

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

V.F. Peresyphkin Department of Phytopathology

"APPROVED"

Dean of the Faculty
Plant Protection,

Biotechnologies and Ecology


Yulia KOLOMIETS

"23" may 2024

"APPROVED"

V.F. Peresyphkin Department of Phytopathology

Minutes № 13 of "10" may 2024

Head of the Department


Dmytro GENTOSH

"REVIEWED"

Guarantor of the AP Plant Protection and Quarant


Myroslav PIKOVSKYI

**CURRICULUM OF ACADEMIC DISCIPLINE
GENERAL MYCOLOGY**

Field of knowledge 20 Agricultural sciences and food
Specialty 202 Plant Protection and Quarantine
Academic programme Plant Protection and Quarantine
Faculty Plant Protection, Biotechnologies and Ecology
Author(s): Bashta O.V., associate professor, Dr. PhD;
Vuiek A.O., assistant, Dr. PhD

Kyiv – 2024



Description of the discipline «GENERAL MYCOLOGY»

Academic degree, specialty, academic programme		
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		
	Full-time	Part-time
Year of study	2	3
Semester	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.	

1. Aim, objectives, 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.

The goal of general mycology as a science is to study the morphological and biological properties and distribution of fungi, their role and significance in human life and economic activity.

Fungi are an extremely numerous group of organisms. Currently, 110,000-120,000 of their species have been described and named, but there is evidence that there are no fewer of them than seed plants, i.e. 250,000-300,000. On average, more than 1,000 new species are described annually. It is believed that the number

of species of fungi is even three to four times greater than that of flowering plants (E. Müller, V. Leffler, 1995).

Today, these organisms are used in biotechnology, at the same time, their large number brings significant damage to the cultivation of agricultural crops, since they occupy a large specific weight (85%) among pathogens (viruses, bacteria, phytonematodes, actinomycetes, mycoplasma organisms).

By their heterotrophy, fungi differ from plants, algae, and cyanobacteria (blue-green algae), which rely on carbon dioxide and sunlight as the only sources of carbon and energy, respectively; by their cell wall, they differ from animals and protozoa (as a rule, by their absence), and by the presence of a true nucleus - from prokaryotic bacteria.

In the process of implementing the program, students study the structure of mushrooms, their metabolism, the physiologically active substances they produce, the basics of taxonomy, the peculiarities of ecological groups of mushrooms, their importance in nature and human economic activity.

As a result of studying general mycology, the student should: to know the task, purpose and objects of general mycology, the structure of mushrooms and their physiological properties, the peculiarities of growth in relation to the substrate, changes in mycelium, its resting stages, reproduction of various groups of mushrooms; be able to independently determine the group to which fungi belong by the structure of the mycelium (higher, lower), isolate a micromycete and study its growth features, determine the method of reproduction, establish the ability to form an anamorph and teleomorph, find out the conditions of its existence and assign it to the group of parasitism (obligate and facultative saprotrophs and parasites).

Acquisition of competences:

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 use appropriate methods of observation, description, identification, classification, cultivation of objects of agrobiocenoses and maintenance of their stability in order to preserve natural diversity.

ELO 16. Know the main historical stages of development of the subject are

2. Programme and structure of the discipline for:

- full-time (part-time) form of study;
- reduced full-time (part-time) form of study

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. STRUCTURE OF FUNGI														
Topic 1.1 The structure of the vegetative body		12	6		3		3	12	1					11
Topic 1.2. Mycelium and its variations		16	6		5		5	16						16
Topic 1.3. 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. BIOCHEMICAL PROPERTIES OF FUNGI														
Topic 2.1. Nutrition of fungi		14	4		4		6							13
Topic 2.2. Fungal metabolism		14	8		12		6	14						14
Topic 2.3. Biologically active substances of fungi		28	16		20		8	28						28
Total for module 2		56	16		20		20	56	1					55
Module 3. GEOGRAPHICAL DISTRIBUTION AND ECOLOGICAL GROUPS OF FUNGI														
Topic 3.1 Geographic distribution of fungi		14	4		5		5	14	1					13
Topic 3.2 Ecological groups of fungi		26	6		10		10	26						26
Total for module 3		40	10		15		15	40	1					39
Module 4. PROPAGATION OF FUNGI														
Topic 4.1 Vegetative		10	4		3		3	10	1					9
Topic 4.2 Reproductive		40	16		12		12	40						40
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													

3. Topics of laboratory 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, chlamydozoospores, chlamydozoospores, 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	2

	identification methods.	
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
Total		60

4. Topics for 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. Tools for assessing expected learning outcomes: (select necessary or add)

- exam;
- credit;
- module tests;
- abstracts;

- presentation of laboratory and practical works;
- other types.

6. Teaching methods:

- verbal method (lecture, discussion);
- practical method (laboratory, practical classes);
- visual method (illustration, demonstration);
- processing learning resources (note-taking, summarising, reviewing, writing an abstract);
- video method (remote, multimedia, web-based, etc.);
- self-study (completing assignments);
- individual research work;
- other types.

7. Assessment methods: (select necessary or add)

- exam;
- credit;
- oral or written assessment;
- module tests;
- team projects;
- presentation of laboratory and practical works;
- presentations at academic events
- other types.

8. Distribution of points received by students

The assessment of students' knowledge and skills is conducted by means of a 100-point scale and is converted into national grades according to Table 1 of the current *Exam and Credit Regulations at NULES of Ukraine*.

Student's rating, points	National grading of exams and credits	
	exams	credits
90-100	excellent	pass
74-89	good	
60-73	satisfactorily	
0-59	unsatisfactorily	fail

To determine a student's rating in the discipline R_{DIS} (up to 100 points), the received assessment rating R_A (up to 30 points) is added to the academic performance rating R_{AP} (up to 70 points): $R_{DIS} = R_{AP} + R_A$.

9. Teaching and learning aids

- e-learning course of the discipline
(<https://elearn.nubip.edu.ua/course/view.php?id=3104>);
- lectures and presentations (in electronic form);
- textbooks, manuals, tutorials;
- guidelines for studying a discipline by full-time and part-time students;
- internship programmes of the discipline (if included in the curriculum).

10. Recommended sources of information

Main:

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 / Jeff Lowenfels. Other titles: Organic grower's guide to mycorrhizae Description: Portland, Oregon: Timber Press. 2017. 208 pp.
4. Norflus F. Using Open Resources to Teach Mycology / The American Biology Teacher (2021). Vol. 83 (8). P. 504–512.
5. Sheldrake M. Entangled life: how fungi make our worlds, change our minds and shape our future. NY: Random House. 2020. 345 p.
6. States of the World's Plants and Fungi. Royal Botanic Gardens Kew. 2020. 100 pp.
7. 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.
8. The Fungi. Sarah C. Watkinson, Lynne Boddy, Nicholas Money. Third Edition. 2015. 452 p.
9. Ecology of mushrooms. Review: G.L. Antonyak, Z.I. Kalinets-Mamchur, I.O. Dudka, N.O. Babich, N.E. Panas. Ecology of mushrooms. Lviv. 2013. 628 p.

Addition:

1. Fungal Machines: Sensing and Computing with Fungi (Emergence, Complexity and Computation, 47) by A. Adamatzky. Switzerland: Springer. 2023. 570 pp.
2. Meetings with remarkable mushrooms: forays with fungi across hemispheres / Alison Pouliot. Chicago: The University of Chicago Press. 2023. 233 pp.

3. Mystical Mushrooms: Discover the Magic and Folklore of Fantastic Fungi by Aurora Kane. New York: Rock Point. 2023. 243 pp.
4. Bisko N.A., Lomberg M.L., Mitropolska N.Yu., Mykhaylova O.B. Collection of mushroom cultures (IBK). – /Institute of Botany named after M.G. Kholodny National Academy of Sciences of Ukraine. - Kyiv: "Alterpress". 2016. 120 p.
5. Prodromus of spore plants of Ukraine: lichens [Text]: monograph / S. Ya. Kondratyuk [and others]; Under the editorship P. M. Tsarenko. Kyiv: Naukova dumka. 2021. 730 p.

Internet resources:

1. Educational and informational portal of the National University of Bioresources and Nature Management of Ukraine: website. URL: <https://elearn.nubip.edu.ua>
2. Fungi of Ukraine <http://www.cybertruffle.org.uk/>
3. Red Book of Ukraine: <http://redbook-ua.org/category/fungi/>
4. ASCOfrance <http://www.ascofrance.com/>
5. Forest pests: <http://www.forestryimages.org/pests.cfm>
6. Index Fungorum <http://www.indexfungorum.org/>
7. Mycobank <http://www.mycobank.org>
8. Mycorrhizal Associations: <http://mycorrhizas.info/evol.html>
9. Pyrenomycetes of South Western France <http://pyrenomycetes.free.fr/>
10. Xylariaceae: Home <http://mycology.sinica.edu.tw/Xylariaceae/>