Agricultural Microbiology

Research lines:

Ecology and Microorganism-plant Interaction

Study of the dispersion, survival, and control of phytopathogenic microorganism, and aspects of their interactions with endophytic and epiphytic microorganisms from the soil, rhizosphere, plants, and the environment. Bioprospection and biotechnological applications of microorganisms and secondary metabolites in agriculture and industry.

Genetic Diversity and Microbial Biotechnology

Study of the diversity, detection, identification, and phylogenetic systematics of microorganisms, and molecular interactions between plants and beneficial and phytopathogenic microorganisms.

Microbiological Safety of agricultural and fishery products

Disciplines:

Genetics of Microorganisms

History and basic concepts of genetics of microorganisms, structure and function of nucleic acids, gene regulation and expression, variability-generating mechanisms in microorganisms.

Taxonomy and Microbial Diversity

General knowledge on the diversity and taxonomic classification of prokaryotic and eukaryotic microorganisms, and viruses, and their agricultural, environmental and biotechnological importance.

Morphophysiology and Microbial Biochemistry

Providing students with fundamentals of the structure and function of biomolecules; notions of enzymology; bioenergetics; metabolism of synthesis and degradation of carbohydrates, lipids, and nitrogen compounds in eukaryotic and prokaryotic cells; photosynthesis.

Phytopathogenic Microorganisms

Theoretical and practical basic principles related to phytopathogenic bacteria, fungi, and viruses, involving morphophysiological aspects, taxonomy, pathogenesis, parasitism physiology, symptomatology, dissemination, epidemiology, and plant disease management.

Pathogenic Microorganism-plant Interactions

Microorganism-host interactions (bacteria, fungi, viruses, nematodes). Mechanisms of adhesion, invasion, multiplication, reproduction, dissemination, and survival. Recognition and defense mechanisms. Ecology of pathogens causing shoot, root, and vascular diseases.

Soil Biology

Soil organisms; soil ecology; microbial metabolism and processes; soil organic matter; biochemical transformations and element cycling; rhizosphere; biological nitrogen fixation; mycorrhizal associations; environmental impact of the use of phytosanitary products in the soil on the microbial population; xenobiotics and soil bioremediation.

Sanitary Control of Food

Principles and history of sanitary control of food. Hygienic-sanitary standards in food services and food industries. Quality programs applied to food production. Analysis and fiscal control of food products. Health Surveillance System. Sanitary inspection methods. Outbreak investigation. Sanitary legislation.

Ecology of Phytopathogens

Basic concepts. Phytopathogens as causes of epidemics. Epidemics of historical significance. Host, pathogen, environment, and disease monitoring. Environmental factors in the agroecosystem and microbial ecology. Air and soil inoculation dynamics (survival, release, dispersion, and deposition). Primary and secondary cycles. Progress of epidemics. Characterization and spatial analysis of epidemics. Pathometry. Interaction between phytopathogens and other microorganisms. Classification of diseases and ecology of phytopathogens. Control principles and effect on the life cycle of phytopathogens.

Microbial Ecology

The discipline will focus on the role of microorganisms in the biological cycles of elements in the ecosystem, soil, and water. Moreover, it will address the performance of microorganisms in soil formation and maintenance, and the relationships between microorganisms, plants, and animals.

Epidemiology of Water- and Foodborne Diseases

Critical study of the major waterborne diseases, considering the characterization and origin of etiological agents, isolation methods, forms of transmission, natural history of the disease, and prophylaxis measures. Critical study of the major foodborne diseases transmitted by food of animal origin, considering the characterization and origin of etiological agents, isolation methods, forms of transmission, and prevention measures.

Teaching Internship

This discipline aims to approach and prepare the student for higher education teaching practices, through: diagnosis and contextualization of higher education, planning of practical and theoretical classes, advice on practical work, and guidance in the preparation of the work required in the disciplines, as well as in teacher evaluation activities.

Food Microbiology

Microorganism action and importance in nature and in food. Intrinsic and extrinsic parameters. Principles and methods for food conservation. Changes in food and responsible microorganisms. Microbiological analyses of processed and packaged foods. Quality control in the food industry. Toxi-infections. Microorganisms of importance in food outbreaks.

Seminars I

Techniques for the presentation of seminars and use of audiovisual resources; presentation of current technical-scientific topics in the area of agricultural and environmental microbiology by invited researchers and professors. Every student must present a dissertation project.

Seminars II

Techniques for the presentation of seminars and use of audiovisual resources; presentation of current technical-scientific topics in the area of agricultural and environmental microbiology by invited researchers and professors. Every student must present a seminar on any subject.

Laboratory Techniques in Agricultural Microbiology

Techniques for isolation, cultivation, identification, and preservation of soil microorganisms, endophytic microorganisms, nitrogen-fixing microorganisms, and food microorganisms. Quantification of microorganisms by serial dilution methods and by most probable number counts. Measures and rates of microbial growth. Isolation and observation of environmental fungi and phytopathogenic fungi. Pathogenicity tests. Techniques for extracting and identifying phytonematodes. Techniques for the study of microorganisms in food. Mycorrhizal fungi: root staining and quantification of root colonization, spore extraction and identification, inoculum production, and inoculation in plants. Preservation of microorganisms. Cultural, biochemical, and morphological tests for identification of microorganisms.

Bioinformatics

Organization of prokaryotic and eukaryotic genomes. Horizontal gene transfer, gene shuffling, and gene duplication as evolutionary forces that generate gene variability. Use of search tools for nucleic acid and protein sequences. Access and use of bioinformatics tools in the analysis of protein DNA sequences. Access and use of databases on genome structure and organization. Use of multiple DNA and protein alignments in the search for conserved motifs, and molecular phylogeny.

Microbial Biotechnology Topics Applied to Agriculture

The content will be defined semiannually by the collegiate body, considering the subjects of interest of the students (within the area of Microbial Biotechnology and its Applications in Agriculture), not included in other disciplines, being raised during the evaluation of professional practice, seminars, and research activities.