INSTITUT ZA ŠUMARSTVO • INSTITUTE OF FORESTRY • BEOGRAD

ZBORNIK RADOVA

COLLECTION
TOM 52-53

Yu ISSN 0354-1894

BEOGRAD
2005.

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•

Unos, priprema i računarski slog:

BOJANA SAVIĆ

•

Tiraž:

300 primeraka

Štampa:

EURO LINE, Trgovačka 83, Beograd

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INSTITUT ZA ŠUMARSTVO • BEOGRAD
INSTITUTE OF FORESTRY • BELGRADE
ZBORNIK RADOVA • COLLECTION 52–53, BEOGRAD, 2005.

UDK 581.9:582.475.4(497.7)=111
Originalan naučni rad

WIDESPREAD OF MACEDONIAN PINE *Pinus peuce* Grisebach 1844 ON PELISTER AND SURROUNDING MOUNTAINS

N. Hristovski, N. Ranđelović, V. Ranđelović, S. Stojanovski
Džulijana Tomovska, Lj. Rakonjac, V. Hadži-Jovanovski

Abstract.- The National Park Pelister includes 88 forest tree types which are systematised in 23 families, which is 29% of the total dendroflora in Macedonia. A significant presence of endemic and relic species makes this region specific from several aspects. The most significant species is the Balkan endemic Macedonian pine, whose presence proves the exceptionally complex forest vegetation. The distribution of Macedonian pine (*Pinus peuce* Grisebach 1844) was studied on Pelister, on the surrounding hills and mountains in Macedonia. The presence of significant plant and animal species makes this region extraordinary. The actual state of vegetation on Pelister cannot be studied without the analysis of development during different geological periods and without the anthropogenic effects, especially during the last century. Special attention is focused on climate changes, especially the effect of global warming on the distribution of *Pinus peuce* Grisebach 1844 in Macedonia. Thanks to the severe relief, the terrain configuration, the diversity of flora and fauna, the accessibility, the altitude, snow cover during the winter period, etc. Pelister has exceptional advantages for the development of summer and winter tourism.

Key words: Pelister, *Pinus peuce* Grisebach 1844, distribution, effect of global warming, potentials of tourism development.

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RASPROSTRANJENOST MOLIKE *Pinus peuce* Grisebach 1844
NA PELISTERU I OKOLNIM PLANINAMA

Izvod.- U Nacionalnom parku Pelister registrovano je 88 tipova šumskog drveća, koji su sistematizovani u 23 familije, što predstavlja 29% ukupne makedonske dendroflore. Značajno prisustvo endemičnih i reliktnih vrsta čine ovo područje specifičnim sa više aspekata. Najznačajnija vrsta je balkanska endemična molika, čije prisustvo ukazuje na izuzetno složenu šumsku vegetaciju. U radu je dat prikaz rasprostranjenosti molike (*Pinus peuce* Grisebach 1844) na Pelisteru, okolnim brežuljcima i planinama u Makedoniji. Istaknute su značajne biljne i životinjske vrste, čije prisustvo čini ovo području izuzetnim. Trenutno stanje vegetacije na Pelisteru ne može se sagledati bez analize razvoja tokom različitih geoloških perioda i antropogenih uticaja, naročito u poslednjem veku. Poseban akcenat stavljen je na klimatske promene, naročito na uticaj globalnog zagrevanja na rasprostranjenost *Pinus peuce* Grisebach 1844 u Makedoniji. Imajući u vidu surovost reljefa, konfiguraciju terena, raznovrsnu floru i faunu, dostupnost (otvorenost putevima), nadmorsku visinu, bogatstvo snegom u zimskom periodu i dr., Pelister ima izuzetne prednosti za razvoj letnjeg i zimskog turizma.

Ključne reči: Pelister, *Pinus peuce* Grisebach 1844, rasprostranjenost, uticaj globalnog zagrevanja, mogućnosti za razvoj turizma.

The vegetation on Pelister mountain is of vital importance, and represents a natural arboretum, which should be preserved for future generations. In the Pelister National Park, 88 types of woody plants have been recorded, which systematically fall into 23 families. This number represents 29% of the total Macedonian dendroflora. The Pelister vegetation consists of tertiary elements, whereas the vegetation in the alpine zone of this mountain is represented by elements from the glacial period, known as glacial relicts. On Pelister there is a considerable presence of endemic and relict species, which renders this area specific from several aspects. Tertiary relicts are the Macedonian pine - *Pinus peuce* Grisebach, 1844 (molika, Macedonian pine), the yew - *Taxus baccata*, a glacial relict is *Vaccinium ulinoglosum*, and a borealic relict is *Trollius europaeus* (H r i s t o v s k i, 2004).

The most remarkable woody tree is the Balkan endemic Macedonian pine, which represents the most compact forest vegetation of the Pelister National Park. Even the name of the mountain Pelister is given by the local population according to 5-pin pine („Petlister" on Macedonian), which pass to „pelister" (T a n c e v s k i, 1974).

Fig. 1. ***A view on the National Park Pelister***

Fig. 2. ***Alpine forest of Pinus peuce***

Pinus peuce Grisebach, 1844 was found in Pelister in 1839 by German botanist August Grisebach. Firstly he saw that tree at the wood market in Bitola and was interested about the habitat of that „unknown" 5-leaf pine, which was systematically close to *Pinus cembra*. Later he found that it is a new species and gives the name *Pinus peuce* Grisebach, 1844.

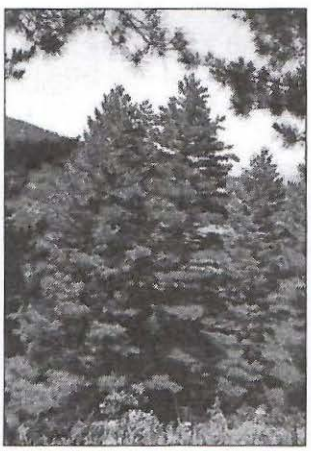

Fig. 3. ***Pinus peuce***

Fig. 4. Barks of ***Pinus peuce***

Fig. 5. ***Five-pin leafs and branches of Pinus peuce***

English name is Macedonian pine, as well as Italian – Pino di Macedonia, whereas the word "molika" is revealed by Pancic (1871).

The current condition of the vegetation cannot be explained without an analysis of its development during the various geological periods and anthropogenic

influences, particularly in the last centuries. Thus, the Macedonian pine' forests have constantly expanded since the proclamation of Pelister as a National Park in 1948, as a result of terrain protection, particularly at the west side of the mountain, above villages: Ramna and Capari, on the nude hills of the Pelister Massif such as: Debel Rid, in the nearness of the rivers Crvena, Lak Potok, Griva and in the valley Sapuncica. It is spreading on many barren terrains on Pelister and due to the global warming molika is spreading on higher parts of Pelister. We consider that if there are no remarkable changes with local or global character, in the next 50 years molika will be disseminated in the form of young forest in these areas in the way such as on the northern slopes toward villages Capari, Rotino and Bratindol. Molika is noticed on 2500 m above sea level. Well developed trunks are noted at the attitude of 2500 m. These trunks at the attitude of 2200 m and more at the alp part have trunk in the form of flag which is result of the continuous exposition at the wind, so one side of tree is with and other is without branches. By Jankovic in 1969 were registered the same cases at the mountain Prokletie at the cross border between Serbia and Montenegro and Albania, were molika is distributed.

The trunk of Macedonian pine is light, soft and long-term, with well expressed core. It is used in construction and making of furniture, whereas its pitch is used in microscopic technique and industry of optical instruments. The pollen of molika is characteristic and important trait for its determination (N i c o t a et al., 1969). We found that the pollen is present in the peat bog located lower than The Big Lake, also in the pollen of bee or honey harvested from molika flower.

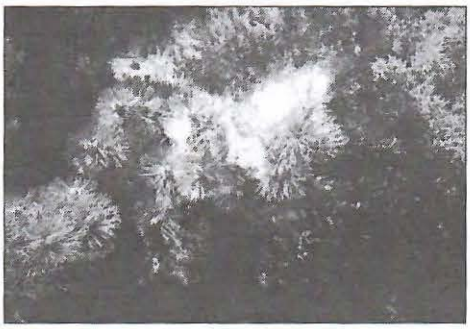

Fig. 6. ***Pollen of Pinus peuce***

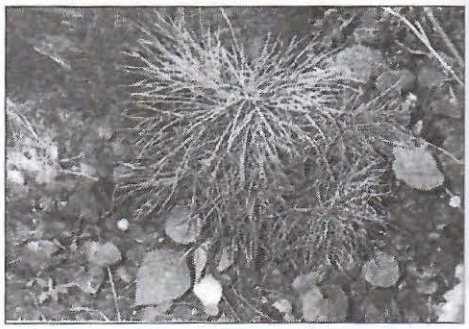

Fig. 7. ***Two stunted examples of Pinus peuce in Bitola***

Pinus peuce is widespread also in surrounding hills and mountains, such as Ilinska, Bigla, Plakensko-Snegovski massif in the diameter of 50 km with spreading of its seed by winds. There it grows on silicate soil, until on the mountains Kozuf, Nidze with Kajmakcalan grows on limestone. The Macedonian pine can be found

on other mountains in Macedonia: Shar Planina, Galicica and Mavrovo. Those pines exist successfully in their treetop. Also exist two stunted examples of this pine in Bitola at 650 m altitude, although they are older than 15 years. The problem is probably in mycorhizal association. Besides these mountains of Macedonia, Macedonian pine is found in other parts of Balkan Peninsula, such as: Northern Greece, Albania, Serbia and Montenegro and Bulgaria. There, we could say that *Pinus peuce* is Balkan tertiary relict and endemic species.

As a result of the storm and thunders in the area of the Hostel Kopanki a lot of trunks were damaged in the part of bark were was passed thunderbolts or their branches were broken. This appearance was noted extensively in the 1999 as well as in the following years. As a result of global warming in spring months 2002 by snow weight many thousands trees on Pelister were claming down and damaged. *Pinus peuce's* forest in some parts of Pelister has diseased tree trunks, and for that reason are undertaken hygienic-sanitary measures for their removal i.e. healing, aiming to preserve *Pinus peuce's* forest for the next generations.

The Macedonian pine appears in various communities, of which the most characteristic are the molika associations with the eagle's fern *Pteridio - Pinetum peucis*, then *Myrtillo - Pinetum peucis* and with the blueberry *Vaccinio - Pinetum peucis*. On the Macedonian pine's trees are growing very often some lichens: *Usnea florida, U. hirta, Ervinia prunastri* and some species of the genus *Cladonia* (M u - r a t i, 1992, 1993). On one part of the northern slopes of Pelister, near Gjavato, in association with *Abies alba* parasitises mistletoe *Viscum album var. abietis.*

Fig. 8. *Branch of Abies alba with Mistletoes Viscum album ssp. abietis*

Fig. 9. *Viscum album ssp. abietis - higher magnification*

In the molika' forest are usually met macromycetes as: *Hygrophorus hypotheius, H. olivaceoalbus, H. agathosmus, Comphidius glutinosus, Chroogomphus rutilus, C. helveticus, Clitocybe nebularis, C. dealbata, Laccaria amethystea, Armilallaris mellea var. obscura, Tricholoma columbeta, T. terreum, Marasmius*

scorodonius, *Pleuroites geogenius*, *Amanita rubescens*, *A. panterina*, *A. nuscaria*, *A. phalloides*, *A. verna*, *A. citrina*, *A. vaginata var. argentea*, *Agraricus augustus*, *A. silvicola*, *Pluteus atricapilus*, *Hypholoma fasciculare*, *Stropharia aeruginosa*, *Pholiota aquarosa*, *P. adiposa*, *P. flammans*, *Inocybe fastigiata*, *Russula sanguinea*, *R. integra*, *R. pseudointegra*, *R. virescens*, *R. cyanohantha*, *R. olivacea*, *R. azurea*, *Lactarius rufus*, *L. volemus*, *L. deliciosus*, *Dryodon erinaceus*, *Hydnum repandum*, *H. rufescens*, *Pseudohydnum gelatinosum*, *Fomes inziengae*, *Inonotus dryadeus*, *Clavaria platillaris*, *Rumaria aurea*, *R. flava*, *R. botrutis*, *Canthrellus cibarius*, *C. ferruginaceus*, *C. lutescens*, *C. tubaeformis*, *Hugrophpropsis auraniaca*, *Boletus edulis*, *B. reticulatus*, *B. pinicola*, *B. speciosus*, *B. calopus*, *B. porosporus*, *Gyroporus castaneus*, *Suillus pictus*, *Xerocomus chrysenteron*, *X. subtomentosus*, *Paxillus involotus*, *Lycopardon perlatum*, *Calvatia excipuliformis*, *Calocera viscosa*, *Spathularia flavida*, *Cyromitra esculenta*, etc. (Vojnovski, 2000, 2004).

Tertiary remainings of *Pinus peuce*, *P. silvestris* and *P. nigra* were found in the volcanic sediments of the mine Suvodol (Bitola) investigating the boring sediments in the period of 1977–1980. These pine species are present now on the mountain Kajmakcalan.

In addition to the Macedonian pine (molika), the Pelister species dating from the diluvial period, such as *Carex curvula* and *Gnapalium supinum* are of particular scientific interest, as well as numerous endemics originating from the diluvial and post-diluvial period, such as: *Festuca kajmakcalana*, *Dianthus kajmakcalana*, *Crocus pelistericus* and the insectivorous plant *Pinguicola leptoceras*. In the alpine part of Pelister, there are rare fern types: *Cryptogramma crispa* and *Athrium disentifolium;* the xerophyte plant *Sempervivum octopedes* and *Jovibarba heuffelii var. heuffelii*, which can be found exclusively on Pelister.

Speaking about vegetation on Pelister, it is also relevant to mention that in addition to the Macedonian pine' forest, there are also mixed fir, beech, hazel forest etc. The meadows with daffodils, which are characteristic relict communities found particularly on the north slopes. The vegetation acquires particular colorfulness from some characteristic plant associations in the alpine part, such as: the geranium with crimson red flowers *Geranium subcaulensis*, the eagle's fern, blueberries, crocuses, primroses, violets, cyclamens, colchicus, etc.

On the territory of the National Park „Pelister", there are locus classicus of more than 20 plant species, out of which 13 taxons have kept their taxonomic status: *Alchemilla peristerica*, *Centaurea deustiformis*, *Crocus pelistericus*, *Dianthus myrtinervus*, *Festuca peristerica*, *Pedicularis orthantha*, *Pinus peuce*, *Ranunculus psilostachys*, *Sedum erythraeum*, *Sempervivum octopedes*, *Silene ventricosa*, *Viola velutina* and *Viola orphanidis*. The species *Alchemilla peristerica* and *Sempervivum octopedes* are considered as local endemic species that grow only on Pelister. The sites of the rare flora elements *Athyrium distentifolium*, *Juncus tenuis*, *Knautia*

magnifica, *Silene congesta*, *Viola doerfleri* and other interesting representatives of the mountain flora *Vinca minor*, *Dianthus stenophylus*, *Viola parvula*, which are important for their limited distribution on the territory of Macedonia, are of the significant importance.

Fig. 10. ***Crocus pelistericus***

Fig. 11. ***Meadow of Narcissus poeticus***

Very rare glacial, relict and endemic species of fauna are present on Pelister. Thus, *Eucypris diebeli* is a newly scientifically described ostracod shrimp from the glacier waters of Pelister. There are three South-Balkan endemics of shell-less slimy snails: *Limax macedonicus leucopus*, *Tandonia macedonica* and *Dorocera turrcicum*. They primarily inhabit the alpine part. Having in mind that a number of the invertebrate animals have not yet been sufficiently examined, it is highly probable that there are more species, which are yet to be described to the science.

Fig. 12. ***Anguis fragilis***

The fauna also contributes to the beauty of the Pelister scenery. From invertebrates are specially established *Chirocephalus diaphanus*, in Small Lake as Balkan relict and endemic crab *Niphragus pancici peristerica* in Big Lake and endemic species *Arctioacamptus macedonicus*, *Illiodromus peristericus* and *Eucypris diebeli*. From insects are found *Scythris crypta*, *S. similis* as Pelister endemic species

Hadena clara macedonica, *Neumora pelisteri* are Macedonian endemic species, *Zerunthia polyxena* are present rare species. The following vertebrate animals can be seen on Pelister: *Salmo trutta peristericus*, *Salmo trutta pelagonicus*, *Salamandra salamandra*, *Rana graeca*, *Rana dalmatina*, *Ablapharus kitaibeli*, *Testudo graeca*, *T. haermani*, *Anguis fragilis* and *Pyrrhocorax pyrrhocorax docili.* Of the mammals, we should mention: *Canis lupus*, *Vulpes vulpes*, *Ursus arctos*, *Capreolus capreolus*, *Rupicapra rupicapra*, *Cervus elephus*, *Meles meles*, *Sus scrofa*, *Felis silvestris*, *Talpa beacournii*, *T stankovici*, *Clethrionomys macedonicus*, *Microtus felteni*, *Lynx lynx balkanicus* etc. The lynx *Lynx lynx balkanicus* is a particularly rare animal, and is strictly protected both in Macedonia and in the wider region (Atanasovski, 2000).

On the *Pinus peuce* tree are nesting the following birds: *Fringilla coelebs*, *Cardielis chloris*, *Parus ater*, *Columba palumbus*, until the following birds eat seed of Macedonian pine: *Passer montanus*, *Loxia curvirostra*, *Serinus serinus*, *Cocothraustes cocothraustes*, *Pyrrhula pyrrhula*, *Cardielis chloris*, *Cardielis spinus*, *Cardielis cardielis*, *Fringilla coelebs*, *Fringilla montifringilla*, *Parus caerulaeus*, *Parus major*, *Columba palumbus*, and mammals: *Sciurus vulgaris*, *Apodemus sylvaticus* and *Meles meles*.

Due to the real ruggedness of the relief, the configuration of the terrain, vegetation, accessible roads, the absolute and relative altitude, the abundance of snow in winter, Pelister has most favorable conditions for developing into a vital tourist and recreational resort, both for summer and winter tourism. This is made possible by the Molika Hotel, the Children's Holiday Home, the tourist area of Strezevo just above Nizopole, as well as the mountaineers' lodges of Kopanki and the Big Lake.

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RASPROSTRANJENOST MOLIKE *Pinus peuce* Grisebach 1844 NA PELISTERU I OKOLNIM PLANINAMA

N. Hristovski, N. Ranđelović, V. Ranđelović, S. Stojanovski
Dzulijana Tomovska, Lj. Rakonjac, V. Hadži-Jovanovski

Rezime

Vegetacija na Pelisteru predstavlja prirodni arboretum izuzetnog značaja, gde su prisutni tercijalni, glacijalni i borealni relikti. Tercijalni relikti su molika – *Pinus peuce* Grisebach 1844 i tisa –*Taxus baccata*, glacijalni relikt je *Vaccinum ulinoglosum*, a borealni relikt je *Trollius europaeus* (Hristovski, 2004). Na Pelisteru su prisutne veoma retke glacijalne, reliktne i endemične vrste faune, koje doprinose njegovoj lepoti. Molika je osim na Pelisteru, rasprostranjena i na okolnim brežuljcima i planinama (Ilinska, Bigla, Plakensko-snegovski planinski masiv), na drugim planinama u Makedoniji (Šar planina, Galičica i Mavrovo) i u drugim delovima Balkanskog poluostrva (Severnoj Grčkoj, Albaniji, Srbiji i Crnoj Gori). Imajući ovo u vidu, možemo konstatovati da je *Pinus peuce* Balkanski tercijarni relikt i endemična vrsta.

Recenzent: dr Marina Talevska, naučni saradnik Odeljenja za hidrobotaniku JNU, Hidrobiološki zavod, Ohrid.

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Ključne reči: do 5

1. **UVOD**
2. **MATERIJAL I METOD RADA**
3. **REZULTATI**
   3.1 Podnaslov
   3.1.1 Podnaslov
   Ne koristiti više od tri nivoa naslova.
4. **DISKUSIJA**
5. **ZAKLJUČAK**

LITERATURA

Rakonjac, Lj., Koprivica, M., Tabaković-Tošić, M., Miletić, Z., Čokeša, V., Marković, N. (2003): Šumska staništa i kulture četinara na Pešterskoj visoravni. Institut za šumarstvo, Beograd, str. 1-163.

Rezime

Redakcija preuzima obavezu prevođenja izvoda, ključnih reči i rezimea.

Redakcija