

**THE FIRST CENTURY OF THE DEVELOPMENT OF  
MYCOLOGY AT THE BIOLOGY STUDIES AT THE  
UNIVERSITY OF BELGRADE (1890–1990)**

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At the beginning of the 19<sup>th</sup> century, Serbia won its independence from the Ottoman Empire. The rapid development of science and various disciplines, including mycology, started soon thereafter. The first significant texts containing data on fungi from this area appeared as early as at the end of the 19<sup>th</sup> century. This text discusses the development of mycology on the Faculty of Biology in Belgrade from that time until the late 1980s, defining and analysing the key moments, the main drivers and the most important researchers-mycologists who laid the foundations and developed the study of mycology at the biology department. Information about some of the above does not exist in written sources or is very difficult to find.

**Keywords:** History of mycology, fungi of Serbia, Milutin Jelić, Vojteh Lindtner

INTRODUCTION

Thanks to their unusual nature, rapid appearance and disappearance, completely different forms and diverse places we encounter them, fungi have for a long time eluded the efforts of people to get to know, classify,

understand and see them as a single related group of organisms. While mushrooms were considered delicious or dangerous food throughout history, it seemed that mildew, harvest spoilage and the destruction of crops represented the wrath of the gods, while mould at the site of decay of wooden houses and bridges was considered a consequence of rotting and decomposition, rather than its cause. It was difficult to even imagine that all these phenomena have to do with a single but special group of related creatures – fungi.

Since Aristotle, all living things had been classified into only two groups: plants or animals. Large, common and recognisable fungi, like various mushrooms, were traditionally placed in the kingdom of plants, primarily because they are sessile. Therefore, it is not surprising that with the development of modern science in the 18<sup>th</sup> century, it was the botanists who slowly began to study these little-known organisms. Despite this, even during the 18<sup>th</sup> century fungi were thought to be the product of some sort of “vegetable crystallisation” (Findlay 1982). The realisation that lichens are, in fact, also fungi that form a symbiosis with algae, and that various blights and yeasts are fungi as well, came only in the 19<sup>th</sup> century. The understanding of the fundamental truth that fungi are neither plants nor animals, and that they form their own separate kingdom, as well as the separation of mycology, as the science of fungi, from botany, had to wait until the second half of the 20<sup>th</sup> century.

### **The Beginnings of Mycological research in Serbia**

The plant science rapidly developed in Serbia in the second half of the 19<sup>th</sup> century, primarily thanks to the work of the founder of modern botany in Serbia Josif Pančić (1814–1888) and his students. He was one of the principal architects of scientific thought in 19<sup>th</sup>-century Serbia. In a country that had just gained independence, and had no significant scientific tradition, J. Pančić lit a bright torch and started the great momentum of research, study and scientific enlightenment. At that time, there was a general enthusiasm in science, almost incomprehensible nowadays considering the situation and conditions that prevailed in Serbia at the time. Several mycologists who worked in those years made a pioneering, but at the same time a very large contribution to science in Serbia that has not been surpassed until today. J. Pančić and the inner circle of his initial students did not deal with fungi, as there was too much work to do regarding the unexplored flora consisting of “real” plants. But they were certainly familiar with current European scientific research and studies of this group of so-called “primitive” or “lower” plants, as fungi were called at the time along with algae and lichens. This is indirectly evidenced by certain newspaper articles (Jakšić 1896), which contained quality data on

fungi. The first scientific articles in Serbia about fungi, which appeared at the end of the 19<sup>th</sup> century, speak of the existing knowledge and interest. The science of fungi, mycology, was a young discipline that was just given a name in 1836 (Ainsworth 1976), representing a challenge for a generation of educated people in Serbia, mostly high school teachers (Ivančević 2014).

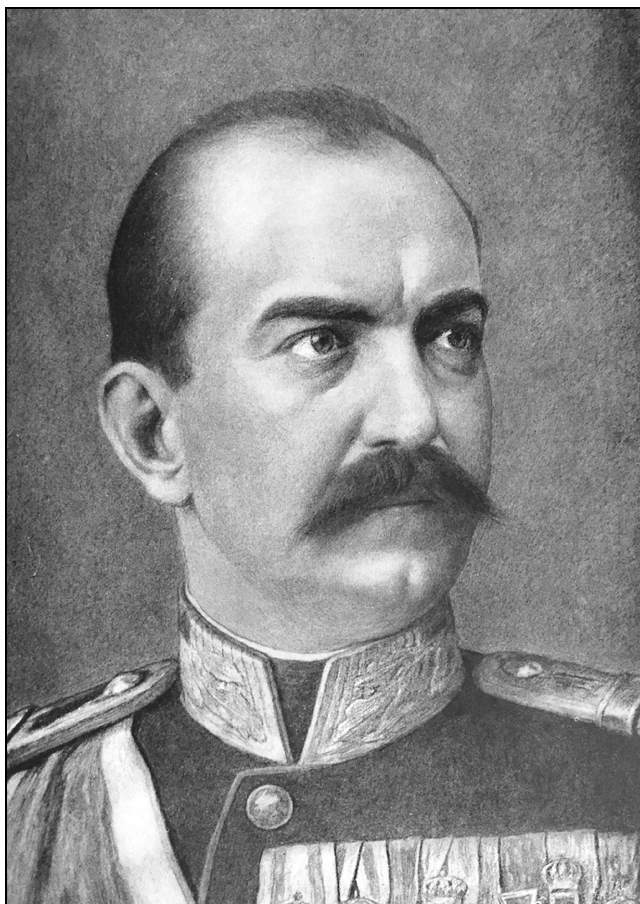


Fig. 1. – King Milan Obrenović, the initiator of the first organized research into hypogeous fungi in Serbia.

The case of truffle research in Serbia, initiated by King Milan Obrenović (Fig. 1.), testifies to the fact that botany professors who taught at the Great School, which later became the University of Belgrade, were actually familiar with fungi (Ivančević 2016). Stevan Jakšić (1862–1899), professor of botany at the Great School, also participated in this research. He published data (Jakšić 1896) on several species of gasteromycetes that were found and listed, as well as on specimens of black truffles (*Tuber* sp.).

One of J. Pančić's students and his assistant in the Botanical Cabinet of the Great School, Živojin Jurišić (1863–1921), also wrote in detail about these explorations of hypogeous fungi and the relevant findings (Fig. 2.).

A scientist with a broad education, primarily a botanist, he worked as professor at the Second Belgrade High School and curator in the botanical cabinet from 1888 (Vlajković 1970). He was one of the initiators and the founder of the Museum of Serbian Land in 1895, today's Museum of Natural History in Belgrade. He later also worked as curator botanist in the museum, from 1911 until his death in 1921 (Jurišić 1966). He was appoin-



Fig. 2. – Živojin Jurišić, the author of pioneering mycological articles in Serbia.

ted manager of the university botanical garden “Jevremovac” in 1899, while he simultaneously worked as a botany lecturer at the Great School. Besides seed plants, he also studied mosses (Jurišić 1900) as one of the first bryologists in Serbia (Pantović & Sabovljević 2017). His texts on hypogeous fungi (Jurišić 1897, 1899) are among the oldest expert mycological publications in Serbia. In addition to citing scientific mycological data, Ž. Jurišić was involved in education and wrote about the possibilities of collecting hypogeous fungi and their economic value. These pioneering steps were however forgotten until the beginning of the 21<sup>st</sup>

century, the expansion of the commercial collection of truffles, and the discovery of their abundance in the forests of present-day Serbia.

At this time, as the 19<sup>th</sup> century changed into the 20<sup>th</sup>, several local authors, mostly secondary school teachers, were engaged in the research of fungi in Serbia. The most prominent among them was Nikola Ranojević (1869–1922), who worked as a teacher in the high schools in Šabac and Pirot, and later in the Second High School in Belgrade (Fig. 3.). From 1900, he was the acting expert on plant diseases at the Ministry of Economy. He founded a laboratory for the investigation of diseases of cultivated plants and was its manager until he passed away. He was also an associate, and held the title of honorary curator, of the Natural History Museum in Belgrade. His collection of fungi and expert library were destroyed during World War I, with the exception of a small number of specimens that are now kept in the Natural History Museum in Belgrade. He was the author of a large number of articles with many published data on fungi in Serbia and discovered several new species. One genus of fungi



Fig. 3. – Nikola Ranojević, one of the pioneers of serious scientific mycological research in Serbia.

was named *Ranojevicia* Bubák in his honour in 1910, and this name remained in science to this day.

### The Period between the Two World Wars

In 1905, the Great School transformed into the University of Belgrade with several separate Faculties. In that period, after the great enthusiasm of the late 19<sup>th</sup> and early 20<sup>th</sup> century, the study of fungi at the faculties was mostly incidental, and none of the university botanists took up this area as their main field of research. Therefore, the extensive article by Petar Đorđević (Đorđević 1928), a professor at the Faculty of Agriculture in Belgrade, devoted exclusively to slime moulds (*Myxomycota; Mycetozoa*), represented an exception and was the result of secondary interest. In his work, in addition to the data on species, P. Đorđević also provided a dichotomous key for plasmodial fungi found in Serbia, based on Lister's classic monograph (Lister 1911). In the same text, P. Đorđević even described two new species of myxomycetes. However, as the new taxa were not described in line with the principles of botanical and mycological nomenclature, and no evidence specimens were preserved, these names must be treated as *Nomen nudum* (Ing & Ivančević 2000). The later development of science will show that slime moulds had phylogenetically separated from fungi a long time ago, and are today classified in the completely different kingdom of *Protozoa*. However, according to tradition, this group is still studied today mainly by mycologists, while the historical aspect of the research of slime moulds is studied within the framework of the history of mycology. Regardless of the above, the period that lasted until the end of the Second World War did not generate any greater interest in the fundamental study of fungi at biology studies in institutions of higher education. To some extent, this period coincides with the decline of classical botanical research in Serbia, also reflected in the stagnation of the Herbarium of the University of Belgrade (Vukojičić *et al.* 2011).

In the period after the First World War and building on the achievements of previous researchers, it was Vojteh Lindtner (1904–1965), curator at the Natural History Museum in Belgrade (Fig. 4.), that was engaged in mycology in Serbia and the newly created state of Yugoslavia (Ivančević 1997). He graduated from the classical gymnasium in Ljubljana in 1923, where he received the prestigious Saint Sava award for research work at the secondary school level and the study of fungi. After that, he studied mining in Ljubljana and Saint-Étienne, following which he enrolled at the Faculty of Philosophy and devoted himself to biology and botany. He was a man of wide interests and extensive education. He was interested primarily



Fig. 4. – Vojteh Lindtner, a renowned mycologist from Yugoslavia and Serbia.

in fungi, but also in flowering plants as a skilled florist. He came to Belgrade in 1932 and, one year later, started working as a volunteer mycologist in the university botanical garden “Jevremovac”. He got a job at the Museum of Natural History in Belgrade in 1940, where he stayed next 25 years, until the end of his life. He compiled a large collection of fungi that later grew into today’s National Fungarium at the Museum of Natural History. He wrote a large number of scientific articles on fungi, two of which were voluminous monographs on smuts (*Ustilaginomycetes*) and downy mildews (*Peronosporaceae*) of Yugoslavia (Lindtner 1950, 1957). He described some 20 new taxa of fungi and plants, and - in his honour - other authors named numerous species of fungi after him. The famous Czech mycologist with whom he collaborated, Albert Pilát, described the new genus *Lindtneria* Pilát in 1938. As the only mycologist, V. Lindtner was lonely for a long time in what was then Serbia and Yugoslavia, until Milica Tortić (1920–2008), a famous researcher and mycologist from Zagreb (today’s Republic of Croatia), started to research fungi in the early 1960s.

### **Mycology at the Faculty of Biology in Belgrade**

Until the Second World War, contents related to algae, fungi and lichens were taught to biology students as part of various botanical courses. Classes were taught by eminent and respected professors such as Nedeljko Košanin, Ljubiša Glišić and Stevan Jakovljević who, however, did not primarily deal with these groups (Stanković 2013). The conditions for the separation of these groups and the development of mycology at the future Faculty of Biology appeared with the arrival of Radivoj Marinović (1902–1981) as lecturer and later professor at the Botanical Institute of the Faculty of Science and Mathematics in Belgrade in 1949. (Fig. 5.) R. Marinović was engaged in botanical research even before the Second World War, mostly in the area of *Negotinski rit* (Negotin Mire) (Blaženčić 1989). He was supported in this endeavour by his professor, the famous Serbian botanist Nedeljko Košanin. R. Marinović opted for algae, one of the groups within the so-called group of “lower plants”, as algae, fungi and lichens were all called at the time. He devoted dozens of scientific papers to the



Fig. 5. – Professor Radivoj Marinović, the author of the first specialized mycology textbook for biology students in Serbia.

flora and vegetation of algae (Blaženčić 1989) and was also the author of a university textbook on this topic (Marinović 1971). On a smaller scale, he also devoted himself to lichens, complex organisms where the fungus is the dominant partner in symbiosis with algae. This mycological part of his opus included several scientific works (Marinović 1961, 1963, Marinović & Bata 1967, Marinović & Stanković 1972), one expert paper (Marinović & Bata 1959) and one scientific-popular text (Marinović 1953).

During the years of his highly fruitful work at the Botanical Institute and the Botanical Garden of the then Faculty of Science and Mathematics in Belgrade, he significantly improved and expanded the teaching at the Department of Botany with new disciplines: anatomy and morphology of plants and systematics of lower plants, which also included microbiology. Special departments for these disciplines were formed later, in the 1970s and 1980s. Although he was not primarily a mycologist, when he published the first modest mycology textbook (Marinović 1952) R. Marinović laid the foundation for future mycology studies at the Faculty of Biology and their further development. This was an act of extraordinary pedagogical responsibility and a pledge for a future where students finally had something tangible on which to base the development of their knowledge, interest and love of mycology. Some 20 years later, he published a more extensive mycological textbook (Fig. 6.) that presented the systematics, morphology and biology of fungi, including lichens (Marinović 1973). This publication was highly valuable and served as the foundation for the development of mycology teaching at the Faculty of Science and Mathematics and later the Faculty of Biology. The textbook was used for many years and was re-printed twice without any changes (Marinović 1981, 1988). Numerous generations of students and future mycologists acquired their initial knowledge precisely from this textbook, thus becoming familiar with the kingdom of fungi.

At the time when professor R. Marinović faced the challenge of writing the first specialised mycology textbook in Serbia, there were almost no traditional names of fungi in the Serbian language and no consensus on expert terms in mycology. Fungi were also studied within the field of phytopathology at the Faculty of Forestry in Belgrade, but with an emphasis on mycoses (Josifović 1951), where specific mycological terms were often provided only in Latin. In his textbook, professor R. Marinović introduced and consistently implemented certain terminological principles. He, too, used only scientific names in Latin for the names of fungi species, thus avoiding problems with creating and inventing (previously non-existent) names in Serbian. On the other hand, for the terms that were by then already introduced into the Serbian mycological terminology, and which related primarily to the morphology and anatomy of fungi, he

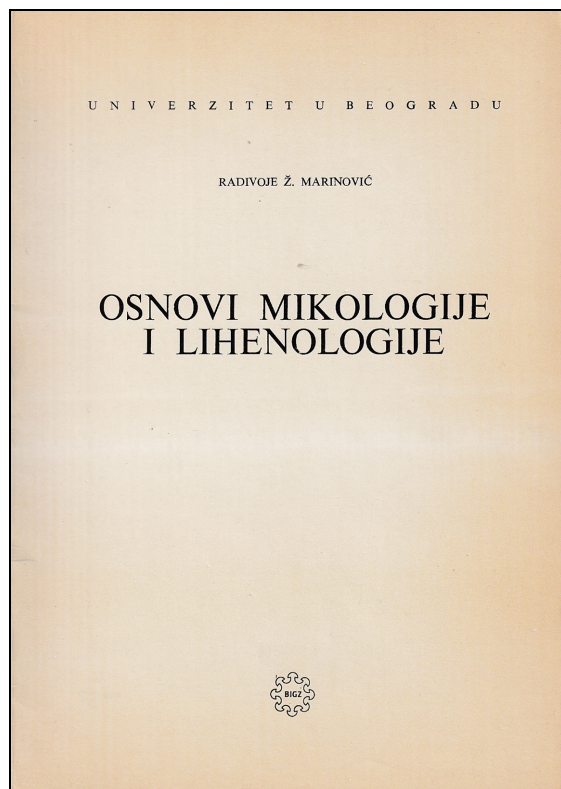


Fig. 6. – The first edition of Marinović's mycology textbook, published in 1973.

applied the principle of borrowing from foreign languages, mostly Latin, that was in line with the current orthographic rules that applied to borrowing words from foreign languages, the so-called 'words of others'. According to the then valid Orthography of *Matica Srpska* and *Matica Hrvatska* (Aleksić *et al.* 1960), words taken from classical languages - Greek and Latin - were written in the Serbian language in Latin and Cyrillic alphabets the way they were pronounced. In pronunciation, their form was adapted to the forms of native words. Almost identical rules apply in today's Serbian language. He also standardised the grammatical genders in which certain terms were adopted; for example, he standardised the term *мицелија* (mycelium) instead of *мицелијум*, etc. Although professor R. Marinović did not explain this in his textbook, he consistently applied the terminology and rules, thus building the basis for the further methodological development of mycology in Serbia. Later, Maria Muntañola-Cvetković, a Professor of the Faculty of Biology, consistently took over these principles and explained them, providing them with additional scientific legitimacy (Muntañola-Cvetković 1987). Unfortunately, despite these

firmly and systematically laid foundations in mycological terminology, not all future authors consistently adhered to these established and well-thought-out principles and rules.

In the mid-1960s, professor R. Marinović headed the Department of Botany at the Biology Department of the Faculty of Science and Mathematics in Belgrade. His assistants were Jelena Blaženčić, on the subject of Plant Morphology (she later opted for algology), and the slightly older Milutin Jelić (1931–1980), on the subject of Systematics of Lower Plants. M. Jelić (Fig. 7.) was the first assistant who fully devoted himself to mycology (Blaženčić 2013, Stanković 2013). Due to the large number of students in Plant Morphology, M. Jelić helped in that subject as well. There are indications that it was the famous professor of ecology from the same Faculty, Milorad Janković, who suggested this field of work and directed him towards mycology (Blaženčić 2013). This is quite understandable since

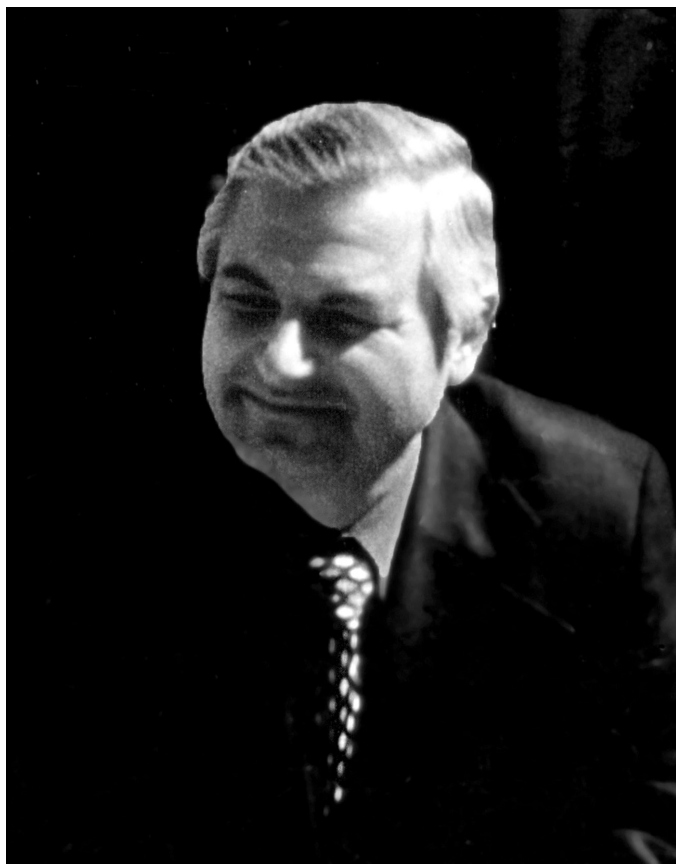


Fig. 7. – Milutin Jelić, the first mycologist in the Biology studies; one of the few surviving photographs, 1976.

M. Janković started his career at the Museum of Natural History in Belgrade next to mycologist V. Lindtner, where he got well acquainted with the potential of the advancement of science of fungi. At the same time, he was extremely creative, with many ideas he used to inspire his associates and direct them towards different domains of biology and ecology. It is therefore not surprising that after he came in contact with professor M. Janković, Jelić opted for an approach inspired by plant ecology and phytocenology in his mycological research. He studied the relationship between fungia, fungal populations and plant communities.

At the time when M. Jelić was just starting his career at the University of Belgrade, V. Lindtner suddenly died in 1965. M. Jelić thus remained the only expert mycologist, as there was no one else in the Botanical Institute and the Botanical Garden in Belgrade who dealt with fungi. That is when he contacted M. Tortić from Zagreb, one of the most important mycologists in Yugoslavia whose career was just gaining momentum. Their collaboration resulted in fruitful work, M. Jelić's professional advancement and joint scientific papers, starting at the end of the 1960s (Tortić & Jelić 1969) and lasting until almost the end of the 1970s (Tortić & Jelić 1977). As Yugoslav representatives, they participated together in the Committee for Mapping of European Macromycetes (Institut for Sporeplanter, under the direction of Prof. M. Lange) in Copenhagen. M. Jelić always treated M. Tortić with exceptional and deep respect (Blaženčić 2024). For the first time, there was an expert at the Department of Botany in Belgrade who devoted himself entirely to mycology, primarily to mushrooms and other so-called macro fungi. According to his collaborators, he was well-liked among his colleagues, known by the nickname Cale, very diligent in field work and collecting materials. He also invested much time, effort and attention to writing and publishing (Blaženčić 2024). In addition to working together with M. Tortić, he also engaged in independent research and publication of scientific papers. After V. Lindtner, he was the first to explore the area of *Deliblatska peščara* (Deliblato Sands) (Jelić 1964 [1961]), the region of unique sandy habitats in Serbia. Together with experts from the Museum of Natural History, he participated in the research of the Djerdap gorge before it was submerged to enable the construction of the Djerdap hydroelectric plant. He later published valuable data and results of that research (Jelić 1966, 1968). The only mycological material that was collected personally by M. Jelić and is still preserved today are the two herbarium boxes of dried specimens which are kept in the Natural History Museum in Belgrade. These originated solely from his explorations in the Djerdap area. Unfortunately, there is no any material from his collection in the Herbarium of the University of Belgrade, so published scientific articles are his main legacy.

Further mycological research led M. Jelić to the area of Mt. Fruška Gora in Vojvodina (Serbia), and he planned to use the collected data for the preparation of his doctoral dissertation. He received great support from his mentor, professor M. Janković. Unfortunately, he tragically lost his life in the evening hours of 11 July 1980, when he was hit by a car on his way home from the Botanical Garden after a full day's work (Blaženčić 2013, Savić 2016). This tragic accident ended a life, but it also marked the end of the momentum of research into ecology of macro fungi that M. Jelić pioneered. His research results from Mt. Fruška Gora were never found following his death. Also, part of the archive of the Faculty of Science and Mathematics containing M. Jelić's work file was destroyed in a flood. Thus, the memory of the first researcher dedicated entirely to mycology at the Botanical Institute and the Botanical Garden of the University of Belgrade (Fig. 8.) remained pale and blurred to future generations, and information about him was difficult to find. M. Tortić honoured M. Jelić in her work with colleague Alix David (Tortić & David 1981), naming a new species of fungi after him: *Skeletocutis jelicii* Tortić & A. David (1981). This species is still valid today, and has been moved to the genus *Ceriporiopsis* [*Ceriporiopsis jelicii* (Tortić & A. David) Ryvardeen & Gilb.]



Fig. 8. – M. Jelić (fourth from the left in the front row) with colleagues from the Institute of Botany in Belgrade, 1973.

Born in Barcelona, Maria Muntañola-Cvetković (1923–2011) came to Belgrade in 1960. (Fig. 9.) She completed her studies in Argentina, where she devoted herself to the study of micro fungi (Vukojević 2012). After arriving in Yugoslavia, she founded the Mycological Laboratory at the Institute for Biological Research “Siniša Stanković”. She also became a Professor at the Faculty of Science and Mathematics in Belgrade. The laboratory was a highly regarded place where numerous domestic and foreign students were educated and worked under her supervision. A top



Fig. 9. – Maria Muntañola-Cvetković, the scientist who introduced the concept of fungi as a separate kingdom to Yugoslavia and Serbia.

scientist of world renown, she taught the subject of Phytopathology in biology studies. She discovered and described 8 new species of fungi, and led numerous domestic and international scientific projects. She was the first in Yugoslavia to publish the then revolutionary position that fungi are fundamentally different organisms compared to plants, and that their systematisation must be based on phylogeny (Muntañola-Cvetković 1978). The presented conclusion was that the differences are so great that fungi belong to kingdom that is completely separate and distinct from that of

plants. This development had been causing a bit of stir in the world's academic community for quite some time, but thanks to the authority of M. Muntañola-Cvetković it was quickly and widely accepted in Serbia. In this way, she laid a stepping stone that was followed by numerous changes in the knowledge of fungi and the attitude towards them in our country (Ivančević 2014). She paved the way in the educational system for the realisation that plants and fungi are different taxonomic kingdoms, and since then school textbooks in Serbia describe fungi as a separate kingdom. Consequently, the public started to accept this previously strange idea much earlier than in most other countries (Ivančević 2014). All this later had significant consequences on the positive attitude towards the protection and conservation of fungi in Serbia.

At that time, valuable information from R. Marinović's textbook on the morphology and systematics of fungi had to be supplemented and harmonised with the changed paradigm, knowledge and new concepts in mycology. The new university textbook (Muntañola-Cvetković 1987) brought about significant novelties and additions to mycology studies (Fig. 10.), which until then were based on R. Marinović's valuable, but by that

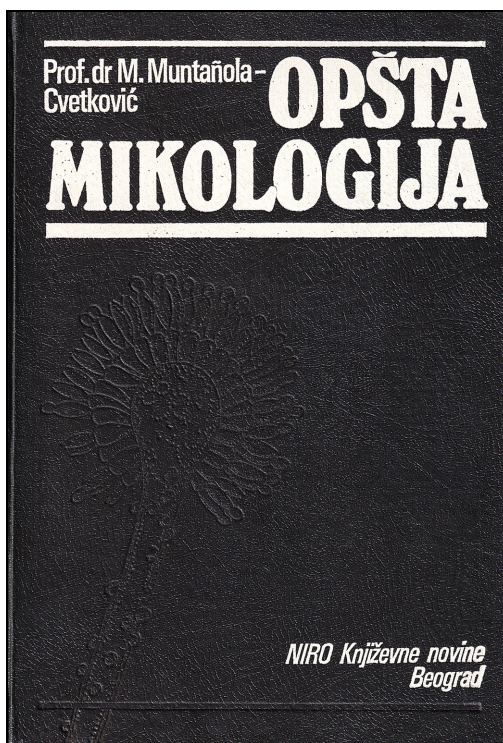


Fig. 10. – The key textbook of general mycology by Muntañola-Cvetković.

time incomplete and slightly outdated book. The new data on the phylogeny and peculiarities of the taxonomy of fungi brought by M. Muntañola-Cvetković broadened the picture that existed earlier. The chapters on the genetics and variability of fungi, on their feeding and metabolism, the ecological factors that affect them and their significance for mankind, as well as the laboratory practicum, widely opened the door to the strong penetration of modern science of fungi and a wide range of its disciplines and topics significant for biology studies at the University of Belgrade. They also shed light on new, complex areas and symbiotic interactions of fungi with other organisms (Ivančević & Muntañola-Cvetković 1988). A publication on mycorrhiza, a phenomenon that reached the epicentre of the world's mycological research at the time (Ivančević 1993), was published for these reasons (Fig. 11.), primarily for the purpose of acquainting and teaching students. M. Muntañola-Cvetković's scientific work in Belgrade was interrupted by the breakup of Yugoslavia and the civil war that started in 1991, which is when she left for Spain.

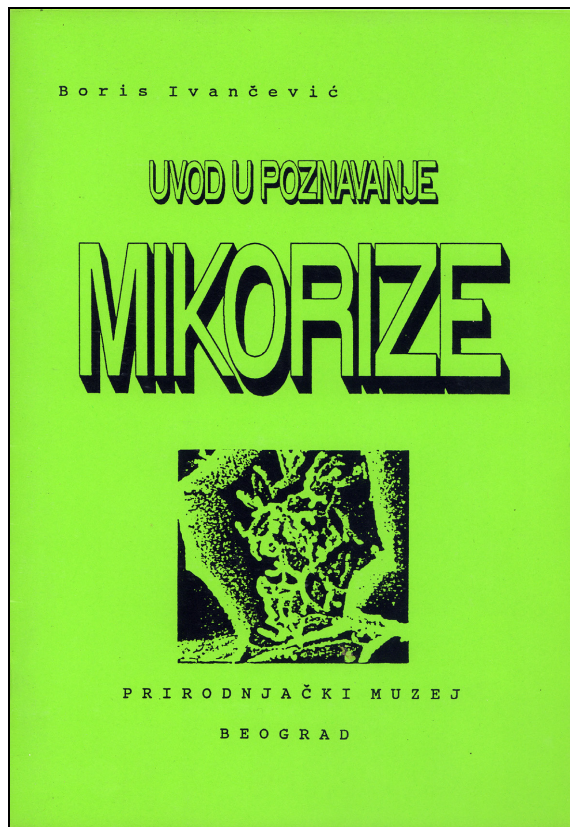


Fig. 11. – New Areas in Mycology Studies – a student booklet on mycorrhiza from 1993.

The knowledge accumulated at the end of the 1980s and the scope of the course on the so-called “lower plants” caused their separation from the framework of classical botany and the continuation of the process of forming new departments that was started by professor R. Marinović. Thanks to the efforts and initiative of professor J. Blaženčić, a special Department of Algology, Mycology and Lichenology (Stanković 2013) was established in 1988 at the Biology Department of the Faculty of Science and Mathematics in Belgrade. After a century of development of mycology within the biology studies at the University of Belgrade, this marked the beginning of a completely new chapter in the study of this area of science. Since then and up to the present day, biology students have been enriched with new knowledge in mycology conveyed by the current teaching staff and associates of this Department, where extensive and modern research on various groups of fungi is currently being conducted.

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## ПРВИ ВЕК РАЗВОЈА МИКОЛОГИЈЕ НА СТУДИЈАМА БИОЛОГИЈЕ УНИВЕРЗИТЕТА У БЕОГРАДУ (1890–1990)

БОРИС Н. ИВАНЧЕВИЋ

### РЕЗИМЕ

Након ослобођења од Османлијског царства почетком 19. века, у Србији почиње нагли развој науке и разних дисциплина међу којима је и микологија. Већ крајем 19. века се појављују први значајни текстови са подацима о гљивама са овог подручја. Истовремено се постепено формира Универзитет у Београду и касније у оквиру њега Биолошки факултет. У тексту се приказује развој проучавања микологије на Биолошком факултету од тада па до краја осамдесетих година 20. века. Дефинисани су и анализирани кључни моменти, главни покретачи и најзначајнији истраживачи-миколози који су поставили темеље и развили изучавање микологије на студијама биологије. Подаци о некима од њих не постоје у писаним изворима или их је веома тешко пронаћи.