GLASNIK INSTITUTA ZA BOTANIKU I BOTANIČKE BAŠTE UNIVERZITETA U BEOGRADU
BULLETIN DE L'INSTITUT ET DU JARDIN BOTANIQUES DE L'UNIVERSITE DE BEOGRAD
Tom XXVIII, 1994, Beograd

UDC 581.5:012
Review

MILORAD ŠIJAK, ANKA DINIĆ

BIBLIOGRAPHY OF PAPERS OF Prof. Dr MILORAD JANKOVIĆ ON PHYTOECOLOGICAL RESEARCHES OF THE BALKAN PINE *(PINUS HELDREICHII* CRIST.) AND THE MACEDONIAN PINE *(PINUS PEUCE* GRIS.)

Faculty of Forestry, University of Belgrade
Institute for Biological Research „Siniša Stanković", Belgrade

Šijak, M., Dinić, A. (1994): *Bibliography of papers of Prof. Dr Milorad Janković on phytoecological researches of the Balkan Pine (Pinus heldreichii Christ.) and the Macedonian Pine (Pinus peuce Gris.).* – Glasnik Instituta za botaniku i botaničke bašte Univerziteta u Beogradu, Tom XXVIII, 81 - 89.

The paper presents the bibliography of papers of Prof. Dr Milorad Janković, and collaborators, dealing with the phytoecological researches of highmountain pines *Pinus heldreichii* Christ. and *Pinus peuce* Gris. The significant papers concerning with phytocoenological, edaphic, microclimatic and ecophysiological studies of Balkan and Macedonian Pine on the mountains Prokletije, Šar-planina and Orjen are presented.

Key words: Bibliography, *Pinus heldreichii, Pinus peuce,* phytoecological researches, mountaine: Prokletije, Šar-planina, Orjen.

Ključne reči: Bibliografija, *Pinus heldreichii, Pinus peuce,* Fitoekološka istraživanja, Prokletije, Šar-planina, Orjen.

Phytoecological investigations of Balkan and Macedonian Pine were carried out on the mountain Prokletije, Šar-planina and Orjen. From the very beginning (1957) the phytocenological studied as well as the studies of ecological conditions of the habitats in forests of these pines were carried out, too.

There were published 47 papers, 20 of them refering to the phytocoenological studies, while the others refer to the studies of detailed ecological conditions in the habitats of these pines.

In this paper a short review of some paper refering to some more significant studies of Balkan and Macedonian Pine will be presented.

One of the first significant papers is the paper dealing with mutual relations between these pines. This is the following: „Consideration of the mutaul relations of Macedonian Pine *(Pinus peuce)* and Balkan Pine *(Pinus heldreichii)*, as well their ecological peculiarities, particularly to the parent rock" (Jankovi ć, 1960). On the Metohian Prokletije Mt these two pine species form an altitudinal belt within the highest region of the forest vegetation up to (1800) 2000 m a.s.l. „Ecological evolution and differentiation of Balkan and Macedonian Pine were going to the direction of specific adaptation to the certain water and light conditions of habitat and phytocoenosis. Balkan Pine *(Pinus heldreichii)* during its evolution has formed in a xerophyte; Macedonian Pine *(Pinus peuce)*, on the contrary, developed in the mesophilous species. On the other side, the xerophytic Balkan Pine at the same time is the heliophyte, while the Mesophyte Macedonian Pine is the district (semi) sciophyte. This basic ecological differnetiation, Macedonian Pine is the mesophytic sciophyte, Balkan Pine is the mesophytic heliophyte, has shown that it is the most important for their distribution and mutual relations (Jankovi ć, 1960). On the Metohian Prokletije Mts the vegetation of Macedonian Pine forests is developed on the northern slopes, particularly over the silicate parent rock. These forests occur over the limestone, if the slopes are mild. On southern slopes over the limestone the Balkan Pine vegetation is developed. It is significant that „for the existence of these two pine species are primarily important chemical properties of the parent rock, not the physical ones (Jankovi ć, 1960)."

More detailed ecological investigations within Balkan and Macedonian Pine forests have shown in which extent the consideration of mutual relations between these two pine species to the parent rock have been correct. Very detailed soil analyses in Balkan Pine forests, on the mountains Orjen, Ostrovica and Šar-planina were presented in the paper „Ecological relation between the relict, (sub) endemic pine species *Pinus heldreichii* and the character of geological substrate and soil in Jugoslavia (Jankovi ć, M. et Stefanovi ć, K. 1971)." After the parent rock, the soils in Balkan pine forests, in investigated areas, are formed over hard limestones, serpentinized peridotite and silicate parent rock. On the limestone terrains on hte Orjen Mt, which represent the mountain massif directly influenced by Mediterranean climate, within Balkan Pine forests it is possible to separate the following soil phases: organogenic black soil, organic-mineral black soil and brownized black soil. On the Šar-planina Mt within Balkan Pine forests the similar pedogenetic phases were noticed, but the soil depth was greater. In Balkan Pine forests over serpentinized peridotite are developed as follows: serpentine balack soil (rendzina), brownized black soil (rendzina) and brown soil over serpentine. The soils over acid silicate parent rock on the Šar-planina Mt belong to the brown acid soils (Jankovi ć and Stefanovi ć, K., 1971). The soil studies within different stands of the Macedonian Pine on the Prokletije Mt (Kožnjar) within an altitudinal belt, from 1700 to 1900 m a.s.l., have shown that over granites and phylites are developed humus-silicate soil in the community *Pinetum peucis typicum* M.

Jank. and brownized humus-silicate soil in the community *Pinetum peucis piceetosum* M. Jank. The brown podzolic soil was found in the community *Wulfenio-Pinetum peucis* M. Jank. (Janković, M. and Stefanović, K. 1978).

According to the parent rock M. Janković (1982) differentiates the following three groups of associations: I. *Pinetum heldreichii calcicolum* M. Jank. prov. (limestone), 2. *Pinetum heldreichii silicicolum* M. Jank. prov. (silicate), 3. *Pinetum heldreichii serpentinicolum* M. Jank. prov. (serpentine); II. 1. *Pinetum peucis calcicolum* M. Jank. prov. (limestone), 2. *Pinetum peucis silicicolum* M. Jank. prov. (silicate), 3. *Pinetum peucis serpentinicolum* M. Jank. prov. (serpentine).

Balkan and Macedonian Pine form mixed stands, too, with the other mountain pine species *(Pinus nigra, P. silvestris, P. mugo),* as follows: *Pineo-Pinetum heldreichii mixtum* M. Jank. prov. and *Pino Pinetum peucis mixtum* M. Jank. prov. (Janković, 1982). Balkan and Macedonian Pine forests were studied, in details, phytocoenologically, as it is evident from the bibliography.

Except the phytocoenological and pedological investigations in forests of Balkan and Macedonian Pine, the particular attention is paid to the phytoclimatic studies. Results from comparative investigations of microclimatic conditions within different zones of the Šar-planina Mt have shown great differences among the communities being studied. The microclimate was studied, as follows, in: Macedonian Pine forest (1700 m a.s.l., NW, slope 25°, silicate), Balkan Pine forest (1700 m a.s.l., SE, 45°, limestone), beech forest (1500 m a.s.l., NW, 15°, silicate) and in Turkey Oak forest (1000 m a.s.l., SE, 45°, silicate), as well in each studied zone outside the forest. From the results we can conclude that there are some differences among these forest types in relation to the light conditions, solar radiation, temperature relations on the soil surface (with or without vegetation and litter, relatively), soil and air humidity relations, evaporation, as follows: Macedonain Pine forest is more dark, cold and humid in relation to the Balkan Pine forest, which is more light, warm and dry; beech forest is more dark and humid in relation to the Turkey oak forest which is more light, warm and dry (Janković et al., 1981).

For the ecological studies of Balkan Pine the following paper is significant: „About the branching specificities of the Balkan Pine *(Pinus heldreichii)* and their ecological aspect" (Janković, 1962). Being markedly heliophilous species, Balkan Pine branching is very sensitive about the light conditions. In the conditions of abundant light, the tree is very branched, but in sheltered places, in valley, without lower branches, the crown is more moved toward the top. Trees which are more exposed to the south, have more developed branches, whereas the side exposed to the north is quite branchless, or the branches are very badly developed. Some trees are set thickly with branches to the very soil surface, so that they are like „hedgehogs", and this the result of a great number of dormant buds. On Balkan Pine trees the lower branches are very viable and longlasting. In a great number of its habitats, the Balkan Pine is exposed to very different anthropo-zoogenic infuences, and the trees are damaged. The lower branches take over, very successfully, the role of damaged and destroyed parts of the tree. The longlasting viability of dormant buds has helped this species to survive in the most unfavorable conditions of its habitats (Janković, 1962).

Ecophysiological investigations of Balkan and Macedonian Pine were carried out in different habitats on the Šar-planina and Prokletije Mts., and they have shown that Balkan Pine is more xerophilous and heliophilous species in relation to Macedonian Pine, and better endures extreme temperatures and great fluctuations over calcareous

parent rock with poorely developed soil. In sheltered habitats Macedonian Pine is to be found, at most, over the silicate with favorable hydrothermic characteristics. „Balkan and Macedonian Pine by their ecological, ecophysiological and chorological characteristics belong, nowadays, to a very endangered part of the gene pool and demand the attention of people, and deserve it, as well as the protection in the frame of the conservation of flora and vegetation in our highmountain Mediterranean and submediterranean regions" (Janković et al. 1987).

In the aim to study the ecoanatomic characteristics of needles, the plant material was collected from natural habitats of Balkan and Macedonina Pine. The Balkan Pine needle is of xeromorphic structure with a very thick cuticle, and liguified too. The Macedonian Pine needles are double narrower in relation to the Balkan Pine needle, having thinner cuticle and lower rate of xeromorphousness (Stevanović, B. and Janković, 1988). „The needle structure and xeromorphous differences are correlatively linked with the other ecophysiological characteristics of these pines, first of all, with their water regime. More xeromorphous Balkan Pine, at the same time, is markedly stenohydric species. However, the Macedonian Pine settle more mesophilous habitats, distinguishing by less pronounced xeromorphoses and some broader scale of change tolerances in the frame of isohydric water budget" (Stevanović, B. and Janković, 1988).

Phytocoenological, pedological, microclimatological and ecophysiological studies of Balkan and Macedonian Pine forests, first of all, have contributed to a better and more comprehensive knowledge of these pines on the mountains Prokletije, Šar-planina and Orjen.

BIBLIOGRAPHY OF *PINUS HELDREICHII* AND *P. PEUCE*

Janković, M.M. (1958): Prilog poznavanju munikovih šuma *(Pinetum heldreichii)* na Metohijskim Prokletijama = A contribution to the knowledge of the Balkan Pine forests *(Pinetum heldreichii)* on the Metohian Prokletije Mts. – Arh. biol. nauka, Beograd, 10, (1-4), 51-57, Zsfg.

Janković, M.M. (1958): Značaj vegetacije Metohijskih Prokletija kao prirodne znamenitosti i potreba njenog ispitivanja i zaštite = Significance of the vegetation of the Metohian Prokletije Mts as the natural importance and need for its research and protection. – Zaštita prirode, Beograd, 12, 19-26, Zsfg.

Janković, M.M. (1959): A study in thermal conditons in some plant communities of mountain Prokletije of Metohija = Proučavanje toplotnih uslova u nekim biljnim zajednicama Metohijskih Prokletija. – Glas. Bot. zav. i Bašte Univ. u Beogradu, I, 1, 29-78, Rez.

Janković, M.M. (1960): Razmatranja o uzajamnim odnosima molike *(Pinus peuce)* i munike *(Pinus heldreichii)*, kao i o njihovim ekološkim osobinama = Considerations upon the mutual relations between the Macedonian Pine *(Pinus peuce)* and Balkan Pine *(Pinus heldreichi)* as well as their ecological characteristics, particularly in relation to the parent rock. – Glas. Bot. zav. i Bašte Univ. u Beogradu, I(V), 2, 141-180, Zsfg.

Janković, M.M. (1960): Šumska vegetaicja munike *(Pinus heldreichiii)* na Metohijskim Prokletijama i potreba njene efikasne zaštite = The forest vegatation of the Balkan Pine *(Pinus heldreichii)* on the Metohian Prokletije Mts and the need for its effective protection. – Zašt. prir., Beograd, 18/19, 37-46, Zsfg.

Janković, M.M., Bogojević, R. (1960): O mikroklimatskim uslovima u nekim zajednicama munikovih šuma *(Pinetum heldreichii)* na Prokletijama u letujem periodu 1959 (Manujskript) = On microclimatic conditions in some associations of Balkan Pine *(Pinetum heldreichii)* on the Prokletije Mts during the summer period in 1959 (Manuscript). – Beograd.

Janković, M.M. (1961): O svetlosnoj klimi šumskih zajednica *Pinetum heldreichii typicum* M. Jank. i *Fagetum abietetosum* Horv. na Prokletijama, prema posmatranjima u 1958. godini = About the light conditions in forest associations *Pinetum heldreichii typicum* M. Jank. and *Fagetum abietetosum* Horv. on the Prokletije Mts, according to the observations in 1958. – Glas. Prir. muz., Beograd, B, 17, 143-213, Zsfg.

Janković, M.M. (1962): O specifičnostima i grananju munike *(Pinus heldreichii)* i njihovom ekološkom aspektu = On the branching specificities of the Balkan Pine *(Pinus heldreichii)* and its ecological aspect. – Arh. biol. nauka, Beograd, 14, 3-4, 169-184 + XXVIII. Zsfg.

Janković, M.M. (1962): O uslovima svetlosne klime u nekim fitocenozama Prokletija = About the light conditions in some phytocoenoses on the Prokletije Mts. – II. Kongr. biol. Jug., Beograd, str. 157.

Janković, M.M., Bogojević, R. (1962): Mikroklimatski uslovi u nekim fitocenozama Prokletija za vreme letnjeg perioda 1960. godine = Microclimatic conditions in some phytocoenoses on the Prokletije Mts during the summer period 1960. – II. Kongr. biol. Jug., Beograd, 157.

Janković, M.M., Bogojević, R. (1962): Prilog poznavanju endemičnih borova munike *(Pinus heldreichii)* i molike *(Pinus peuce)* na severnoj strani Šar-planine i njenim metohijskim ogranicama = A contribution to the knowledge of the forests of endemic pines *Pinus heldreichii* and *Pinus peuce* – on the northern side of theŠara mountain and on its spurs projecting into the Metohija. Arh. biol. nauka, 14, (3-4), 143-155, Zsfg.

Janković, M.M., Bogojević, R. (1962): Prilog poznavanju šuma endemičnih borova munike *(Pinus heldreichii)* i molike *(Pinus peuce)* na severnoj strani Šar-planine i njenim metohijskim ograncima = Contribution to the knowledge of the forests of endemic pines the Balkan Pine *(Pinus heldreichii)* and Macedonian Pine *(Pinus peuce)* on the northern side of the Šar-planina Mt and its Metohian spurs. – II. Kongr. biol. Jug., Beograd, 139-140.

Janković, M.M. (1964): On pecularities in branching of *Pinus heldreichii* and their ecologic aspect = O specifičnostima grananja *Pinus heldreichii* i njihovom ekološkom aspektu. – Arh. biol. nauka, Beograd, 14, 43-80.

Janković, M.M., Bogojević, R. (1964): A contribution to the knowledge of the forests of endemic pines – *Pinus heldreichii* and *Pinus peuce* – on the northern side of the Šara mountain and on its spurs projectiong into the Metohija = Prilog poznavanju šume endemičnih borova munike *(Pinus heldreichii)* i molike *(Pinus peuce)* na severnoj strani Šar-planine i njenim metohijskim oranicama. – Arch. biol. sci., Belgrade, 14, 19-30.

Janković, M.M. (1965): *Fritillario-Pinetum heldreichii* nova zajednica munike *(Pinus heldreichii)* na planini Orjen iznad Boke Kotorske = *Fritillario-Pinetum heldreichii,* a new community of the Balkan Pine *(Pinus heldreichii)* on the Orjen Mt, above the Boka Kotorska. – Arh. biol. nauka, 17, 3, 17P-18P.

Janković, M.M. (1967): *Peucedano-Pinetum heldreichii* M. Jank. nova asocijacija subendemičnog balkanskog bora *Pinus heldreichii* na Orjenu (Prethodno saopštenje) = *Peucedano-Pinetum heldreichii* M. Jnak., the new association of the subendemic Balkan Pine *Pinus heldreichii* on the Orjen Mt (Preliminary report). – Glas. Bot. z. i bašte Univ. u Beogradu, 2, (1-4), 203-206. Zsfg.

Janković, M.M. (1971): Neki problemi ekologije, cenologije i rasprostranjenja endemoreliktne balkanske vrste *Pinus peuce* = Some problems of ecology, coenology and distribution of the endemorelic Balkan pine species *Pinus peuce.* – Zbor. na Simp. na molikata, Skopje, 173-177, Summ.

Janković, M.M. (1971): *Pinus heldreichii* Christ. In: Flora SR Srbije, I (ed. M. Josifović). – Sanu, Beograd, 151.

Janković, M.M., Bogojević, R. (1970): Neki aspekti ekoklimatskih uslova molike *(Pinus peuce)* i molikovih šuma *(Ajugo-Pinetum peucis* M. Jank. et R. Bog.) na Šar planini = Some aspects of ecoclimatic conditions of the Macedonian Pine *(Pinus peuce)* and its forests *(Ajugo-Pinetum peucis* M. Jank. et R. Bog.) on the Šar planina Mt. – Zbor. na simp. na molikata, Skopje, 179-181, Summ.

Janković, M.M., Stefanović, K. (1970): Prilog poznavanju pedološke podloge u različitim zajednicama molike *(Pinus peuce)* u Jugoslaviji = A contribution to the knowledge of the parent rock in different associations of the Macedonian Pinus *(Pinus peuce)* in Yugoslavia. – Zbor. na simp. na molikata, Skopje, 239-241.

Janković, M.M. (1970): Visokoplaninska šumska vegetacijska zona endemoreliktnih balkanskih borova *Pinus heldreichii* i *Pinus peuce* i njen značaj u suzbijanju bujica, lavina i erozije u visokoplaninskim predelima naše zemlje = Highmountain forest vegetation of the endemorelic Balkan pine species *Pinus heldreichii* and *Pinus peuce* and its significance in control of torrents, avalanches and erosion in highmountain regions in our coutnry. – Simp. povodom 50-god. osnivanja i rada Šumarskog fakulteta u Beogradu, Beograd, 10-11.

Janković, M.M., Stefanović, K. (1970): Ekološki odnos (sub) endemične vrste *Pinus heldreichii* prema karakteru geološke podloge i zemljišta Jugoslavije = Ecological relations between the relict, (sub)endemic pine species *Pinus heldreichii* and the character of geological substrate and soil in Jugoslavia. – Ekologija, Beograd, 6, 1, 49-61, Summ.

Janković, M.M. (1972): Visokoplaninska šumska vegetacijska zona endemoreliktnih balkanskih borova *Pinus heldreichii* i *Pinus peuce* i njen značaj u suzbijanju bujica, lavina i erozije u visokoplaninskim predelima naše zemlje = Highmountain forest vegetation of the endemorelic Balkan pine species *Pinus heldreichii* and *Pinus peuce* and its significance in control of torrents, avalanches and erosion in highmountain regions in our country. – Simp. povodom 50-god. osnivanja i rada Šumarskog fakulteta u Beogradu, 29.01.1971, Beograd, 63-70. Zsfg.

Janković, M.M. (1972): Zašitta i obnova biosfere i ekosistema Prokletija, iz aspekta sadašnjeg stanja flore i vegetacije na njima = Conservation and restauration of the biospere and the ecosystems of the mountain massive Prokletije from the aspects of the actual floral and vegatation situation. – Glas. Inst. za bot. i bot. b. Univ. u Beogradu, Beograd, VII, nova ser, 1-4, 115-151, Summ.

Janković, M.M., Bogojević, R., Pejčinović, D. (1973): Neke karakteristike mikroklimatskih uslova u četinarksim šumama Ostrovice = Some characteristics of the microclimatic conditions in coniferous forests on the Ostrovica Mt. – Prvi kongres ekologa Jugoslavije., Beograd, Zbor. ref. i rez., 51.

Janković, M.M., Bogojević, R., Živanović, Ž., Blaženčić, Ž. (1973): Rezultati uporednih proučavanja mikroklimatskih uslova u različitim visinskim pojasevima Šarplanine = Results of comparative studies of microclimatic conditions within different altitudinal zones on the Šar-planina Mt. – I. Kongres ekol. Jug., 27-29.09.1973, Beograd. – Zbor. ref. i rez., 52-53.

Janković, M.M., Stefanović, K. (1974): Uporedno pručavanje zemljišta u munikovim zajednicama *(Pinus heldreichii)* na serpentinu i krečnjaku Ostrovice (Metohija, Šarplanina) = Comparative study of the soil in munika pine communities *(Pinus heldreichii)* on the serpentine and the limestone substrates of Ostrovica (Metohija, Mountain Šara). – Zbor. rad. sa Simp. pov. 100-god. prve jugosl. dendrologije Josifa Pančića, Beograd, SANU, Nauč. skup., I. odel. prir.-mat. nauka, 1, 171-177. Summ.

Janković, M.M. (1975): Pregled asocijacija munikovih šuma *(Pinetum heldreichii)* u Jugosalviji = Survey of associations of munika *(Pinetum heldreichii)* in Yugoslavia. – Međunar. simp. o munici, Dečani, 4-7.VI 1972. – Zbor. rad., Peć, 146-158, Summ.

Janković, M.M., Bogojević, R. (1975): Neke karakteristike mikroklime u munikovim šumama *(Pinetum heldreichii-Seslerietum autumnalis* M. Jank. et R. Bog.) na Ošljaku, Šarplanina = Some characteristics of microclimate in *Pinus heldreichii forests – Pinetum heldreichii-Seslerietum autumnalis* M. Jank. et R. Bog. – on Ošljak, Šarplanina. – Međunar. simp. o munici, Dečani, 4-7.VI 1972, Zbor. rad., Zavod za šumarstvo, Peć, 134-145, Summ.

Janković, M.M., Stefanović, K. (1975): Pedološki pokrivač i vegetacija munikovih šuma na Šaplanini *(Pinetum heldreichii-Seslerietum autumnalis* M. Jank. et R. Bog.) = Pedologic cover and vegetation of *Pinus heldreichii forests* on Šarplanina *(Pinetum heldreichii-Seslerietum autumnalis* M. Jank. et R. Bog.). – Međunar. simp. o munici, Dečani, 4-7.VI 1972, Zbor. rd., Zavod za šumarstvo, Peć, 171-177, Summ.

Janković, M.M., Velčev, V. (1975): Pancirnaja sosna *(Pinus heldreichii* Christ.) i ee soobščestva na Balkanskom poluostrove = Munika *(Pinus heldreichii* Christ.) i njene zajednice na Balkanskom poluostrvu = The Balkan Pine *(Pinus heldreichii* Christ.) and its communities on the Balkan Penincula. – Problems of Balkan flora and vegetation (Problemy flory i rastitel'nosti Balkanskogo poluostrova), Proceed. of theFirst intern. symp. on Balkan flora and vegetation, Varna, 7-14.VI 1973, 286-295.

Janković, M.M., Popović, R., Matijašević, B. (1975): Neki rezultati fiziološko-ekoloških proučavanja munike *(Pinus heldreichii)* na Ošljaku, Šarplanina = Some results of the physio-ecological studies of *Pinus heldreichii forests (Pinetum heldreichii-Seslerietum autumnalis* M. Jank. et R. Bog.) on Ošljak, Šarplanina. – Međunar. simp. o munici, Dečani, 4-7.VI 1972, Zbor. rad., Zavod za šumarstvo, Peć, 159-170, Summ.

Janković, M.M. (1977): Opšti pogled na šumske ekosisteme Prokletija – njihova struktura, dinamika i problemi njihove zaštite = General view upon forest ecosystems on the Prokletije Mt – their structure, dynamics and problems of their conservation. – Naučni skup „Struktura, dinamika i zaštita ekosistema i njihovih komponenata na Dinaridima", 16-17.XII 1977, Biol. inst., Rezimei referata, Sarajevo, 7.

Janković, M.M., Bogojević, R. (1977): Struktura i dinamika osnovnih mikroklimatsih elemenata u nekim šumskim ekosistemima Prokletija = Structure and dynamics of the principal microclimatic elemetns in some forest ecosystems on the Prokletije Mt. – Naučni skup „Struktura, dinamika i zaštita ekosistema i njihovih komponenata na Dinaridima", 16-17.XII 1977, Biol. inst., Sarajevo, Rezimei referata, 8-9.

Janković, M.M., Stefanović, K. (1977): Struktura, geneza i osnovni tipovi zemljišta u nekim najznačajnijim šumskim ekosistemima Prokletija = Structure, genesis and principal soil types in some most important forest ecosystems on the Prokletije Mt. – Naučni skup „Struktura, dinamika i zaštita ekosistema i njihovih komponenata na Dinaridima", 16-17.XII 1977, Biol. inst. Sarajevo, Rezimei referata, 10.

Janković, M.M., Popović, R., Dimitrijević, J. (1977): Neke osnovne fiziološko-ekološke karakteristike vodnog režima (struktura i dinamika procesa) nekih značajnijih vrsta biljaka u munikovim i molikovim šumskim zajednicama Prokletija = Some principal physiological-ecological characteristics of the water regime (structure and dynamics of the process) of some more important plant species in the Macedonian and Balkan Pine forest communities on the Prokletije Mt. – Naučni skup „Struktura, dinamika i zaštita ekosistema i njihovih komponenata na Dinaridima", 16-17.XI 1977, Biol. inst. Sarajevo, Rezimei referata, 27.

Janković, M.M., Stefanović, K. (1978): Geneza i osnovni tipovi zemljišta u nekim najznačajnijim šumskim ekosistemima Prokletija = Genesis and the basic types of soil in some of the major forest ecosystems on the Prokletije mountains. – God. Biol. inst., Sarajevo, XXXI, 49-56. Summ.

Janković, M.M., Stefanović, K. (1980): Neke karakteristike režima CO_2 u munikovim šumama (*Pinetum heldreichii-Seslerietum autumnalis* M. Jank. et R. Bog.) na Ošljaku, Šarplanina = Some characteristics of the CO_2 regime in the Munika pine forests (*Pinetum heldreichii-Seslerietum autumnalis* M. Jank. et R. Bog.) on Ošljak, the Šarplanina mountain. – Ekologija, Beograd, 15, 1, 67-74. Summ.

Janković, M.M. (1981): Prilog poznavanju vegetacije i fitocenoza nekih visokoplaninskih borova (*Pinus heldreichii, P. peuce* i *P. mugo*) na Šarplanini i njenim metohijskim ograncima (Ošljak, Kodža Balkan, Ostrovica) = A contribution to the knowledge of the vegetation and plant communities of some highmountain pines (*Pinus heldreichii, P. peuce* and *P. mugo*) on the Šarplanina mountains and their Metochian branches (Ošljak, Kodža Balkan, Ostrovica). – Glas. Šum. fak., Beograd, 57, 127-134. Summ.

Janković, M.M., Bogojević, R., Živanović, Ž., Blaženčić, Ž. (1981): Rezultati uporednog proučavanja mikroklimatskih uslova u različitim vegetacijskim šumskim pojasevima Šarplanine = Results of the comparative studiese of microclimatic conditions within different altitudinal forest zones of the Šarplanina mountains (Preliminary report). – Ekologija, Beograd, 16, 1, 57-78. Summ.

Jaknović, M.M. (1982): Prilog poznavanju vegetacije Šarplanine sa posebnim osvrtom na neke značajnije reliktne vrste biljaka = Contribution to the study of the vegetation of the Šarplanina mountain with particular references to some conspicuous relict plant species. – Glas. Inst. bot. i bot. b. Univ. u Beogradu, (XIII)XV, 1-3, 75-129. Summ.

Janković, M.M., Popović, R., Dimitrijević, J. (1986): Prilog poznavanju ekofiziologije endemo-reliktnih vrsta balkanskih borova *Pinus heldreichii* i *Pinus peuce* = A contribution to the knowledge of the ecophysiology of endemo-relict Balkan pine species *Pinus heldreichii* and *Pinus peuce*. – I. Simp. o flori i vegetaciji SR Srbije, Beograd, 3-5.VI 1986, 52.

Janković, M.M., Popović, R., Dimitrijević, J., Stevanović, B. (1987): Prilog poznavanju ekofiziologije endemoreliktnih balkanskih borova *Pinus heldreichii* i *Pinus peuce* = Contribution to the ecophysiology of the endemo-relic Balkan pine species *Pinus heldreichii* and *Pinus peuce*. – Glas. Inst. bot. i bot. b. Univ. u Beogradu, Beograd, XXI, 5-16. Summ.

Stevanović, B., Janković, M.M. (1988): Ekoanatomske odlike četina endemo-reliktnih visokoplaninskih balkanskih borova munike (*Pinus heldreichii* Christ.) i molike (*Pinus peuce* Gris.) = Ecoanatomical characteristics of needles of the endemo-relic highmountain Balkan pine species the Balkan Pine (*Pinus heldreichii* Christ.) and Macedonian Pine (*Pinus peuce* Gris.). – Glas. Inst. bot. i bot. b. Univ. u Beogradu, Beograd, XXII, 51-62. Summ.

Janković, M.M. (1990): O veoma značajnoj potrebi vaspostavljanja kontinuiranog vegetacijskog pojasa endemoreliktnih balkanskih borova *Pinus heldreichii* i *Pinus peuce* u planinama SR Srbije i Balkanskog poluostrva = Upon a very significant need of establishing the continual vegetation belt of endemo-relic Balkan pine species *Pinus heldreichii* and *Pinus peuce* on mountains of the SR Serbia and Balkan Peninsula. – Ekologija, Beograd, 26, 2, 61-66. Summ.

Janković, M.M., Stevanović, V., Jovanović, S. (1990): Ekologija, biogeografija (fitogeografija) i zaštita žive prirode Šar-planine i njenih metohijskih ogranaka na području opštine Štrpce = Ecology, biogeography (phytogeography) and conservation of nature of the Šar-planina Mt and their Metohian branches on the territory of the commune Štrpce. – In: Opština Štrpce, Sirinička župa – Odlike prirodne sredine. SANU, Geogr. isnt. „Jovan Cvijić", Beograd, Pos. izd., 37/1, 273-366.

Janković, M.M. (1995): Problemi vaspostavljanja potencijalne, klimatogene i klimaksne vegetacije (šumske i žbunaste) putem antropogeno potpomognute prirodne revitalizacije na prostorima balkanskog krša = Problems of establishing the potential, climatogenic and climax vegetation (forest and shrub) through the anthropogenic supported natural revitalization in the area of the Balkan karst. – Zbornik rad. II. simp. o zašt. karsta, Beograd. Akademski speleol.-alpin. klub, Beograd. (In press).

Rezime

MILORAD ŠIJAK, ANKA DINIĆ

BIBLIOGRAFIJA RADOVA Prof. Dr MILORADA JANKOVIĆA O FITOEKOLOŠKIM ISTRAŽIVANJIMA MUNIKE *(PINUS HELDREICHII* CHRIST.) I MOLIKE *(PINUS PEUCE* GRIS.)

Šumarski fakultet, Univerzitet u Beogradu
Institut za biološka istraživanja „Siniša Stanković", Beograd

U radu je prikazana bibliografija radova profesora Milorada Jankovića i saradnika o fitoekološkim istraživanjima visokoplaninskih borova *Pinus heldreichii* Christ. i *Pinus peuce* Gris. Analizirani su značajniji radovi koji se odnosi na fitocenološka, edafska, mikroklimatska i ekofiziološka proučavanja šuma munike i molike na Prokletijama, Šar-planini i Orjenu.

Od ukupno 47 publikovanih radova, 20 se odnose na fitocenološka ispitivanja, a 27 na detaljnija proučavanja ekoloških uslova u kojima žive munika i molika.

Među prvim značajnijim radovima je rad: „Razmatranja o uzajamnim odnosima molike *(Pinus peuce)* i munike *(Pinus heldreichii),* kao i o njihovim ekološkim osobinama, posebno u odnosu na geološku podlogu" (Janković, 1960). Na Metohijskim Prokletijama ove dve vrste borova izgrađuju jedan visinski pojas u najvišem regionu šumske vegetacije do (1800) 2000 m nadmorske visine.Vegetacija molikovih šuma je razvijena na severnim planinskim stranama, pre svega na silikatnoj podlozi. Ove šume se javljaju i na krečnjaku ako je nagib terena dovoljno blag. Na južnim planinskim stranama na krečnjaku je razvijena vegetacija munike. Značajno je da su za „život munike i molike primarno važne ne hemijske, već fizičke osobine geološke podloge (Janković, 1960)."

U radu: „Ekološki odnos reliktne i (sub)endemične balkanske vrste *Pinus heldreichii* prema karakteru geološke podloge i zemljišta u Jugoslaviji", vrlo detaljno su analizirana zemljišta na jedrim krečnjacima, serpentinisanom peridotitu i na silikatnoj podlozi u munikovim šumama na Orjenu, Ostrovici i Šar-planini (Janković, M. i Stefanović, K., 1971). Molikove šume su proučavane na Prokletijama (Kožnjar) na granitima i filitima (Janković, M. i Stefanović, K., 1978).

Prema geološkoj podlozi, M. Janković (1982) razlikuje tri grupe asocijacija: I. 1. *Pinetum heldreichii calcicolum* M. Jank. prov. (krečnjak), 2. *Pinetum heldreichii silicicolum* M. Jank. prov. (silikat) i 3. *Pinetum heldreichii serpentinicolum* M. Jank. prov. (serpentin); II. 1. *Pinetum peucis calcicolum* M. Jank. prov. (krečnjak), 2. *Pinetum peucis silicicolum* M. Jank. prov. (silikat), i 3. *Pinetum peucis serpentinicolum* M. Jank. prov. (serpentin). Munika i molika grade i mešovite zajednice sa planinskim borovima *(Pinus silvestris, P. nigra, P. mugo),* i to su: *Pineo-Pinetum heldreichii mixtum* M. Jank. prov. i *Pineo-Pinetum peucis mixtum* M. Jank. prov. (Janković, 1982). Munikove i molikove šume su detaljno fitocenološki proučavane, što se vidi i iz priložene bibliografije.

Pored fitocenoloških i pedoloških ispitivanja u šumama munike i molike, posebna pažnja je posvećena proučavanju fitoklime. Rezultati uporednih proučavanja mikroklimatskih uslova u različitim pojasevima Šar-planine, pokazali su velike razlike između proučavanih zajednica. Pokazalo se da „. . . u pogledu svetlosnog režima, režima sunčevog zračenja, temperaturnog režima površine zemljišta sa i bez vegetacije odnosno stelje, temperaturnog režima zemljišta i vazduha, režima vlažnosti i isparavanja, molikova šuma može da se označi kao tamnija, hladnija i vlažnija u odnosu na munikovu, svetliju, topliju i suvlju, a bukova šuma tamnija, hladnija i vlažnija u odnosu na hrastovu – svetliju, topliju i suvlju " (Jaković, M. et al., 1981).

U proučavanju ekologije munike, značajan je rad: „O specifičnostima u grananju munike *(Pinus heldreichii)* i njihovom ekološkom aspektu" (Jaković, 1962). Kao izrazito heliofitno drvo, razvoj grana munike je veoma osetljiv na jačinu svetlosti. Stabla koja su više okrenuta jugu, nose veliki broj razvijenih grana, dok strana u senci, okrenuta severu, ili je uopšte bez grana, ili su grane daleko slabije razvijene. Munika je na većini svojih staništa izložena raznovrsnim antropozoogenim uticajima, pa se stabla oštećuju. Donje gane preuzimaju uspešno ulogu uništenog i oštećenog stabla. Dugotrajna vitalnost uspavanih pupoljaka pomogla je ovoj vrsti da se održi u najnepovoljnijim uslovima svojih staništa (Jaković, 1962).

Ekofiziološka ispitivanja munike i molike vršena na različitim staništima Šar-planine i Prokletija su pokazala da je munika kserofilnija i heliofilnija vrsta, u odnosu na moliku, da dobro podnosi ekstremne temperature i velika kolebanja na krečnjačkoj podlozi sa slabo razvijenim zemljištem. Na zaklonjenim staništima nalazi se molika, najčešće na silikatu na zemljištu povoljnih hidrotermičkih karakteristika (Jaković et al., 1987).

U cilju ispitivanja ekoanatomskih odlika četina, biljni materijal je uzet sa prirodnih staništa munike i molike sa Šar-planine. Četina munike ima kseromorfnu građu sa kutikulom veoma debelom i lignifikovanom. Četina molike je upola uža od četine munike, sa nešto tanjom kutikulom i odlikuje se nižim stepenom kseromorfnosti (Stevanović, B. i Janković, M., 1988).

Fitocenološka, pedološka, mikroklimatološka i ekofiziološka proučavanja šuma munike i molike, pre svega na Prokletijama, Šar-planini i Orjenu, doprinela su sveobuhvatnom poznavanju ekologije munike i molike.