

COURSE OF STUDY: Master Course in Plant Medicine (LM69)

ACADEMIC YEAR: 2023-2024

ACADEMIC SUBJECT: Physiological plant pathology (C.I. Plant physiology and Physiological plant pathology)

General information	
Year of the course	<i>Second</i>
Academic calendar (starting and ending date)	<i>First semester (September 25, 2023 – January 19, 2024)</i>
Credits (CFU/ETCS):	<i>3</i>
SSD	<i>AGR/12</i>
Language	<i>Italian</i>
Mode of attendance	<i>Optional</i>

Professor/ Lecturer	
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Virtual room	<i>Microsoft Teams Code: myfj8t1</i>
Office Hours (and modalities: e.g., by appointment, on line, etc.)	<i>Monday to Friday 10:30 - 12:30 according to an established appointment requested by phone or e-mail</i>

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
<i>75</i>	<i>16</i>	<i>14</i>	<i>45</i>
CFU/ETCS			
<i>3</i>	<i>2</i>	<i>1</i>	

Learning Objectives	<i>The course aims to provide in-depth knowledge about: - methodologies for the study of cytological, morphological, biochemical, physiological and genetic alterations caused by pathogens in plants; - tools adopted by pathogens to attack the host; - signalling molecules synthesized by the pathogen and plant host during the chain of events involved in disease development; - plant-pathogen interactions as a tool to prevent or manage plant diseases; - bacterial or fungal biomolecules as agrochemicals.</i>
Course prerequisites	<i>Knowledge of Physiology and pathology requests for admission to the Master course in Plant Medicine</i>

Teaching strategies	<i>The topics of the course will be treated with:</i> <ul style="list-style-type: none"> • <i>Lectures presented through PowerPoint and other supports.</i> • <i>Classroom or laboratory exercises</i> • <i>Working groups</i>
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	<ul style="list-style-type: none"> • <i>Lab, field, and greenhouse training.</i> • <i>Case studies</i> • <i>Comparison with the experiences of stakeholders'</i> <p><i>Public platforms (e.g., Teams) and dedicated platforms (Agridodcast) will be used in E-learning mode, especially at the request of students with disabilities, working students, student athletes and students with new-borns.</i></p> <p><i>The topics of the course presented as case studies and in frontal teaching, will be discussed in the classroom and will be the subject of exercises and lab experiences. The results of the exercises and lab experiences will be also discussed jointly and in group work.</i></p>
<p>Expected learning outcomes in terms of</p>	<p><i>At the end of the training course, the student will be able to know:</i></p> <ul style="list-style-type: none"> ○ <i>the main morphological, biochemical, physiological, cytological, and genetic alterations caused by pathogens in plants;</i> ○ <i>methodologies for the study of the main metabolic pathways involved in physiological alterations;</i> ○ <i>virulence factors and molecules-signal produced by plant pathogens and their effects on the physiological functions of plants;</i> ○ <i>molecules produced by the plant host as a response to the presence of pathogen;</i> ○ <i>biomolecules produced by plant-pathogenic fungi and bacteria used in agriculture as phytosanitary devices.</i> ○ <i>o virulence factors produced by pathogens and plant defence molecules at different stages of the infectious process.</i>
<p>Knowledge and understanding on:</p>	<p><i>The student will be able to understand:</i></p> <ul style="list-style-type: none"> ○ <i>the main morphological, biochemical, physiological, cytological, and genetic alterations caused by pathogens in plants</i> ○ <i>methodologies for the study of the main metabolic pathways involved in physiological alterations.</i> ○ <i>virulence factors and molecules-signal produced by plant pathogens and their effects on the physiological functions of plants;</i> ○ <i>the principal molecules synthesized by the plant as a response to the presence of pathogen;</i> ○ <i>biomolecules produced by plant-pathogenic fungi and bacteria useful in agriculture.</i>
<p>Applying knowledge and understanding on:</p>	<ul style="list-style-type: none"> ○ <i>Capacity to identify the type of stress to which a plant is subjected and the mechanisms associated with it;</i> ○ <i>Capacity to associate pathogen-virulence-factors and plant-defence-molecules at the different stages of the infection process;</i> ○ <i>Knowledge about biomolecules applied as chemicals.</i>
<p>Soft skills</p>	<ul style="list-style-type: none"> • <i>Making informed judgments and choices</i> <ul style="list-style-type: none"> ○ <i>Ability to analyse plant-pathogen interaction as the physiological decayed pathways.</i> • <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> ○ <i>Ability to discuss critically the physio-pathological bases of plant-pathogen interaction-environment-resident organisms</i> • <i>Capacities to continue learning</i> <ul style="list-style-type: none"> ○ <i>The ability to use information and understanding obtained from the course to continuously upgrade new knowledge concerning Physiological plant-pathogens interactions.</i> ○ <i>recognize the physiological basis of plant-pathogen interaction;</i> ○ <i>suggest the virulence factors used by plant pathogens and the defences carried out by the infected plant.</i> ○ <i>The expected results of learning, in terms of knowledge and skills, are</i>

	<i>listed in Annex A of the Teaching Regulation of the Master Course in Plant Medicine (expressed by means of the European Descriptors of the Master Course; concerning the Plant Protection disciplines).</i>
Syllabus	
Content knowledge	<p><i>Refer to: disease, pathogenesis and disease cycle.</i></p> <p><i>Cytological, morphological, biochemical, physiological and genetic alterations caused by pathogens in plants and methodologies of study.</i></p> <p><i>Pathogen virulence factors (enzymes, microbial toxins, exopolysaccharides, growth regulator substances, plasmids, suppressors of plant defence response).</i></p> <p><i>Signal-molecules produced by the pathogen before, during and after plant-pathogen-interaction. Production, perception and transduction of biochemical signals in plant defence. Activation of metabolic cycles involved in the resistance. Phenolic metabolism, phytoalexins. Induction of chemical defences. Study of molecular mechanism in the plant disease.</i></p> <p><i>Plant-pathogen-environment-interactions to prevent or contrast diseases development; Biomolecules produced by plant-pathogenic bacteria or fungi as chemicals.</i></p>
Texts and readings	<ul style="list-style-type: none"> • <i>Notes on lectures distributed during the course.</i> • <i>Matta A., Pennazio S., 1984 - Elementi di fisiopatologia vegetale, Pitagora.</i> • <i>Stacey G., Mullin B., Gresshoff P.M. (Eds.), 1997 - Biology of plant-microbe interactions. International Society for molecular plant-microbe interactions, APS.</i> • <i>Keen N. T., Mayama S., Leach J.E., Tsuyumu S. (Eds.), 2001 - Delivery and perception of pathogen signals in plants. APS.</i> • <i>Prell H.H., Day P.R., 2000 - Plant-Fungal pathogen Interaction: A classical and molecular view. Springer-Verlag.</i> • <i>Buchanan B.B., Gruissem W., Jones R.L., 2003 - Biochemistry and Molecular Biology of Plants (cap. 20-21-24), ASPP.</i> • <i>Agrios G.N., fifth edition. Plant Pathology. Elsevier Academic Press .</i>
Notes, additional materials	<i>The texts are available at the Di.S.S.P.A. Plant Pathology section library and at the office of the teacher.</i>
Repository	<i>Microsoft Teams class: qrvrkal</i>
Assessment	
Assessment methods	<p><i>The exam, unique, and collegial for the I.C. Plant physiology and Physiological plant pathology is an oral test on the topics developed during lectures, class, or laboratory exercises, working groups, Lab, field and greenhouse training as reported in the Didactic regulation of the Master Course in Plant Medicine (article 9) and in the syllabus (Annex A).</i></p> <p><i>The evaluation of the student's preparation is based on established criteria, as detailed in Annex A of the study regulations of the master's degree program. For students enrolled in the academic year in which the module is taught, there is an intermediate exemption oral test. This exemption regards the subjects of lectures and laboratory classes held in the period before the test itself (about half of the program). The exemption test for Physiological plant pathology module consists at least of two oral questions about lectures and laboratory classes held in the period before the test itself. The positive result of the exemption is valid for one academic year.</i></p> <p><i>For students fit to the exemption test, the final oral exam will point to topics of lectures and laboratory classes held in the subsequent period of the test itself.</i></p>

	<p><i>For Physiological plant pathology module at least of two oral questions will be given. For these students, the assessment of the exam is expressed as an average between the exemption and the final exam. For students who have NOT passed/supported the exemption test, the exam for the Physiological plant pathology module consists at least of four questions.</i></p> <p><i>For foreign students, the exam can be done in English.</i></p>
Assessment criteria	<ul style="list-style-type: none"> • <i>Knowledge and understanding</i> <ul style="list-style-type: none"> ○ Describe the main alterations caused by pathogens in diseased plants and the appropriate methodologies of study; ○ Describe the plant-pathogen-environment interactions in terms of virulence factors, molecules-signal, biochemical signals and their physio-pathological aspects and applications in agriculture • <i>Applying knowledge and understanding</i> <ul style="list-style-type: none"> ○ Describe the plant-pathogen-environment interactions from a phytopathological point of view • <i>Autonomy of judgment</i> <ul style="list-style-type: none"> ○ Express reasonable assumptions on Plant-pathogen-environment interaction in terms of changed physiological functions. • <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> ○ Express reasonable assumptions on Plant-pathogen-environment interaction in terms of changed physiological functions ○ The students have to be able to explain topics acquired during classes. • <i>Communication skills</i> <ul style="list-style-type: none"> ○ Describe with appropriate language the physiopathology of plant-pathogen-environment interaction ○ Organize the acquired knowledge in the form of a didactic presentation and articulate it for didactic purposes • <i>Capacities to continue learning</i> <ul style="list-style-type: none"> ○ The student is expected to show achievement, according to previously reported expected learning, outcome, at least of satisfactory knowledge levels, to start professional activity.
Final exam and grading criteria	<p><i>The verification of the learning outcomes related to the individual indicators will take place during the lessons, laboratories, ongoing tests, and final exam. It is expected that the student correctly understands the question posed and provides it in a synthetic way but with adequate arguments, the details necessary to formulate the correct answer, also through links to similar topics covered in the teaching program. The evaluation of the ongoing test and the exam is expressed in thirtieths.</i></p> <p><i>The evaluation will refer to the following rating scale:</i></p> <p><i>Fragmentary knowledge, poor and incorrect exposure (< 18 insufficient)</i></p> <p><i>Knowledge of general content, simple exposition (18 – 20)</i></p> <p><i>Appropriate knowledge, not deepened simple exposition (21 – 23)</i></p> <p><i>Appropriate and broad knowledge, presented in an articulate way (24 – 25).</i></p> <p><i>Precise and complete knowledge, clear and correct exposure (26 – 27)</i></p> <p><i>Comprehensive and in-depth knowledge, safe and correct exposure (28 – 29)</i></p> <p><i>In-depth knowledge, mastery of exposure, and interdisciplinary links (30 and 30 laude)</i></p>
Further information	