The Diversity and Ecology of Macromycetes on Soils of Adjara, Georgia

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Abstract. The publication is devoted to the study of the diversity of the species composition of macromycetes on different soils of Adjara, Georgia. The aim of the study was to identify and determine the composition of different macroscopic fungi in different soils; establishment of the scale of development and spread of macromycetes in adverse and favorable conditions. Morphological features of collected fruiting bodies, such as shape, size, colour, odor, hymenophore and velum types, etc., were analysed. Spore slides were prepared in glycerin and fuchsin acid and observed under a light microscope. Some samples were isolated on a Malt agar medium, and macroscopic and microscopic characteristics of isolates were observed for precise identification. Identifications were done using relevant literature. At locations in the outdoor area and in the greenhouse, a total of 165 macrofungal species were recorded fruiting on soil, between them 35 species are considered edible, 14 poisonous, while 106 species are inedible. Most of the species belong to the division Basidiomycota (151) and only 14 to the division Ascomycota. Identified species distributed in 5 Classes, 13 Orders, 36 families and 68 Genuse. The highest number of soil-inhabiting basidiomycetous macrofungal species was in the forest soil plot (116), followed by the Pasture soil (29). The on families with the highest number of species was Russulaceae (17%), Agaricaceae (15%), Boletaceae (12%), Cortinariaceae (9%) and Psathyrellaceae - 8%. The remaining 31 families -39%. Lactarius, Cortinarius, Russula, Amanita and et al., were the richest genus. All 6 substrates studied, it observed that the species that had a higher frequency were Agaricus subrufescens, Calvatia cyathiformis and Leucocoprinus cretaceus, occurring in soil, soil/litter and pasture. On the other hand, Agaricus campestris, A. rufoaurantiacus, Chlorophyllum hortense and Volvopluteus earlier among others, were collected only from two substrates (soil/and plant residue). The other genera (most of it) occurred in only one substrate. Peaks macromycetes was in May and October, when the average temperature remained between 22 - 26°C and relative humidity between 78% and 92%. The occurrence of macromycetes was higher in May, when the temperature was milder and stable on average 24°C. Found that Adjara support a large and diverse community of macrofungi fruiting on soil, many species of which are previously undiscovered and undescribed. On this basis, works of longer duration and more intensive sampling are needed to
obtain data regarding fungal communities, with more attention to specific variables such as microclimate, soil moisture, soil type, soil pH and vegetation types.

1. Introduction
Soil is the habitat for algae, bacteria, fungi, viruses and protozoa. Among them, fungi are crucial for the environment as well as for the production of food. They recycle soil nutrients and generally have a symbiotic relationship with most plants. Fungi provide diverse physical, chemical and biological habitats, are found in large numbers in soil usually between one and ten million per gram of soil [1, 2]. Fungi hold key roles in overall ecosystem processes [3-11]. Knowledge of the diversity of fungi has considerable significance, especially from the aspect of their role in biodegradation, i.e., degradation of plant residues and carbon cycles in nature, as well as in synthesis of various biologically active agents. However, despite their functional importance, they are often overlooked and left out of conservation initiatives [12, 13, 14]. Studies of soils fungi in the Adjara, Georgia began 35 years ago [15, 16]. In this region, soil Mycromycetes is well studied [17, 18]. As for the soil macroscopic fungi of Adjara, the present time has not been studied.

Outcomes of this, the purpose of this study was to investigate the diversity of macromycetes in outdoor areas and the greenhouse of the Adjara; Establishment of the scale of development and distribution of fungi in adverse and favorable conditions; to determine whether specific environmental conditions and floristic content have effects on their development.

2. Materials and methods
The object of the study was various soils and fungi in the 5 ecosystem of the Adjara. The samples were collected from the 37 points: Adjaria, Georgia, in the vicinity of Batumi Botanical Garden; Kobuleti (Cixisdziri, Chakvi, Cecxlauri, Alambari, Mīrala); Khelvachauri (Acharisckali, Akhalsheni, Chutuneti, Gonio, Kvariati, Mirveti, Sarfi); Keda (Dandalo, Tshmorisi, Pirvelimaisi, Kvashta, Kokotauri); Xulo (Agara, Didachara, Khikhadziri, Saxalta, Oktomberi, Dioknisi, Danisparauli, Beshumi, Goderdzi, Khikhadziri, Sarichairi Mountainous Adjara); Shuakhevi (Akhaldaba, Baratauli, Buturauli, Chvana, Gogadzeebi, Kidzinidzeebi, Intskirveti, Shubani).

Collections of these species have been examined by standard light microscopy (Pereval, Carl Zeiss, Jena and Olympus, BX50, Hamburg, Germany). The SEM micrographs have been prepared by means of a JSM-35 (Japan) SEM microscope. The specimens examined are deposited at HAL, KW and TGM (23). Species identification was based on the morphological characteristics of single-spored isolates as described by [19, 20].

2.1. Isotypos
LAB M F BSU (Laboratory Mikologi and Fitopatologi, Batumi Shota Rustaveli State University, Adjara, Georgia).

2.2. Sterilization technique
Petri plates, media bottles, distilled water, syringes were sterilized in the autoclave. For sterilization purpose, all apparatus was autoclaved for 30 minutes at 121°C. After autoclaving, all sterilized material was dried in an oven at 90°C.
2.3. Isolation of fungi
Fruiting bodies were photographed in natural habitats and data on the substrate, neighbouring plants and collection dates were noted. Morphological features of collected fruiting bodies, such as shape, size, colour, odor, hymenophore and velum types, etc., were analysed. Spore slides were prepared in glycerin and fuchsin acid and observed under a light microscope (Zeiss Axio Imager M.1, with AxioVision Release 4.6 software). Some samples were isolated on a Malt agar medium, and macroscopic and microscopic characteristics of isolates were observed for precise identification.

2.4. Identification of fungi
Identifications were done using relevant literature [21-26]. Fungal classification and nomenclature are in compliance with Index Fungorum, and a list of species is presented in alphabetic order. Species were also classified in the ecological-trophic groups defined by Arnolds [27].

3. Results and discussions
3.1. Systematic analysis of macromycetes
During the longterm survey period at locations in the outdoor area and in the greenhouse In total, 163 macrofungal species were recorded fruiting on soil. Most of the species belong to the division Basidiomycota (151) and only 14 to the division Ascomycota. Identified species distributed in 5 Classes, 13 Orders, 36 families and 68 Genuse (Table 1).

| Exciter Division | Class | Order | Family | Genus | Species |
|------------------|-------|-------|--------|-------|---------|
| Ascomycota       | Sordariomycetes | Xylariales | Xylariaceae | Xylaria | 3       |
|                  | Leotiomycetes | Helotiales | Cudoniaceae | Spathularia | 1       |
|                  | Pezizomycetes | Pezizales | Pezizaceae | Peziza | 2       |
|                  | Pezizomycetes | Pyronemataceae | Helvella | Helvella | 2       |
|                  | Pezizomycetes | Discinaceae | Gyromitra | 1       |
|                  | Pezizomycetes | Helvellaceae | Sarcoscypha | 1       |
|                  | Pezizomycetes | Sarcoscyphaceae | 1       |
|                  | Eurotiomycetes | Eurotiales | Elaphomycetaceae | Elaphomyces | 1       |
| Basidiomycota    | Agaricomycetes | Agaricales | Agaricaceae | 6       |
|                  | Agaricomycetes | Calvatia | 1       |
|                  | Agaricomycetes | Chlorophyllum | 1       |
|                  | Agaricomycetes | Copinus | 1       |
|                  | Agaricomycetes | Cystoderma | 1       |
|                  | Agaricomycetes | Cystoderma | 1       |
|                  | Agaricomycetes | Disciseda | 1       |
|                  | Agaricomycetes | Leucoagaricus | 2       |
|                  | Agaricomycetes | Leucocoprinus | 2       |
|                  | Agaricomycetes | Lycoperdon | 3       |
|                  | Agaricomycetes | Phaeolepiota | 2       |
|                  | Agaricomycetes | Phaeolepiota | 1       |
|                  | Agaricomycetes | Mutinus | 1       |
|                  | Agaricomycetes | Inocybe | 2       |
|                  | Agaricomycetes | Hygrocybe | 1       |
| Order                  | Family            | Genus          | Count |
|-----------------------|-------------------|----------------|-------|
| Amanitaceae           | Amanita           | 10             |
| Entolomataceae        | Clitopilus        | 1              |
| Cortinariaceae        | Cortinarius       | 12             |
|                       | Phaeocollybia     | 1              |
| Hymenogastraceae      | Psilocybe         | 2              |
| Marasmiaceae          | Gymnopus          | 2              |
|                       | Marasmius         | 2              |
| Nidulariaceae         | Cyathus           | 1              |
| Pluteaceae            | Volvopluteus      | 2              |
| Psathyrellaceae       | Coprinellus       | 5              |
|                       | Coprinopsis       | 1              |
|                       | Parasola          | 2              |
|                       | Psathyrella       | 3              |
| Physalaciaceae        | Flammulina        | 1              |
|                       | Armillaria        | 1              |
| Phleogenaceae         | Phleogena         | 1              |
| Pluteaceae            | Pluteus           | 2              |
| Nidulariaceae         | Cyathus           | 1              |
| Clavariaceae          | Clavaria          | 1              |
| Tricholomataceae      | Clitocybe         | 2-75           |
|                       | Rhizocybe         | 1              |
| Strophariaceae        | Kuehneromyces     | 1              |
|                       | Stropharia        | 1              |
| Cantharellales        | Cantharellaceae   | 1              |
| Gomphales             | Gomphaceae        | 1              |
|                       | Clavariadelphus   | 1              |
| Phallales             | Phallaceae        | 1              |
|                       | Aseroe            | 1              |
| Russulales            | Russulaceae       | 14             |
|                       | Lactarius         | 14             |
|                       | Russula           | 11             |
| Lycoperdales          | Lycoperdaece      | 1              |
|                       | Bovista           | 3              |
|                       | Calocybe          | 1              |
| Boletales             | Boletaceae        | 3              |
|                       | Boletus           | 3              |
|                       | Cyanoboletus      | 1              |
|                       | Harry             | 1              |
|                       | Imleria           | 1              |
|                       | Leccinellum       | 7              |
|                       | Leccinum          | 4              |
|                       | Pulveroboletus    | 1              |
|                       | Tuber             | 1              |
|                       | Paxillus          | 1              |
|                       | Pisolithus        | 1              |
| Sclerodermataceae     | Scleroderma       | 1              |
|                       | Phallaceae        | 1              |
|                       | Phallus           | 1              |
| Hymenochaetales       | Hymenochaetaceae  | 1              |
|                       | Coltricia         | 1              |

| Total Count           | 2                |
|                       | 5                |
|                       | 13               |
|                       | 36               |
|                       | 68               |
|                       | 165              |
The on families with the highest number of species was Russulaceae (17%), Agaricaceae (15%), Boletaceae (12%), Cortinariaceae (9%) and Psathyrellaceae - 8%, The remaining 31 families -39% (Figure 1). The in genus with the highest number of species was Lactarius, Cortinarius, Russula, Amanita and et al.

![Figure 1. Percentage distribution of fungi in different types of soil of Adjara](image)

Analysis of the collected species showed that only 35 species are considered edible, 14 poisonous, while 106 species are inedible. Among edible species (Figure 2), 6 species are from the genus Agaricus (A. arvensis, A. augustus, A. campestris, A. rufouarumtacius, A. sylvaticus, A. subrufescens), 5 the genus Laccaria (L. deliciosus L. eucalypti, L. laccata L. trivialis, L. volemus), 4 the genus Leccinum (L. aurantiacum, L. holopus, L. quercinum, L. scabrum), 3 the genus Russula (R. aeruginea, R. claroflava, R. cyanoxantha). The rest of the genera are represented by One or two species.

![Figure 2. Representative edible mushrooms occurring on the of Adjara: 1-Agaricus arvensis, 2-A. august, 3-A. campestris, 4-A. rufouarumtacius, 5-A. sylvaticus, 6-A. subrufescens, 7-Amanita caesarea, 8-Boletus edulis, 9-B. betulicola, 10-B. subtomentosus, 11-Bovista plumbea, 12-Calocybe gambosa, 13-Cantharellus cibarius, 14-Clitocybe gibba, 15-Clitopilus prunulus, 16-Coprinus comatus, 17-Cortinarius caperatus, 18-C. pulverulentus, 19-Kuehne-romyces mutabilis, 20-Lactarius deliciosus,](image)
21-L. eucalypti, 22-L. laccata, 23-L. trivialis, 24-L. volemus, 25-Leccinum aurantiacum, 26- L. holopus, 27-L. quercinum, 28-L. scabrum, 29-L. cretaceous, 30-Macrolepiota procera, 31- Marasmius oreades, 32-L. quercinum, 33-L. scabrum, 34-Russula aeruginea, 35-R. claroflava, 34-R. cyanoxantha, 35-Suillus granulates.

In the case of poisonous species (Figure 3), 8 species are from the genus Amanita (A. bisporiger, A. citrina, A. gemmata, A. muscaria, A. pantherina, A. porphyry, A. regalis, A. verna), three from the genus Inocybe (I. geophylla, I. napipes, I. rimosa), two from the genus Cortinarius (C. pavonius, C. sanguineus) and genus Paxillus (P. involutus).

Inter-annual variation of mushroom species diversity was also observed. Human activities contribute positively to mushroom diversity in the study area by creating some unique micro-habitats that support thximum conservation of mushroom diversity, conservation measures excuding all human activities should be avoided.

![Figure 3. Representative poisonous fungi occurring on the of Adjara: 1-Amanita bisporiger, 2-A. citrina, 3-A. gemmata, 4-A. muscaria, 5-A. porphyry, 6-A. regalis, 7-A. pantherina, 8-A. verna, 9-Cortinarius pavonius, 10-C. sanguineus, 11-Inocybe geophylla, 12-I. napipes, 13-I. rimosa, 14-Paxillus involutus.](image-url)

3.2. Ecological aspects of macromycetes

From Table - 2 it was that the highest number of soil-inhabiting macrofungal species was in the forest soil plot, followed by the pasture soil and greenhouse soils. Of the 165 species, 84 were known as ectomycorrhizal and 81 were considered saprotrofes. Considering all 6 ecosistem studied, it observed that the species that had a higher frequency were, Agaricus subrufescens, Calvatia cyathiformis, Leucocoprinus cretaceus and et al. occurring in soil, soil/forest, pasture, agricultural, green house, litter and lawn. On the other hand, Macrolepiota molybdites, M. procerca, Phallus ravenelii et al. were collected from some substrates. Agaricus campestris, A. rufopurpureus, Chlorophyllum hortense, Volvopluteus asiaticus, V. earlei and et al. - from two substrates. Lactarius eucalypti, L. indigo and et al. was the most often recorded ectomycorrhizal basidiomycetous macrofungus.

Observations, showed that occurrence peaks macromycetes was in May and October, when the average temperature remained between 22 - 26°C and relative humidity between 78% and 92%. The occurrence of macromycetes was higher in May, when the temperature was milder and stable on average 24°C, the monthly precipitation was well distributed around 126 mm and the average relative humidity of 92%. The occurrence of a long period without rainfall in March and April, as well as higher average temperature in the range of 28°C did not allow the growth of the mushroom, despite the relative humidity remaining around 83%. Despite the low rainfall in July and August, a small number of macromycetes found due to the temperatures around 22°C, which decreased
evapotranspiration. In November and April was recorded the lower occurrence of Agaricales. In periods where there was too much rain, the amount of collected samples decreased. Our findings suggest that spatial processes, perhaps dispersal limitation, and light availability were the most important factors affecting macrofungi community in broad-leaved forest. Similar results have been obtained by various researchers [27, 28, 29].

**Table 2. List of macromycetes collected in the Adjara**

| Fungi                        | Soil type          | Forest soils | Pasture soils | Agricultural soils | Greenhouse soils | Litter soils | Lawn soils | Ecological trophic groups |
|------------------------------|--------------------|--------------|---------------|-------------------|-----------------|--------------|------------|--------------------------|
| Cheilymenia granulata        | Ascomycota         | -            | -             | -                 | -               | -            | -          | S                        |
| Elaphomyces ranulatus        |                    | +            | -             | -                 | -               | -            | -          | M                        |
| Gyromitra esculenta          |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Helvella crispa              |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Helvella lacunosa            |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Humaria hemisphaerica        |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Peziza repanda               |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Peziza vesiculosa            |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Sarcoscypha coccinea         |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Spathularia flavida          |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Tarzetta catinus             |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Xylaria digitata             |                    | -            | -             | -                 | -               | +            | -          | S                        |
| Xylaria longipes             |                    | -            | -             | -                 | -               | +            | -          | S                        |
| Xylaria polymorpha           |                    | -            | -             | -                 | -               | -            | -          | S                        |
| Cantharellus cibarius        | Basidiomycota, Aphylloraphales | +   | -             | -                 | -               | -            | -          | M                        |
| Coltricia perennis           |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Ramaria stricta              |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Sarcodon imbricatus          |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Thelephora carophyllea       |                    | +            | -             | -                 | -               | -            | -          | M                        |
| Thelephora palmate           |                    | +            | -             | -                 | -               | -            | -          | M                        |
| Thelephora terrestris        |                    | +            | -             | -                 | -               | -            | -          | M                        |
| Amanita bisporiger           | Basidiomycota, Agaricales | +   | -             | -                 | -               | -            | -          | S                        |
| Amanita caesarea             |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Amanita citrina              |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Amanita gemmata              |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Amanita pantherina           |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Amanita porphyra             |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Amanita regalis              |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Amanita verna                |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Amanita virosa               |                    | +            | -             | -                 | -               | -            | -          | S                        |
| Species                        | Amanita sp. | + | - | - | - | - | M |
|-------------------------------|-------------|---|---|---|---|---|---|
| Armillariella tabescens       | +           | - | - | - | - | + | S |
| Aseroë rubra                  | -           | - | - | - | + | - | S |
| Bovista dermoxantha           | -           | + | - | - | - | - | S |
| Bovista nigrescens            | -           | + | - | - | - | - | S |
| Bovista plumbea               | -           | + | - | - | - | - | S |
| Boletus edulis                | -           | + | + | - | - | - | M |
| Boletus pseudosulphureus      | -           | + | + | - | - | - | M |
| Boletus subtomentosus         | -           | + | + | - | - | - | M |
| Calocybe gambosa              | +           | + | + | - | - | - | S |
| Calvatia cyathiformis         | +           | - | + | + | + | + | S |
| Calvatia gigantean            | -           | + | - | - | - | - | S |
| Cantharellus cinnabarinus     | +           | + | - | - | - | - | M |
| Cantharellus cibarius         | +           | - | - | - | - | - | M |
| Cantharellus umbonata         | +           | - | - | - | - | - | M |
| Cheilymenia granulata         | -           | - | - | + | - | - | S |
| Chlorophyllum hortense         | +           | + | - | - | - | - | S |
| Clavariadelphus pistillaris   | +           | - | - | - | - | - | M |
| Clavaria zollingeri           | +           | - | - | - | - | - | S |
| Clitocybe gibba               | +           | - | - | - | - | - | S |
| Clitocybe nebularis           | +           | - | - | - | - | - | S |
| Clitopilus prunulus           | -           | + | + | - | - | - | M |
| Coltricia perennis            | +           | - | - | - | - | - | S |
| Coprinellus domesticus        | -           | - | - | + | - | - | S |
| Coprinellus impatiens         | -           | - | - | + | - | - | S |
| Coprinellus micaceus          | -           | + | - | - | + | - | S |
| Coprinellus radians           | -           | - | - | + | - | - | S |
| Coprinellus xanthothrix       | -           | - | - | + | - | - | S |
| Coprinopsis atramentaria      | -           | - | + | - | - | - | S |
| Coprinus comatus              | +           | - | - | - | - | - | S |
| Cortinarius altissimus        | +           | - | - | - | - | - | M |
| Cortinarius caperatus         | +           | - | - | - | - | - | M |
| Cortinarius cinnamomeus       | +           | - | - | - | - | - | M |
| Cortinarius kioloensis        | +           | - | - | - | - | - | M |
| Cortinarius hallowellensis    | +           | - | - | - | - | - | M |
| Cortinarius neotropicus       | +           | - | - | - | - | - | M |
| Cortinarius pavonius          | +           | - | - | - | - | - | M |
| Cortinarius pholideus         | +           | - | - | - | - | - | M |
| Cortinarius sanguineus        | +           | - | - | - | - | - | M |
| Cortinarius violaceus         | +           | - | - | - | - | - | M |
| Cortinarius sp.               | +           | - | - | - | - | - | M |
| Cortinarius sp.               | +           | - | - | - | - | - | M |
| Craterellus cantharellus      | +           | - | - | - | - | - | M |
| Cyanoboletus pulvulentus      | +           | - | - | - | - | - | M |
| Cyclopyce aegerita            | -           | + | + | - | - | - | S |
| Cyathus striatus              | -           | + | + | - | - | - | S |
| Cystoderma amianthinum        | +           | - | - | - | - | - | S |
| Disciseda bovista             | -           | + | - | - | - | - | S |
| Flammulina velutipes          | -           | - | + | - | - | - | S |
| Species                        | L.   | M.   | N.   | O.   | P.   | Q.   | R.   | S.   |
|-------------------------------|------|------|------|------|------|------|------|------|
| Gymnopus dryophilus           | +    | -    | -    | -    | -    | -    | -    | S    |
| Gyroporus cyanescens          | +    | -    | -    | -    | -    | -    | -    | M    |
| Harrya chromapes              | +    | -    | -    | -    | -    | -    | -    | M    |
| Hygrocybe miniata             | +    | +    | -    | -    | -    | -    | -    | M    |
| Imelira badia                 | +    | -    | -    | -    | -    | -    | -    | M    |
| Inocybe geophylla             | +    | -    | -    | -    | -    | -    | -    | S    |
| Inocybe nappies               | +    | -    | -    | -    | -    | -    | -    | S    |
| Kuehneromyces mutabilis       | +    | -    | -    | -    | -    | -    | -    | S    |
| Laccaria bicolor              | +    | -    | -    | -    | -    | -    | -    | M    |
| Laccaria laccata              | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius deliciosus          | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius eucalypti           | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius indigo              | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius necator             | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius piperatus           | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius torminosus          | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius rufus               | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius trivialis           | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius scrobiculatus       | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius vellereus           | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius volemus             | +    | -    | -    | -    | -    | -    | -    | M    |
| Lactarius zonarius            | +    | -    | -    | -    | -    | -    | -    | M    |
| Leccinellum albellum          | +    | -    | -    | -    | -    | -    | -    | M    |
| Leccinellum corsicum          | +    | -    | -    | -    | -    | -    | -    | M    |
| Leccinellum crocipodium       | +    | -    | -    | -    | -    | -    | -    | M    |
| Leccinellum griseum           | +    | -    | -    | -    | -    | -    | -    | M    |
| Leccinellum lepidum           | +    | -    | -    | -    | -    | -    | -    | M    |
| Leccinellum lutescabrum       | +    | -    | -    | -    | -    | -    | -    | M    |
| Leccinellum quercophillum     | +    | -    | -    | -    | -    | -    | -    | M    |
| Leccinum aurantiacum          | +    | -    | -    | -    | -    | -    | -    | M    |
| Leccinum holopus              | +    | -    | -    | -    | -    | -    | -    | M    |
| Leccinum scabrum              | +    | -    | -    | -    | -    | -    | -    | M    |
| Leccinum versipelle           | +    | -    | -    | -    | -    | -    | -    | M    |
| Leucoagaricus nymphastrum     | +    | +    | -    | -    | -    | -    | -    | S    |
| Leucoagaricus rubrotinctus    | -    | -    | -    | +    | -    | -    | -    | S    |
| Leucocopus birnbaumii         | -    | -    | -    | +    | -    | +    | -    | S    |
| Leucocopus brebiissonii       | +    | +    | +    | +    | +    | +    | +    | S    |
| Lycoperdon echinatum          | +    | -    | -    | -    | -    | -    | -    | S    |
| Lycoperdon marginatum         | +    | -    | -    | -    | -    | -    | -    | S    |
| Lycoperdon perlatum           | +    | +    | +    | +    | +    | +    | +    | S    |
| Macrolepiota molybdites       | -    | +    | +    | +    | +    | +    | +    | S    |
| Macrolepiota procera          | +    | +    | +    | +    | +    | +    | +    | S    |
| Marasmius epodius             | -    | -    | -    | +    | -    | -    | -    | M    |
| Marasmius rotula              | -    | -    | -    | +    | -    | -    | -    | S    |
| Mutinus caninus               | +    | -    | -    | -    | -    | -    | -    | S    |
| Parasola hemerobia            | -    | -    | -    | +    | -    | -    | -    | S    |
| Parasola leiocephala          | -    | -    | -    | +    | -    | -    | -    | S    |
| Paxillus involutus            | +    | -    | -    | -    | -    | -    | -    | M    |
| Phaeocollybia jennyae         | +    | -    | -    | -    | -    | -    | -    | M    |
| Phaeolepiota aurea            | -    | -    | -    | +    | +    | +    | +    | S    |
From the collected soil samples, the occurrence of species in different samples soil is shown in Table 2 (presence ‘+’ and absence ‘-’); S = saprotrophic; M = mycorrhizal.

| Species                     | Presence | Absence |
|-----------------------------|----------|---------|
| Phallus ravenelli          | +        | +       |
| Pisolithus tinctorius       | +        | -       |
| Phleogena faginea           | -        | -       |
| Pleurotus phlebophorus     | -        | -       |
| Pleurotus romellii         | -        | +       |
| Psathyrella multipedata     | -        | +       |
| Psathyrella pygmaea         | -        | +       |
| Psathyrella rostellata      | -        | +       |
| Psilocybe atlantis         | -        | +       |
| Psilocybe cubensis          | -        | +       |
| Pulveroboletus ravenellii  | +        | -       |
| Rhizocybe pruinosa          | -        | -       |
| Russula adusta             | +        | -       |
| Russula aeruginea          | +        | -       |
| Russula claraflav           | +        | -       |
| Russula cyanoxantha        | +        | -       |
| Russula emetica            | +        | -       |
| Russula lutea              | +        | -       |
| Russula rosea              | +        | -       |
| Russula virescens          | +        | -       |
| Russula delica             | +        | -       |
| Russula foetens            | +        | -       |
| Russula vesca              | +        | -       |
| Stropharia coronilla       | -        | +       |
| Suillus bovinus            | +        | -       |
| Suillus granulatus         | +        | -       |
| Suillus luteus             | +        | -       |
| Tuber brumale              | +        | -       |
| Volvopluteus asiaticus     | -        | +       |
| Volvopluteus earlei        | -        | +       |

**Total:** 165

4. Conclusion

As the first monitoring of macrofungi in the Adjara, Georgia, the present study increases our knowledge about the biodiversity of that area and about the mycobiota in general.

Determined that neither rainfall nor temperature could separately explain conclusively the variation in fruiting body emergence of macrofungi fruiting on soil.

Revealed that most species fruiting on soil emerged in the season in Adjara May and October in all 6 plots.

However, because individual fruit bodies of ectomycorrhizal species were not traced to their host species, the above finding cannot be explained.
Highlights that works of longer duration and more intensive sampling are needed to obtain data regarding fungal communities, with more attention to specific variables such as microclimate, soil moisture, soil type, soil pH and vegetation types.

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