BRAWIJAYA UNIVERSITY

FACULTY OF AGRICULTURE

DEPARTMENT OF PLANT PESTS AND DISEASES / MASTER OF AGRICULTURAL ENTOMOLOGY STUDY PROGRAM

SEMESTER COURSE PLAN

COURSES	CODE	CLUSTERS OF COURSES	CREDITS	SEMESTER	Date of Preparation
Biological Control	PTH81137	Agricultural Entomology	2 SKS 2.34 ECTS	Odd	June 8, 2021

AUTHORIZATION	Developer Lecturer	Course Coordinator	Head of Study Program
Department of Plant Pests and Diseases	Dr. Ir. Sri Karindah, MS. Dr. Ir. Retno Dyah Puspitarini, MS.	Name Signature	Dr. Akhmad Rizali, SP., M.Si. Signature

Learning Outcomes	ILO STUDY PROGRAM	
	1	Able to work together and have social sensitivity and high concern for society and the environment.

	2	Mastering concept, theories and methods in the field of agricultural entomology
	3	Mastering the concept of integrated pest management in the context of sustainable agriculture
	4	Mastering the theory of biotechnology in controlling plant pest and managing plant resistance
	5	Have skills in contributing to solving problems in society through research design in the field of agricultural entomology
	6	Have skills in developing innovations and proven applications for solving problems in society in the field of agricultural entomology in an inter/multidisciplinary manner within the framework of sustainable agriculture
	Course Learning Outcome	
	1	Students are expected to be able to understand and implement biological control, classical biological control, and modern biological control; Biological control evaluation; and The Role of Biological Control in Integrated Pest Management
	2	Able to integrate biological control in Integrated Pest Management and evaluate the application of biological control
Brief Description of Course	This course discusses the ecological basis of biological control, other sciences related to biological control, biological control application techniques and their role in Integrated Pest Management	
Learning Material / Subject	1) Introduction 2) The ecological basis of biological control and the role of population models in biological control 3) Insect taxonomy and biological control 4) Theory and application of biological control (conservation of natural enemies) 5) Theory and application of biological control (augmentation of natural enemies) 6) Theory and application of biological control (introduction of natural enemies)	

7) The use of microorganisms as biological agents
8) Mass breeding (I)
9) Mass breeding (II)
10) Field-scale and greenhouse biological control
11) Biological control evaluation
12) Safety of biological control practices for agroecosystems
13) Successes and failures of biological control
14) The role of biological control in integrated pest management and prospects in Indonesia

Relationship of CLO and ILO

	A 1	K1	K2	K3	S1	S2	S3
CLO 1	0.5	0	0	0	0	0	0.5
CLO 2	0	0.5	0	0.5	0	0	0
CLO 3	0	0	0.5	0	0	0.5	0
CLO 4	0.5	0	0	0.5	0	0	0
CLO 5	0	0	0.5	0	0	0	0.5
CLO 6	0	0.5	0	0.5	0	0	0

Book

Main

1. DeBach P, Schlinger EI. 1973. Biological control of Insect &; Weeds. Chapman & Hall.
2. Kalshoven, L.G.E. 1981. Pest of Crops in Indonesia. Revised by P.A. Van der Laan. PT. New ichtiar, Van Hoeve

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<tr><td></td><td colspan="2"><ol start="3">
Ehlers RU. 2011. Regulation of Biological Control Agents. Springer
Morales-Ramos JA. 2022. Mass Production of Beneficial Organisms: Invertebrates and Entomopathogens. 2ndEdition. Academic Press
Mason P. 2022. Biological Control: Global Impacts, Challenges and Future Directions of Pest Management. CRC Press</td></tr>
<tr><td></td><td>Supporting References</td><td></td></tr>
<tr><td></td><td colspan="2">Wibowo D, Rahardjo BT, Karindah S, Muhammad FN. 2023. The diversity and abundance of weeds in sugarcane (Saccharum officinarum) plantations and its relationships with Hymenoptera parasitoids diversity. Biodiversity Journal of Biological Diversity 24(4).
Syahidah T, Rizali A, Prasetyo LB, Buchori D. 2021. Composition of tropical agricultural landscape alters the structure of host-parasitoid food webs. Heliyon, 7(7).
Rizali A, Himawan T, Yuniasari N, Yuliastanti N, Bachtiar MA, Rafid EDR. 2022. Contribution of agricultural landscape composition on shaping the interaction between pests and natural enemies in cacao agroforestry. AGRIVITA, Journal of Agricultural Science 44(3): 479-489.
Rizali A, Saputra RA, Alfian M. 2021. Pest control technology for Plutella xylostella L. on green mustard (Brassica juncea L.) using Bacillus thuringiensis. Tropical Wetland Journal, 7(2): 52-60.</td></tr>
<tr><td>Learning Media</td><td>Software:</td><td>Hardware:</td></tr>
<tr><td></td><td>Ppt Files</td><td>Computer, LCD</td></tr>
<tr><td>Team Teaching</td><td colspan="2">Dr. Ir. Sri Karindah, MS.

Dr. Ir. Retno Dyah Puspitarini, MS.</td></tr>
<tr><td>Required Courses</td><td colspan="2">1) None</td></tr>
</table>

Week	Sub-CLO (as expected final capability)	Indicators	Criteria & Forms of Assessment	Learning Methods (Lectures / Assignments / other forms of learning)	Time (Duration)	Learning Materials / [References]	Proportion (%)
1	Students are able to master material about the definition and scope of Biological Control course material	accuracy in explaining Biological Control	Criterion: accuracy of students in explaining the understanding of Biological, Ecological and Taxonomy-Based Biological Control, Ecology and Insect Taxonomy Form of Assessment:	Method: Contextual Instruction Lectures and discussions Self-study	100 minutes	• Scope of biological control • Other sciences related to biological control • The history of biological control in Indonesia and abroad	5 %

			Results of discussion				
2	Students are able to study the ecological basis of biological control and the role of population models in Biological Control	Accuracy of examining the ecological basis of biological control and the role of population models in Biological Control	Criterion: The accuracy of students studying about densely meshed factors (pests vs. natural enemy complexes) Scoring form: Quiz	Method : Contextual Instruction Lectures and discussions Self-study	100 minutes Self-study (2x60 minutes)	• The concept and mechanism of natural control • Islands theory for biological control	5 %
3	Students are able to examine the importance of the role of Taxonomy in the success of Biocontrol	Accurately examine the important role of taxonomy in the success of Biocontrol and give examples of entomophagous insects	Criterion: Students are able to distinguish the types of natural enemies Form of assessment:	Method: Lectures and discussions Self-study	100 minutes + 120 minutes	• The importance of insect taxonomy for biological control • Important family of entomophagous insects (predators and parasitoids)	5 %

			Tasks - Reports				
4	Students are able to master knowledge and plan conservation of natural enemies with habitat management to support Biological Control	accurately describes the conservation of natural enemies as a biological control technique	Criterion: accuracy of measuring and structuring habitat components for conservation of natural enemies Form of assessment: assignment	Method: Lectures and discussions Self-study	100 minutes Self-study (2x60 minutes):	• Conservation of natural enemies • Habitat management to support biological control • Pesticide selection • Refugia and trap plants	5 %

5	Students are able to master knowledge and plan augmentation of natural enemies in greenhouses and in the field to support Biological Control	Accuracy in planning and implementing natural enemy augmentation as a biological control technique	precision of measuring and structuring components for augmentation of natural enemies
			
			Form of assessment:
			
			report
				Method:
				
				Lectures and discussions
				
				Self-study
					100 minutes
					
					Self-study
						• Augmentation:
						  • Inoculative
						  • Inundative
						  • In the greenhouse
						  • In the Field
							5 %

6	Students are able to master knowledge and plan the introduction of natural enemies to support Biological Control	accuracy in explaining and planning about the introduction of natural enemies as a biological control technique	Accuracy in planning and managing components for the introduction of natural enemies
			
			Form of assessment:
			
			report
				Methods: Lectures, and discussion	100 minutes	• Introduction of natural enemies:
						  • Exploration of natural enemies
						  • Evaluation of potential natural enemies
						  • Planning and preparation for the introduction
						• Colonization: release procedure
							5 %

7	Students are able to master knowledge and plan the use of microorganisms as biological agents	Accuracy explains the use of microorganisms as biological agents	Accuracy in planning and managing components for the introduction of natural enemies Form of assessment: Tasks - reports	Method: Lectures, and discussion	100 minutes	• Selection of microorganisms as biological agents • Epizootic and enzootic	5 %
8	Mid-Term Exam						15 %
9	Students are able to develop knowledge and plan mass breeding of natural enemies to support Biological Control	accuracy of planning and carrying out mass breeding of natural enemies	accuracy in planning and managing factors of mass breeding factors Form of assessment: Task - Presentation	Method: Lectures, and discussion	100 minutes	• Information of insect entomophages and their hosts • Mass breeding program	5 %

10	Students are able to develop knowledge and plan mass breeding of natural enemies to support Biological Control	accuracy of planning and carrying out mass breeding of natural enemies	accuracy in planning and managing nutritional and environmental factors for mass breeding of natural enemies Form of assessment: Tasks - Reports	Method: Lectures, and discussion	• 100 minutes	• Nutrition for entomophagous insects and their hosts • Facilities and equipment in the rearing facility • Quality Control	5 %
11	Students are able to plan and implement biological control on a field scale and in greenhouses	accuracy of planning and implementing biological control on a field scale and in greenhouses	accuracy in planning and management Biological control at field scale and in greenhouses with complex integration of natural enemies Form of assessment: Tasks - Presentations	Method: Lectures, and discussion	• 100 minutes	• Conditions and conditions required for biological control in the field and/or in greenhouses • Complex integration of natural enemies	5 %

12	Students master knowledge about biological control evaluation	accuracy of systematically explaining biological control evaluation methods	accuracy of systematically explaining biological control evaluation methods Task: Presentation	Method: Lectures, and discussion	100 minutes	• By trial - trial • By compiling a balance sheet of life in the field • Justification of biological control	5 %
13	Students are able to assess the negative impacts of biological control practices for non-target organisms	Accuracy in identifying negative impacts of biological control practices for non-target organisms	Accuracy in identifying negative impacts of biological control practices for non-target organisms Form of assessment: Assignment	Method: Lectures, and discussion	100 minutes	-Negative impacts of biological control on non-target organisms (use of insect pathogens, shifting presence of indigenous natural enemies) - Intraguild predation detected by DNA analysis	5 %

14	Students are able to identify the successes and failures of Biological Control	accuracy in identifying successes and failures of Biological Control	accuracy in identifying factors causing success or failure of biological control Form of assessment: Assignment	Lectures, and discussion	100 minutes	• Examples of success and success factors • Examples of biological control failures	5%
15	Students are able to master knowledge about the relationship between Biological Control and Integrated Pest Management, as well as the Prospects of Biological Control in Indonesia	accurately explain the relationship between Biological Control and Integrated Pest Management, as well as the Prospects for Biological Control in Indonesia	accurately summarize and examine the relationship between Biological Control and Integrated Pest Management, as well as the Prospects for Biological Control in Indonesia	Lectures, and discussion	100 minutes	• The relationship between biological control and integrated pest management • Current and future biological control in Indonesia	5 %

			Form of assessment: Tasks - Short articles				
16	Final Exam						15 %