## **Disease and Pest Management**

### **A. Diseases**

Prof. Vittorio Rossi

***COURSE AIMS AND EXPECTED learning outcomes***

The course aims to provide students with the knowledge and expertise necessary to manage disease control in sustainable and in organic viticulture.

At the end of the course the students will be able to: look at vineyards as complex ecosystems, in which several components interact dynamically; consider grape pathogens as one of these components and understand the relationships among pathogens and other components (e.g., weather, soil, plants, other microorganisms); critically exploit this knowledge to develop sustainable vineyard protection strategies and tactics. Students will be able to: plan and conduct monitoring activities in vineyards with traditional and innovative (e.g., based on IoTs) methods; autonomously manage the information and data necessary to support decision-making for crop protection, also with the help of innovative tools (e.g., mathematical models, web-based decision support systems); and finally analyse the results to point out mistakes or knowledge gaps.

Students will develop the capability of autonomously elaborating on and critically analysing the current knowledge by using a multidisciplinary approach, in such a way to acquire the ability to face and solve new and/or unexpected phytosanitary issues. Students will also be able to communicate what they have learned in a clear, exhaustive and unambiguous way to their interlocutors.

***COURSE CONTENT***

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| **Topics** | CFU  |
| Introduction to sustainable grape protection: concepts in sustainable grape protection; principles of Integrated Pest Management; Directive 128/2009/EC; a framework for IPM implementation | 1 |
| Methods for sustainable grape protection: new tools and methods for IPM, including resistant varieties, sanitation, vineyard monitoring and scouting, modelling and other decision-making tools; biocontrol agents and other non-chemical methods for disease control; characteristics of plant protection products; anti-resistance strategies; pesticide distribution; precision crop-protection. | 2 |
| Mathematical models for grape disease and protection: insights on plant disease modelling; empirical versus mechanistic models; principles of model validation and use in scheduling fungicide applications; strengths and weaknesses of model’s use. Practical examples of models for downy and powdery mildews, Botrytis bunch rot and Black-rot.  | 1 |
| Decision support tools for sustainable grape protection: tools for supporting grape growers in practical implementation of IPM; on-site devices, warning systems, and decision support systems (DSSs); strengths and weaknesses of the different tools; the DSS vite.net as a case-study. | 1 |
| Field visits and practical exercises | 1 |

***READING LIST***

References and reading materials will be set during the course.

***TEACHING METHOD***

* Classroom lectures with the help of power point presentations and videos, with time dedicated to questions and requests for clarification and / or in-depth analysis.
* Exercises in the classroom and in the field concerning the equipment used for monitoring pathogens, such as different types of spore traps, app for the disease diagnosis, diagrams for disease measurement/assessment, and environmental variables. Exercises with web-based decision support systems.
* Seminars with experts to deepen specific topics of particular relevance.

***ASSESSMENT METHOD AND CRITERIA***

The final exam consists of a written test with 31 questions to be addressed in a maximum of 60 minutes. The questions may require, for example, single or multiple answers, the identification of correct options in a list or their ordering based on relative importance, as well as open answers. The commission will assign a score from zero to one to each of the written replies given by the student. When all the replies are rated to one, then the final rating is 30 with laudem.

***WARNINGS AND PREREQUISITES***

The students should have basic knowledge on plant pathology and on grape diseases caused by oomycetes, fungi, bacteria, phytoplasmas and viruses (life cycle, biology, disease symptoms and epidemiology).

Students should register at the course on the Blackboard platform, and check it regularly for downloading the teaching material, further information or updates.

In case the current Covid-19 health emergency does not allow frontal teaching, remote teaching will be carried out through synchronous or asynchronous procedures that will be promptly notified to students

Prof. Vittorio Rossi is available to meet students after class at Department of Sustainable Crop Production

### **A. Pests**

Ilaria Negri

***COURSE AIMS AND EXPECTED LEARNING OUTCOMES***

The aim of the course is to provide knowledge about classification, morphology and anatomy, biology, ethology, and ecology of the main grape pests, related damages, plant symptoms, and integrated pest management strategies. At the end of the course, students will acquire knowledge of: a) the biology, ethology, and ecology of the key-pests of grape and their interactions with the main components of agro-ecosystems (e.g.: environmental conditions, beneficial insects, natural enemies, etc.); b) the main methods and tools for monitoring and sampling pests; c) pest management strategies to implement vineyard protection according to IPM guidelines. At the end of the course students should be able to identify grape pests, symptoms and damages (direct and indirect, if any) on host plants, as well as the most important natural enemies, and to take decisions on the following issues: if, when and how to apply integrated control techniques to avoid and / or reduce pest damages.

***COURSE CONTENT***

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| **Topics** | CFU |
| Basics of entomology. Insects harmful to grapevine. Plant-sucking and plant-eating insects: biology, morphology and anatomy, ecology, ethology and classification. Plant damages and symptoms. Vector-borne pathogens, plant diseases and symptoms, molecular diagnosis of pathogens.  | 1,5 |
| Introduction to other grape pest (mites): biology, morphology and anatomy, ecology and classification; plant damages and symptoms.  | 0,5 |
| Pest monitoring. Sampling, thresholds, and modeling. Pest management: chemical, biological, biotechnological and agronomical control of grape pests. Areawide Pest Management (AWPM) technologies and approaches. Legally mandated crop protection actions. Integrated Pest Management (IPM) plans for sustainable vineyard protection and organic viticulture. | 1 |
| Field visits and practical exercises | 1 |

***READING LIST***

Reading lists will be provided during the course.

***TEACHING METHOD***

The teaching method will consist of lectures covering the main topics of the course and interactive teaching methods, including problem solving, reading and discussing scientific articles, use of audio-visual materials, and samples’ observations in order to actively engage students.

***ASSESSMENT METHOD***

Final written test with 31 questions to be addressed in a maximum of 60 minutes. The test will require open answers and single or multiple answers, the identification of correct options in a list or their ordering based on relative importance. The open answer evaluation will consider the question comprehension and the pertinence of the answer to the question, the organization of the answer, the use and mastery of the scientific language, the proficiency in the subject, and the student ability to make use of the knowledge acquired. A score from zero to one will be assigned to each of the written replies given by the student. When all the replies are rated to one, then the final rating is 30 with laude.

#### *NOTES AND PRE-REQUIREMENTS*

Students should register at the course on the Blackboard platform, and check it regularly for further information or updates.

The students shall have basic knowledge on biology and zoology.

The teacher will meet students after class at Department of Sustainable Crop Production.

#### In case the current Covid-19 health emergency does not allow frontal teaching, remote teaching will be carried out through synchronous or asynchronous procedures that will be promptly notified to students