

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

Faculty of plant protection, biotechnologies and ecology



« APPROVED »

Dean of the Faculty of plant protection,
biotechnologies and ecology

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protocol № 9 from My, 18th, 2023 p.
Scientific council of the Faculty of plant
protection, biotechnologies and ecology

« CONSIDERED AND CONFORMED »

on the meeting of the Department of
Entomology, integrated pest management
and plant quarantine

Protocol №14 from April, 19th, 2023

Department head

Mykola Dolya

Mykola Dolya

GARANT of EP 202 «Plant protection
and quarantine»

Myroslav Pikovskiy

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CURRICULUM

of the course

ББ22

Biological control

Major 202 Plant protection and quarantine
Educational Program Plant protection and quarantine
Faculty of plant protection, biotechnologies and ecology
Author: Associate professor, PhD in biology, Stefanovska T.R.

Kyiv 2023

1. Course description

«Біологічний захист рослин»

Field of knowledge, field of study, specialty, educational qualification level		
Degree of higher education	First (bachelor)	
Major	202 Plant protection and quarantine	
Educational program	Plant protection and quarantine	
Course description		
Вид	Elective	
Загальна кількість годин	120	
Number of Modules	2	
Research paper	None	
Форма контролю	exam	
Course performance indicators		
	Regular study	Corresponding study
Study year	4	4
Semester	8	8
Lectures	30	-
Labs	30	
Independent work	30	
Total	120	

2. Goals and objectives of the course

The goal is to provide bachelors with knowledge about biological methods of integrated plant protection, about the main agents of biocontrol of pests, diseases, and weeds of agricultural crops, as well as familiarization with practical aspects of bioprotection.

Task

- To lay the foundations of the student's fundamental training in the field of biological plant protection
- To acquaint students with the peculiarities of the development of beneficial organisms, the habitats of individual phases of their development, phenology and ecology
- To teach students to identify in a timely manner, correctly establish the species affiliation and on the basis of the economic thresholds of harmfulness (ESH) and the level of effectiveness of entomophages (REE)
- Teach students to correctly choose an effective method of biological control of harmful organisms, taking into account the specific phytosanitary condition

As a result of studying the academic discipline, the student must know: theoretical and practical bases of plant bioprotection; basic methods of bioprotection; the main types of biocontrol agents and their mechanisms of action; classification, methods and regulations for the use of microbiological biological preparations

to control the number of harmful organisms while preserving useful fauna and the environment.

Competence acquisition:

Integral competence. The ability to solve complex specialized tasks and practical problems of professional activity by plant protection and quarantine specialty and to apply theoretical knowledge and methods in production situations characterized by complexity and uncertainty of conditions.

of a bachelor in plant protection and quarantine - the ability to implement educational and social tasks:

General competencies of a bachelor's degree in plant protection and quarantine - the ability to implement educational and social tasks:

GC 3. Ability to communicate in a foreign language, ability to work in a foreign language environment.

GC 7. Ability to learn and master modern knowledge and search, process and analyze information from various sources

GC 9. Ability to make informed decisions.

Special (Professional) competencies of a bachelor's degree in plant protection and quarantine - the ability to perform professional duties by type of professional work:

SC 1. Ability to carry out phytosanitary diagnostics of plant diseases, insects, ticks, nematodes, rodents and weeds according to the latest principles and methods

SC 5. Ability to develop and apply plant protection technologies for agricultural and other purposes.

SC 8. Ability to comprehensively apply methods for long-term regulation, development and spread of pests to an economically insignificant level based on forecasts, economic thresholds of harmfulness, effectiveness of beneficial organisms, energy-saving and environmental technologies that provide reliable plant protection and environmental safety in accordance with the WTO SPS Agreement and the provisions of the European Union

Program learning outcomes:

PLO 6. Correctly use appropriate methods of observation, description, identification, classification, cultivation of agrobiocenoses and maintenance of their stability to preserve natural diversity

PLO 7. Draw up technological maps for organizing plant protection measures

PLO 15. Realize the value of protecting the independence, territorial integrity and democratic system of Ukraine

2. Structure of the course

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4. Topics of seminars (It is not applicable)

№ з/П	Назва теми	Numer of hours
1		
2		
...		

5. Topics of practical works

№	Topic	Hours
1	Main orders wher entomophsgues belong to	2
2	Study of the features of reproduction and development of entomoacarifages	4
3	Entomophages of polyphagous pests	2
4	Entomophages of cereal and grain crops' pests	2
5	Entomophages of legumes	2
	Entomophages of technical crops	2
7	Entomophages of vegetable crops in the open field	2
8	Entomophages of vegetable and ornamental crops in green house	2
9	Entomophages of orchards and berries plantations	2
10	Definition of the main types of trichogramma used in Ukraine	2
11	Viral based insecticides for biocontrol	2
12	Bacterial products for biocontrol	2
13	Microbial products that are based on entomopathogenic and antagonists to disease fungi in biocontrol	2

6. Topics for independent assignments

№ з/П	Topics	Кількість годин
1	To develop presentation in the format of PPT " Biological insecticides of BTU"	6
2	To analyze the main criteria of trichogram quality control on the example of Cherkasbiozahyst company	6
3	To make an analytical review of the main parasitic insects produced by the Koppert company and used in the biological protection of plants	6
4	Analytical review of companies producing and commercillay release Trichogramma in Ukraine	6
5	Ways to activate the activity of entomophages	6
6	Biological methods to control weeds	6
7	Genetic methid in plant protection	6
8	Biological control. Perspective directiona	6

9	Utilisation of biofungicides. Pro and contra	6
10	The prospect of using biological protection of plants on berry crops	6

7. Review questions, sets of tests to access the level of student knowledge

7. a. Review questions

1. Basics of biological protection of plants.
2. Biological preparations for protecting plants from diseases.
3. Biological regulation of the number of weeds.
4. Genetic methods of plant protection.
5. Biofertilizers for plants.
6. Microorganisms - antagonists of phytopathogens.
7. Pathogens of plant diseases.
8. Entomophages and acariphages in the biological protection of plants.
9. Biological preparations for protecting plants from pests.
10. Ecological bases of biological protection of plants.
11. Biological protection: pros and cons.
12. The place of biological methods in integrated plant protection.
13. Plant diseases, classification, main characteristics, mechanisms of action.
14. Bacteria - phytopathogens.
15. Viruses of plants.
16. Patterns of development, distribution, mass outbreaks (epiphytotia).
17. General anatomical and physiological changes in the body of patients.
18. Immunity and quarantine of plants.
19. How to predict the appearance of diseases?
20. Weeds of agricultural crops, main characteristics, mechanisms of action.
21. Basic methods of biological protection of plants.
22. Entomophages and acariphages in plant protection.
23. Insect pathogens as bioagents.
24. Microorganisms antagonists of phytopathogens.
25. Biological preparations for plant protection: fungal, bacterial, etc.
26. Preparations based on BAR.
27. Genetic methods of plant protection.
28. Agrotechnical methods of plant protection.
29. Insecticides and rodenticides.
30. Entomopathogenic drugs.

31. Biological method of protecting indoor plants from pests and diseases.
32. Use of hormonal preparations in the plant protection system.
33. The main herbivores and methods of their use in the fight against weedy vegetation.
34. Modern antibiotics used in plant protection.
35. Biological method in the system of grain protection against pests and diseases.

7.6. Test to check knowledge from the course "Biological control"

1. The method consisting in the use of living beings or products of their vital activity to reduce damage from harmful organisms is called:

- a) agrotechnical; b) biotechnical; c) biological; d) chemical; e) immunological

Correct answer: a)

2. Name the company of the world producer of microbiological pesticides

- a) EnzymAgro; b) Syngenta; c) Koppert; d) Ukravita; e) Byer

Correct answer: c)

3. What percentage was the biological method among other methods of protecting plants from harmful organisms in Ukraine in 2019

- a) 15.5%; b) 10.6%; c) 5.6%; d) 3.4%; e) 2.1%

Correct answer: d)

4. Accept or deny the statement

Is the growth of biological pesticides expected in the world in the next 20 years?

Yes

No

Correct answer: "Yes"

5. The market of biological pesticides in Ukraine is dominated by biological fungicides

Yes

No

Correct answer: "Yes"

6. Name the stage of development of biological plant protection in Ukraine at the present time

- a) inspection; b) descriptive; c) search and application; d) technological; e) molecular-biological

Correct answer: e)

7. Name the outstanding scientist-compatriot who studied muscardine mushrooms on bread beetles in the 19th century

- a) Mykola Dyadechko; b) Antonio Bassi; c) Carl Linnaeus; d) Augusto Androvaddi; e) Ilya Mechnikov

Correct answer: e)

8. In which country in ancient times red ants were used against pests in orange orchards?

a) Italy; b) Greece; c) China; d) Egypt; e) Sweden

Correct answer: c)

9. When rhodolia was brought to the USA to control the population of the grooved belly of Iceria

a) 60 years of the 19th century; b) 80 years of the 19th century; c) 20 years of the 20th century; d) ancient times) in the 20s of the 22nd century

Correct answer: b)

10. Louis Pasteur studied mulberry silkworm diseases that inhibited the development of sericulture in France

Yes

No

Correct answer: "Yes"

11. Name the predator of aphids

a) The seven-pointed ladybug; b) Colorado beetle; c) Aleohara two-striped; d) Trichogramma ordinary; e) Encarsia of Formosa

Correct answer: a)

12. What are the parasites that live and develop on the surface of the host's body and feed through a hole made in its skin called?

a) mandatory; b) ectoparasites; c) optional; d) endoparasites e) commensals

Correct answer: d)

13. Name the entomophagus of the cabbage fly

. a) Aleohara two-striped; c) ordinary trichogram; d) Aphidius Ervi d) Seven-spot ladybug.

Correct answer: a)

14. The krasotyl beetle engages in predation in the larval and adult stages

Yes

No

Correct answer: "Yes"

15. Name the parasite of insect larvae

a) Gabbrobracon sheltered; c) ordinary trichogram; d) Seven-pointed ladybird e) Common goldeneye.

Correct answer: a)

16. Name the most ecologically oriented method of using pesticides to reduce the negative impact on natural enemies of pests involved in the biological protection of plants

a) pre-sowing treatment of seeds; c) granular introduction of drugs; d) spraying; e) application with irrigation

Correct answer: a)

17. The level of effectiveness of an entomophagus REE is the ability of an entomophagus to control the number of pests at a level lower than the economic threshold of harmfulness

Yes

NO

Correct answer: "Yes"

18. Name the soil treatment method that has the most positive effect on beneficial insects whose development cycle is related to the soil

a) Deep plowing; b) minimal processing; c) zero processing; d) Strip plowing; e) Ultrasurface treatment

Correct answer: a)

19. Name the method of creating a sufficient fodder base for additional nutrition of entomophages in order to preserve them

a) use of herbicides; c) drip irrigation; d) sowing nectar-bearing plants (honey-bearing plants); e) application of microfertilizers

Correct answer: d)

20. Name the group of insecticides that have the most negative effect on beetles

a) pyrethroids; b) nicotinoids; c) organophosphorus compounds; d) fungal microbiological insecticides; e) bacterial microbiological insecticides

Correct answer: a)

21. To which order does the trichogram belong?

1) Hymenoptera; b) Hymenoptera; c) Lepidoptera; d) Diptera; e) isosceles.

Correct answer: a)

22. What are the signs of a scoop egg infected with trichogram?

a) acquires a black color for 4-8 days; b) acquires a red color for 4-8 days; c) becomes wrinkled; d) a white liquid flows from the affected egg

Correct answer: a)

23. The effectiveness of using the trichogramma against European corn borer depends on three factors: 1) the timely formation of the butterflies' flight; 2) the selection of the type of trichogram; compliance with the correct regulations of use

Yes

No

Correct answer: "Yes"

24. Name three insects on which trichogram is a parasite

a) European corn borer; b) spider mite; c) the seven-pointed sun; d) grain aphid; e) turtle bug.

Correct answer: a)

25. Name the release rate of the trichogram against the stem butterfly during the first release

a) 10-20 thousand females per hectare; b) 30-50 thousand females per hectare; c) the rate of the first release depends on the number of eggs laid; d) 1-20 thousand females per hectare; e) 60-70

8. Teaching methods

- Explanatory and illustrative method. This method is used as widely as possible to transmit a large amount of information. It can be used to present and learn facts, approaches, assessments, conclusions.
- Reproductive method. It involves the application of what has been learned based on a pattern or rule. The activity of those who are taught is algorithmic, that is, it corresponds to instructions, orders, rules - in situations similar to the presented sample.
- Problem presentation method. Using any sources and means, the teacher, before teaching the material, poses a problem, formulates a cognitive task, and then, revealing the system of evidence, comparing views, different approaches, shows a way to solve the task
- Partial search, or heuristic method. Its essence is the organization of an active search for a solution to cognitive tasks proposed by the teacher (or independently formulated) either under the guidance of the teacher or on the basis of heuristic programs and instructions. Such a method, one of the varieties of which is a heuristic conversation, is a proven way of activating thinking, encouraging knowledge.
- Research method. After analyzing the material, setting problems and tasks, and brief oral or written instruction, the trainees independently study the literature, sources, conduct observations and measurements, and perform other research activities. Initiative, independence, creative search are most fully manifested in research activities.
- Presentations, demonstration, discussion, analysis of specific situations, discussion, conversations, debates, case methods, work in small groups, etc.

9. Forms of student knowledge control

According to the place of control in the educational process, preliminary (incoming), current, milestone and final control are distinguished.

Preliminary control (diagnostics of students' initial level of knowledge) is used as a prerequisite for successful planning and management of the educational process. It makes it possible to determine the existing level of knowledge of the day of their use by the teacher as an orientation in the complexity of the material. *Preliminary control in the form of a check and*

assessment of residual knowledge is also carried out some time after the final exam in a certain discipline both for the purpose of assessing the strength of knowledge and for the purpose of determining the level of knowledge in the supporting subjects to determine the possibility of accepting new educational disciplines.

Current control of knowledge is an organic part of the entire pedagogical process and serves as a means of detecting the degree of perception (assimilation) of educational material. Management of the educational process is possible only on the basis of current control data.

The tasks of current control are reduced to:

- to reveal the volume, depth and quality of perception (assimilation) of the studied material;
- identify deficiencies in knowledge and outline ways to eliminate them;
- to reveal the degree of responsibility of students and their attitude to work, establishing the reasons that prevent their work;
- identify the level of mastery of independent work skills and outline the ways and means of their development;
- stimulate students' interest in the subject and their activity in learning. The main task of current control is to help students organize their work, learn independently, responsibly and systematically study all subjects.

Current control is a continuation of the educational activities of the teacher and the teaching staff, it is related to all types of educational work and should teach students to prepare for the test from the first day of classes and every day, and not at the end of the semester or academic year. At the same time, the current control is an indicator of the work of the teaching staff. Of course, students study up to ten subjects simultaneously in a semester, and not all teachers make the same demands on them.

Frontier (modular) knowledge control is an indicator of the quality of studying individual sections, topics and related cognitive, methodical, psychological and organizational qualities of students. Its task is to signal the state of the student learning process in order to take pedagogical measures for its optimal regulation.

The final control is an exam of students with the aim of assessing their knowledge and skills in accordance with the specialist model. The final control includes semester, course and state exams, as well as tests before the exam. The main purpose of the exams is to establish the actual content of students' knowledge in terms of volume, quality and depth and the ability to apply them in practical activities. It is natural that the final control, to a greater extent than other types of control, performs a control function, requires systematization and generalization of knowledge and to a certain extent implements the educational, developmental and educational

functions of control. The main forms of control of students' knowledge are control at lectures, at seminars and practical classes, during extracurricular hours, at consultations, tests and exams.

Control in extracurricular time:

- Checking the course of homework, research and control works. The quality and accuracy of execution, accuracy and originality of solutions, review of the special are evaluated

10. Distribution of points received by students.

The student's knowledge is assessed on a 100-point scale and translated into national assessments according to Table 1." Provisions on examinations and zilikas in NUBiP of Ukraine (03.03.2021 p. Protocol № 7)

Student rating points	National grade based on exam results	
	Final exams	Credits
90-100	excellent	passed
74-89	good	
60-73	satisfactory	
0-59	unsatisfactory	not passed

To determine the student's rating for mastering the Rdis discipline (up to 100 points), the obtained rating from the certification (up to 30 points) is added to the student's rating for the RHP academic work (up to 70 points): $RDIS = RHP + RHP$

11. Methodological support

Scientific and methodological support of the educational process includes: state standards of education, curricula, educational programs from all normative and selective educational disciplines; programs of educational, industrial and other types of practices; textbooks and training aids; instructional and methodical materials for seminar, practical and laboratory classes; individual educational and research tasks; control works; text and electronic versions of tests for current and final control, methodical materials for organizing students' independent work, performance of individual tasks, course and diploma theses.

12. Study sources

- Білик М.О. Біологічний захист рослин від шкідливих організмів: підручник; Харків: Майдан, 2022. 356 стр.

- Opende Koul, G S Dhaliwal, G W Cuperus. Integrated Pest Management: Potential, Constraints and Challenges CABI Publishing,2004, 329 pp.
- Gimme H Walter - Insect Pest Management and Ecological Research Cambridge University Press.2023, 300p.
- Heimpel, G. E., & Mills, N. J. (2017). *Biological control*. Cambridge University Press. Publisher:Cambridge University Press Online ISBN:9781139029117 DOI:<https://doi.org/10.1017/9781139029117>
- Jeffers, A., & Chong, J. H. (2021). Biological control strategies in integrated pest management (IPM) programs. Clemson University Cooperative, Land-Grant Press by Clemson Extension, LGP, 1111, 1-9.
- Hoddle, M. S. (2023). A new paradigm: proactive biological control of invasive insect pests. *BioControl*, 1-14.

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