

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF  
UKRAINE**

V.F. Peresyphkin Department of Phytopathology

**APPROVED**  
Faculty of Plant Protection,  
Biotechnologies and Ecology  
«21»May2025

**CURRICULUM OF ACADEMIC DISCIPLINE**  
**GENERAL MYCOLOGY**

Area of knowledge20 Agricultural sciences and food  
Specialty 202 Plant Protection and Quarantine  
Academic programme Plant Protection and Quarantine  
Faculty Plant Protection, Biotechnologies and Ecology  
Developed by: Vuiek A.O., assistant, Dr. PhD

Kyiv – 2025

## Description of the discipline GENERAL MYCOLOGY

General Mycology is one of the key core disciplines in the training of plant protection specialists. It provides in-depth knowledge of the morphological and biological characteristics of fungi, their roles in natural ecosystems and agrocenoses, as well as their impact on the phytosanitary condition of plants. This discipline is closely integrated with a number of general and specialized subjects, including botany, plant physiology, microbiology, soil science, crop production, biochemistry, biotechnology, phytopathology, plant immunity, plant breeding, and seed science.

Area of knowledge, specialty, academic programme, academic degree		
Academic degree	bachelor's	
Specialty	202 Plant Protection and Quarantine	
Academic programme	Plant Protection and Quarantine	
Characteristics of the discipline		
Type	compulsory	
Total number of hours	180	
Number of ECTS credits	6	
Number of modules	4	
Course project (work) (if any)	-	
Form of assessment	exam / credit	
Indicators of the discipline for full-time and part-time forms of university study		
	University study	
	Full-time	Part-time
Year of study	2	3
Term	3, 4	5, 6
Lectures	60 h.	4 h.
Practical classes and seminars		
Laboratory classes	60 h.	-
Self-study	60 h.	176 h.
Number of hours per week for full-time students	4 h.	3

### 1. Aim, competences and expected learning outcomes of the discipline

General mycology is one of the main profiling disciplines in the training of a specialist in plant protection. It is closely related to many general biological and special disciplines: botany, plant physiology, microbiology, soil science, agriculture, plant biochemistry and biotechnology, general and agricultural phytopathology, plant immunity, zoology, general and agricultural entomology, plant breeding, breeding and seed production

#### **Competences acquired:**

Integral competence (IC):

The ability to solve complex specialized tasks and practical problems of professional activity in plant protection and quarantine and to apply theoretical knowledge and methods of phytosanitary monitoring, inspection, analysis, expertise characterized by complexity and uncertainty of conditions.

General competences (GC):

GC 2. Ability to apply knowledge in practical situations.

GC 3. Knowledge and understanding of the subject area and understanding of professional activity.

GC 12. Skills of performing safe activities.

Expected Learning Outcomes (ELO):

ELO 6. Correctly apply appropriate methods of observation, description, identification, classification, and cultivation of agrobiocenosis objects, as well as methods for maintaining their stability to preserve natural biodiversity.

ELO 16. To know the main historical stages of the development of the subject area.

Modules and topics	Number of hours													
	full-time								part-time					
	weeks	total	including					in total	including					
			l	p	lab	ind	s.st		l	p	lab	ind	s.st	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Module 1. <b>STRUCTURE OF FUNGI</b>														
Topic 1. The structure of the vegetative body		12	6		3		3	12	1					11
Topic 2. Mycelium and its variations		16	6		5		5	16						16
Topic 3. Fungi as a constituent structure of the vegetative body of lichens		6	2		2		2	6						6
Total for module 1		34	14		10		10	34	1					33
Module 2. <b>BIOCHEMICAL PROPERTIES OF FUNGI</b>														
Topic 1. Nutrition of fungi		14	4		4		6							13
Topic 2. Fungal metabolism		14	8		12		6	14						14
Topic 3. Biologically active substances of fungi		28	16		20		8	28						28
Total for module 2		56	16		20		20	56	1					55
Module 3. <b>GEOGRAPHICAL DISTRIBUTION AND ECOLOGICAL GROUPS OF FUNGI</b>														
Topic 1. Geographic distribution of fungi		14	4		5		5	14	1					13
Topic 2. Ecological groups of fungi		26	6		10		10	26						26
Total for module 3		40	10		15		15	40	1					39
Module 4. <b>PROPAGATION OF FUNGI</b>														
Topic 1. Vegetative reproduction of fungi		10	4		3		3	10	1					9
Topic 2. Reproductive reproduction of fungi		10	4		3		3	10						10
Topic 3. Asexual reproduction of fungi		10	4		3		3	10						10
Topic 4. Reproduction of fungi (Ascomycota division)		10	4		3		3	10						10
Topic 5. Reproduction of fungi (Basidiomycota division)		10	4		3		3	10						10
Total for module 2		50	20		15		15	50	1					49

Total hours	180	60		60		60		4				176
Course project (work)												
(if included in the curriculum)		-	-	-		-		-	-	-		-
Total hours												

## 2. Topics of lectures

No.	Topic	Hours
1	Structure of the fungal vegetative body	6
2	Mycelium and its modifications	6
3	Fungi as a component of the vegetative body of lichens	2
4	Fungal nutrition	4
5	Fungal metabolism	4
6	Biologically active compounds of fungi	8
7	Geographical distribution of fungi	4
8	Ecological groups of fungi	6
9	Vegetative reproduction in fungi	4
10	Reproductive strategies of fungi	4
11	Asexual reproduction of fungi	4
12	Reproduction of fungi (Ascomycota division)	4
13	Reproduction of fungi (Basidiomycota division)	4

## 3. Topic of laboratory (practical, seminars) classes

No	Topic title	Hours
1	Microscopic study of fungal cells. Methods of staining the constituent parts of the cell.	2
2	Study of the morphological structure of the hypha of the fungus. Types of hyphal branching. Vegetative body in	2
3	yeast fungi.	2
4	Mycelium structure. Fungal colony. Septated and non- septated mycelium. Morphological structure of appressoria, haustoria and anastomoses, clamp connections and pear-shaped swellings.	2
5	Resting stages of fungi: oidia, chlamydospores, hemes, films, cords, rhizoctonia, rhizomorphs, sclerotia, their morphological and microscopic structure.	2
6	Morphological structure of lichens.	2
7	Laboratory utensils, tools, equipment for laboratory research	2
8	Nutrient media, their components. Preparation and sterilization conditions.	2
9	Cultivation of fungi (influence of temperature and humidity).	2
10	The concept of "pure culture". Sowing methods for obtaining "pure cultures" of fungi.	2
11	Fungi growth, growth phases. Determination of fungal growth.	2
12	Study of the activity of fungal enzymes.	2
13	Study of antibiotic properties of fungi.	2
14	Study of toxin-forming fungi.	2
15	Study of the activity of volatile metabolites of fungi.	2

16	Study of non-volatile metabolites of fungi	2
17	Study of antagonistic properties of fungi	2
18	Soil fungi, methods of their isolation.	2
19	Identification of species isolated from soil.	2
20	Air fungi, water fungi, methods of their isolation.	2
21	Identification of species isolated from air and water.	2
22	Phytopathogenic fungi, methods of their isolation.	4
23	Methods of identifying species of fungi that cause plant diseases.	1
24	Fungi that cause mycosis and mycotoxicosis. Research and identification methods.	2
25	Endo- and exogenous method of spore formation during asexual reproduction.	4
26	Sexual reproduction of lower fungi. Planogamy Zyogamy Oogamy	2
27	Reproduction of marsupial mushrooms. Formation of bags and ascospores.	2
28	Yeast reproduction	1
29	Fruit bodies of marsupial mushrooms.	2
30	Reproduction of basidial fungi. Basidia, its structure	2
<b>Total</b>		60

#### 4. Topics of self-study

No s/n	Topic title	Hours
1	Morphological diversity of fungal spores.	10
2	Influence of the substrate on the branching and formation of mycelial changes.	10
3	Symbiosis of fungi and algae, features of development and existence	5
4	Fungi are objects of biotechnology	10
5	Fungi are objects of the food industry	10
6	The role of fungal organisms in crop production	10
7	Fundamental and molecular methods in mycology.	5
Total		60

#### 5. Methods of assessing expected learning outcomes:

*(select necessary or add)*

- oral or written survey;
- interview;
- test;
- defending laboratory/practical, design/graphical works, projects;
- peer-to-peer assessment, self-assessment.

#### 6. Teaching methods *(select necessary or add):*

- problem-based method;
- practice oriented studying method;
- case method;
- project education method;
- flipped classroom, mixed education method;
- research based method;
- learning discussions and debates method;
- team work, brainstorm method

## 7. Results assessment.

The student's knowledge is assessed by means of a 100-point scale converted into the national grades according to the "Exam and Credit Regulations at NULES of Ukraine" in force

### 8.1. Distribution of points by types of educational activities

Educational activity	Results	Assessment
<i>Module 1. STRUCTURE OF FUNGI</i>		
	Correctly apply appropriate methods of observation, description, identification, classification, and cultivation of agrobiocenosis objects, as well as methods for maintaining their stability to preserve natural biodiversity.	
Laboratory work 1.		12
Laboratory work 2.		12
Laboratory work 3.		12
Laboratory work 4.		12
Laboratory work 5.		12
Self-study 1.	To know the main historical stages of the development of the subject area.	10
Module control work 1.		30
<b>Total for module 1</b>		100
<i>Module 2. BIOCHEMICAL PROPERTIES OF FUNGI</i>		
	Correctly apply appropriate methods of observation, description, identification, classification, and cultivation of agrobiocenosis objects, as well as methods for maintaining their stability to preserve natural biodiversity.	
Laboratory work 1.		7
Laboratory work 2.		7
Laboratory work 3.		7
Laboratory work 4.		7
Laboratory work 5.		7
Self-study 1.		5
Laboratory work 1.		7
Laboratory work 2.		7
Laboratory work 3.		7
Laboratory work 4.		7
Laboratory work 5.		7
Self-study 2.		5
Module control work 2.		30
<b>Total for module 1</b>		100
<i>Module 3. GEOGRAPHICAL DISTRIBUTION AND ECOLOGICAL GROUPS OF FUNGI</i>		
	Correctly apply appropriate methods of observation, description, identification, classification, and cultivation of agrobiocenosis objects, as well as methods for maintaining their stability to preserve natural biodiversity.	
Laboratory work 1.		10
Laboratory work 2.		10
Laboratory work 3.		10
Laboratory work 4.		10
Laboratory work 5.		10
Laboratory work 6.		5
Laboratory work 7.		5
Laboratory work 8.		5
Self-study		5
Module control work 3.		30
<b>Total for module 1</b>		100
<i>Module 4. PROPAGATION OF FUNGI</i>		
	Correctly apply appropriate methods of observation, description, identification, classification, and cultivation of agrobiocenosis objects, as well as methods for	
Laboratory work 1.		10
Laboratory work 2.		10
Laboratory work 3.		10
Laboratory work 4.		10

Laboratory work 5.	maintaining their stability to preserve natural biodiversity. To know the main historical stages of the development of the subject area.	10
Laboratory work 6.		8
Laboratory work 7.		8
Self-study 5.		2
Self-study 6.		2
Module control work 4.		30
<b>Total for module 2</b>		<b>100</b>
<b>Class work</b>	<b><math>(M1 + M2)/2 \cdot 0,7 \leq 70</math></b>	
<b>Exam/credit</b>	<b>30</b>	
<b>Total for year</b>	<b><math>(\text{Class work} + \text{exam}) \leq 100</math></b>	
Course project/work (if any)		<b>100</b>

## 8.2. Scale for assessing student's knowledge

Student's rating, points	National grading (exam/credits)
90-100	excellent
74-89	good
60-73	satisfactory
0-59	unsatisfactory

## 8.3. Assessment policy

<b>Deadlines and exam retaking rules</b>	Works that are submitted late without valid reasons will be assessed with a lower grade. Module tests may be retaken with the permission of the lecturer if there are valid reasons
<b>Academic integrity rules</b>	Cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct references to the literature used
<b>Attendance rules</b>	Attendance is compulsory. For good reasons (e.g. illness, international internship), training can take place individually (online by the faculty dean's consent)

## 8. Teaching and learning aids:

- e-learning course of the discipline  
<https://elearn.nubip.edu.ua/course/view.php?id=3104>
- references to digital educational resources:
  - <https://www.indexfungorum.org/names/names.asp> ;
  - <http://www.cybertruffle.org.uk/>
  - <http://www.ascofrance.com/>
  - <http://www.forestryimages.org/pests.cfm6>
  - <http://www.mycobank.org>
  - <http://pyrenomycetes.free.fr/>
  - <https://mycolog.com/index.htmltextbooks> ;
- guidelines for studying a discipline by full-time and part-time students;
- internship programmes of the discipline (if included in the curriculum).

## 9. Recommended sources of information

1. *Evolution of Fungi and Fungal-Like Organisms*. Ed. S. Pöggeler, T. James 2d Edition. Springer Nature: Switzerland. 2023. 331 pp.

2. *Fantastic Fungi: How Mushrooms Can Heal, Shift Consciousness, and Save the Planet* by Paul Stamets. San Rafael: Earth aware. 2019. 353 pp.
3. Lowenfels J. *Teaming with fungi: the organic grower's guide to mycorrhizae*
4. / Jeff Lowenfels. Other titles: *Organic grower's guide to mycorrhizae* Description: Portland, Oregon: Timber Press. 2017. 208 pp.
5. Norflus F. *Using Open Resources to Teach Mycology / The American Biology Teacher* (2021). Vol. 83 (8). P. 504–512.
6. Sheldrake M. *Entangled life: how fungi make our worlds, change our minds and shape our future*. NY: Random House. 2020. 345 p.
7. *States of the World's Plants and Fungi*. Royal Botanic Gardens Kew. 2020. 100 pp.
8. *The Lives of Fungi: A Natural History of Our Planet's Decomposers*. By Britt A. Bunyard. Princeton (New Jersey): Princeton. University Press. 2022. 288 pp.
9. *The Fungi*. Sarah C. Watkinson, Lynne Boddy, Nicholas Money. Third Edition. 2015. 452 p.
10. *Ecology of mushrooms*. Review: G.L. Antonyak, Z.I. Kalinets-Mamchur,
11. I.O. Dudka, N.O. Babich, N.E. Panas. *Ecology of mushrooms*. Lviv. 2013. 628 p.

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