General information	
Academic subject	**Diagnosis and Biotechnologies in Plant Pathology**
Degree course	**Master's degree Plant Medicine (LM69)**
Academic Year	2021-2022 (First year, second semester)
European Credit Transfer and Accumulation System (ECTS)	6
Language	Italian (English will be used when required for foreign students into didactic material)
Academic calendar (starting and ending date)	March 1st -June 17th 2022 (Pause 2022 April 20th – May 6th, for midterm exam)
Attendance	No

Professor/ Lecturer	
Name and Surname	**Stefania POLLATRO**
E-mail	stefania.pollastro@uniba.it
Telephone	080 5442910 - 3391855984
Department and address	Department of Soil, Plant and Food Sciences - first plexus, Plant Pathology Section, Third floor room n.1
Virtual headquarters	Teams platform entry code **azivdyz**
Tutoring (time and day)	Official visiting hours in presence: 8.30-13.30 from Monday to Friday according to an established appointment requested by phone or e-mail. Tutoring could be also on e-learning platforms (Teams) at different times by appointment. Other tutoring methods can be defined on demand.

Syllabus	
Learning Objectives	**Plant Protection disciplines** The course aims to provide in-depth knowledge on biological, biochemical, serological, molecular methodologies, image analysis and nanotechnology for the diagnosis of plant pathogens, as well as elements on the applications of biotechnologies to plant pathology to the recovery of plants from infectious agents and disease resistance.
Course prerequisites	Basic knowledge on biology, botany, plant physiology, general plant pathology, mycology, bacteriology, virology, and special plant pathology.
Contents	**Phytopathological diagnosis** **Pre-analytical phase**: ○ 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** ○ traditional and innovative techniques (ATMT, REMI, PEG, Electroporation, CrisperCAS9) for the biotechnological transformation of microorganisms of interest in plant pathology 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.
Books and bibliography	-Boonham N., Tomlinson J., Mumford R, 2016. Molecular methods in plant disease diagnostics: Principles and protocols. - 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 - Gullino M.L., Bonants P.J.M., 2015. Detection and Diagnostics of Plant Pathogens
Additional materials	Powerpoints are not usable as learning material but can help the student during own study and in the using of suggested materials (Book, scientific papers, website). Materials in English are additional and can be reference texts for incoming international students Scientific papers supplied by the professor

	Example of websites •http://bugs.bio.usyd.edu.au/learning/resources/PlantPathology/ •http://erec.ifas.ufl.edu/plant_pathology_guidelines/index.shtml •http://issuu.com/scisoc/docs/43818/1 •http://ohioline.osu.edu/hyg-fact/3000/ •http://www.apsnet.org/edcenter/intropp/LabExercises/Pages/Cytology.aspx •http://www.apsnet.org/edcenter/instcomm/TeachingArticles/Pages/TeachingPlantDiseaseDiagnosis.aspx http://www.plantpath.wisc.edu/PDDCEducation/MasterGardener/General/Slide1.htm

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
150	32	28	90
ECTS			
6	4	2	

Teaching strategy	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, working groups, case studies. The self-direction, teamwork, self-assessment, and the use of technologies will be promoted. 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
Expected learning outcomes	
Knowledge and understanding on:	○ methods and techniques that can be used for the diagnostic assessment (field, monitoring, surveillance, quarantine) ○ methods and techniques that can be used to identify the causal agents of disease ○ methods to obtain pathogen free-mother plants from infective plant pathogens and to obtain plants resistant to plant pathogens ○ methods and technologies that can be used for the production, storage and use of plant propagating material genetically assessed and with improved sanitary status
Applying knowledge and understanding on:	○ know how to apply the main methods of clinical plant pathology for detection, identification and characterization of plant disease and plant pathogens ○ know how to keep a sample ○ knowing how to make a correct request for a laboratory investigation from a substantial and formal point of view ○ knowing how to take, treat and store phytopathological samples for laboratory analyses ○ be aware of the sources of variability in the measurement of laboratory parameters dependent on the sample ○ be aware of the potential and limitations of the information provided by laboratory tests ○ know the fundamental interpretative criteria of a phytopathological report

	○ know how to apply the main biotechnological techniques to produce plant material free from infective plant pathogens ○ know how to manage the pathogen free-mother plants ○ know how to apply the main biotechnological techniques for obtaining GMOs and MOGM for the study of complex phenomena
Soft skills	*Making informed judgments and choices* ○ ability to carry out diagnostic hypotheses and anamnesis on phytopathological cases ○ ability to identify the most appropriate diagnostic methodology for the reference context ○ ability to identify and apply the most appropriate technique to characterize pathogens ○ ability to identify and propose the most appropriate techniques to produce plants with an improved sanitary status *Communicating knowledge and understanding* ○ ability to communicate in oral and written forms using technical Italian and English language, ○ ability to participate to multidisciplinary working groups ○ ability to communicate both technically and economically as well as humanly and ethically *Capacities to continue learning* ○ 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. 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)

Assessment and feedback	
Methods of assessment	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). 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). 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. 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. 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.
Evaluation criteria	• *Knowledge and understanding* ○ Evaluation of knowledge and understanding on methods and 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. • *Applying knowledge and understanding* ○ 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. • *Autonomy of judgment* ○ assessment of the ability to analyze a phytopathological study case suggesting the appropriate solution • *Communicating knowledge and understanding* ○ evaluation of the personal ability to communicate in oral form using technical language, to participate to multidisciplinary working groups. • *Communication skills* ○ ability to organize the acquired knowledge for educational-training purposes as well as for technical reports. • *Capacities to continue learning* ○ evaluation of the ability to learn both diagnostic and sanitation protocols for plant pathogens and traditional and innovative resistance techniques.
Criteria for assessment and attribution of the final mark	The evaluation of the exam is expressed in thirtieths. The final mark will consider the theoretical and practical knowledge acquired, the ability to apply the 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.
Additional information	

Via Amendola, 165/A 70126 Bari (Italy)
(+39) 080 5443052 - 2910 (+39) 080 5442911
E- mdp.disspa@uniba.it
https://www.uniba.it/ricerca/dipartimenti/disspa/2021-2022/clmmdp
c.f. 80002170720 p. iva 01086760723