	43
2	8,1	10,4	1,1	229	5	5
3	9,3	18,5	6,7	79	53	3
4	7,5	12,7	9,6	702	55	8
5	5,3	11,3	2,5	204	10	30
6	6,1	14,2	5,8	298	28	35
7	5,1	15,4	10,2	498	44	23
8	4,4	8,2	0,7	30	4	17
9	5,7	10,5	3,1	302	12	100
10	6,0	12,2	2,0	80	8	48
11	3,8	7,4	2,1	251	3	30
12	6,9	14,6	9,1	504	46	100

The average height of the line composed of yew varies along tracts from 3 to 9 m, and the average diameter varies from 7 to 20 cm. By age, yew trees are of different ages. The distribution of stems in thickness steps varies significantly. The main reasons for this are various growing conditions and varying degrees of human impact.

Due to its shade tolerance, yew grows well with a relative illumination of 10-15% (upper part of the crown). In this case, the illumination of the lower part of the crown of yew trees can be as low as 600 lux, and the upper part - up to 4000 lux. Under conditions of low light content, the age of the needles, its size and weight, the density of shoot, vary considerably.

The length of the crown of yew is usually from 74 to 85%. The density of the branching changes substantially. The size of the growth of the lateral branches in the upper part of the crown is higher than that in the lower part by 37-63%.

Thoroughly yew in the amount of more than 200 trees per 1 ha is represented only in five of the twelve tracts surveyed (see Table 3). The situation with the yew is aggravated by the fact that the preserved fragments of its distribution range are reduced both in their number and in area.

The causes of yaw fallout are mainly due to exposure to wild animals (biotic factor). Cutting down trees (anthropogenic factor) is in some cases 23% of the total number of mortality. The destruction of yew by windfall and windbreak, landslides and mudslides (abiotic factor) is up to 5% of the outfall. The first to suffer are tracts located in close proximity to roads and settlements (Table 4).

Table 4: Number and causes of yew trees

Object number	Height above sea level, m	Distance from the settlement, km	The amount of mortality,% of the total	The causes of the dropout and the proportion,%		
				biotic	Abiotic	anthropogenic

ISSN: 0975-8585

1	650	1,5	43	40	-	3
2	700	6	5	-	-	5
3	700	3,1	13	-	-	13
4	700	4	8	1	5	2
5	700	5	30	30	-	-
6	800	7	35	35	-	-
7	800	2,0	23	19	4	-
8	900	4,7	17	5	-	12
9	900	9,5	-	-	-	-
10	950	3,7	48	40	5	3
11	1000	2,2	30	3	4	23
12	1100	12,0	-	-	-	-

The proportion of damaged yew trees depends on the availability of the tract for the population and animals. The smaller the distance to the nearest settlement, the more damaged trees

Undergrowth. The number of undergrowth of the tisis, its state and the nature of its distribution over the area vary in all the studied phytocenoses (Table 5). It follows from the table that the total amount of non-viable and damaged undergrowth at the tracts does not exceed 33%. The proportion of viable undergrowth of the tis increases with increasing height above sea level.

Table 5: The number of undergrowth yew and its state by tracts

Number tract	Height above sea level, m	The number of undergrowth, units / ha	The proportion of viable undergrowth,%	Theoccurrence,%
1	650	Unit	-	-
2	700	112	84	7
3	700	214	67	13
4	700	2365	78	73
5	700	Unit	-	-
6	800	248	73	7
7	800	397	87	13
8	900	Unit	-	-
9	900	96	84	7
10	950	318	78	13
11	1000	548	81	17
12	1100	1843	90	77

The magnitude of the occurrence of undergrowth yew rarely exceeds 13%. The only tract where the natural renewal of yew can be considered satisfactory is the Fassalugardan tract (700 m above sea level). There is a yew of 2365 units per ha, with a frequency of 73%. However, 75-92% undergrowth is represented by small specimens.

According to the state of life, practically the entire undergrowth of the yew is viable. Dry specimens are extremely rare. Individuals damaged by animals, decay or landslides during the period of heavy rains and spring snowmelt are more common.

Under the canopy of stands, undergrowth is represented by shade-tolerant species: Eastern beech (Fagus orientalisLipsky.), Berry Yew tree (Taxusbaccata L.), Common Hornbeam, or European Hornbeam (Carpinusbetulus L.), Elm (UlmusscabraMill.), Black Alder (Alnusglutinosa L. Gaertn), table 6.

ISSN: 0975-8585

Table 6: Distribution of undergrowth by breeds and height groups depending on the height above sea level, specimen / ha

Breed	700 m above sea level			1000 m above sea level			1100 m above sea level		
	large	average	small	large	average	small	large	average	small
Beech	100	233	4296	-	-	-	232	83	299
Yew	-	200	2165	17	50	481	249	266	1328
Hornbeam	67	366	3330	50	100	631	-	-	-
Other	-	66	1066	-	-	3188	-	-	-
Total	167	865	10857	67	150	4333	481	349	1627
Total	11889			4550			2457		

Minor undergrowth, more adapted to the harsh conditions of light content, prevails in quantity. On the other hand, an increase in the number of undergrowth is associated with more favorable forest conditions due to a decrease in height above sea level. This is also influenced by the taxation characteristics of the upper tier of tree stands (relative fullness, closeness of crowns, average height and tree species).

The composition of the undergrowth by height groups differs significantly (Table 7). Large undergrowth is represented mainly by beech, hornbeam and yew, up to 7 species can participate in small undergrowth. In general, the proportion of yew in the composition of the younger generation can range from 12 to 75%.

Table 7: Composition of undergrowth by height groups at the objects of study

Object number	Height group		
	large	Medium	small
4	60Бк 40Г	42Г 27Бк 23Тс 4Вп 4Ил	40Бк 30Г 20Тс 7Кло 2Вп 1Лп
11	75Г 25Тс	67Г 33Тс	30Клп 18Лп 15Г 15Кло 11Тс 10Ил 1Дс
12	52Тс 48Бк	24Бк 76Тс	82Тс 18Бк

In the studied objects, the structure of the under stretis differs significantly in height. This can be explained by the characteristics of the stands of the first and second tiers, the steepness of the slopes, the availability of tracts for the population.

In the Fassalu gardan tract (700 m above sea level, with a slope of 15–20 °), the structure of young growth by height and age was studied in detail (Table 8). As can be seen, the greatest number of undergrowth of a yew is represented by specimens at the age of 2-3 years, in height - up to 13 cm.

Table 8: Structure of the undergrowth of the yew by height and age under the canopy of the beech forest

	Height of undergrowth, cm									
	2-7	8-13	14-19	20-25	26-31	32-36	37-43	more 43	total	%
2-3	89	21	-	-	-	-	-	-	110	68,9
4-5	2	13	1	-	-	-	-	-	16	10,2
6-7	1	4	3	-	-	-	-	-	8	5,1
8-9	-	3	7	2	-	-	1	-	13	8,2
10-11	-	-	-	3	2	-	-	-	5	3,2
12-13	-	1	-	1	-	-	1	-	3	1,9
14-15	-	-	-	1	1	1	-	-	3	1,9
more 15	-	-	-	-	-	-	-	1	1	0,6
total	92	42	11	7	3	1	2	1	159	-
%	58,0	26,4	6,9	4,3	1,9	0,6	1,3	0,6	-	100

On steep slopes, there is an intense soil washout. Under these conditions, the vegetation of the lower tiers is preserved only at the trunks of the trees from the upland part. The undergrowth of a yew here is found in the buckets, near fallen trunks and large branches, which play the role of fashin. Simultaneously with an increase in the steepness of the slope, the number of undergrowth, undergrowth and live ground cover is sharply reduced.

However, the presence of grassy vegetation in stands with yew trees plays a significant role in reducing the intensity of soil erosion and preventing the yew seeds from washing down down the slope. Consequently, the vegetation of all tiers contributes to the natural renewal of yew trees on steep slopes.

Seed production Abundant crops of yew berry seeds on the territory of North Ossetia are repeated every 2-3 years. Seeds ripen in the year of flowering by the end of September - early October. Arillus is a good bait for birds. They are the main distributors of yew seeds.

In good years, not all yew trees of reproductive age are capable of carrying seeds. Yield estimation using the model branches method showed the following results (Table 9).

Table 9: The yield of seeds by tract

Object number and height above sea level, m	Weight 100 seeds, g	The average number of seeds per tree, pieces
1 – 700	51,02±0,058	1140
10 – 1000	43,10 ±0,051	710
12 – 1100	46,45±0,067	1010

Differences in the mass of seeds (with and without arylus) taken from different tracts are reliable at the 95% level of significance (the actual values of the Student criterion are 8.3 and 2.5, respectively; tabular, 2.1). The differences in the size of the seeds (nuts) are not significant.

The “bloom” period at the study sites begins in the second half of March, less often in April, and lasts until the beginning of May. Microstrobile spore isolation or “dusting” occurs from March to May. Dusting of megasporangium begins earlier and ends later than the analogous phase of microsporangia. This is a device for guaranteed fertilization.

The undergrowth is rare and is not represented in all tracts (Table 10). The species composition is poor (the total number of species is 7). Elderberry black, Caucasian blueberries predominate. The total number of underbrush in the tracts does not exceed 370 **ind./ha**, and the average height is not more than 3 m. The occurrence of certain types of underbrush does not exceed 10%.

Table 10: Species composition of the underbrush and its number at the study sites

Number of tract	Species name	Number, units/ha
2	Elderberry black (Sambucusnigra L.)	133
	Caucasian bilberry (Vacciniumarctostaphylos L.)	234
3	Elderberry black (Sambucusnigra L.)	167
	Caucasian bilberry (Vacciniumarctostaphylos L.)	33
4	Caucasian bilberry (Vacciniumarctostaphylos L.)	234
7	Caucasian bilberry (Vacciniumarctostaphylos L.)	33
8	Caucasian bilberry (Vacciniumarctostaphylos L.)	67
9	Caucasian bilberry (Vacciniumarctostaphylos L.)	33
11	Barberry (Berberisvulgaris L.)	33
	Dogwood (Cornusmas L.)	101
	Kalina (Virburnumlantana L.)	33

	Hazel (Corylusavelana L.)	33
	Euonymus (Euonymuseuropaea L.)	67
12	Caucasian bilberry (Vaccinium arctostaphylos L.)	201

The live ground cover is also represented by a small number of species (from 4 to 16). The total projective cover is 5–18%. The magnitude of the prevalence of species varies significantly (2-30%).

The constant companions of the yew berry from the composition of the living ground cover are the raven eye (Paris quadrifoliaBieb.), the blackberry (RobushirtusWaldstet Kit.), the fern (Dryopterisfilix-mas L. Schott.), Oxalis (Oxalis acetosella L.), Petrov the cross (Lathraeasquamaria L.) is the most shade-tolerant plants of the Caucasus mountain forests. A complete list of species accompanying the yew zujlyjve in the Caucasus is presented in a database prepared by the authors [Basayev et al., 2016].

Thus, the structure of the surveyed objects are very diverse. The common thing for them is that under the canopy of the upper tier, the yew forms a separate tier. But for individual tracts, the taxation indicators of the tier vary greatly, which can be explained by the influence of such factors as height above sea level, the steepness of the slope, the characteristics of the upper tier, and distance from settlements.

Soils. The most common soils in places of natural growth of the yew berry are brown forest podzolized soils. The humus content in them reaches 7% or more.

Yew can grow on other soils. The soil on the test plot 2 (tract Fassalu gardan, 1000 m above sea level) residual-carbonate mountain forest brown on carbonate clay. It has a neutral reaction of the upper horizons (pH = 6.4) and alkaline - lower (pH = 8.0). It differs from other mountain-forest brown soils by the full saturation of the absorbing complex and the presence of residual carbonates in the lower part of the profile. The soil has a high humus content (more than 8% in horizon A), is well structured (Table 11).

Table 11: Results of chemical analyzes of residual carbonate mountain forest brown soil

Horizon, power, cm	Humus,%	pH H_2O	Hydrolytic acidity, mg-eq / 100 g	The amount of exchange grounds, mg-eq / 100 g	The degree of saturation with bases,%
A 5-12	8,14	6,43	0,16	49,95	99
B 20-30	1,86	6,93	0,05	51,10	100
BC 38-46	1,06	8,00	0,11	53,20	100

Due to its shade tolerance, yew has a dense crown, especially in the upper part. If the spanning of the branches in the upper part of the crown is taken as 100%, then about 50% will be at the bottom. The number of branches per 1 m trunk length varies greatly, from 4.8 to 8.3. It depends on the height and age of the tree, on the light conditions under the forest canopy. With increasing height above sea level, the length of the crown and the number of branches per 1 m of the trunk length decreases.

In the upper part of the crown, the age of the needles reaches 12 years, whereas in the middle and lower parts only 6-8 years. At the base of the branches near the trunk of the needles is missing. The needles of the yew are able to assimilate CO_2 at an illumination of 2-3% of the illumination of the open space (Table 12).

Table 12: The level of illumination of the crown of model trees at the lower and upper border of distribution of yew, lux

Part of the crown	Base of branches		Inside the crown		Crown surface	
	700 m	1100 m	700 m	1100 m	700 m	1100 m
Upper	-	-	-	-	3000	2117
Average	433	220	1567	347	2067	1907

Bottom	184	177	933	187	1567	853

The needles of yew trees in the upper part of the crown are larger than on the shoots of the middle and lower parts of the crown. With an increase in height above sea level, the length of the needles and the number of needles on the annual shoot decrease, and the weight of 100 needles increases (Table 13).

Table 13: The length of the annual runaway and the number of needles on the shoot at the yew, depending on the height above sea level

Part of the crown	700 m above sea level		1100 m above sea level	
	length of the shoot, cm	number of needles, pcs.	length of the shoot, cm	number of needles, pcs.
Top part	54 ± 0,54	32 ± 0,64	50 ± 0,56	27 ± 0,54
Middle part	49 ± 0,50	30 ± 0,58	45 ± 0,45	25 ± 0,50
Bottom part	53 ± 0,53	30 ± 0,60	48 ± 0,48	22 ± 0,44
Weight 100 needles, g	1,67 ± 0,18		2,35 ± 0,23	

In the direction from the periphery of the crown to the trunk and from the upper part to the lower needles, yew takes a transitional and then a shadow type of structure. The greatest number of needles contain shoots located in the upper part of the crown, at the ends of the branches.

CONCLUSION

Yew berry is a species listed in the Red Book of Russia. This is due to the fact that the area of forests with the participation of yew in their composition is steadily decreasing. The total area of recorded forests with yew berry on the territory of the forest fund of RNO-Alania is less than 100 hectares. Forest inventory materials do not contain information on the composition and area of tree stands with yew.

The materials obtained during the study show that in their structure phytocenoses involving yew are very diverse. Common for them - in all cases under the canopy of the upper tier, the yew forms the second tier. The main characteristics of the tier depend on the height above sea level, the steepness of the slope, the taxation characteristics of the first tier, and the distance from settlements.

It was established that, in general, the number of undergrowths of the yew increases with an increase in height above sea level and with distance from populated areas.

The lower tiers of vegetation do not have a significant impact on the natural renewal of yew. First of all, this is due to the insignificant representation of underbrush and living ground cover in phytocenoses with the participation of yew in their composition.

Living ground cover on steep slopes is a deterrent to soil erosion; it plays the role of a filter that delays soil particles, litter and seeds. Thus, a lively ground cover, fragmentary presented on steep slopes, contributes to the natural renewal of yew in mountain forests.

The obtained data can contribute to the improvement of research on monitoring yew forests, when planning measures for the conservation and reproduction of yew berry in the North Caucasus.

REFERENCES

[1] Odinaev, E. D. Landscape agriculture of mountain areas and slope lands of Russia / by E. D. Odinaev, T. U. Guriev. - Moscow: Agropress, 2001. - 404 p.
[2] Altukhov, M. D. plant protection in the North-Western Caucasus / M. D. Altukhov, S. A. Litvinskaya. – Krasnodar: Book. ed., 1989. - 190 p.
[3] Arbuzov B. V., Kazmin V. D. Yew in the North Ossetian nature reserve and adjacent territory // Protection and research of rare plant species in the reserves. - M., 1992. - S. 92-101.

[4] Balls, A. B. Socio-economic problems of sustainable forestry development of the North Caucasian republics of the Russian Federation: Monograph / A. V. Balls, M.: GOU VPO at MSFU, 2005. - 192 p.
[5] Bityukov, N. Ah. Natural conditions and resources of the Caucasus / N. Ah. Bityukov, V. I. Anisimov, N. Mmm. Pestereva. - Sochi, 2011. - 276 p.
[6] Bazaev, A. B., Gryazkin A.V., hetagurov H. M., Nikolaev I. A., Kochkin A. A. Plants satellites yew // Certificate of state registration database No. 2016620966 from 19.07.2016.
[7] Bazaev, A. B., gryazkin, A. V., the renewable potential of the yew. / environmental problems of the Arctic and the Northern territories/ interuniversity collection of scientific works. Arkangelsk: 2016, Issue 19. - Pp. 29-32.
[8] Bazaev, A. B., Geraskin, A. V., X Khetagurov. Properties of wood of yew // proceedings of the Gorsky state agrarian University. 2016. No. 53. Part 2. - Pp. 171-176.
[9] Budun, Nature, natural resources of North Ossetia and their protection. - Vladikavkaz: RIO, 1994. - 254 p.
[10] The Economics of recreation in the forests of the Western Caucasus / V. I. Voskoboynikov life of / / Scientific. 2016. No. 8. - P. 6-15.
[11] Gapeev, V. N. Forests and forest management in North Ossetia in the twentieth century / V. N. Habeeb. - Vladikavkaz: IPO SOIGSI, 2011. - 544 p.
[12] Gordienko, V. A., the use of the forest in the North Caucasus / G. K. Solntsev, V. A. Gordienko. Federal forestry service of Russia. - M.: Witness, 1999. - 472 p.
[13] Gryazkin A.V. Pat. 2084129 Russian Federation, MKI C 6 a 01 G 23/00. Method of accounting for undergrowth / - № 94022328/13; Application. 10.06.94; Pub. 20.07.97, Byul. No. 20.
[14] Koval, I. P. Ecological functions of mountain forests of the North Caucasus / I. P. Koval, N..Bitjukov. - Moscow: Vniitslesresurs, 2000. - 480 p.
[15] Komarnicki N. A. Kudryashov L., Uranium A. A. Systematics of plants. M.: publishing House of the Ministry of education, 1962. 726 p.
[16] UN conference on environment and development / ed. - V. L. Koptyuk. - Novosibirsk: ed. SB RAS, 1992. - 88 p.
[17] Guliyev V. S., Z. I. Tolbatov Yew // Nature. 1985. No. 3. P. 96 – 97.
[18] Semagina R. N. The state of natural regeneration of yew berries in the black sea forests of the Caucasian reserve. Bul. Moscow society of nature testers. 1983. Vol. 88. otd. biologist. Vol. 4. - P. 146-149.
[19] The order of the Government of the Russian Federation from 1989 20.09.2018 N-R. On approval of strategy of development of the forest complex of the Russian Federation until 2030.
[20] Dhar A, Ruprecht H, Klumpp R, Vacik H (2006) Stand structure and natural regeneration of Taxusbaccata at “Stiwollgraben” in Austria. Dendrobiology 56: 19–26. Google Scholar.
[21] EU 2015. Multi-annual Implementation Plan of the new WE Forest Strategy. European Commissions, Brussels, 3.9.2015, SWD (2015) 164 final. 34 pp.
[22] Farris E, Filigheddu R (2008) Effects of browsing in relation to vegetation cover on common yew (Taxusbaccata L.) recruitment in Mediterranean environments. Plant Ecol 199: 309–318. CrossRefGoogle Scholar.
[23] Hulme PE (1996) Natural regeneration of yew (Taxusbaccata L.): microsite, seed or herbivore limitation? J Ecol 84:853–861CrossRefGoogle Scholar.
[24] García D, Zamora R, Hódar JA, Gómez JM, Castro J (2000) Yew (Taxusbaccata L.) regeneration is facilitated by fruity-fleshed shrubs in Mediterranean environments. BiolConserv 95: 31–38. CrossRefGoogle Scholar.
[25] Global Forest Resources Assessment. FAO Forestry Paper 140. Rome, Food and Agriculture Organization. 2001. http://www.fao.org/forestry/fo/fra/ [Geo-2-416].
[26] KhetagurovKh.M., Gryazkin A.V., Gutal M.M., Feklistov P.A. To the question of the efficient resources use in the maple forests type of the Caucasus // Sustainable development of mountain territories. - 2018. - V. 10. - № 3 (37). - P. 373-382. DOI: 10.21177/1998-4502-2018-10-3-373-382.
[27] Non-wood news. Food and agriculture organization of the United Nations. - Rome, 2006. – 97 p.
[28] Nygren, A. Ecological, Socio-Cultural, Economic and Political Factors Influencing the Contribution of Non-Timber Forest Products to Local Livelihoods / A. Nygren, C. Lacuna-Richman, K. Keinänen [et al.] / Case Studies from Honduras and the Philippines. Small-scale Forest Economics // Management and Policy. - 2006. - 5(2). – P. 249-269.
[29] Schirone B, Ferreira RC, Vessella F, Schirone A, Piredda R, Simeone MC (2010) Taxusbaccata in the Azores: a relict form at risk of imminent extinction. BiodiversConserv 19:1547–1565CrossRefGoogle Scholar.

[30] Semagina RN (1983) State of natural renewal of common yew (Taxusbaccata) in Black Sea forests of the Caucasian reservation. ByullMosk Ova IspytPrirOtdBiol 88:146–149Google Scholar.
[31] Thomas PA, Polwart A (2003) Taxusbaccata L. Biological flora of the British Isles. J Ecol 91:489–524CrossRefGoogle Scholar.
[32] World Forestry Congress (WFC) side event. // Strengthening global part to advance sustainable development of non-wood forest products, held in Canada on 20 September 2003 (URL: http://www.sfp.forprod.vt.edu/discussion).
[33] Wyka T, Robakowski P, Żytkowiak R (2008) Leaf age as a factor in anatomical and physiological acclimative responses of Taxusbaccata L. needles to contrasting irradiance environments. Phytosynth Res 95: 87–99. CrossRefGoogle Scholar.