

HISTORY TO THE STUDY OF ECTOMYCORRHIZAL FUNGI  
OF ARMENIA (FAMILY RUSSULACEAE)

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In this article the data of distribution and the study of ectomycorrhizal fungi from family Russulaceae, detected in Armenia are summarized. The paper presents both historical information on the studies of these species and the results of mycological studies of recent years.

**Keywords:** Agarical basidiomycetes, ectomycorrhizal fungi, family Russulaceae, plant associations.

Agaricoid basidiomycetes are very interesting groups of organisms, which have a great function in natural ecosystem. They are important elements of the food chain in biocenosis, and forest's coexistence cannot survive without those. These fungi participated in organic mineralization of nutrients and the formation of humus. Mycorrhizal fungi have great significance in forest ecosystem. They are very important especially for poor soils and without them, the forest's existence would be impossible.

The hyphal network of mycorrhizal roots greatly increases the access and uptake of water and mineral nutrients. Mycorrhizas greatly increase rooting volume physiology, which translates to faster growth and a shorter production cycle [1]. Mycorrhizas also protect roots against pathogenic root fungi due to both the physical effects of a mycorrhizal-produced chitin cell wall covering and certain chemical effects such as antibiotic exudates [2].

The species from family Russulaceae are a specific group of ectomycorrhizal fungi, which grow in coniferous and broad-rooted forests. They have very important role in plant associations and contribute to the growth and development of many valuable plant species. According to the literature, these mushrooms have a growth-stimulating effect on pine seeds and plantations and promote plantations life-enhancing [3].

It should be noted, that in Armenia the diversity of the family Russulaceae is not studied purposefully, although they are quite spread in the republic and have a great interest from industrial point of view. As a matter of fact, a comprehensive study of this group of fungi should be done make ecological and regulatory analyzes, to investigate their spread areal in Armenia, generalize the literature data published so far.

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The first notes about Armenian flora, including the fungi one can meet in publications of great naturalist and physician of the 15<sup>th</sup> century Amirdovlat Amasiatsi [4]. In his “Unnecessary for Ignoramuses” publication, he provides unique and concise information about Transcaucasia, the Small Caucasus and the Balkan flora. There are some information about macromycetes, too. So, he mentions some truffles (*Tuber album*, *T. brumale*, *T. melanosporum*), bracket fungi (family Polyporaceae) and ergot fungi (*Claviceps purpurea*), their useful properties and show different recipes of application [5].

Later, at the beginning of the 20<sup>th</sup> century, new data about fungi detected in Armenia have been received which were mainly brought by non-mycologists and were characterized by randomness, for example, Yu. Voronov’s work (1915), who was studying the flora of the Caucasus and have mentioned some species of macromycetes, which were collected from Armenia, especially *Battarrea phalodes* gasteroid fungi, found in Ijevan Region [6].

V.V. Voronikhin in his book “Materials about the Flora of the Caucasus”, which was published in 1927, notes about 1073 species of fungi. From these fungi 12 species belong to Agaricomycetes and 3 species belong to Gasteromycetes and Heterobasidiomycetes [7].

Mycological studies in Armenia started in 1930 by D.N. Terevnikova-Babayan and A.A. Babayan. They have given a list of 193 species of fungi in Armenia, where also have been mentioned about some species of ectomycorrhizal macromycetes [8].

Targeted studies of cup fungi in Armenia begun in the 1950s, by D.N. Terevnikova-Babayan. She presented data in collaboration with D.P. Cholakhyan. The article provides detailed information about 46 cup fungal species, 9 of them belong to family Russulaceae.

Withal, 3 species from genera *Lactarius* are described: *Lactarius flexuosus*, *L. torminosus*, *L. pallidus*. 6 species from genera *Russula* are presented: *Russula delica*, *R. lilacea*, *R. fragilis*, *R. foetens*, *R. rubra*, *R. xerampelina* [9]. Later, a brochure based on these data was published by Terevnikova-Babayan “Edible and poisonous mushrooms of Armenia and their use” [10].

In 1998 Nanagulyan and Taslakhchyan have noted, that in terms of territoriality the North-Eastern part of Armenia is the most studied. The physico-geographical conditions of this region are quite favorable for growth of mushrooms [8].

In her article J.H. Melik-Khachatryan presented data about 47 species of fungi, 16 species of them belong to the family Russulaceae, moreover, 7 species (*Russula nigricans*, *R. heterophylla*, *R. lutea*, *R. chamaeleontina*, *Lactarius deliciosus* Fr. var. *pini* Vassilkov., *L. insulsus*, *L. rufus*) are mentioned for the first time in Armenia [11].

The data of studies of mycoflora in the North-Eastern part of Armenia are summarized in the monograph of J.H. Melik-Khachatryan [12]. She summarized her long-term research results in the 5<sup>th</sup> multivolume publication of “Mycoflora of Armenia”. The author gives data about 392 species of agarical fungi, noting that in the Republic of Armenia they are presented with more species, than other macromycetes. With its diversity the mycorrhizal family Russulaceae with 44 species is remarkable [13].

In mycobiota study, especially species distributed and common in state preserves have great significance. Studying the macromycetes of Dilijan and Khosrov State Reserves has begun since 1977. The results of these researches were summarized

in the monograph of S.G. Nanagulyan and M.G. Taslakhchyan, where 636 species of fungi were described from two reserve areas, including 42 species, which belong to family Russulaceae and they were met only in Dilijan State Reserve [14].

Later, summarizing the results of her long-term research, S.G. Nanagulyan published a number of articles and a book, in which data of about 565 species of Agaricomycetes are presented. The family Russulaceae is presented with 64 species: genus *Lactarius* with 31 and genus *Russula* with 33 species [15, 16].

L.V. Margaryan has comprehensive studies of macromycetes composition of the species in the Shikahogh State Reserve of the Republic of Armenia. For the first time there has been targeted research on the diversity of macromycetes in this reserve. There are 436 species of macromycetes in the studied area, which belong to 176 genera, 74 families, 22 orders, 7 classes, 2 subdivisions and 2 divisions: Ascomycota and Basidiomycota. Found macroscopic fungi of leading families systematic analysis showed that Russulaceae family is represented by 26 species, which is 5.9% of the total number [17].

Since 2015 we have created the database of mycorrhizal fungi of Armenia, which will serve as a basis for our further works. The database of mycorrhizal fungi includes 211 species of macromycetes, which belong to 32 genera and they are included into 20 families. The analysis of symbiotrophic or ectomycorrhizal fungi database has shown, that the presented families leaders are Boletaceae (*Boletus*, *Chalciporus*, *Leccinum*, *Suillus*) and Cortinariaceae (*Cortinarius*, *Hebeloma*, *Inocybe*, *Rozites*) with 4 genera, and Russulaceae (*Lactarius*, *Russula*), Tricholomataceae (*Laccaria*, *Tricholoma*), Amanitaceae (*Amanita*, *Amanitopsis*), Gomphidaceae (*Gomphidius*, *Chroogomphus*), Thelephoraceae (*Sarcodon*, *Thelephora*) with 2 genera. The mycorrhizal fungi of the database account the 17% of the republic's 1220 species of macromycetes. In database genera *Russula* is presented with 32 and *Lactarius* with 31 species [18].

Thus, our investigation has shown that in the territory of the Republic of Armenia 64 species of mycorrhizal fungi from family Russulaceae are found, which are distributed in Ijevan, Aparan, Lori, Zangezur and Sevan Floristic Regions.

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