BRAWIJAYA UNIVERSITY

FACULTY OF AGRICULTURE

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

SEMESTER COURSE PLAN

SUBJECT	CODE	COURSE CULTURE	CREDITS	SEMESTER	Date of Preparation
Stored Pests	PTH82244	Master of Agricultural Entomology	2 2,34 ECTS	Even	8 June 2021

AUTHORIZATION	Lecturer	Course Coordinator	Head of Study Program
Department of Plant Pests and Diseases	Prof. Dr. Ir. Ludji Pantja Astuti, MS Dr. Akhmad Rizali, SP., M.Si Dr. Silvi Ikawati, SP., M.Sc	Name Signature	Dr. Akhmad Rizali, SP, M.Si Signature

Learning Outcomes	ILO STUDY PROGRAM	
	1	Have the ability to analyze facts in post-harvest pest problems that infest food in storge and dare to make decisions to solve problems in the community so as to make a positive contribution in the provision of national food continuously.

	2	Have basic knowledge of bioecology of various postharvest pests and storage ecosystem management as a basis for healthy and sustainable postharvest pest management.
	Course Learning Outcome	
	1	After taking this course, students can develop their abilities and creativity in an effort to manage postharvest pests to prevent and/or minimize the impact of economic losses caused.
Course Brief Description	The storage product pest pest course studies the understanding of postharvest pests, the history of infestation, the importance, diversity, and factors causing population increase as well as healthy and safe management strategies for the environment in sustainable life.	
Learning Materials / Subjects	1. Introduction: Introduction to storage product pest 2. The significance of storage product pest 3. Classification of storage product pest 4. Ecology of storage product pest 5. Identification of the storage product pest : order Coleoptera 6. Identification of the storage product pest : orders Lepidoptera, Acarina, Rodentia and Aves 7. Storage product pest pest control 8. Mid-term Exam 9. Sampling and dense estimation of storage product pest populations 10. Estimation of yield loss and establishment of control techniques 11. Sanitation and exclusion 12. Biological control 13. Temperature treatment and aeration 14. Modification of storage atmosphere 15. Application of inert dust, vegetable insecticides, and synthetic chemical insecticides 16. Final Exam	

Relationship between CLO and ILO	

	ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6	ILO 7
CLO 1	0.50	0.50	0.00	0.00	0.00	0.00	0.00

References	**Main**	

1. Hagstrum, D. W. and B. Subramanyam. 2006. Fundamental of Stored Product Entomology. AACC International. St. Paul, Minnesota. USA. p. 323.
2. Rees, D. 2004. Insects of Stored Products. CSIRO Publishing. Australia. p. 181.
3. Bhargava, M. C. and K. C. Kumawat. 2010. Pests of Stored Grains and Their Management. New India Publishing Agency. p. 256.
4. Kumar, R. 2017. Insect Pests of Stored Grain: Biology, Behavior and Management Strategies. CRC Press. P. 394.
5. Subramanyam, B. and D. W. Hagstrum. 2000. Alternatives to Pesticides in Stored-Product IPM. Kluwer Academic Publishers. London. p. 437.
6. Subramanyam, B. and D. W. Hagstrum. 1996. Integrated Management of Insects in Stored Products. CRC Press. p. 425.
7. Baskaran,M. R. K., N. Muthukrishnan, S. Prabhu, K. Ramaraju, J. Jayaraj, S. Mohan, C. Chinnusamy. 2015. Integrated Control of Stored Products Pests and Diseases. Agrotech Publishing Academy. p. 440.
8. Athanassiou, C. G. and F. H. Arthur. 2018. Recent Advances in Stored Product Protection. Springer. p. 273.
9. Astuti, L. P. 2019. Strategi Pengelolaan Hama Gudang. UB Press. p. 170.
10. Astuti, L. P., Mario, M. B., Aulia, S. V., Batubara, R. N., Harianto, E. N. P. 2022. Kunci Identifikasi Serangga Hama Pascapanen: Coleoptera dan Lepidoptera. UB Press. p. 252.

<table>
<tr><td rowspan="2"></td><td>Supporting References</td><td></td></tr>
<tr><td colspan="2">1. Hill, D. S. 2002. Pests of Stored Foodstuffs and Their Control. Kluwer Academic Publishers. London. p. 476.
2. Hagstrum, D. W. and B. Subramanyam. 2009. Stored-Product Insect Resource. AACC International. St. Paul, Minnesota. USA. p. 510.
3. Wilbur, D. A. and R. B. Mills. 1985. Stored Grain Insects. pp.552-576. IN Fundamentals of Applied Entomology (ed. R. E. Pfadt. Macmillan Publishing Co. Inc. New York. Coller Macmillan Publishers. London.
4. Munro, J. W. 1966. Pests of Stored Products. Hutchinson & CO. LTD. New York. p. 234.
5. Jayas,D. G., N. D. G. White and W. E. Muir. 1995. Stored-Grain Ecosystem. Marcel Dekker, Inc. New York. Basel. Hongkong. p. 757.
6. Cohen. 2004 Insect Diets. Science and Technology. CRC Press. Washington D. C. p. 324.
7. Astuti, L. P., Rizali, A., Firnanda, A., Widjayanti, T. 2020. Physical and chemical properties of flour product affect the development of Tribolium castaneum. Journal of Stored Product Research 86: 101555.
8. Astuti, L. P., Prabowo, P. P., Rizali, A., Mutala'liah, M. 2019. Collonization and Oviposition Preference of Six Weevil Species on Various Colors of Storage Container. Jurnal Perlindungan Tanaman Indonesia 23(2).
9. Astuti, L. P., Ramadhani, F. S., Sitanggang, H. A., Rizali, A., Setiawan, Y., Mutala'liah. 2021. Development of Corcyra cephalonica (Stainton) on six varieties of brown and milled rice. Journal of Entomological Research 45(3): 385-392.</td></tr>
<tr><td rowspan="2">Instructional Media</td><td>Software:</td><td>Hardware:</td></tr>
<tr><td>Microsoft Windows dan Microsoft Office</td><td>Computer, LCD</td></tr>
<tr><td>Teaching Team</td><td colspan="2">1. Prof. Dr. Ir. Ludji Pantja Astuti, MS
2. Dr. Akhmad Rizali, SP., M.Si
3. Dr. Silvi Ikawati, SP., M.Sc</td></tr>
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Requirements Courses	1.

Week	Sub-CLO (as expected final capability)	Indicator	Criteria & Forms of Assessment	Learning Methods (Lectures / Assignments / other forms of learning)	Time (Duration)	Learning Materials [References]	Proportion (%)
1	Students are able to understand comprehensively about the understanding, history and sources of storage product pest infestation.	Ability to respond to learning materials, follow learning activities about the history of infestations and sources of storage product pest infestations	Form of Assessment: reviewing articles on the origin of the emergence of barn pests Judging criteria: Synthesizing ability article	Lectures and Discussions	100 minutes Task (2x60 minutes)	Understanding storage product pest, history and sources of storage product pest infestation Book: Home: 2 & 8 Supporters: 3 & 4	5 %

2	Students master knowledge about the importance of storage product pest, forms of damage as well as estimation and detection due to storage product pest infestation	Ability to respond to learning materials, participate in learning activities and identify forms ofdamage and detect and estimate losses due to storage product pest infestation and carry out tasks	Form of assessment: review of articles The role of storage product pest in the food storage process, able to detect and estimate losses due to storage product pest infection Criterion: Synthesizing ability article	Lectures and Discussions	100 minutes Self-study (2x60 minutes)	The importance of storage product pest concerns the detection of forms of damage and the estimation of losses caused. Book: Home: 3, 4, & 9 Supporters: 1 & 3	5%
3	Students master knowledge about the classification of storage product pest based on feed sources, pest phases and how to damage, their	accuracy of identifying barn pests and carrying out tasks	Form of assessment: review article Kriteria: Accuracy in identifying the status of various	Lectures and Discussions	100 minutes Self-study (2x60 minutes)	Classification of storage product pest based on feed source, pest phase and how to destroy, their importance and systematics	5%

	importance, and systematics.		types of storage product pest			Book Home: 2 & 9 Support:1, 3 & 5	
4	Students master knowledge about storage product pest ecology	Accuracy explains about ecological factors and their effects on storage product pest	Form of assessment: Presentation on The influence of ecological factors on storage product pest Criteria: Student accuracy explains systematically	Lectures and discussions, presentations	100 minutes Self-study (2x60 minutes):	The ecology of barn pests concerning the description of climatic factors, feed, natural enemies and human activities. Book: Home: 2 & 9 Supporters: 4, 5, 6	5 %
5	Students master knowledge about storage product pest biology from insect classes (Order Coleoptera)	Ability to respond to learning materials, participate in learning activities and understand the biology of	Form of assessment: assignment - presentation on the biology of various species of	Lectures and Discussions, presentations	100 minutes Self-study (2x60 minutes):	Morphological and bioecological identification of storage product pest of the order Coleoptera	5 %

		storage product pest of the order Coleoptera	barn pests in the order Coleoptera Criteria: The accuracy of students explaining systematically			Book: Home: 1, 2, 3, 4 & 9 Supporters: 1,3 & 4	
6	Students master knowledge about storage product pest biology from insect classes (Order Lepidoptera, Acarina, Rodentia, and Aves)	Ability to respond to learning materials, participate in learning activities and understand storage product pest in the orders Lepidoptera, Pickleina, Rodentia, and Aves and carry out tasks	Form of assessment: task - presentation on the biology of various species of storage product pest in the orders Lepidoptera, Acarina, Rodentia, and Aves Criterion: Student accuracy explains systematically	Lectures and Discussions, presentations	100 minutes Self-study (2x60 minutes):	Morphological and bioecological identification of storage product pest of the orders Lepidoptera, Acarina, Rodentia, and Aves) Book: Home: 1,2, 3, 4 & 9 Supporters: 1&4	5 %

7	Students master knowledge about Storage Product Pest Control	Ability to set criteria for various preventive, curative efforts and plan PHGT implementation	Form of assessment: Review articles on PHGT Criterion: Accuracy and systematics in synthesizing articles	Lectures and Discussions,	100 minutes Self-study (2x60 minutes):	Preventive, curative, and IPM efforts in storage product pest control Book: Home: 1,2, 3,4, 5, 6, 7, & 9 Supporters: 4	5 %
8	Mid-term Exam						5 %
9	Students master and are able to determine sampling techniques and dense estimation of storage product pest populations	Accuracy and skill in sampling techniques and solid estimation of storage product pest populations	Form of assessment: Tugas - a case study of the technique sampling and solid estimation of storage product pest populations **Criterion:** Depth of analyzing a given case study	Lectures and Discussions	100 minutes Self-study (2x60 minutes)	Sampling techniques and solid estimation of storage product pest populations Book: Home: 1, 5 & 9 Supporter:-	5 %

10	Students master how to estimate crop losses resistant to storage product pest and determine control techniques	Accuracy of analyzing yield loss estimates of plants resistant to storage product pest and determination of control techniques	Bentuk rating: Planning report on estimation of yield loss and utilization of commodity products that are resistant to storage product pest Criterion: Accuracy in systematically planning	Lectures and Discussions	100 minutes Self-study (2x60 minutes)	Background and history, Estimation of yield loss, Bioassay and resilience evaluation, physical and biochemical resistance mechanisms, GMOs, and their utilization and advantages and limitations Book: Home: 1, 5 & 9 Pendukung: -	5 %

11	Students master knowledge of control techniques through sanitation and exclusion of storage product pest	Accuracy in explaining sanitation and exclusion	Form of assessment: Review / study on sanitation planning and management and exclusion Criterion: Ability to synthesize articles	Lectures and Discussions	100 minutes Self-study (2x60 minutes)	Background, history and utilization of sanitation and exclusion and its advantages and limitations Book: Home: 1, 5 & 9 Supporters: 1	5 %
12	Students master knowledge of control techniques using natural enemies	Accuracy explains about the role of natural enemies in storage product pest control	Form of assessment: Write a review of the role of natural enemies in storage product pest control Criterion: Accuracy and systematics in synthesizing articles	Lectures and Discussions	100 minutes Self-study (2x60 minutes):	Background and history of biological control, the role of parasitoids, predators and pathogens against storage product pest, advantages and limitations, and implementation strategies. Book: Home: 1, 5 & 9 Supporter:-	5 %

13	Students master knowledge of control techniques through temperature treatment and aeration	Accuracy explains about Temperature treatment and aeration	Form of assessment: Write a review of temperature treatment and aeration Criterion: Accuracy andaesthetics in synthesizing articles	Lectures and Discussions	100 minutes Self-study (2x60 minutes):	Application of aeration and principle of extreme high/low temperature treatment of storage product pest populations and their advantages and limitations Book: Home:1, 5 & 9 Supporter:-	5 %
14	Students master knowledge of control techniques through atmospheric modification and their effects on storage product pest	Accuracy describes atmospheric modifications and their effects on storage product pest	Form of assessment: Write a review / study of atmospheric modification its effect on storage product pest Criteria:	Lectures and Discussions	100 minutes Self-study (2x60 minutes):	Its background and history, modification of the concentration of oxygen, carbon dioxide, and Nitrogen, and its effect on storage product pest and their advantages and limitations	5 %

			Accuracy and systematics in synthesizing articles			Book: Home: 1, 5 & 9 Supporter:-	
15	Students master knowledge of control techniques using bruise ash, vegetable insecticides and synthetic chemicals	Accuracy of explaining and application skills of bruise ash, vegetable insecticides and synthetic chemicals	Form of assessment: Write a review / study on the use of bruise ash, vegetable insecticides and synthetic chemicals in storage product pest control Criteria: Accuracy and systematics in synthesizing articles	Lectures and Discussions	100 minutes Self-study (2x60 minutes):	Background and history of the use of bruise ash, vegetable insecticides and synthetic chemicals in storage product pest control and their advantages and limitations Book: Home: 1, 5 & 9 Supporter:-	5 %
16	**Final Exam**						5 %