



**BRAWIJAYA UNIVERSITY**

**FACULTY OF AGRICULTURE**

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

**SEMESTER COURSES PLAN**

<b>COURSES</b>	<b>CODE</b>	<b>CLUSTERS OF COURSES</b>	<b>CREDIT</b>	<b>SEMESTER</b>	<b>Date of Preparation</b>
Insect Molecular Biology	PTH82228	Agricultural Entomology	3 4,15 ECTS	Even	8 June 2021
<b>AUTHORIZATION</b>	<b>Course Developer Lecturer</b>		<b>Course Coordinator</b>		<b>Head of Study Program</b>
Department of Plant Pests and Diseases	Hagus Tarno SP., MP., Dr. Agr.Sc Dr. Ir. Sri Karindah, MS. Prof. Ir. Liliek Sulistyowati, Ph.D.		Name  Signature		Dr. Akhmad Rizali, SP., M.Si.  Signature
<b>Learning Outcomes</b>	<b>ILO STUDY PROGRAM</b>				
	1	Able to work together and have social sensitivity and high concern for society and the environment			

	2	Mastering concepts, theories and methods in the field of agricultural entomology
	3	Mastering the theory of biotechnology in controlling plant pests and managing plant resistance
	<b>CLO</b>	
	1	Students are expected to be able to develop knowledge about molecular biology in the field of agricultural entomology.
	2.	Students are expected to be able to manage research on insect molecular biology to solve pest control problems
<b>Brief Description of MK</b>	This course discusses insect genetics, insect molecular identification techniques, molecular biology methods to be applied in pest control.	
<b>Learning Material / Subject</b>	<ol style="list-style-type: none"> <li>1) Synthesis of Mendelian inheritance and molecular biology</li> <li>2) Genes on chromosomes and Mutation</li> <li>3) Biochemical genetics</li> <li>4) Developmental genetics</li> <li>5) Ecological genetics</li> <li>6) Introduction to molecular tools and techniques for insect identification and detections</li> <li>7) Transposable Elements and the Evolution of Insects</li> <li>8) Mid-term Exam</li> <li>9) Transgenics (Mass rearing and sterile insect releases for the control)</li> <li>10) DNA Barcoding to improve invasive pest identification</li> <li>11) Tracing temporal and geographic distribution of resistance to insecticide</li> <li>12) Insight into different host ranges of insects by transcriptomic and microbiome analysis</li> <li>13) Tracking trophic links through predator-prey food-webs</li> <li>14) Insect Pheromone Receptors – Key Elements in Sensing Intraspecific Chemical Signals</li> <li>15) Case studies - Symbion, insects as an ecological indicator, and enhancing the effectivity of insect pathogen.</li> </ol>	

	16) Final Exam								
<b>Relationship of CLO and ILO</b>		A1	K1	K2	K3	S1	S2	S3	
	CLO 1	0.25	0.5	0	0.5	0	0	0	
	CLO 2	0	0.5	0	0.5	0	0	0	
<b>Book</b>	<b>Main</b>								
		<ol style="list-style-type: none"> <li>1. Crampton JM, Eggleston P. 1992. Insect Molecular Science.</li> <li>2. Gilbert LI. 2012. Insect Molecular Biology and Biochemistry.</li> <li>3. Hoy MA. 2019. Insect Molecular Genetics: An Introduction to Principles and Applications 4th Edition.</li> <li>4. Kumar, D., &amp; Gong, C. (Eds.). (2018). Trends in insect molecular biology and biotechnology. Springer.</li> </ol>							
	<b>Supporting References</b>	<ol style="list-style-type: none"> <li>1. Senoaji W, Rahardjo BT, Tarno H. 2021. Proteomic approach: Identification of Nephotettix virescens vector protein transmitting the tungro virus in rice. Biodiversitas 22: 2750-2755.</li> <li>2. Senoaji W, Rahardjo BT, Tarno H. 2021. Hubungan Antara Profil Protein Populasi Vektor Wereng Hijau Nephotettix virescens dan Gejala Penularan Tungro pada Tanaman Padi. Jurnal Penelitian Pertanian Tanaman Pangan 5(1): 25.</li> <li>3. Yu G, Lai S, Liao S, Cao Y, Li W, Long C, Tarno H, Wang J. 2023. Complete Mitochondrial Genome of Scolytoplatypodini Species (Coleoptera: Curculionidae: Scolytinae) and Phylogenetic Implications. Genes, 14(1): 162.</li> </ol>							
<b>Learning Media</b>	<b>Software:</b>						<b>Hardware:</b>		
								Computer, LCD	

<b>Team Teaching</b>	Hagus Tarno SP., MP., Dr. Agr.Sc Dr. Ir. Sri Karindah, MS. Prof. Ir. Liliek Sulistyowati, Ph.D.
<b>Required Courses</b>	-

<b>Week to -</b>	<b>Sub-CLO (as expected final capability)</b>	<b>Indicator</b>	<b>Criteria &amp; Forms of Assessment</b>	<b>Learning Methods (Lectures / Assignments / other forms of learning)</b>	<b>Time (Duration)</b>	<b>Learning Materials / [References]</b>	<b>Proportion (%)</b>
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1	Students are able to understand comprehensively about the Synthesis of Mendelian inheritance and molecular biology	accuracy in mastering learning material and systematically re-explaining the Synthesis of Mendelian inheritance and molecular biology	<p>Criterion:</p> <p>accuracy of students in mastering the understanding of Synthesis of Mendelian inheritance and molecular biology</p> <p>Form of Assessment:</p> <p>Accuracy of Response and Opinion in Discussions</p>	<p>Method:</p> <p>Lectures and discussions</p> <p>Self-study</p>	<p>100 minutes</p> <p>Self-study (2x60 minutes)</p>	<p>Inheritance, basic terminology, central dogma of molecular biology, experimental organisms, DNA replication and transmission</p> <p>Book:</p> <p>Gilbert LI. 2012.</p>	5 %
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2	Students are able to master knowledge about Genes on chromosomes and Mutation	accuracy in using learning materials and systematically re-explaining Genes on chromosomes and Mutation	<p>Criteria:</p> <p>accuracy of students in mastering the understanding of Genes on chromosomes and Mutation</p> <p>Form of Assessment:</p> <p>Accuracy of Response and Opinion in Discussions</p>	<p>Method:</p> <p>Lectures and discussions</p> <p>Self-study</p>	<p>100 minutes</p> <p>Self-study (2x60 minutes)</p>	<p>-Insect chromosome structure, cell cycles (including anomalous cycles, linkage analysis, linkage disequilibrium.</p> <p>-Chromosome rearrangements, balancer chromosomes, mutation classification, mutant screens, deficiency mapping</p> <p>Pustaka:</p> <p>Gilbert LI. 2012.</p>	
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3	Students are able to master knowledge about Biochemical genetics	accuracy in mastering learning material and systematically re-explaining Biochemical genetics	Criteria: accuracy of students in mastering the understanding of Biochemical genetics  Form of Assessment: Assignment	Method: Lectures and discussions  Self-study	100 minutes  Self-study (2x60 minutes)	Epistasis, biochemical pathways, complementation analysis, reverse genetics, RNAi.  Book: Gilbert LI. 2012.	
4	Students are able to master knowledge about Developmental genetics	accuracy in mastering learning material and systematically re-explaining about Developmental genetics	Criteria: The accuracy of students in mastering the understanding of developmental genetics	Method: Lectures and discussions  Self-study	100 minutes  Self-study (2x60 minutes)	Maternal effect, zygotic effect, regulation of gene expression, sex determination.  book: Gilbert LI. 2012.	

			Form of Assessment: Assignment				
5	Students are able to master knowledge about Ecological genetics	accuracy in mastering learning materials and systematically re-explaining ecological genetics	Criteria: Accuracy of Students in Mastering the Understanding of Ecological Genetics  Form of Assessment: accuracy of response and opinion in discussion	Method: Lectures and discussions  Self-study	100 minutes Self-study (2x60 minutes)	Molecular markers, genes in populations, speciation, mimicry.  Book: Gilbert LI. 2012.	



6	Students are able to master knowledge about introduction to molecular tools and techniques for insect identification and detections	Accuracy in mastering the learning material and systematically explaining the introduction to molecular tools and techniques for insect identification and detections	Criteria: Accuracy of Students in Mastering the Understanding of Ecological Genetics Form of Assessment: Presentation	Method: Lectures and discussions Self-study	100 minutes Self-study (2x60 minutes)	Book: <a href="https://drive.google.com/file/d/1-kss5aMizOGGFo5FW37LWB0rxbdWRAUH/view?usp=sharing">https://drive.google.com/file/d/1-kss5aMizOGGFo5FW37LWB0rxbdWRAUH/view?usp=sharing</a>	
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7	Students are able to master knowledge about Transposable Elements and the Evolution of Insects	accuracy in mastering learning material and systematically re-explaining Transposable Elements and the Evolution of Insects	Criteria: accuracy of students in mastering the understanding of Transposable Elements and the Evolution of Insects  Form of Assessment: Task	Method: Lectures and discussions  Self-study	100 minutes  Self-study (2x60 minutes)	Transposable Elements and the Evolution of Insects  Book:  <a href="https://drive.google.com/file/d/1-kss5aMizOGGFo5FW37LWB0rxbdwRAUH/view?usp=sharing">https://drive.google.com/file/d/1-kss5aMizOGGFo5FW37LWB0rxbdwRAUH/view?usp=sharing</a>	
8	Mid-term Exam						
9	Students are able to master knowledge about Transgenics (Mass rearing and sterile insect releases for the control)	accuracy in mastering learning material and systematically re-explaining Transgenics (Mass	Criteria: accuracy of students in mastering the understanding of Transgenics	Lectures, and discussion	100 minutes  Self-study (2x60 minutes):	Insect transformation for both experimentation and population control	

		rearing and sterile insect releases for the control)	(Mass rearing and sterile insect releases for the control)  Form of assessment:  Presentation			Transgenics (Mass rearing and sterile insect releases for the control)  Book: Gilbert LI. 2012  <a href="https://drive.google.com/file/d/1hCkUCA16O6Skyw3bi5Wgt8fRveLwncMQ/view?usp=sharing">https://drive.google.com/file/d/1hCkUCA16O6Skyw3bi5Wgt8fRveLwncMQ/view?usp=sharing</a>	
10	Students are able to master knowledge about DNA Barcoding to improve invasive pest identification	accuracy in mastering learning materials and systematically re-explaining DNA Barcoding to improve invasive pest identification	Criteria:  The accuracy of students in mastering the understanding of DNA Barcoding to improve invasive pest identification  Form of assessment:  Presentation	Lectures, and discussion	100 minutes  Self-study (2x60 minutes):	DNA Barcoding to improve invasive pest identification  Book:  Madden, Mary J. L., Robert G. Young, John W. Brown, Scott E. Miller, Andrew J. Frewin, and Robert H. Hanner. "Using DNA Barcoding to Improve Invasive Pest Identification at U.S. Ports-of-Entry." Edited by Massimo Labra. PLOS ONE 14, no. 9	

						(September 17, 2019): e0222291. doi:10.1371/journal.pone.0222291.  <a href="https://drive.google.com/file/d/15QUfrnQoOQREHb4n1WMCnaMmQIG22Z7A/view?usp=sharing">https://drive.google.com/file/d/15QUfrnQoOQREHb4n1WMCnaMmQIG22Z7A/view?usp=sharing</a>	
11	Students are able to master knowledge about temporal tracing and geographic distribution of resistance to insecticide	accuracy in mastering learning material and systematically re-explainingG tracing temporal and geographic distribution of resistance to insecticide	Criteria:  Accuracy of Students in Mastering the Understanding of Tracing Temporal and Geographic Distribution of Resistance to Insecticide  Form of assessment:  assignment	Discussion	100 minutes  Self-study (2x60 minutes):	tracing temporal and geographic distribution of resistance to insecticide  Book:  Tancredi, Alessandra, Davide Papandrea, Michele Marconcini, Rebeca Carballar-Lejarazu, Mauricio Casas-Martinez, Eugenia Lo, Xiao-Guang Chen, Anna R. Malacrida, and Mariangela Bonizzoni. "Tracing Temporal and Geographic Distribution	

						<p>of Resistance to Pyrethroids in the Arboviral Vector <i>Aedes Albopictus</i>." Edited by Robert L. Aldridge. PLOS Neglected Tropical Diseases 14, no. 6 (June 22, 2020): e0008350. <a href="https://doi.org/10.1371/journal.pntd.0008350">https://doi.org/10.1371/journal.pntd.0008350</a></p> <p><a href="https://drive.google.com/file/d/102Gs7sQMqvWAtnM9fuTBd4F3mhLSiu0k/view?usp=sharing">https://drive.google.com/file/d/102Gs7sQMqvWAtnM9fuTBd4F3mhLSiu0k/view?usp=sharing</a></p>	
12	Students are able to master knowledge about insight into different host ranges of insects by transcriptomic and microbiome analysis	Accuracy in mastering the learning material and systematically re-explaining the insight into different host ranges of insects by transcriptomic and microbiome analysis	<p>Criteria:</p> <p>The accuracy of students in mastering the understanding of insight into different host ranges of insects by transcriptomic and microbiome analysis</p>	Discussion	<p>100 minutes</p> <p>Self-study (2x60 minutes):</p>	<p>insight into different host ranges of insects by transcriptomic and microbiome analysis</p> <p>Book:</p> <p>Savitha, T., A. Sankaranarayanan, and Ashraf Y. Z. Khalifa. "An Insight of Microbiome Science." <i>Microbiome-Host Interactions</i> (February 25, 2021): 1–9.</p>	

			Form of assessment: assignment			doi:10.1201/9781003037521-1.	
13	Students are able to master knowledge about tracking trophic links through predator-prey food-webs	Accuracy in mastering the learning material and systematically re-explaining about tracking trophic links through predator-prey food-webs	Criteria:  Student accuracy in mastering the understanding of tracking trophic links through predator-prey food-webs  Form of assessment: presentation			tracking trophic links through predator-prey food-webs  Book:  <a href="https://drive.google.com/file/d/13D1uRNMeMmsFpy1vVvhK_soBid4o5CTh/view?usp=sharing">https://drive.google.com/file/d/13D1uRNMeMmsFpy1vVvhK_soBid4o5CTh/view?usp=sharing</a>	
14	Students are able to master knowledge about insect Pheromone Receptors – Key Elements in Sensing Intraspecific Chemical Signals	accuracy in mastering the learning material and systematically re-explaining about insect Pheromone Receptors – Key Elements in Sensing	Criteria:  accuracy of students in mastering the understanding of insect Pheromone Receptors – Key	Discussion	100 minutes  Self-study (2x60 minutes):	Insect Pheromone Receptors – Key Elements in Sensing Intraspecific Chemical Signals  Book:	

		Intraspecific Chemical Signals.	Elements in Sensing Intraspecific Chemical Signals.  Form of assessment: presentation			Fleischer, Jörg, and Jürgen Krieger. "Insect Pheromone Receptors – Key Elements in Sensing Intraspecific Chemical Signals." <i>Frontiers in Cellular Neuroscience</i> 12 (November 20, 2018). doi:10.3389/fncel.2018.00425.  <a href="https://drive.google.com/file/d/18Fq0fGwQC_Bt4pelYbXR_UNz-b6vUJ00/view?usp=sharing">https://drive.google.com/file/d/18Fq0fGwQC_Bt4pelYbXR_UNz-b6vUJ00/view?usp=sharing</a>	
15	Students are able to critically review and analyze case studies on - Symbion, insects as an ecological indicator, and enhancing the effectivity of insect pathogens.	ketepatan berpikir kritis dan menganalisa studi kasus tentang Symbion, insects as an ecological indicator, and enhancing the effectivity of insect pathogen.	Criterion: accuracy of students critically reviewing case studies about Symbion, insects as an ecological indicator, and enhancing the effectivity of insect pathogens.	Discussion	100 minutes  Self-study (2x60 minutes):	Case studies - Symbion, insects as an ecological indicator, and enhancing the effectivity of insect pathogen.	

			Form value: Perfection of Case Study Report				
16	Final Exam						