

*Federal State Autonomous Educational Institution of Higher Education
«RUDN University»*

*Agrarian and Technological Institute
Recommended by ISSC*

WORKING PROGRAM OF THE DISCIPLINE

Наименование дисциплины

Molecular Methods of Diagnostic

Recommended for the direction of training/specialty

35.06.01 «Agriculture»

Program Profile 06.01.07 «Plant Protection»

PhD Program

1. Goals and objectives of the discipline:

The **objective** of the discipline is to train specialists in the field of molecular diagnostics of viral, bacterial, fungal and nematode plant diseases; the formation of modern knowledge and holistic ideas about the genetics and biochemistry of phytopathogenic microorganisms among graduate students, and the use of specific signs for their detection and diagnosis.

Discipline objectives

To study the main methods of detection and determination of phytopathogenic microorganisms, the peculiarities of genetics and physiology of phytopathogenic organisms.

2. Place of discipline in the structure of GPC BO:

The discipline "Molecular Methods of Diagnostic" refers to the variable part of the GPC and the professional cycle of the direction "Agriculture" of block 1 of the curriculum.

Table 1 shows the previous and subsequent disciplines aimed at the formation of discipline competencies in accordance with the competence matrix of GPC BO.

Prior and subsequent disciplines aimed at the formation of competencies

№	Code and name of competence	Preceding disciplines	Subsequent disciplines (groups of disciplines)
General professional competencies			
1	GCC-1 - possession of the methodology of theoretical and experimental research in the field of agriculture, agronomy, plant protection, selection and genetics of agricultural crops, soil science, agrochemistry, landscape development of territories, technologies for the production of agricultural products		Plant Protection Features of the inheritance of resistance of organisms
2	GPC-3 - the ability to develop new research methods and their application in the field of agriculture, agronomy, plant protection, breeding and genetics of agricultural crops, soil science, agrochemistry, landscaping, agricultural production technologies,		Защита растений Особенности наследования резистентности организмов

	considering the observance of copyright		
Professional Competence			
1	PC-1: the ability to understand modern agricultural problems and use fundamental agricultural concepts in the field of professional activity to formulate and solve new problems		Plant protection Features of the inheritance of resistance of organisms
2	PC-6 - the ability to apply the methodological foundations of the design and implementation of laboratory agricultural research using modern equipment and computing systems (in accordance with the goals of the graduate student training program), the ability to generate new ideas and methodological solutions		Защита растений Особенности наследования резистентности организмов

1. Requirements for the results of mastering the discipline

The process of studying the discipline is aimed at the formation of the following competencies:

General professional competencies:

GPC-1 - possession of the methodology of theoretical and experimental research in the field of agriculture, agronomy, plant protection, selection and genetics of agricultural crops, soil science, agrochemistry, landscape development of territories, technologies for the production of agricultural products

GPC-3 - the ability to develop new research methods and their application in the field of agriculture, agronomy, plant protection, breeding and genetics of agricultural crops, soil science, agrochemistry, landscape development of territories, technologies for the production of agricultural products, considering the observance of copyright

Professional competencies:

GC-1: the ability to understand modern agricultural problems and use fundamental agricultural concepts in the field of professional activity to formulate and solve new problems

GC-6 - the ability to apply the methodological foundations of the design and implementation of laboratory agricultural research using modern equipment and computing systems (in accordance with the goals of the graduate student training program), the ability to generate new ideas and methodological solutions

As a result of studying the discipline, a graduate student must:

Know:

- modern scientific systems and methods that are universal in the scientific community;

- modern methods of diagnostics and accounting of harmful organisms, methods for assessing the effectiveness of means and methods of plant protection;
- modern methods of molecular diagnostics of phytopathogens.

Be able to:

- independently diagnose and consider the objects of research;
- plan laboratory and field experiments on plant protection;
- analyze materials and generalize the results of scientific experiments in the field of integrated plant protection;
- to carry out molecular diagnostics of phytopathogens.

Own:

- skills in planning, organizing and conducting scientific experimental research in the field of plant protection; the ability to objectively analyze and report on the results of work;
- skills in molecular diagnostics of phytopathogens.

4. Scope of discipline and types of educational work

The total workload of the course is 4 credit units.

Type of educational work	Total hours	Semesters			
		1	2	3	4
Classroom Lessons (Total)	80				80
Including:	-		-	-	-
<i>Lectures</i>	40				40
<i>Practical lessons (PL)</i>	40				40
<i>Seminars (S)</i>					
<i>Laboratory work (LW)</i>					
Independent work (Total)	37				37
Control	27				27
Total work rendered	hrs				
	units.	144			144
		4			4

5. Content of the discipline

5.1. Contents of discipline sections

Content of the discipline

№	Name of the discipline section	Section content (topics)
1	Molecular diagnostics of phytopathogens	Molecular diagnostics and its types. Main directions, history of science. Sampling strategy.
2	Visual diagnostics and indicator plants	Methods for visual diagnostics of phytopathogens and assessment of indicator plants
3	Electron microscopy and serological diagnostics	Electron microscopy and serological diagnostics
4	Basic detection methods in molecular diagnostics of phytopathogens	General information. Use of universal and multicopy loci.
5	Detection of phytopathogenic fungi, bacteria, viruses / viroids	Methods for the detection of phytopathogenic fungi, bacteria, viruses / viroids

6	Real-time PCR. Biochips	Staging methods PCR. Working with biochips
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5.2. Sections of disciplines and types of classes

№	Name of the discipline section	Lec.	Practicum	Lab work	Seminar	IW	Total Hours
1.	Types of molecular diagnostics of phytopathogens	6	6		8	4	24
2.	Visual diagnostics and indicator plants	7	7		7	4	25
3	Electron microscopy and serological diagnostics	7	7		7	5	26
4	Basic detection methods in molecular diagnostics of phytopathogens	7	7		7	5	26
5	Detection of phytopathogenic fungi, bacteria, viruses / viroids	7	7		7	5	26
6	Real-time PCR. Biochips	6	6		8	4	24
		40	40		37	27	144

6. Material and technical support of the discipline: Laboratory of phytopathology, laboratory of entomology, laboratory of plant immunity, laboratory of phytopathogen diagnostics, illustrative material, handouts, multimedia complex.

7. Information support of the discipline

a) Software

- Windows 7 Corporate.
- Microsoft Office.
- Adobe Acrobat.
- Microscopes.
- Herbarium material.
- Visual tabular material.
- Pathogen Collection.
- MStat Software Program.

b) Databases, reference and search systems:

- 1.. Genome-wide approaches to functional analysis of repetitive elements:
<http://dis.podelise.ru/text/index-26556.html>
2. Background information on molecular diagnostics at the free encyclopedia Wikipedia
<https://ru.wikipedia.org/wiki>
3. Географическая информационная система «Агроэкологический атлас России и сопредельных стран: экологически значимые растения, их болезни, вредители и сорные растения» <http://www.agroatlas.ru/ru/>

4. Molecular diagnostic methods for potato diseases:
http://agrokorenevo.ru/metody_molekulyarnoy_diagnostiki_bo
5. Website of the International Society of PHYTOPATHOLOGISTS
 InternationalSocietyforPlantPathology <http://www.isppweb.org/>
6. Reference site for potato breeding and protection www.kartofel.org
7. URL: <http://biblioclub.ru/index.php?page=book&id=143079>. Date of the application
 25.11.2014.
8. www.binran.ru
9. www.elibrary.ru
10. www.diclib.com
11. www.lomonosov-fund.ru
 University library online: <http://www.biblioclub.ru>
1. 1. National digital resource "RUKONT": <http://rucont.ru>
 2. IQlib: <http://www.iqlib.ru>
 3. ScienceDirect: <http://www.sciencedirect.com>
 4. Sage Publications: <http://online.sagepub.com>
 5. Web of Science: <http://www.isiknowledge.com>
 6. University information system RUSSIA: <http://www.cir.ru/index.jsp>
 7. Educational portal of RUDN University: <http://web-local.rudn.ru/>
- Consultant <http://www.studmedlib.ru>

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- 8. Educational and methodological support of the discipline) Main literature**
1. Гирсова Н.В., Кастальева Т.Б., Можаяева К.А. Методика определения фитоплазм с использованием молекулярных методов диагностики: ПЦР ПДРФ. М., 2013, 23 с.
 2. Detection of Plant-Pathogenic Bacteria in Seed and Other Planting Material, Sec. Edition. Eds: M'Barek Fatmi, Ron R. Walcott, and Norman W. Schaad 2017. 372 pp. ISBN 978-0-89054-539-3

б) additional literatur

1. Биоразнообразии растений, микроорганизмов и методы их изучения: сб. ст. / Тюм. гос. ун-т; отв. ред. Н.А. Боме. – Тюмень: Изд-во ТюмГУ, 2008. – 140 с.
2. Практикум по микробиологии: учеб. пособие для студ. вузов, обуч. по напр. "Биология", спец. "Микробиология" / ред. А. И. Нетрусов. – М.: Академия, 2005. – 608 с.
3. Кухарчик, Н.В. Вирусные и фитоплазменные болезни плодовых и ягодных культур в Беларуси / Н.В. Кухарчик; под ред. Г.В. Малахова. – Минск: Белорусская наука, 2012. – 230 с.

10. Educational and methodological support of the discipline:

11. Methodical instructions for students on mastering the discipline (module)

Postgraduate students must observe discipline, come to classes on time, submit homework for testing, prepare for the test and control work provided for in the course, be active in the classroom. An important place in the educational process is occupied by the independent work of graduate students. To organize independent work on the course, modern information technologies

are used: online complexes of educational and teaching materials (program, list of recommended literature and information resources, tasks for self-control), free access to the Internet for working with databases. As part of independent work, students prepare a patent application or a Scopus / WoS article.

Semester work

Job type	Number of tasks	No. of points	Total points
Writing a review article	1	50	50
Seminar work, homework, presentation	6	5	30
Final certification (exam)	1	20	20
TOTAL (maximum points)			100

Features of the implementation of discipline for people with disabilities and people with disabilities. Training in the discipline of disabled people and persons with disabilities (hereinafter HIA) is carried out by the teacher, considering the characteristics of psychophysical development, individual capabilities and health status of such students. For students with musculoskeletal disorders and hearing disabilities, lectures will be accompanied by multimedia tools and handouts.

For students with visual disabilities, the use of technical means for enhancing residual vision is provided, and the possibility of developing audio materials is also provided. In this discipline, training for disabled people and people with disabilities can be carried out both in the classroom and remotely using the capabilities of the electronic educational environment (TUIS) and e-mail.

In the course of classroom training, various means of interactive learning are used, including group discussions, brainstorming, business games, project work in small groups, which makes it possible to include all participants in the educational process in active work on mastering the discipline. Such teaching methods are aimed at teamwork, discussion, group decision-making, contribute to group cohesion and provide opportunities for communication not only with the teacher, but also with other students, cooperation in the process of cognitive activity. Training of disabled people and persons with disabilities can be carried out according to an approved individual schedule, taking into account the characteristics of their psychophysical development and health status, which implies the individualization of the content, methods, pace of the student's learning activity, the ability to follow the specific actions of the student when solving specific problems, making the need, the required adjustments in the training process.

It provides for individual consultations (including counseling via e-mail), the provision of additional educational and methodological materials (depending on the diagnosis).

12. Fund of assessment tools for intermediate certification of students by discipline (module)

Materials for assessing the level of mastering the educational material of the discipline "Modern methods of diagnostics of pests" (evaluation materials), including a list of competencies indicating the stages of their formation, description of indicators and criteria for assessing competencies at various stages of their formation, description of assessment scales, standard control tasks or other materials necessary for assessing knowledge, skills, skills and (or) experience of activity, characterizing the stages of the formation of competencies in the process of mastering the educational program, methodological materials that determine the procedures for assessing knowledge, skills, skills and (or) experience of activities that characterize the stages of formation competencies are developed in full and are available for students on the discipline page at TUIS RUDN. The program was drawn up in accordance with the requirements of RUDN University.

Director of Agrobiotechnology Department



E.N. Pakina Пакина

E.H.

