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# PARASITES AND SAPROPHYTES FUNGI ON TREES AND SHRUBS FROM UNSU FOREST, IAȘI COUNTY

**Abstract of PhD Thesis**

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**CUPRINS**

# INTRODUCTION

As a complex ecological system, the forest always impressed by his massiveness, by the remarkable dimension of the trees, by the richness of the all elements that are building it.

The fungus can affect the woody plants with affects on the quality and quantity of the production for the sylvan ecosystems. However with their involvement in the vegetal substrates decomposing the saprophyte fungus accomplishes a very important ecological function, releasing the chemical elements required for the biogeochemical circuits.

This paper aims to identify and know the parasites and saprophyte fungus on trees and shrubs from Unsu Forest, as a result of the field researches conducted during 2008-2012 years.

In this paper there are approached related topics to the physic-geographical characterization of the researched area, the history of mycological and botanical researches, methods for preventing and combating of the harmful fungus, working method, parasites and saprophytes fungus diversity, and the mycocoenological analyses of them.

The measures to prevent and combat the harmful fungus are generally presented, because the existing dates indicates the fact that their application in the Unsu forest is not possible because if the high of the economic costs.

The completion of the doctoral years gave me the possibility to thanks to all who supported and guided me throw these years.

## I. Physic-geographical characterization of Unsu Forest

### *I.1 Geographical location*

Unsu forest is located on the area of the villages Gorban, Moşna, Cozmeşti, in the south east of the Iaşi County. It occupies an area of 283.9 hectares, it has 34-40 parcels and it belongs to the Third Production Unit Gorban from the Răducăneni forestry – Sylvan Direction Iaşi (Davidescu Ş. et al., 2007).

## II. History of researches

### *II.1 History of the botanical and sylvan researches in Unsu Forest*

The first information's referring to the Unsu Forest occurs in 1893 year, when Chiriţă C. mentions about Unsu and Voloaca Forest located on Unsu and Voloaca hills. Today Voloaca Forest is included in Unsu Forest.

Brândză D. (1879-1883) quotes *Sanguisorba officinalis L.* species as being present in Gura-Bohotin village.

Dumitriu-Tătăranu I. **(**1954) it indicates the presence of two oak species in Huşi Forestry: *Quercus pubescens* (downy oak) and *Quercus pedunculiflora* (silver oak). Unsu and Voloaca forests are quoted as being a part of the Huşi Forestry in that time.

Costin Eugen **(**1955) presents the natural distribution of quercine from South of Moldavia and insists on some hybrid species of *Quercus*.

Paşcovschi S. and Doniţă N. in 1967 mentions the presence of *Viburnum lantana L.* species in Unsu and Voloaca Forests, and also the presence of some other species, varieties and shapes of *Quercus.*

### *II.3 History of mycological research from Iaşi County*

Mycology researches do not present any information's referring to the existence of fungus in Unsu Forest.

In C. Sandu-Ville paper "*Ciupercile erysiphaceae din România",* published in 1967 year, it is noticed the presence of two macromycetes species in Moşna village, village on whose area Unsu forest is located. This species are represented by *Sphaerotheca macularis* and *Microsphaera alphitoides* Willd.

## III. PREVENT AND COMBAT THE HARMFUL FUNGUS

Preventing and combating phytopathogenic agents which affects the sylvan timber production represent a major problem, because it can have as first consequences timber rottenness, tree dryness, sylvan fruits and seed destruction, and not last it affects the sylvan economy and it affects the environment.

All the measures taken for preventing and combating of the phytoparasites it is named phytoterapy and include two categories of measurements: preventives and therapeutic (Mititiuc M., 1994).

- Prophylactic measures are focused on preventing the development and spread of the disease, they are more effective, less expansive and in most of the cases clean for the environment;
- Curative measures are focused on phytopathogenic agent's destruction and also on raising the resistance of the plants to infection, these measures are applied after phytopathogenic agents attack, there are much expensive and difficult to implement.

## IV. WORKING METHOD

### *IV.1. FUNGUS COLLECT*

The collecting of fungus aimed to harvest of juvenile and mature sample, complete, lacking larvae, taking in the same time a portion from the timber on which they are developing. Examination for determination was realized especially on the fresh collected material, because the herborized material may not keep the characters for determination.

### *IV.2. Fungus preserve*

Fungus preserve was achieved by similar phanerogams technique on the fungus which leaves on dead or aged leafes, and in the case of macromycetes species the preserving was accomplished after drying in custom sizes paper envelopes.

### *IV.3. Microscope examination*

Microscopic study of the fungus is indispensable and required, being made on alive or fixed material in the form of microscopic preparations.

*Examination of fresh fungus* - can be performed directly on the substrate (plant organs) with binocular loupe (stereomicroscope).

*Prepared microscope material examination* – it is accomplished in the purpose of research in detail the structure of the fungus. The steps for realizing the microscopic prepared suppose the following sequence: material removal, cutting, fixing, staining and mounting in custom installation environments.

### *IV.4. Parasite and saprophyte fungus determination*

To determine saprophytic and parasitic fungus species it was used literature showing determination keys, diagnostic features of species: Bielli E., 1999, Bon M., 1988, Borgarino D., Hurtado C., 2001, Breitenbach & Kränzlin 1986, 2000, Corlățeanu S., 1959, Eliade E., 1963, 1968, Eliade & Toma M., 1971 Hansen & Knudsen, 1992, 1997, 2000, Jűlich W., 1989, Mititiuc & Iacob, 1997, Pârvu M., 1996, 2007, Sandu-Ville C., 1967, Sălăgeanu & Sălăgeanu, 1985, Săvulescu T., 1953, Şesan & Tănase, 2004, Tănase et al., 2009, Tănase & Şesan T., 2006, Tudor I., 2007.

Host woody plant species were identified and determined mainly with the literature papers like: Ciocârlan V., 2009 and Sârbu I. et al., 2001.

### IV.5. Working method for phytocoenology and mycocoenological analyses

This method involved two stages:

- One stage where the vegetation was investigated by accomplish of phytocoenologic surveys;

- One other stage where a mycocoenological analyses was made inside of the vegetal associations.

### IV. 5.2. Working method for mycocoenological analyses inside of the vegetal associations

In Unsu Forest vegetal associations it was performed mycological observations between August 2008 and June 2012. For the mycological investigations it was considered the coverage of the association area inside of the forest plan, the number of executed surveys varies between 10 and 35. (Table no. 9.).

**Table no. 9. Number of executed surveys inside of the associations**

| No. | Vegetal Association | No. of executed Surveys |
|---|---|---|
| 1. | *Bromo sterilis–Robinietum pseudoacaciae* (Poćs 1954) Soó 1964 | 11 |
| 2. | *Evonymo europaeae–Carpinetum* Chifu (1995) 1997 | 23 |
| 3. | *Fraxino angustifoliae–Quercetum pedunculiflorae* Chifu, Sârbu et Ştefan (1998) 2004 | 35 |
| 4. | *Lunario–Aceretum pseudoplatani* Richard ex Schlüter in Grüneberg et Schlüter 1957 | 10 |
| 5. | *Salici –Populetum* Meijer–Drees 1936 | 10 |
| **TOTAL:** | | **89** |

Mycocoenological characterization was made by the calculation of two index categories:

- *Analithic*: abundance, frequency, constancy;
- *Synthetic* (*similarity index*): cenotic affinity Jaccard index (q), Sorensen similarity index ($Q_s$).

## V. PARASITES AND SAPROPHYTES FUNGUS DIVERSITY ON TREES AND SHRUBS FROM UNSU FOREST

### *V.1. Systematically abstract for parasites and saprophytes fungus on trees and shrubs from Unsu Forest*

Following mycological researches executed it was identified 213 saprophyte and parasite species. Taxon nomenclature and their classification is according with the one published by Kirk P. M. et al. on the website www.indexfungorum.org and it stands on Dictionary of the Fungi, 10th edition.

Macromycetes species included in the Red List of macrofungus from Romania (Tănase & Pop, 2005) are listed in the systematic epitome with the ♦ symbol:

- ♦ ***Gymnopus foetidus*** **(Sowerby) J.L. Mata & R.H. Petersen**
- ♦ ***Mycena crocata*** **(Schrad.) P. Kumm.**
- ♦ ***Pluteus petasatus*** **(Fr.) Gillet**
- ♦ ***Grifola frondosa*** **(Dicks.) Gray**

### *V.2. Taxonomic analyses of parasites and saprophytes fungus on trees and shrubs from Unsu Forest*

Taxonomic analyses of the identified species, highlights 213 species of parasites and saprophytes fungus which belongs to two kingdoms, 3 phyla, 9 classes, 60 families, 133 genera.

Considering the number of the species the best represented are Basidiomycota phylum (170 species), Agaricomycetes classes (162 species), Agaricales order (79 species), Polyporaceae family (26 species) and Mycena genus (9 species).

The numerical situation of the fungus – host plant combinations record a number of 327 combinations, with the following distribution; 263 basidiomycetes – woody host plant combinations, 57 combinations ascomicetes – woody host plant, 7 combinations amoebozoa – woody host plant.

The woody host plant species are encapsulated in 16 spermatophyte families, among whom the Fagaceae family (29%) is the best represented, followed by Tiliaceae (19%), Rosaceae (16%), Oleaceae (11%), Salicaceae (8%), Juglandaceae (5%), and Fabaceae (5%) families.

Phylum **Ascomycota** is represented by 39 species, which belongs to 28 genera, encapsulated in 17 families, 10 orders and 4 classes. In this phylum it stands out the Xylariales order, Xylariaceae family, Erysiphaceae and the genera *Erysiphe.*

Phylum **Basidiomycota** is represented by 170 species, which belongs to 101 genus, encapsulated in 40 families, 16 order and 4 classes. The Agaricales (45%), Polyporales (19 %) and Hymenochaetales (12%) orders are dominated based on the number of species.

Family's analyses reveal the preponderance of lignicolous species from the families Polyporaceae, Hymenochaetaceae and Meruliaceae. Between the representative genera we remember: *Mycena, Phellinus, Polyporales* and *Trametes* with a high number of species.

The **Amoebozoa** phylum was identified 4 species, encapsulated in one class, 3 orders, 3 families and 4 genera.

### *V.3. Ecological analyses of parasites and saprophytes fungus*

On the trees and shrubs from Unsu Forest it was identified 213 parasites and saprophytes fungus belonging after the nutrition modus to the fallowing ecological categories: parasites (P), lignicolous saprophytes (SL), lignicolous parasites (PL), lignicolous saproparasites (SPL).

The most dominant ecological category is the lignicolous saprophyte category (142 species), followed by the parasites (22 species), saproparasites (33 species) and lignicolous parasites (16 species).

### *V.4. Substrate distribution of parasites and saprophytes fungus from Unsu Forest*

During the mycological investigations carried out in the Unsu Forest it was watched also the woody substrate on which the fungus sporule corpus are developing.

The analyzed data shows that the majorities of the species was encouted on steams (trunks) (41%) and tree branch (37%). The remaining species are placed on stumps (14%), leaves/shoots (7%) and fruits (1%). The substrate analyses allowed the common species identification on different types of substrate**.** The most species are common on custom types of tree branches and trunks, followed by the ones on common on trunks and stumps, while the common species of fungus on tree branches, trunks, stumps, leaves and fruits are in a much lower number.

### *V.5. Parasites and saprophytes fungus dynamics from Unsu Forest*

Mycological observations made in the Unsu Forest during 2008-2012 years have been focused also on recording the moment when the sporule corpus appeared. For that purpose, the site visits were conducted between the months March – November yearly. In addition to this the fallowing investigations conducted in December 2008, December 2011 and February 2010 can be added.

The field data analysis reveals a two ascendancy moments curve: one in the time February – May and the other one in June – October. However the analyses of the data show that the maximal number of the collected species was accomplished in October.

### *V.6. The economic value of the lignicolous macromycetes from Unsu Forest*

In addition to the important role which fungus have on the biochemical circuits, they have a great importance for the humans, because some of them are useful as food for humans from ancient times, some others have negative effects in the form of severe poisoning.

The lignicolous macromycetes species identified were encapsulated based on nutritive value in the fallowing groups (Sălăgeanu & Sălăgeanu, 1985): eatable with small alimentary value, eatable with high alimentary value, eatable with a very high alimentary value, not eatable. Most of the identified species are not eatable (174 species) and a very low number between them are eatable (18 species). This can be explained by the fact that lignicolous macromycetes species develop perennial sporule corpus but also the annual ones with a hard consistency and only few of them develop fleshy sporule corpus.

The analysis of the eatable degree of the lignicolous macromycetes notices the fact that the most part of the identified species are eatable but with low alimentary value. Among this we can distinguish: *Auricularia auricula-judae, Clitocybe gibba, Fistulina hepatica, Flammulina velutipes, Grifola frondosa, Laetiporus sulphureus, Megacollybia platyphylla, Pluteus cervinus, Pluteus petasatus* and *Polyporus squamosus.*

## VI. Mycological observations on Unsu Forest

### *VI.1. Description of the vegetal associations from Unsu Forest*

#### VI.1.1. *Fraxino angustifoliae–Quercetum pedunculiflorae* Chifu, Sârbu et Ştefan (1998) 2004 association

**Chorology:** Gura-Bohotin, Cozmeşti

**Ecology**: It is a regional association, identified on Prut valley and then on Siret, Bârlad valley, etc. on flat land, wetland, with the groundwater near the surface, on eutrophic soils with neutral reaction (Chifu T. et al., 2006).

**Floristic composition and phytocoenotic structure**. Tree layer with a 60-90% coverage, is dominated by *Quercus pedunculiflora*, to which we add *Fraxinus angustifolia, Fraxinus excelsior, Acer campestre*, *Acer platanoides, Quercus robur*, *Robinia pseudoacacia* and *Tilia cordata*.

On the shrubs layer, with 5-30% coverage, we can observe some samples like: *Crataegus monogyna, Cornus mas*, *Sambucus nigra*, etc.

On the herbaceous layer, which has 25-50% coverage, the fallowing species can be remarked: *Arctium lappa*, *Brachypodium sylvaticum*, *Dactylis glomerata, Geum urbanum, Viola odorata,* etc.

### *VI.2. Mycocoenological analysis of the vegetal associations from Unsu Forest*

#### VI.2.1. *Mycocoenological analysis Fraxino angustifoliae –Quercetum pedunculiflorae* Chifu, Sârbu et Ştefan (1998) 2004 associations.

In the *Fraxino angustifoliae–Quercetum pedunculiflorae association* it were identified 116 species from Fungi (114) and Protozoa (2 species) kingdoms

The ecological spectrum of association macromycetes is determined by the illuminating species like *Quercus pedunculiflora* and *Fraxinus angustifolia,* on which especially the species *Quercus robur, Fraxinus excelsior* and *Cerasus aviumare* added.

Ecological categories analyses reveal the presence of the following types: 83 lignicolous saprophytes species, 21 lignicolous saproparasites species and 12 lignicolous parasites species.

**Lignicolous saprophytes** species are well represented in the vegetal association, being found on wood substrates which belongs especially to the *Quercus pedunculiflora* K. Koch., *Quercus robur* L., *Fraxinus excelsior* L., *Fraxinus angustifolia* L. and *Cerasus avium* L species.

Calculation of abundance and frequency indexes reveals the species *Hymenochaete rubiginosa, Trametes hirsuta* and *Phellinus torulosus* with similar and higher values relative to the other species. This is explained by the presence of annual and perennial sporule corpus.

From the **lignicolous saproparasites** species category the species *Daedaleopsis confragosa* is remarked with the high values of the frequency and abundance indexes.

*Phellinus robustus* and *Phellinus pomaceus* species records the highest frequency from the **lignicolous parasites** species.

The biological forms analysis reveals the dominance of the epixyle species, founded especially on *Quercus* genus synusium.

## VI.3. Mycoenological similarities in Unsu Forest

To notice the mycoenological similarities from Unsu Forest two approaches were used:

1. A general approach which aims to highlights the similarities between the vegetal association, and the result is the affinity dendogram based on the Jaccard index (Varvara M. et al., 2001).
    - After data processing we reached a 5,5% similarity degree between the *Bromo sterilis–Robinietum pseudoacaciae* (3) *Lunario–Aceretum pseudoplatani* (4), *Salici–Populetum* (5) and associations *Fraxino angustifoliae–Quercetum pedunculiflorae* (1), *Evonymo europaeae–Carpinetum* (2). This similarity can be explained by the existence of a different composition for the woody plant species inside the vegetal association, but also by the localization in different arrears inside of the forest which prevent the sporule release especially to the polyphagous species. (**Figure no. 45.)**.
2. A customized approach based on the results of performing surveys in vegetal associations, the result was the similarity dendogram between different species from the same surveys, build based on the Sorensen index (Ștefan N., 2005).
    - After completing the stages of the similarity dendogram construction, in the *Fraxino angustifoliae–Quercetum pedunculiflorae* association it was reached a 2,34% similarity degree between the macromycetes species from the survey no 6 and all the other species from the analyzed survey. This value is determined by the structural complexity of the individual analyzed surveys, collecting time and also to the existence of the perennial sporule corpus (*Phellinus robustus, Phellinus pomaceus*) or seasonal ones (*Hapalopilus nidulans*) inside of the investigated surveys from the association.

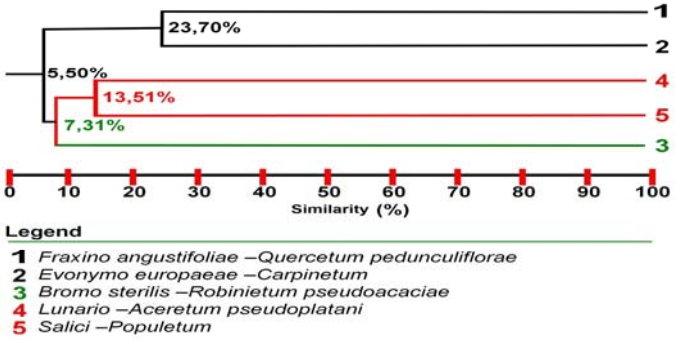


**Figure no. 45. – General similarity dendogram**

## CONCLUSIONS

- Mycological observations had been made in Unsu Forest, located in the south east of Iasi County, on the area of Gorban, Cozmesti and Mosna villages.
- Consultation of the specificity literature indicates the fact that on Unsu Forest no mycological researches have been made until the start of the research period for this PhD thesis.
- Between 2008 and 2012 years it were identified 213 species of parasites and saprophytes fungus systematically classified into 2 kingdoms, 3 phyla, 9 classes, 29 orders, 60 families and 133 genera.
- Fungi kingdom with the Ascomycota and Basidiomycota phyla is well represented compared with Protozoa kingdom which presents only 4 species included in the Amoebozoa phyla.
- Phylum Basidiomycota is characterized by the presence of four species included in the Red List macrofungus in Romania, as endangered species: *Grifola frondosa, Gymnopus foetidus*, *Mycena crocata* and *Pluteus petasatus*.
- *Coriolopsis gallica*, *Phaeomarasmius erinaceus, Pluteus thomsonii*, *Gloeophyllum odoratum*, *Pseudoinonotus dryadeus, Inonotus obliquus*, *Sarcodontia crocea*, *Polyporus badius* species can be encapsulated in the rare category species from Unsu Forest, because of the very low frequency during the investigations.
- It was identified a number of 327 combinations between the parasites and saprophytes fungus and the woody host plant, of which the most are made with the basidiomycetes fungi.
- It is distinguished by the number of the combinations made the woody plant species from the families Fagaceae, Tiliaceae, Rosaceae, Oleaceae, Salicaceae, Juglandaceae, Fabaceae and genera *Quercus, Cerasus, Fraxinus* and *Tilia.*
- Parasitc and saprophytic identified fungus have most of the combinations with the trees (95%) and in a very low percentage with the shrubs (5%).
- An analysis of the ecological categories reveals the dominance of the lignicolous saprophyte species, followed by the saproparasites, parasites and the lignicolous parasites species.
- Seasonal dynamics of parasitic and saprophytic fungus shows the maximal number for collected species in October.
- Most of the lignicolous macromycetes identified are not eatable, and the rest of them are either eatable or poisonous.
- Phytocoenologic conducted investigations lead to the identification of 5 vegetal associations: *Fraxino angustifoliae–Quercetum pedunculiflorae, Evonymo europaeae–Carpinetum, Bromo sterilis–Robinietum pseudoacaciae*, *Lunario–Aceretum pseudoplatani*, and *Salici–Populetum*, in these associations it was made a mycoenological analyses.
- The presence of a 5.50% similarity degree between all five vegetal associations which had been investigated can be explained by the existence of a different composition for the woody plant species inside the vegetal association.
- The analyses of the presence of the lignicolous macromycetes species in different surveys from the vegetal associations *Fraxino angustifoliae–Quercetum pedunculiflorae* and *Evonymo europaeae–Carpinetum,* revealed the existence of low similarity degree, because the species presence is influenced by the structural complexity of the surveys, the period on which the data was collected, the inclination angle and the anthropogenic factors pressure.
- Anthropogenic pressure exerted especially in 2011 and 2012 years, as a result of the increased forestry work, in the associations *Bromo sterilis–Robinietum pseudoacaciae, Evonymo europaeae–Carpinetum*, *Fraxino angustifoliae–Quercetum pedunculiflorae* determined behavior changes with repercussions on appearance and develop of the species.

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