

GRADUATE PROGRAM *Master's Degree in Biotechnologies for Food Quality and Safety (LM7)*

ACADEMIC YEAR 2023/2024

COURSE TITLE *Biotechnologies for the Health and Safety of Plant Productions (9 ECTS)*

Key information about the course	
Academic year/Year of study	<i>First year</i>
Delivery period	<i>2nd semester (MARCH – JUNE 2024)</i>
University credits (CFU/European Credit Transfer and Accumulation System)	9
SSD Scientific-disciplinary sector	<i>AGR12 – Plant Pathology</i>
Language of delivery	Italian. English, if necessary for foreign students.
Attendance mode	<i>Optional but strongly recommended</i>

Instructor	
Name and Surname	<i>Franco Nigro</i>
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Office/Location	<i>Department of Soil, Plant, and Food Sciences – South Wing Section of Plant Pathology, Third floor, room No. 6.</i>
Office/Location	<i>Piattaforma Teams lw2vt06 and email</i>
Reception/Office hours	<i>Tuesday, Wednesday, and Thursday from 3:00 PM to 4:30 PM. It is preferable to arrange appointments via email. The meeting can take place in person at the teacher's office or virtually, on Teams, and upon request on another platform</i>

Teaching organization			
Hour			
Total	Frontal teaching	Practice (laboratory, fieldwork, exercises, other)	Individual study
225	56	24	145
CFU/ETCS			
9	7	2	

Educational objectives/learning outcomes	The course aims to provide students with knowledge of the main alterations of biotic origin harmful to the health and safety of plant products, as well as to provide elements for the understanding of their molecular determinism.
Prerequisites	Knowledge of General Plant Biology and General Plant Pathology

Teaching methods	<i>The topics of the course will be covered with the help of PowerPoint presentations, videos, shared readings of scientific articles, and research on the web. Practical laboratory activities, case study resolution, and educational visits to companies and research centers will be part of the exercises. All the materials used for the lessons will be made available to students on a dedicated Teams platform during the course and in the following three years.</i>
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Risultati di apprendimento previsti	The expected learning outcomes in terms of knowledge, skills, and abilities are indicated for each Dublin Descriptor (DD) in accordance with what is specified in
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<p>To be indicated for each Dublin Descriptor (DD)</p> <p>DD1 Knowledge and understanding.</p> <p>DD2 Applied knowledge and understanding.</p> <p>DD3-5 Transversal skills.</p>	<p>Article 4 of the educational regulations of the study program.</p> <p>Dublin Descriptor 1: knowledge and understanding</p> <ul style="list-style-type: none"> • Knowledge of alterations of biotic origin caused by fungi, bacteria, phytoplasmas, and viruses harmful to the health and safety of plant products. • Knowledge and understanding of the main physiological and molecular mechanisms underlying the pathogenic activity of fungi, bacteria, phytoplasmas, and viruses. • Knowledge of contaminants (fungicides, insecticides, preservatives, etc.) harmful to the health and safety of plant-based foods. • Knowledge of different diagnostic approaches for the identification of agents causing biotic alterations. <p>Dublin Descriptor 2: ability to apply knowledge and understanding</p> <ul style="list-style-type: none"> • Ability to apply various diagnostic techniques for the identification of agents causing biotic alterations. • Knowledge and understanding of biotechnological tools for the protection of plant products, employing both traditional approaches (microbial antagonists) and transgenic methods. • Possession of adequate technical-scientific language. • Acquisition of skills in handling agents causing alterations (fungi and bacteria) and in setting up a PCR reaction. <p>- Dublin Descriptor 3: critical and judgmental abilities</p> <ul style="list-style-type: none"> • Autonomy of judgment; • At the end of the course, the student should be able to: • Identify the key aspects of emerging issues in biotechnologies applied to the protection of the health and safety of plant productions, proposing solutions based on acquired patterns or new alternatives. • Autonomously evaluate the complexity of experimental data related to the applications of biotechnologies for the protection and enhancement of plant productions, correctly interpreting the results. <p>- Dublin Descriptor 4: ability to communicate what has been learned.</p> <ul style="list-style-type: none"> • Communication skills; • At the end of the course, the student should be able to: • Effectively use biotechnological terminology in the field of plant pathology and possess tools for oral, written, and graphic communication, even during events presenting and disseminating biotechnological applications for disease protection and the quality of plant productions. • Develop critical awareness and independent thinking. • Interact with other students and articulate one's own thoughts. • Express oneself with appropriate technical-scientific language. • Communicate orally and in writing with specific reference to disciplinary lexicons in Italian and English. • Communicate one's thoughts in multidisciplinary group activities. <p>- Dublin Descriptor 5: ability to continue studying independently throughout life.</p> <ul style="list-style-type: none"> • Capacity for autonomous learning; <p>At the end of the course, the student should be able to:</p> <ul style="list-style-type: none"> • Develop scientific curiosity and research through both scientific and popular journals. • Learn and deepen the application of biotechnologies suitable for the protection of the health and safety of plant productions by consulting databases and bibliographic resources, both in print and electronic form, or through participation in specific events.
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	<ul style="list-style-type: none"> Independently rework the information learned during the course. Ability to deepen and update one's knowledge related to biotechnologies for the health and safety of plant products. <p>The expected learning outcomes, in terms of knowledge and skills, are reported in Article 2 of the Educational Regulations of the Study Program (expressed through the European descriptors of the qualification).</p>
Teaching contents (Syllabus)	<p>Eukaryotic Plant Pathogens: Oomycota and Fungi: general characteristics, systematics' elements, morphology, and biology. Genomics in fungi, secretion systems, and effectors. Host sensing. Secretion systems and effectors. Degrading enzymes of the cell wall and their inhibitors. Secondary metabolism of fungi. Degrading enzymes of the cell wall and their inhibitors.</p> <p>Prokaryotic Plant Pathogens: Bacteria and phytoplasmas: general characteristics, systematic elements, morphology, and biology. Pathogenesis mechanisms of phytopathogenic bacteria. Quorum Sensing and Quorum Quenching. Pathogenesis mechanisms of prokaryotic plant pathogens.</p> <p>Plant/Pathogen/Environment Interaction: Plant immune system: biochemical and molecular basics of pathogen recognition and activation of plant defenses. Role of plant hormones in regulating immune responses. Hypersensitive response (HR) and systemic acquired resistance (SAR).</p> <p>Plant-Fungi Interaction. Plant-Prokaryotes Interaction. Plant-Virus/Viroid Interaction.</p> <p>Strategies for Plant and Crop Protection: Phytosanitary barriers: certification and phytosanitary legislation. Quarantine pathogens and priority harmful organisms. Biological protection: definitions and scopes. Microbial antagonism. Trichoderma spp. The role of the phytobiome in plant/pathogen/environment interaction. Chemical protection: fungicides - mechanisms of action and resistance mechanisms. Induction of resistance in plants. Soil suppressiveness.</p> <p>Biotechnologies for Pathogen Resistance.</p> <p>Diagnostic Techniques for Pathogenic Agents: Prokaryotes, eukaryotes, viruses, and viroids. Sensors, biosensors, and image analysis in phytopathological diagnostics: main characteristics, functioning mechanisms, and fields of application.</p>
Reference texts	<ul style="list-style-type: none"> PATOLOGIA VEGETALE MOLECOLARE edited by M. Reverberi, M. Ruocco, L. Covarelli, L. Sella, 2022 Piccin Editore. AGRIOS' PLANT PATHOLOGY Sixth Edition, edited by Richard Oliver, Academic Press, 2024. Scientific articles and reviews from the relevant literature. Lecture notes and educational materials distributed during the course.
<ul style="list-style-type: none"> Notes on reference texts 	The lecture notes and slides complement and do not substitute for the content of the reference texts.
Materiali didattici	The educational materials will be available for students in the Teams Class with

	the access code "lw2vt06" during the course and in the following three years.
Evaluation	
Methods of learning assessment	<p>For students enrolled in the academic year in which the course is offered, an exemption exam is provided. The exemption exam consists of an oral test on the topics covered during the theoretical and theoretical-practical lessons in the classroom and laboratory up to the exam date. The exemption will be evaluated with a suitability judgment, and in case of a positive outcome, the subsequent oral exam will focus on the topics covered during the theoretical and theoretical-practical lessons in the classroom and laboratory after the exam date. The result of this exam contributes to the assessment of the final exam and is valid for one academic year.</p> <p>The exam consists of an oral test on the topics covered during the theoretical and theoretical-practical lessons in the classroom and laboratory, as outlined in the Educational Regulations of the Degree Course. The assessment of the student's preparation is based on predetermined criteria, as detailed in the Educational Regulations of the Degree Course.</p> <p>The final exam for foreign students can be conducted in English following the above-described procedures.</p>
Evaluation Criteria	<p>Knowledge and Understanding:</p> <ul style="list-style-type: none"> • <i>Understanding of the factors and mechanisms of biotic alteration in plant production.</i> • <i>Knowledge of biotechnological interventions for the protection of the health and safety of plant productions.</i> <p>Applied Knowledge and Understanding:</p> <ul style="list-style-type: none"> • <i>Level of comprehension of case studies related to the application of biotechnological approaches, whether traditional or innovative, for the protection against biotic alterations in plant productions.</i> <p>Autonomy of Judgment:</p> <ul style="list-style-type: none"> • <i>Ability to identify central aspects of new issues in the fields of biotechnologies for the protection of the health and safety of plant productions, whether fresh or preserved, using known approaches or developing innovative solutions.</i> • <i>Ability to autonomously assess the complexity of experimental data related to the applications of biotechnologies for the protection of plant products and interpret their significance.</i> <p>Communicative Skills:</p> <ul style="list-style-type: none"> • <i>Ability to use appropriate biotechnological language in the field of phytopathology and the protection of plant products.</i> <p>Learning Skills:</p> <ul style="list-style-type: none"> • <i>Ability to understand scientific articles related to the application of modern biotechnological processes for the protection of the safety and health of plant products.</i> • <i>Ability to rework acquired concepts and make connections between different topics.</i>
Measurement Criteria for	<i>The evaluation of the student's preparation is based on predetermined criteria, as</i>

Learning and Assignment of the Final Grade	<i>outlined in the Educational Regulations of the BQSA Degree Course (Art. 4). For students who have taken the exemption exam, the evaluation of the final exam takes into account the score obtained in the exemption exam not as an arithmetic average but as a weighted score relative to the program covered by the exemption exam. In assigning the final grade, consideration will be given to the theoretical and practical knowledge acquired, the ability to apply such knowledge, autonomy of judgment, and communicative skills.</i>
Other	
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