COURSE OF STUDY *Sustainable agriculture techniques*

ACADEMIC YEAR *2024-2025*

ACADEMIC SUBJECT *General and agricultural entomology*

General information	
Year of the course	I year
Academic calendar	II semester
Credits (ETCS):	4.5
SSD	General and applied entomology - AGR/11
Language	Italian
Mode of attendance	Not mandatory but highly recommended

Professor/ Lecturer	
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Virtual room	Teams code: **bydh2aw**
Office Hours	Every day upon scheduled appointment

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/Self-study hours
110	30	15	65
ETCS			
4.5			

Learning Objectives	To provide basic morphological, biological and ecological knowledge of the major groups of animals of agricultural interest. The study covers levels of organization and functional systems, intra- and interspecific relationships, adaptations to the environment and animal behavior. In addition, essential topics for the containment of populations of harmful organisms (nematodes, mites, insects, molluscs and rodents) with respect to natural balances and human health will be treated. In particular, topics related to entomology are explored by studying its external and internal morphology, biology, ethology, reproduction, development, ecological relationships, and biotic-environmental potential; brief space is devoted to means and strategies of control.
Course prerequisites	Rudiments of animal biology.

Teaching strategie	The teaching topics will be delivered through lectures by offering numerous examples and using Power Point presentations and videos. Students will be accompanied in the acquisition of knowledge with the performance of classroom and laboratory exercise activities with the aim of having them achieve their own autonomy of investigation, observation, evaluation of the material examined and communication of the outcomes of these exercise activities.
Expected learning outcomes in terms of	

Knowledge and understanding on:	○ basic knowledge for understanding the fundamental aspects of morphology, bio-ethology, and ecology of animal organisms and insects in particular
Applying knowledge and understanding on:	○ ability to distinguish animal members in the context of activities that take place in the field of plant production and in natural areas
Soft skills	• *Making informed judgments and choices* ○ ability to understand the bio-ethological and ecological phenomena that determine the success of plant-damaging animal organisms, particularly phytophagous insects, in the context under consideration ○ ability to apply corrective interventions that limit the success of plant-damaging animal organisms, particularly phytophagous insects • *Communicating knowledge and understanding* ○ ability to describe animal organisms, particularly insects, bio-ethological and ecological phenomena involving them in the context considered • *Capacities to continue learning* ○ ability to deepen and update knowledge of animal organisms, particularly phytophagous insects, their antagonists, and biological, ethological, and ecological phenomena involving them in the context under consideration
Syllabus	
Content knowledge	Introduction to the teaching course. Structural organization of animals with emphasis on agricultural entomology - histology (epithelial tissue, connective tissue). Digestive system and nutrition, mode of food intake, digestion. Respiratory system and gas exchange; skin, tracheal, gill, lung respiration; respiratory pigments. Fluid circulation, circulatory system, propulsive organ, blood and hemolymph. Excretion and osmoregulation; ammoniotelic, uricotelic, ureotelic animals; adaptations in terrestrial animals; specialized organs (protonephric, metanephric, Malpighian tubes, kidney). Nervous tissue, neurons, central nervous system, peripheral nervous system (sense organs). Endocrine system. Integument and its productions, skeleton; movement and locomotion (muscle tissue). Reproductive system. Symmetry and metamerism. Reproduction and Development - Asexual reproduction (cleavage, budding, fragmentation, polyembryony). Sexual reproduction; gonochorism and hermaphroditism; gametogenesis, gamete morphology; amphigonia, fertilization and parthenogenesis. Oviparity, ovoviviparity, viviparity. Sex determination (progamic, synamic, metagamic). Egg types, embryonic development, postembryonic development (direct and indirect; definite and indefinite; continuous and discontinuous; allometry). Neoteny. Dimorphism, polymorphism. Classification of animals, evolutionary theory and phenomena of adaptation. Definition of species, zoological nomenclature, systematics. Ethology and Ecology - Innate, learned and reflex behavior; tactisms and tropisms. Society. Symbiosis (mutualistic and antagonistic). Trophic relationships (trophic levels, chain, pyramid and network). Animal adaptations: communication, foberism, mimicry, biological rhythms and clocks. Mechanisms of dispersal in space (active, passive, migration) and time (diapause, quiescence, hibernation). Zoogeographic regions. Biotope, biocenosis, populations, population density and dynamics, biotic potential, natural ecosystem, agroecosystem. Phyla of economic interest in agriculture: nematodes; mites; Insects; pulmonate gastropods; rodents. Integrated control and integrated production - Means of control: biological, biotechnical, agronomic, physical, chemical

	Exercises - Means and instruments of investigation; collection, handling and conser- vation of zoological and entomological specimens; breeding of animal organisms; identification of animal organisms. Recognition of insects and associated symptoms. Breeding of some species for the purpose of studying bio-ethological cycle and symptomatology.
Texts and readings	• Lectures Power Points (pdf version) • Pollini A., 1998. Manuale di Entomologia applicata. Edagricole, Bologna. • Masutti L. Zangheri S., 2001. Entomologia generale e applicata. Cedam, Padova. • Chinery M., 1997. Atlante di Entomologia. Gruppo D'Adamo Editore, Padova. • Tremblay E., 2018. Entomologia applicata. Vol1: Generalità e mezzi di controllo. Liguori Editore • Pennacchio F., 2014. Gli insetti e il loro controllo. Liguori Editore
Notes, additional materials	
Repository	Students will be able to obtain copies of presentations used during lectures, including tutorials when they involve lab application protocols, by accessing the MSTeams platform. Specific papers and other study materials (reviews, free-for-all texts, movies, etc.) will also be made available on the same platform.

Assessment	
Assessment methods	The teaching includes a midterm learning verification (not compulsory and concerning only students enrolled in the first year of the course), completion of the exam at the end of the teaching (only for students who have successfully taken the midterm), and the profit exam (for all students who have not taken a midterm). The mid-term verification will cover the topics covered up to half of the teaching while the completion of the verification will cover the remaining topics. The final assessment will be given by the average of the grades. The verification will be carried out in the form of an interview regarding the topics developed during the theoretical and theoretical-practical lectures in the classroom and laboratory, as stated in the Didactic Regulations of the Course and in the study plan (Annex A), proportionate to the number of ECTS assessed. A minimum of four questions in total will be asked including two on the zoological and two entomological aspects. The evaluation of the student's preparation is based on predetermined criteria as detailed in Annex A of the Didactic Regulations of the Course. The sufficiency will be achieved when the student demonstrates knowledge of the morphology and bio-ethology of animals of agricultural interest, phytophagous insects and their antagonists, possibly performing context analysis and proposing the most appropriate integrated and biological management practices for plant protection and biodiversity conservation practices for species that have significance in natural and biological control.

Assessment criteria	• *Knowledge and understanding*
	  ○ describe the basic morphological, bio-ethological and ecological characteristics of animal organisms, particularly insects, and understand their functional correlations
	• *Applying knowledge and understanding*
	  ○ describe the factors that can induce the success of different ecological classes of animal organisms in crop production, with special emphasis on phytophagous insects
	• *Autonomy of judgment*

	○ express reasonable hypotheses for intervening on factors that may induce phytophagous insects success ○ evaluate the design and implementation of remedial interventions that limit the success of phytophagous insects in production settings • *Communicating knowledge and understanding* ○ Express reasonable hypotheses to interfere on the factors that may induce the success of different ecological classes of animal organisms in crop production with special emphasis on phytophagous insects • *Communication skills* ○ comprehensively describe and illustrate, with appropriateness in terms, richness in examples, and with connections to the basic aspects that characterize the success of animal organisms, with special emphasis on insects • *Capacities to continue learning* ○ adapt the basic cognitive tools acquired during the course of education to explain and solve multiple application problems and diverse case studies
Final exam and grading criteria	The evaluation of the midterm/final verification and profit examination is expressed in 30ies, and the examination is considered passed when the grade is greater than or equal to 18. Successful completion of the midterm examination is valid for the academic year. The final grade will be formulated on the basis of the knowledge acquired by the student, the ability to analyze and process possible field situations as well as the potential actions required by the situations addressed during the interview. To achieve a high final grade, the student must have developed autonomy of judgment, adequate argumentation and exposition skills. Honors will be granted in case of clarity and comprehensiveness of exposition, accompanied by a manifest ability to go into depth.
Further information	