

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SUMY NATIONAL AGRARIAN UNIVERSITY**

Department of Plant Protection, named after Associate Professor Mishnjov A.

"APPROVED"

**The Head of the Department of Plant Protection, named
after Associate Professor Mishnjov A.**

“ _____ ” _____ 2019__p.
_____ (V.A. Vlasenko)

**THE CURRICULUM OF THE TRAINING COURSE
POPULATION BIOLOGY OF PHYTHOPATHOGENIC FUNGI**

Speciality: 202 “Plant Protection and Quarantine”

Faculty: Agrotechnologies and Natural Resource management

2019 - 2020 academic year

The Curriculum of the training course Population biology of phytopathogenic fungi

Developed by: **Rozhkova T.O.**, Associate Professor of the Department of Plant Protection, named after Associate Professor Mishnjov A., PhD in Biology _____

Tatarynova V.I., Associate Professor of the Department of Plant Protection, named after As.Pr. Mishnjov A., PhD in Agricultural Sciences _____

The curriculum was approved at a meeting of the Department of Plant Protection named after Associate Professor Mishnjov A.

Protocol № 23 of May,2, 2019

The Head of the Department _____ **(V.A. Vlasenko)**

Approved:

The Head of postgraduate studies _____ (I. V. Lozynska)

The Dean of the Faculty _____ (I.M. Kovalenko)

The Methodist of the Methodological department _____ (G.O. Baboshyna)

Registered in the electronic database: date: _____ 2019

1. Description of the training course

Name of indicators	Field of Study, area of training, educational and qualification level	Training course characteristics	
		full-time education	shortened term
Number of credits - 4	Field of Study: 20 Agrarian Sciences and Foodstuffs	<i>Optional</i>	
Modules – 2	Speciality: 202 Plant Protection and Quarantine	Academic year:	
Content modules: 2		2019-2020	
		Year	
Total hours - 120		1	
		Term	
		2	
	Lectures		
Weekly hours for full-time study: Lecture classes – 2	Higher education level: <i>third (educational and scientific)</i> Higher education degree: PhD	12 hours	
		Practical classes, seminars	
		Practical classes	
		24 год.	
		Individual work	
		Individual classes: 84	
		Type of control: credit	

1. The purpose and objectives of the training course

Purpose: to develop professional knowledge of post-graduate students regarding the modern understanding of the populations of phytopathogenic fungi, the peculiarities of their changes, the consequences of population changes and the modern principles of studying their structure.

Objective: to study methods for determining the structure of populations of phytopathogenic fungi; study of factors that influence changes in populations; Familiarity with the structure of populations of dangerous pathogens.

As a result of study, the graduate student should:

know:

- Methods for studying the structure of populations of phytopathogenic fungi;
- Features of isolation of phytopathogens from the affected tissues;
- Methods of isolation of phytopathogenic fungi monoisolates;
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be able to:

- isolate pathogens from the affected plants;
- work with pure cultures;
- isolate phytopathogenic fungi monoisolates;
- apply different methods of studying the structure of populations of phytopathogenic fungi;
- conduct expert research.

The general competencies that the applicant must master

Code	General competencies
GC 1	Ability to learn, master modern knowledge, self-improve and form a systematic scientific outlook
GC 2	Ability to critically analyze and evaluate modern scientific achievements, synthesis of holistic knowledge, complex problem solving
GC 3	Ability to abstract creative thinking, identify, receive, systematize, synthesize and analyze information from various sources with the use of modern information technologies in scientific activity.
GC 5	Ability to generate new ideas and make informed decisions to achieve goals.
GC 8	Ability to show initiative, take responsibility, motivate people and move toward a common goal.
GC 11	Ability to prepare scientific texts, present, discuss and debate scientific results in their scientific work in national and foreign languages, to an extent sufficient for full understanding, demonstrating a culture of scientific verbal and written language.

The professional competencies that the applicant must master

Code	Professional competencies
PC 1	Ability to apply methods for determination and identification of harmful organisms, to carry out scientifically sound phytosanitary diagnostics in agrobiocenoses and to control the density of harmful organisms.
PC 2	Ability to develop effective scientific models and technological schemes for identifying regulated objects in order to ensure compliance with phytosanitary measures in import-export products and the latest crop management systems.
PC 3	Ability to identify patterns of development and spread of a complex of harmful organisms and to develop scientifically sound protective measures.
PC 5	Ability to develop technological schemes of effective control of a complex of harmful organisms on the basis of regular knowledge and skills in the field of entomology, phytopathology and herbology.
PC 6	Ability to carry out laboratory studies, analyze the relationships of plants and harmful organisms with the development of a methodology for the management of harmful organisms at species and population levels at agricultural sites, both intended and non-intended.

Expected learning outcomes of the course
Program results

Code	Program results
PR 3	To have up-to-date advanced conceptual and methodological knowledge in performing scientific and / or professional activities and at the border of subject areas of knowledge, guided by the principles of academic integrity and scientific ethics.
PR 7	Be able to work with various literary sources, carry out, process, analyze and organize the information received. Understanding of scientific articles in the field of the chosen specialty. Ability to work with up-to-date bibliographic and abstract databases, as well as scientometric platforms such as Web of Science, Scopus and others.
PR 8	Be able to critically analyze, evaluate and synthesize new scientific provisions, various information sources, scientific literature, research of domestic and foreign authors on plant protection and quarantine. Keep up with the latest developments in the industry and find scientific sources relevant to the field of scientific interest of the applicant. Analyze information sources, identify contradictions and previously unsolved problems or parts of them, formulate working hypotheses.
PR 9	Understand the peculiarities of structure and be able to prepare scientific papers (monographs, scientific articles, etc.), following the principles of academic integrity. It is qualified to reflect the results of scientific researches in scientific articles published both in professional domestic publications and in publications that are included in international scientometric bases.
PR 14	Initiate, organize and conduct comprehensive plant protection and quarantine studies that lead to new knowledge.
PR 21	Combine different technological methods of scientific research, including laboratory, to solve typical professional problems, taking into account national and world standards for plant protection and quarantine. Perform research according to methodologies.

Module 1.

Content module 1. Populations of phytopathogenic fungi and factors that influence their formation

Topic 1. Understanding the population of phytopathogenic fungi. The essence of the population of phytopathogenic fungi. Differences between definitions and understanding of populations of other microorganisms. Examples of populations of pathogens of dangerous diseases.

Topic 2. Factors influencing the formation of phytopathogen populations. Variability of phytopathogens. Climate and weather conditions of the season. Influence of populations of nourishing plants. Migration. Gene drift. Human activity.

Module 2.

Content module 2. Basic principles for the study of populations of phytopathogenic fungi

Topic 3. Study of population polymorphism by virulence. Understanding the pathogenicity, virulence, aggressiveness of phytopathogenic fungi. Isolation of phytopathogenic fungi from the affected plants. Understanding monoisolates. Differentiators, features of their creation. Basic

principles of studying the structure of populations of phytopathogenic fungi by virulence. Examples of the study of the structure of populations of phytopathogenic fungi by virulence.

Topic 4. Genetic differentiation of phytopathogens races. The essence of genetic differentiation of races of phytopathogens. History of the study of fungi populations by genetic analysis. Modern examples of differentiation of races of phytopathogenic fungi.

Topic 5. Study of populations of phytopathogenic fungi for resistance to fungicides. The reasons for the decrease in the effectiveness of fungicides. The emergence of resistant forms of pathogens. Examples of populations of phytopathogenic fungi for resistance to fungicides.

Topic 6. Nucleic acid structure in population studies of phytopathogenic fungi. Molecular methods for the study of populations of phytopathogenic fungi. Examples of the study of populations of phytopathogenic fungi by molecular methods.

4. Structure of the course

Names of content modules and topics	Number of hours					
	total	including				
		lectures	practical	lab	Individ.	Indiv.work
Module 1						
<i>Content module 1. Populations of phytopathogenic fungi and factors that influence their formation</i>						
Topic 1. Understanding the population of phytopathogenic fungi.	22	2			20	
Topic 2. Factors influencing the formation of phytopathogen populations.	4	2				
Total hours	26	4			20	
Module 2						
<i>Content module 2. Basic principles for the study of populations of phytopathogenic fungi</i>						
Topic 3. Study of population polymorphism by virulence.	12	2	10			
Topic 4. Genetic differentiation of phytopathogens races.	10	2	8			
Topic 5. Study of populations of phytopathogenic fungi for resistance to fungicides.	66	2			64	
Topic 6. Nucleic acid structure in population studies of phytopathogenic fungi.	8	2	6			
Total hours		8	24		64	
Total hours		12	24		84	

5. Topics and lectures plan

№	Topics	Number of hours
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3/π		
1	2	3
1	Topic 1. Understanding the population of phytopathogenic fungi. The essence of the population of phytopathogenic fungi. Differences between definitions and understanding of populations of other microorganisms. Examples of populations of pathogens of dangerous diseases.	2
2	Topic 2. Factors influencing the formation of phytopathogen populations. Variability of phytopathogens. Climate and weather conditions of the season. Influence of populations of nourishing plants. Migration. Gene drift. Human activity.	2
3	Topic 3. Study of population polymorphism by virulence. Understanding the pathogenicity, virulence, aggressiveness of phytopathogenic fungi. Isolation of phytopathogenic fungi from the affected plants. Understanding monoisolates. Differentiators, features of their creation. Basic principles of studying the structure of populations of phytopathogenic fungi by virulence. Examples of the study of the structure of populations of phytopathogenic fungi by virulence.	2
4	Topic 4. Genetic differentiation of phytopathogens races. The essence of genetic differentiation of races of phytopathogens. History of the study of fungi populations by genetic analysis. Modern examples of differentiation of races of phytopathogenic fungi.	2
5	Topic 5. Study of populations of phytopathogenic fungi for resistance to fungicides. The reasons for the decrease in the effectiveness of fungicides. The emergence of resistant forms of pathogens. Examples of populations of phytopathogenic fungi for resistance to fungicides.	2
6	Topic 6. Nucleic acid structure in population studies of phytopathogenic fungi. Molecular methods for the study of populations of phytopathogenic fungi. Examples of the study of populations of phytopathogenic fungi by molecular methods.	2
	Total	12

6. Practical topics

№ 3/π	Topics	Number of hours
1	Isolation of monospore isolates.	2
2	The history of brown rust pathogen population study in Ukraine.	2
3	Study of wheat rust pathogen population using differentiators.	2
4	The study of brand population of wheat with the help of differentiators ..	2
5	Studying the population of the causative agent of dark brown barley spot with the help of differentiators.	2
6	Genetic analysis of the population of the causative agent of potato blight	2
7	Genetic analysis of the population of the causative agent of brown spot of tomato	2
8	Genetic analysis of wheat powdery mildew pathogen population	2

9	Studying the genetic structure of the <i>Villosiclava virens</i> population using microsatellite markers	2
10	The study of the population of <i>Pyrenophora tritici-repentis</i> by molecular methods	2
11	Molecular methods for the study of barley net blotch pathogen.	2
12	Molecular methods for the study of the population structure of <i>Rhizoctonia solani</i>	2
	Total	24

7. Individual tasks

№	Task	Number of hours
1	To study literary sources about the loss of resistance of wheat varieties to powdery mildew pathogen	20
2	To study literary sources about the decrease in the effectiveness of fungicides to blight	30
3	Write a thesis about the decrease in the effectiveness of fungicidal protection of wheat	34
	Total	84

8. Learning methods

1. Methods of learning by source of knowledge:

1.1. **Verbal:** story, explanation, discussion (heuristic and reproductive), lecture, coaching, etc..

1.2. **Visual:** demonstration, illustration, observation.

1.3. **Practical:** laboratory method, practical work, exercise.

In the case of small groups, the following teaching methods are used:

Personalized Learning
Differentiated Instruction
Inquiry-based Learning

9. Control methods

1. Rating control over a 100-point ECTS rating scale

2. Implementation of the interim control during the term (modules writing)

3. Multicriteria assessment of students' current work:

- the level of knowledge demonstrated in practical, laboratory classes;

- activity during the discussion of the issues raised in the class;

- results of laboratory work execution and defense;

- self study of the topic as a whole or of individual issues;

- analytical and calculation tasks performance;

- abstracts writing;

- test results;

Assessment of the applicant is carried out by commission (the committee includes members of the department)

4. Direct consideration in the final assessment of the student's fulfillment of a specific individual task:

- Scientific research work.

11. Distribution of points received by full-time students

Current testing		Individual tasks	Attestation	Total
Content module 1	Content module 2	15	15	100
35 points	35 points			

Rating scale: national and ECTS

Sum of points for all kinds of educational activity	ECTS grade	National scale grades	
		for exam, course project (work), practice	for credit
90 – 100	A	excellent	passed
82-89	B	good	
75-81	C		
69-74	D	satisfactory	
60-68	E		
35-59	FX	unsatisfactorily with possibility of re-drafting	not passed with possibility of re-drafting
1-34	F	unsatisfactory with the compulsory re-study of the discipline	not passed with the compulsory re-study of the discipline

12. Recommended literature

1. Population biology of phytopathogenic fungi / Yu.T. Dyakov. - Moscow: Ant, 1998. - 382 p.
2. Fundamental phytopathology / under the editorship of Yu.T. Dyakova. Moscow: KRASAND, 2012. 512p.
3. Marutin F.M. Phytopathology: Textbook / Ф.М. Marutin, V.K. Panteleev, MO Bilik; under the editorship of F.M. Marutina. - Kharkiv: Espada, 2008. - 552 p.
4. Phytopathology: textbook for training Bachelors Degree 6.090101 "Agronomy" in higher agrarian educational establishments II-IV levels of accreditation / I.L. Markov [and others]; under the editorship of PhD in Biological sciences, prof. I. Markov; National University of Bioresources and Environmental Management of Ukraine. - Kiev: Phoenix, 2015. – 455p.
5. General and molecular phytopathology: Textbook. / [Dyakov Yu.T., Ozeretskovskaya O. L., Javakhia V. G., Bagirova S. F.]. - M.: Publishing House of the Society of Phytopathologists, 2001. - 302 p.
6. General phytopathology: a textbook for high schools / [Popkova K.V., Shkalikov V.A., Stroykov Yu.M. and others.]. - 2nd ed., Revised. and add. - M.: Drofa, 2005. -- 445 p.

Additional

1. Leontiev D.V., Akulov O.Yu. General Mycology: A Textbook for Higher Educational Institutions / D.V. Leont'ev, O.Yu. Akulov. - X.: View. Edit. Group "Basis", 2007. - 228 p.
2. Dyakov Yu.T. Entertaining Mycology / Yuriy Tarichanovich Dyakov. - M.: Book House "LIBROKOM", 2013. - 240 p.