



UNIVERSITÀ  
DEGLI STUDI DI BARI  
ALDO MORO

DIPARTIMENTO DI  
SCIENZE DEL SUOLO, DELLA  
PIANTA E DEGLI ALIMENTI

# LAUREA MAGISTRALE IN MEDICINA DELLE PIANTE

INTERNATIONAL JOINT MASTER DEGREE IN  
**PLANT MEDICINE**



General Information			
Academic subject	<b>Diagnosis and Biotechnologies in Plant Pathology</b>		
Degree course	<b>Master's degree Plant Medicine (LM69)</b>		
Curriculum			
ECTS credits	6		
Compulsory attendance	No		
Language	Italian (English will be used when required for foreign students into didactic material)		

  

Subject teacher	Name Surname	Mail address	SSD
	<b>Stefania POLLATRO</b>	stefania.pollastro@uniba.it	AGR/12

  

ECTS credits details	Area		
Basic teaching activities	Plant Protection disciplines		

  

Class schedule	
Period	First semester
Year	Second year
Type of class	Lectures, 4 ECTS (32 hours) Laboratory and field classroom, working groups, study case, and transferring of stakeholders' experiences 2 ECTS (28 hours) E-learning using public (eg Teams) and dedicated (Agripodcast) platforms can be used, on demand as learning facilities for students with disabilities and for working students, student athletes and students with babies

  

Time management	
Hours	150
In-class study hours	60 (32 Lectures + 28 Lab & field cl.)
Out-of-class study hours	90

  

Academic calendar	
Class begins	2020 March 2
Class ends	2020 June 12

  

Syllabus	
Prerequisites/requirements	Basic knowledge on biology, botany, plant physiology, general plant pathology, mycology, bacteriology, virology and special plant pathology.
Expected learning outcomes	<p><i>Knowledge and understanding on:</i></p> <ul style="list-style-type: none"> <li>○ methods and techniques that can be used for the diagnostic assessment (field, monitoring, surveillance, quarantine);</li> <li>○ methods and techniques that can be used to identify the causal agents of disease;</li> <li>○ methods to obtain pathogen free-mother plants from infective plant pathogens and to obtain plants resistant to plant pathogens</li> <li>○ methods and technologies that can be used for the production, storage and use of plant propagating material genetically assessed and with improved sanitary status.</li> </ul>



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	<p><i>Applying knowledge and understanding on:</i></p> <ul style="list-style-type: none"> <li>○ Know how to apply the main methods of clinical plant pathology for detection, identification and characterization of plant disease and plant pathogens;</li> <li>○ Know how to keep a sample;</li> <li>○ Knowing how to make a correct request for a laboratory investigation from a substantial and formal point of view;</li> <li>○ Knowing how to take, treat and store phytopathological samples for laboratory analyses;</li> <li>○ Be aware of the sources of variability in the measurement of laboratory parameters dependent on the sample;</li> <li>○ Be aware of the potential and limitations of the information provided by laboratory tests;</li> <li>○ Know the fundamental interpretative criteria of a phytopathological report</li> <li>○ Know how to apply the main biotechnological techniques for the production of plant material free from infective plant pathogens;</li> <li>○ Know how to manage the pathogen free-mother plants</li> <li>○ Know how to apply the main biotechnological techniques for obtaining GMOs and MOGM for the study of complex phenomena</li> </ul> <p><i>Making informed judgments and choices:</i></p> <ul style="list-style-type: none"> <li>○ ability to carry out diagnostic hypotheses and anamnesis on phytopathological cases</li> <li>○ ability to identify the most appropriate diagnostic methodology for the reference context</li> <li>○ ability to identify and apply the most appropriate technique to characterize pathogens</li> <li>○ ability to identify and propose the most appropriate techniques to produce plants with an improved sanitary status</li> </ul> <p><i>Communicating knowledge and understanding</i></p> <ul style="list-style-type: none"> <li>○ ability to communicate in oral and written forms using technical Italian and English language,</li> <li>○ ability to participate to multidisciplinary working groups</li> <li>○ ability to communicate both technically and economically as well as humanly and ethically</li> </ul> <p><i>Capacities to continue learning</i></p> <ul style="list-style-type: none"> <li>○ Ability to improve his proper knowledge consulting scientific and technical papers and websites to deepen and update his knowledge on diagnostic and sanitation protocols, for plant pathogens and traditional and innovative pathogen resistance techniques.</li> </ul> <p>Expected learning outcomes, as knowledge and ability, are reported in the annex A of the Didactic Regulation of the course Plant Medicine (expressed by European Descriptors)</p>
Contents	<p><b>Phytopathological diagnosis</b></p> <p><b>Pre-analytical phase:</b></p>



- medical history, symptoms and signs and factors that influence field symptoms (host, pathogen, environmental conditions);
- areas of application of diagnostic assays (monitoring, surveillance, quarantine, field)
- sampling, collection, transport, storage and management of the sample

**Analytical phase:**

- How, when and why to use laboratory tests
- Biological diagnosis: method of transmission of infectious agents; mechanical transmission; transmission by grafting (indexing); culture isolations, biochemical and olfactory assays
- Serological diagnosis: direct serological techniques, indirect serological techniques
- Microscopy: optical microscopy, electronic immunomicroscopy; ISEM -Immuno sorbent electron microscopy; decoration (detection of viruses with antibodies); DIP searches for viral particles from raw juice from leaves.
- Diagnostic imaging, biosensors, nanosensors
- Molecular diagnosis: conventional and innovative methods based on PCR (Nested-PCR, Colony PCR, RAPD, SCAR, qPCR, ddPCR, RT-PCR, LAMP, multiplex, etc.), electrophoretic analysis of nucleic acids of pathogens and viral (dsRNA) and viroidal RNAs; molecular hybridization); sequencing
- Portable devices
- Quality criteria of phytopathology analysis laboratories and quality of analytical measurements (imprecision, exactness, accuracy, measurement errors, reference values).

**Post-analytical phase:**

- reporting and interpretation of the analytical result

**Phytopathological biotechnology**

**Production of primary sources**

- sanitary selection;
- thermotherapy: in vivo and in vitro;
- *in vitro* culture of meristematic apices;
- micrograft
- somatic embryogenesis
- cryotherapy

**Resistance**

- quantitative and qualitative resistance;
- resistance transfer techniques: o conventional (breeding) or biotechnological (GMO)

**Production of genetically modified microorganisms**

- transformation (Electroporation, polyethylene glycol-mediated transformation (PEG); Agrobacterium tumefaciens mediated transformation (ATMT)
- CRISPR-CAS9

In the practical part of the course, the student will be able to apply the main methods of isolation and cultivation of pathogens, and to understand, apply and compare the main serological and molecular diagnostic methods used in plant pathology for the diagnosis of



	diseases caused from viruses, bacteria, phytoplasmas and fungi. In addition, the student will be provided with elements of modern biotechnological techniques applied in plant pathology, and the student will be able to develop and design a diagnostic and / or biotechnological idea, that, when possible, he will experiment in operational feasibility.
Course program	
Bibliography	<p>Agrios G.N., 2015. Plant Pathology</p> <p>-Boonham N., Tomlinson J., Mumford R, 2016. Molecular methods in plant disease diagnostics: Principles and protocols.</p> <p>- Dehne, H.-W., Adam, G., Diekmann, M., Frahm, J., Mauler-Machnik, A., van Halteren, P., 1996. Diagnosis and Identification of Plant Pathogens, Proceedings of the 4th International Symposium of the European Foundation for Plant Pathology</p> <p>- Gullino ML, Bonants P.J.M., 2015. Detection and Diagnostics of Plant Pathogens</p> <p>- Pubblicazioni scientifiche in inglese</p> <p>- Matta A., 199. Fondamenti di Patologia Vegetale. Patron Editore.</p> <p>- Powerpoints (these are not usable as learning material but can help the student during own study)</p>
Notes	None
Teaching methods	The course topics will be treated with the help of Power Point presentations, with upside-down teaching tools and with the support of external experts with seminar activities and classroom, laboratory and field exercises, group activities, case studies.
Assessment methods	<p>Only the students enrolled in the academic year during which this module is provided, can have a midterm exam during the time of teaching. The result of it remains valid for the whole academic year and concurs to the final evaluation of the student (in proportion to the ECTS evaluated during the midterm exam).</p> <p>The exam, as well the midterm exam, consists of an oral test, with the possible presentation of an application project, with questions related to the lectures and visits, such as reported in the Didactic Regulation in Plant Medicine (art.9) and in the syllabus (annex A).</p> <p>The exam consists of three questions, two of them related to the diagnosis and one on biotechnologies. Additionally, the student must be discussing his own project work. The attribution of the final mark will consider the theoretical and practical knowledge acquired, the ability to apply the aforementioned knowledge, autonomy of judgment, communication skills and on the ability to integrate the acquired knowledge in a project work. The evaluation of the student is based on criteria previously fixed such as reported in the Annex A of the Didactic Regulation of the Master Course in Plant Medicine</p> <p>If the midterm exam is taken, the assessment of the profit exam is expressed as an average between the mark given on the exemption and the profit exam.</p> <p>For Foreign students the midterm exam as well as the exam could be in English, and if, required as written test articulated in three open questions.</p>
Evaluation criteria	<ul style="list-style-type: none"> <li>• <i>Knowledge and understanding</i> <ul style="list-style-type: none"> <li>○ Evaluation of knowledge and understanding on methods and</li> </ul> </li> </ul>



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	<p>techniques that can be used for the diagnostic assessment; to identify the causal agents of disease; to obtain pathogen free-mother plants from infective plant pathogens and to obtain plants resistant to plant pathogens; for the production, storage and use of plant propagating material genetically assessed and with improved sanitary status; on sanitation techniques and resistance strategies to plant disease.</p> <ul style="list-style-type: none"> <li>• <i>Applying knowledge and understanding</i> <ul style="list-style-type: none"> <li>○ evaluation of the ability to apply the different techniques to detect, identify and characterize plant pathogens (viruses, bacteria, fungi, etc.); to apply the sanitation techniques to produce plant propagating material with improved sanitary status; and to apply the appropriate resistance strategy to a plant pathogen.</li> </ul> </li> <li>• <i>Autonomy of judgment</i> <ul style="list-style-type: none"> <li>○ assessment of the ability to analyze a phytopathological study case suggesting the appropriate solution</li> </ul> </li> <li>• <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> <li>○ evaluation of the personal ability to communicate in oral form using technical language, to participate to multidisciplinary working groups.</li> </ul> </li> <li>• <i>Communication skills</i> <ul style="list-style-type: none"> <li>○ ability to organize the acquired knowledge for educational-training purposes as well as for technical reports.</li> </ul> </li> <li>• <i>Capacities to continue learning</i> <ul style="list-style-type: none"> <li>○ evaluation of the ability to learn both diagnostic and sanitation protocols for plant pathogens and traditional and innovative resistance techniques.</li> </ul> </li> </ul>
Further information	<p><b>Visiting hours</b> Official visiting hours: 8.30-15.30 according to an established appointment requested by phone or e-mail. Tutoring could be also on e-learning platforms.</p>