


2014

# ENTO 403/803: Management of Horticultural Crop Pests—A Peer Review of Teaching Project Benchmark Portfolio

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**Benchmark Course Portfolio  
Peer Review of Teaching  
2013-2014  
University of Nebraska, Lincoln**

**ENTO 403/803  
Management of  
Horticultural  
Crop Pests**

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## Objectives of Peer Review Course Portfolio

I have been the instructor for ENTO 403/803 since 2008 and I still struggle with finding a course structure that meets the needs of all learners. Students are from diverse backgrounds that include entomology, horticulture, and turf grass management majors. I perceive that students are not sufficiently challenged, or their lack of interest in the subject (my perception) makes learning difficult, so rather than feeling they want to work hard to learn, they simply find the easiest way through and walk away without caring about or achieving the learning objectives I have set.

I find this class to be the most challenging of all I teach for several reasons:

1. It is offered online (makes it hard to determine if students “get it”).
2. The students come from diverse backgrounds and have different needs they hope to fulfill by taking the class.
3. Undergraduate and graduate students are enrolled simultaneously.

I feel I need to take this course to a higher level where I can engage students of all backgrounds, and ensure that each of them has the skills needed, and the ability to make informed decisions about the management of horticultural pest insects.

Specific concerns are listed below.

Concerns
How to engage students from greatly varied backgrounds in an online format...what methods, at what level, how to challenge and encourage learning for all.
Meaningful assessment. What works?
Are students even looking at the syllabus?
How do I spark an interest in students that take the class only because it's required.

Key goals of portfolio.

1. Enhance the learning and teaching experience.
2. Promote greater subject synthesis and critical thinking.
3. Find appropriate and meaningful methods of assessment.
4. Spark an interest in entomology in students with minimal background.
5. My major goal is to use the portfolio to improve my approach to student learning in all classes, and perhaps pass what I have accomplished on to other faculty in my department.



## Description of the Course

ENTO 403/803 is an online course that focuses on the identification, biology, ecology and management of insect pests of horticultural crops, including vegetables, deciduous fruits and nuts, trees and shrubs, greenhouse crops, turf and ornamentals. Emphasis is placed on Integrated Pest Management (IPM) strategies employed to maintain pests below damaging levels while minimizing the use of traditional insecticides. I strive to promote problem solving and critical thinking skills in this class. The syllabus is presented in [Appendix 1](#).

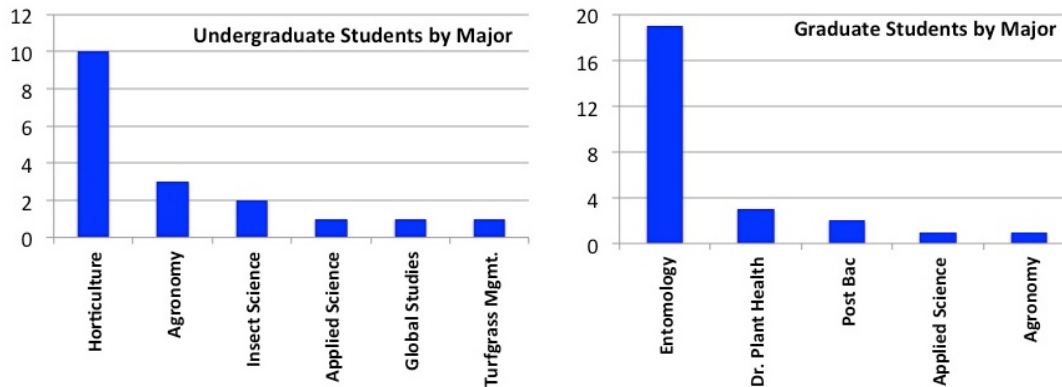
In this class we discuss how insects function, and relate the basics of what was learned to management and control. Specifically, we examine insect pests by group, emphasizing identification, damage, biology and management of major...as well as a few minor species.

### Course goals and learning objectives.

1. Students will be introduced to key concepts and background knowledge that will help them make enriched decisions in their career as a horticulturalists, or entomologists.
2. Proper identification is essential in pest management. In this class students learn how to ID insects, learn to recognize beneficial and harmful arthropods associated with horticultural plantings and understand the basics of pest biology (life cycles, behavior, damage, resources needed to survive).
3. To develop effective pest control tactics, students must understand the principles of Integrated Pest Management and how they relate to horticultural crop settings.
4. Diagnostic skills are essential. Students learn to characterize different types of plant injury and associate the injury with the arthropod pest that is responsible.
5. Problem solving skills are essential for effective pest management. Students are challenged with scenarios where they can analyze a given situation and provide a plan to solve complex pest management problems using critical and creative thinking.
6. Students learn to write effectively to communicate scientific data and information to non-technical audiences.

Students. Of the various classes I teach, this one is most unique in terms of demographics. Both undergraduate and graduate students are enrolled. The majority of undergraduate students in this class come from a turf or horticultural background. It is a requirement for their major. A few turf science and insect science students also enroll in the class. Most graduate students that take the course are online entomology students, but there are some horticulture doctoral students that take it as well. The course is designed to build off a limited background in entomology, but it is expected that students have completed an introductory insect biology course before enrolling. Some students in the class are quite proficient in entomology while most have a very limited background.

A total of 34 students were enrolled in the class, Spring 2014. Of the 18 undergraduate students enrolled, only 2 were entomology (Insect Science) majors (Fig. 1). Most of the remaining 16 undergraduate students were horticulture and agronomy majors. The majority (15) of the undergraduate students were seniors. Nineteen of the graduate students taking the class were online MS entomology majors (Fig. 1). The others were in various MS and professional programs.



**Figure 1.** Majors of undergraduate and graduate students enrolled in ENTO 403/803.

Personal Reflection of the Course. ENTO 403/803 is an important class for many students. It is required by undergraduate horticulture majors at UNL, but because it is offered online, it is also of interest to entomology and horticulture graduate students across the U.S. and globally. I would like to create a course that captures the interest of students from diverse backgrounds and locations and help prepare them to problem solve the pest management issues they will face throughout their careers. The challenge is how to create such a course...one that engages all students in a meaningful manner, and what activities and assessments truly add to this goal.

## Materials, Methods, and Activities

ENTO 403/803 is offered online every spring semester. It is only open only to undergraduates' during odd years, but undergraduate and graduate students can take it during even years.

I have divided the class into 4 primary learning modules:

1. Biology, Management, and Media
2. Turf pests and management
3. Horticultural pests and management
4. Landscape pests and management

There are also a few miscellaneous lectures that follow the fourth learning module.

Course Activities and Assessments. Blackboard is used for delivery of all materials pertinent to this course (lectures, asynchronous discussions, assignments such as readings or links to readings, and assessment materials).

- Lectures and Readings. Narrated Power Point presentations are used to deliver lectures. Text and images are used to emphasize key points. A total of 35 lectures ([follow this link to see topics](#)) were recorded and made available to students. Students have the option to view lectures as flash files via Adobe Presenter, or as narrated PDF files (see [Appendix 2](#) for an example of an online lecture). In addition to lectures, readings are assigned to enhance student's comprehension of the topics.
- Discussion Board. I create asynchronous discussion threads to capture important points for each week. The first thing I ask them to do is introduce themselves. Subsequent threads focus on a particular topic, a pertinent article in the news, reading materials, or an interesting insect. I do this to develop a sense of community among online students, to move beyond the lecture model, and to promote the analysis of situations and provide

guidance on how to solve problems using critical, or creative thinking, and scientific reasoning. Although I do not grade for participation I do strongly encourage students to at least read through posts.

- Fact Sheets. Each student is either assigned, or they choose 2 insect/or closely related arthropod species of horticultural importance. For each arthropod, the student gathers the following information: identifying characteristics for the adult and immature stages, description of damage (if any), summary of the life cycle, procedures for assessing (sampling) populations, economic thresholds (if any), and a discussion of feasible management methods/control measures. After finding the needed information, students write a 1 to 2-page summary. Each summary is written with public education in mind. I edit each paper and if changes are suggested, I send back to the student. They have a week to resubmit with changes (instructions are included in [Appendix 3](#)).
- Quizzes/Exams: There are four subject quizzes given after completion of each learning module. These quizzes are used to assess knowledge of horticultural pest biology, ecology, and management and to challenge students with scenarios that require problem solving. A comprehensive final exam, modeled after the subject quizzes, is also given. The quizzes and final exam are delivered online and students are allowed to take them "open book". Completed assessments are due 1 week after posting and are returned to me via e-mail attachment. Undergraduate and graduate students take different quizzes/exams.
- Identification Quizzes: Throughout the course, I emphasize the importance of proper identification of horticultural pests. I give the students 5 quizzes throughout the semester meant to challenge their identification skills. In some cases, I also ask them to provide a short synopsis of the pest's biology. Identifications are made to family level at the minimum, and in many cases, they are asked to identify to genus and species, or common name. The identification quizzes are open book and students have one week to complete them. I use a formative assessment approach for identification quizzes, if a student miss-identifies, I return the quiz and encourage them to contact me for additional hints if needed. I give them 2 days to return the quiz with a different answer.

Rationale for Teaching Methods. Like most research-based Ph.D. graduates I had no formal education in the art of teaching and approached it using the model I was accustomed to...disseminate information and hope some of it sticks. But, after my initial experiences in the classroom and hearing the same old question, "What do we need to know for the test?" my interest in learning how to teach has grown. I have evolved somewhat and now feel that expecting the regurgitation of facts is not the answer to preparing students for a lifetime of learning.

As I reflect upon the role of this course, I realize it is likely the only advanced entomology class many of these students will take before graduating and transitioning into their careers as plant production and care professionals. It has to have maximum impact and provide students with relevant and useful knowledge, and forge a pathway of thought needed to solve pest issues. When I first took the class over from a retiring colleague, I attempted to retain his approach to teaching, and tried to use his lectures. In his class, the former instructor showed students images of many insects. Students were required to memorize and recognize many of them by sight, and to know their biology, ecology and tactics for management. From my own experience I know that very little information learned this way is retained long-term. I therefore completely changed the course to reflect what I felt was important for these students to retain...and that is the ability to recognize damage to plants due to insect feeding, understand that not all insects are pests, to know how to identify insects, and how to use the internet to find information to piece together a management plan using integrated methods.

Changes from previous years. I have made several changes to ENTO 403/803 since taking over as course instructor. This past year, I made a few changes that were based on discussions fall during Peer Review of Teaching retreats last fall.

1. Challenging graduate students with case studies presented on the discussion board. Students were not graded on participation but some questions on their quizzes and final exam were generated from their discussions. I also did this to create a more challenging class for graduate students so I can work at a more basic level with the undergraduate students.
2. I started using identification quizzes for assessment two years ago. However, this year I made them a little more challenging and started to use a formative assessment approach.
3. I tried to interact more with students through increased emails, and posting more fun, off-topic articles on the discussion board.

## **The Course and the Broader Curriculum**

ENTO 403/803, Management of Horticultural Crop Pests, is a course designed to fill a specific learning niche in the field of insect pest management. It is required for students majoring in horticulture, and turf and landscape management, but not insect science. The only prerequisite for this course is an introductory insect biology course.

Graduate students earning their MS in entomology through online courses also take the class. They have had more advanced training in entomology and for them this class serves to further develop their knowledge of pest diversity, biology and their ability to develop management tactics for a variety of pests. I feel the class under-challenges graduate students.

The class was originally developed in 1998 to expand the curriculum of the new, online MS in Entomology degree program at UNL. On campus undergraduate students took a similar class, ENTO 303, Horticultural Insects. ENTO 303 was taught every other year on campus. Students met for 2 lectures and one lab period each week. Under this model, the undergraduate and graduate students were separated into 2 different courses and each was taught at the appropriate level. However, based on the recommendation of the Departmental Review team to reduce course listings, we removed ENTO 303 in 2011 and offered only ENTO 403/803 online. I restructured the class at that time to accommodate the entomological backgrounds of non-major undergraduate students. In 2011 I started offering ENTO 403/803 every year. During even years it is open to graduate and undergraduate students. During odd years it is only open to undergraduate students, but still just online.

During even years, when the class is open to all students, enrollment often exceeds 30 students. This is fairly high enrollment for an entomology class. It recently became part of the curriculum for an AgIDEA program in horticulture. In 2012 I had 6 Ph.D. students from NCSU enroll in the class. In some cases I use the class for recruitment of potential online entomology graduate students by encouraging them to participate as a guest student.

## **Analysis of Student Learning**

The Peer Review of Teaching Program seems to focus primarily on undergraduate courses. Therefore the following analysis is based entirely on undergraduate assessments.



There are several assessment activities implemented throughout the semester. I do this not only to gauge learning, but I am also making an attempt to keep students engaged in the online environment. I have found from teaching asynchronous online courses that if a student is regularly challenged, they are more likely to keep up with lectures rather than quickly fall behind. Ultimately I want to know if students:

1. Are viewing lectures and reading provided papers.
2. Are learning how to identify the insects that we discuss in lectures and in the discussion board.
3. Are able to find information not presented in lectures to develop strategies to manage pests.
4. Remain interested in the materials.

I had originally planned to provide students with 4 subject quizzes, 5 identification quizzes, 2 fact sheet learning activities, and a final exam. Because of time constraints I was only able to give 3 of the 4 subject quizzes, and 4 instead of 5 identification quizzes.

Identification Quizzes. Students were given 4 quizzes during the semester that focused solely on proper identification. For each quiz I created a powerpoint and PDF file with images of the insects (see [Appendix 4](#) for an ID quiz example). If needed, I used arrows pointed to key features used in identification. Students emailed their answer sheet to me (example [Appendix 5](#)). If anything was misidentified, I emailed them back with a list of what they missed and allowed them to go back and change their answer. They were given one chance and if they asked, I would provide them with additional cues. Each quiz showed 10 specimens and was worth a total of 20 points. Scores for each identification quiz are presented below.

<b>ID Quiz 1</b>	<b>Initial Attempt</b>	<b>Second Attempt</b>	<b>% Change</b>
Low Score	17	19	
High Score	20	20	
Mean	18.6	19.7	+ 5.4
SD	1.5	1.1	

<b>ID Quiz 2</b>	<b>Initial Attempt</b>	<b>Second Attempt</b>	<b>% Change</b>
Low Score	12	17	
High Score	20	20	
Mean	18.8	19.5	+ 4.6
SD	2.1	1.0	

<b>ID Quiz 3</b>	<b>Initial Attempt</b>	<b>Second Attempt</b>	<b>% Change</b>
Low Score	18	20	
High Score	20	20	
Mean	19.4	20	+ 3.0
SD	0.8	0	

<b>ID Quiz 4</b>	<b>Initial Attempt</b>	<b>Second Attempt</b>	<b>% Change</b>
Low Score	15	20	
High Score	20	20	
Mean	19.5	20	+ 2.5
SD	1.2	0	

As expected, quiz scores improved when students were given the chance to correct misidentifications. However, I was surprised that the average score of the initial attempt increase through the semester. This corresponded with a decrease in the percent change between the initial and second attempt. I don't want to read too much into the limited data, but it would be

nice to think that the students learned how to identify insects, or became more comfortable with identification process as the semester progressed.

Subject Quizzes and Final Exam. Following the first 3 learning modules, I provided an assessment. Each was worth 50 points. I also gave students a 100-point comprehensive final exam. Analysis of scores is shown below.

	Quiz 1 (%)	Quiz 2 (%)	Quiz 3 (%)	Final (%)
Low Score	82	84	86	80
High Score	100	100	100	100
Mean	95.3	98.1	98	95.4
SD	7.6	4.2	4.4	6.5

As observed with the identification quizzes, there was an improvement in the average score, at least between quiz 1, and the others. There was a consistent improvement in low scores. As an example of scoring, I will discuss the lowest scoring quiz 1 ([Appendix 6](#)) and compare that to a high score example ([Appendix 7](#)).

Student 1 earned 41 of the possible 50 points. Four of the 9 points the student missed were from 2 lectures presented the second week of the course. Initially I thought the student was just unable to watch those lectures before the quiz. But this is an open book assessment and the student had an opportunity to watch the lectures or to look for the information in readings, the discussion board, or online. The student missed all the points for one short essay question. Information for this question came from a discussion board thread. The student either misread the question or did not know where to find the information, or wasn't willing to look. This particular student's quiz scores improved through the semester.

Student 2 earned all possible points. In addition to correctly answering all multiple choice, short answer questions, the student synthesized information presented in lectures, on the discussion board, and from readings to go into great detail to develop excellent answers.

Overall, I was pleased with the performance of all students on the quizzes and final exam. Most took the time to find the information they needed to answer questions correctly. My open book exams tend to be more rigorous than those given in the classroom. They do require the student to find information. Students not achieving this may have misjudged the amount of time the quiz would take to complete, or they simply were not too interested in answering questions completely.

Fact sheets. These items were not graded until final suggested edits to the papers were made. All students made suggested changes and full credit was given for each paper. I was very pleased with the quality of the fact sheets (see [Appendix 8](#) for an example from an undergraduate student).

Student Survey. I developed a list of prompts related to course content, delivery and organization (see [Appendix 9](#) for survey). Students were asked to recommend keeping, stopping, or starting various activities and to provide input on course improvement. The survey was emailed to students during the 15<sup>th</sup> week of the class, and I requested they be returned, via email, to a departmental administrative assistant. Returned surveys were then forwarded to me with the student name and email address removed. Students were informed that their responses would be anonymous.

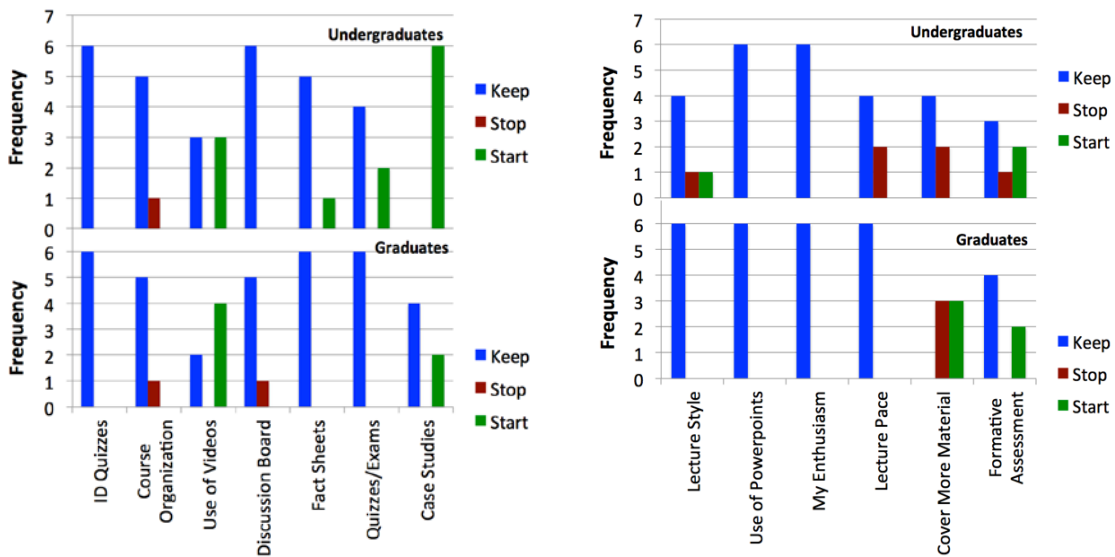
Twelve students completed the survey. Of the 6 graduate students that returned the survey, 5 were majors and 1 was not. The opposite was true for the 6 undergraduates that responded, with 1 major and 5 non-majors.

Recommendations for keeping, starting, or stopping particular elements of the course are shown in Figure 2. For the most part, students seemed pleased with course delivery (lecture style,

organization, use of PowerPoint's, use of the discussion board, my level of enthusiasm, and pace of the lectures). However, there was some concern from a few undergraduates that the pace of the lecture was too fast and that I covered too much material. Interestingly, graduate students were split, with half saying the amount of material we cover is just right, and the others wishing we covered more material.

Both undergraduate and graduate students recommended that I keep the insect identification quizzes. They did, however, seem confused by the use of formative assessment for the quizzes with some saying I should start this practice. Most students also recommended keeping the subject quizzes. However, the undergraduate students that recommended stop giving quizzes commented that they thought they are valuable, but would like to see me shift to more short answer, matching, fill in the blank, and/or true/false rather than essay questions. The fact sheets were popular with students. I base this not only on the results of the survey, but also on unsolicited feedback I got at the end of the semester.

To make the course more challenging for graduate students, I primarily used problem-based scenarios on quizzes, and assign a few case studies for them to read. These readings are not required for undergraduates. When asked about using case studies as a way to improve student learning, a third of the graduate students responded use them more while all undergraduates would like to see them incorporated into the curriculum.



**Figure 2.** Responses of undergraduate and graduate students enrolled in Management of Horticultural Crop Pests to keeping, stopping, or starting various components of the course. **Keep** (it benefits your learning), **Stop** (it hinders your learning), or **Start** (something that would benefit your learning).

In this survey I also asked students if they thought the class was too difficult, too easy, or just about right. All respondents answered “just about right”. I have also received feedback through individual communication with a few students that they would like to have the course offered on campus. I decided to ask, on the survey, if students would like it offered face to face or keep it online. All graduate students responded that it should be offered online, but one suggested both. Most of the graduate students that took this class are in an online program so it does make sense that they would like to keep an online section. The undergraduates were split, wanting it online and taught face to face.

Specific comments from students varied. The general theme for most graduate students was that I provide more opportunities for synchronous and asynchronous discussion and that I

consider covering more material. Undergraduate comments included a push for more case study-based examples, that the subject quiz format be changed to reduce essay questions, and that the course be taught face to face.

Responses between undergraduate and graduate students were more similar than I expected. The perception I have developed is that undergraduate students are working hard to keep up while graduate students are bored and not challenged. I realize this is a small sample size but it gives me some confidence that my course modifications are accomplishing what I have hoped they would.

## Planned Changes

The most important fact I learned in the development of this portfolio is that students are more satisfied with the class than I anticipated. This was very encouraging but not surprisingly, several elements of the course that could use improvement were exposed. Planned changes are as follows:

1. This class is taught every spring semester. I am going to propose to the departmental curriculum committee that I teach the class online every even semester and offer it on campus the following year. Undergraduate students could then decide what mode of instruction suits their schedule, and their preference. Graduate students would be allowed the same choice but most are online students so they would not have an opportunity to take it face to face.
2. When taught online, I will schedule a weekly synchronous discussion through a peer-to-peer program such as Adobe Connect, or Google hangout. I will not make participation mandatory but it will offer a real connection to the instructor and classmates that some students desire.
3. The fact sheets are popular and I intend to keep using them. However, some students may prefer to develop video segments rather than write the sheets. I will give students to option to write 2 fact sheets, or to make a video. I will develop a grading rubric for each.
4. Subject quizzes for undergraduate students will be modified to include, or be entirely multiple choice, true/false, or matching questions. These quizzes will be made available on Blackboard and automatically graded.
5. I will assign readings involving case studies at the end of each learning module and we will discuss each in class or on the discussion board.
6. I will add an additional course activity that involves problem solving. At the beginning of the 12<sup>th</sup> week, each student will be assigned a scenario, and must follow a set procedure (learned in class) for approaching the mitigating the problem (proper identification, learning pest biology, what is going on in the ecosystem, what management methods would you use). Each student will present his or her findings on blackboard, or in class and we will discuss each during the 14<sup>th</sup> and 15<sup>th</sup> week.
7. To allow time for the problem-based activity the comprehensive final exam will be replaced with a subject quiz that assesses learning for the last learning module.
8. I would like to develop a tool to help students; especially non-majors see how their knowledge has changed throughout the course. I am unsure how to approach this right now, but it would perhaps get them excited about the content and their ability to identify and manage pest problems encountered in their careers as plant care professionals. At this moment I am considering a first-week assessment, and giving them the same assessment at the end of the semester.

## **Summary and Overall Assessment of Portfolio Process**

After completing this portfolio, I feel like I have done a better job structuring and teaching the class than I originally thought. The only tool I had to judge prior to this was course assessment by student evaluation. While I do value student assessment, the evaluations do not address student learning as aligned with course learning goals. This portfolio will be an excellent document for reflection, and will also be useful for sharing with my peers, and department head.

For several years, I have struggled with development of useful assessment tools. Not just tools that challenge the student, but assessments that align with course goals. While my understanding of assessment has grown, I have a feeling I still have much more to learn about assessment and what is learning. This process of completing this portfolio has confirmed that.

Have my learning goals been met? Some have, some have not. Teaching is truly a dynamic process. I have much more to understand and implement before I have this...or any other class that I teach, right where I want it. But opportunities like this help to make me a more effective facilitator of learning.



# APPENDICES

## Appendix 1. Course Syllabus

### Syllabus: Entomology 403/803 Management of Horticultural Crop Insects Spring 2014

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**Office Hours** The best way to reach me is by email or text to my mobile...I prefer text, just let me know who you are. If you email, expect a response within a few hours, although I sometimes take a little longer. If you call and I do not answer, leave a message and I will get back to you as soon as possible. Calls at home are fine up until about 10 pm central time.

If you are on campus, come by my office (Room 214 Entomology Hall).

#### ABOUT THE COURSE

This course will focus on identification, biology, ecology and management of insect pests of horticultural crops, including vegetables, deciduous fruits and nuts, trees and shrubs, greenhouse crops, turf and ornamentals. Emphasis will be on Integrated Pest Management (IPM) strategies employed to maintain pests below damaging levels while minimizing the use of traditional insecticides. I strive to promote problem solving and critical thinking skills in this class.

We will discuss how insects function, and relate the basics of what was learned to insect management and control. Specifically, we will examine insect pests by group, emphasizing identification, damage, biology and management of major...as well as a few minor species.

#### COURSE OBJECTIVES

1. Learn key concepts and background knowledge that will help you make enriched decisions in your career as a horticulturalist, entomologist, or other field.
2. Recognize beneficial and harmful arthropods associated with horticultural plantings and understand the basics of pest biology (life cycles, behavior, damage, resources need to survive).
3. Understand the principles of Integrated Pest Management and how they relate to horticultural crop settings.
4. Characterize different types of plant injury and associate it with the arthropod pest that is responsible.
5. Analyze given situations and provide a plan to solve complex pest management problems using critical and creative thinking.

6. Identify and employ all facets of modern pest management programs, including sampling, interpretation of available thresholds, and multiple management strategies
7. Write effectively to communicate scientific data and information to non-technical audiences.

## INSTRUCTIONAL METHOD

Blackboard will be used for delivery of all materials pertinent to this course (lectures, asynchronous discussions, assignments such as readings or links to readings, and assessment materials). Power Point presentations will be used to deliver lectures, which will include text and images and will be strengthened by narration to emphasize key points. In addition, readings will be assigned. Each student is expected to take good lecture notes and to complete all reading assignments. Items covered in lectures, but not covered in the assigned readings or handouts are fair game for examination material. Further, all reading material will not be discussed in class lectures, but the student is still responsible for being familiar with these parts of the assignments. Asynchronous discussion threads will be used to assess student comprehension of lecture and reading materials. It is expected that in a discussion format, all students will participate with original inputs.

## TEXTBOOKS

THERE ARE NO REQUIRED TEXT BOOKS.....readings or links to readings will be posted on Blackboard.

## STUDENT ASSIGNMENTS AND EXAMS

**Quizzes/Exams:** There will be 4 within semester subject assessment quizzes (50 points each) and a comprehensive final exam (100 points). Exams will be delivered online, taken "open book". The completed exams will be typed out and returned to the instructor by e-mail attachment. Undergraduate students may take a different exam than graduate students.

Question formats may include true/false, written definitions, short answer, multiple choice, matching, or fill in the blank, but primary emphasis will be placed on essay questions. Some of the questions on the exams will require online searches and/or some library research.

**Identification Quizzes:** Throughout the course, we will discuss the importance of proper identification of horticultural pests. We will have periodic quizzes to assess student ability to make accurate identifications of pests, and to provide a short synopsis of the pest's biology. Identifications will be made to family level at the minimum, and in many cases, you will be asked to ID to genus and species...or at least common name. There will be 5 quizzes, each worth 20 points.

**Fact Sheets/Web Site Development:** Each student will choose 2 insects/or closely related arthropods of Horticultural importance, for which he/she will gather the following information for each: identifying characteristics for the adult and immature, description of damage (if any), summary of life cycle, procedures for assessing (sampling) populations, economic thresholds (if any), and discussion of feasible management methods/control measures. Each summary should be written with public education in mind. Each will be worth 50 points.

## Point Breakdown

Assessment	Quantity	Points Per	Total Points
Mid-Semester Quizzes	4	50	200
Final Exam	1	100	100
Identification Quizzes	5	20	100
Fact Sheets	2	50	100
Total			<b>500 points</b>

Letter grades will be assigned based on straight percentages of 100 - 90% A range, 89 - 80% B ranges, etc. The department of entomology and the Office of Graduate Studies requires that graduate students receive a **B or better grade** in order for the class to count towards graduation.

### **SCALE**

100 – 98	A+	89 - 87	B+
97 – 94	A	86 - 83	B
93 – 90	A-	82 - 80	B-

**Tentative lecture topics: (I have not included dates for quizzes...I will post dates as soon as possible)**

### **Module 1: Biology, Management and Media**

- Topic 1 Introduction to horticultural settings and associated pests
- Topic 2 Insect biology and ecology (in relation to horticulture)
- Topic 3 Insect feeding and plant damage
- Topic 4 Integrated Pest Management overview
- Topic 5 Insect Identification
- Topic 6 Web resources and social media (twitter)

#### **Subject Quiz 1**

### **Module 2: Turf**

- Topic 1 Overview of Turf Pests
- Topic 2 Root feeders
- Topic 3 Stem feeders
- Topic 4 Foliage Feeders

#### **ID Quiz 1**

- Topic 5 Management of Turf Pests

#### **Subject Quiz 2**

### **Module 3: Horticultural crops**

- Topic 1 Pests of leguminous crops
- Topic 2 Pests of solanaceous crops
- Topic 3 Pests of cucurbitaceous crops
- Topic 4 Pests of cruciferous crops

#### **ID Quiz 2**

- Topic 5 Greenhouse and floral pests
- Topic 6 Pests of deciduous fruits
- Topic 7 Pests of nuts
- Topic 8 Miscellaneous

#### **ID Quiz 3**

- Topic 9 Management

### **Subject Quiz 3**

#### **Module 4: Landscape**

Topic 1 Pests of trees and shrubs

#### **ID Quiz 4**

Topic 2 Pests of landscape production/plantings

Topic 3 Pests of floral production/plantings

Topic 4 Miscellaneous

#### **ID Quiz 5**

Topic 5 Management

### **Subject Quiz 4**

#### **Module 5: Wrapping it up**

Topic 1 Insect pollinators

Topic 2 Miscellaneous

**Comprehensive Final Exam...emailed to you April 30th....due May 7th**

#### **About the Discussion Board:**

I use the discussion board area of blackboard frequently. On it I post scenarios, interesting articles or papers, and questions. Participation is not mandatory, but is definitely appreciated. However, exam questions may be generated from some of the discussion.

In addition, I will provide you with an open forum where you can ask questions, or chat with you peers.

#### **Additional Information:**

##### ***PLEDGE OF INSTRUCTIONAL STANDARDS***

*Entomology instructors will provide our students a complete syllabus meeting all UNL standards, our classes will be based on current science and will follow published schedules and descriptions, and our instructors will be timely in returning grades and in responding to our students.*

##### ***ADA STATEMENT***

*Students with disabilities are encouraged to contact Christy Horn for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY (updated 8/20/07)*

##### ***CHEATING***

*The University of Nebraska-Lincoln has a policy about academic dishonesty, as indicated in the Student Code of Conduct (see Undergraduate Bulletin). As a student at UNL, you enjoy rights and protections under the code and are obligated to conduct yourself in compliance with the code.*

*As the Student Code of Conduct indicates, academic sanctions for misconduct subject to appeal are at the discretion of the instructor, and may include giving the student a failing grade for the course. In this course, the least penalty that will be imposed for misconduct is a one letter grade reduction in the course grade, but in most instances the penalty for cheating will be a failing grade in the course.*

*“Students are expected to adhere to guidelines concerning academic dishonesty as specified in Entomology policy (insert web link) in accordance with Section 4.2 of the University Student Code of Conduct (<http://stuafs.unl.edu/ja/code/>).”*



Appendix 2. Example of an online lecture. This is just a sample from a lecture on a turf pest.

6/2/14

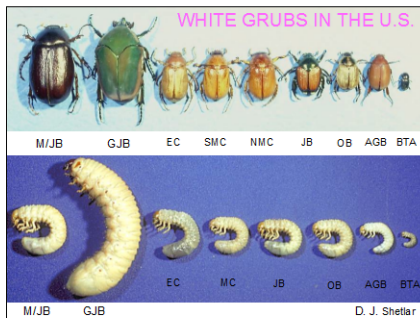


**White Grubs:**

- Are among the most destructive turf grass pests
- Feed below the soil surface on the roots and rhizomes of all commonly used turf grass species and cultivars (in addition to other plants)
- Can eliminate the entire root system
- Are capable of destroying large areas of turf in a short period of time when populations are high

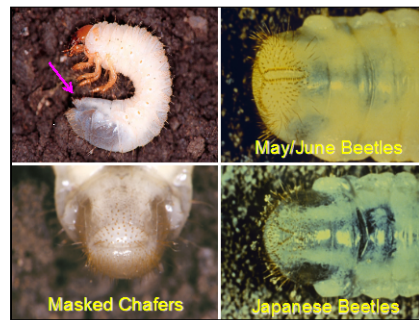
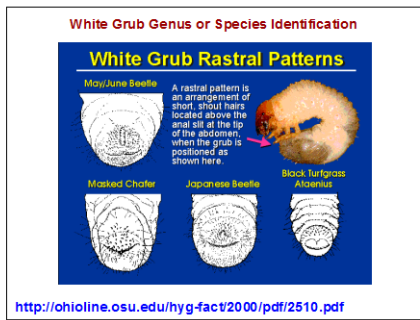
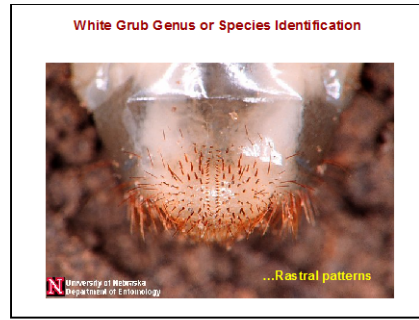
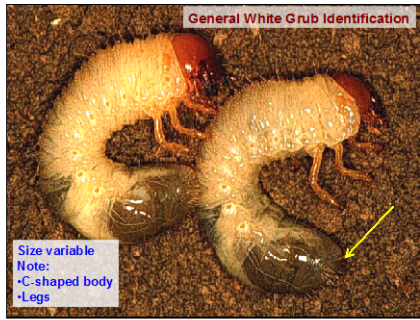
**White grubs: (Coleoptera: Scarabaeidae)**

- Are the "C"-shaped larvae of several scarab beetles.
- Grub larvae mature to a length of up to 5 cm (depending on the species)
- They are white to tannish in color with brown head capsules, and have prominent legs.



In Nebraska, the larvae of only a few species cause significant injury to turf.

- The masked chafers, *Cyclocephala* spp. (annual grubs)
- May/June beetles, *Phyllophaga* spp. (three-year grubs)
- The black turfgrass ataenius, *Ataenius spretulus*
- The Japanese beetle, *Popillia japonica*



**Life cycle**

- Varies by geographical location and grub species.
- A general example:
  - larvae fed through summer and fall, then overwinter in lower soil profile
  - larvae migrate upwards to feed on roots in the spring.
  - pupate a few inches below the soil surface and adults emerge in late spring to early summer.
  - adults mate and lay eggs in the soil
  - enclosed grubs begin feeding on grass roots throughout the summer and early fall.
- Depending on the species, generation times range from a few months to 4 years.



### Appendix 3. Instructions for writing fact sheets.

#### Fact Sheets (Due April 28):

You will choose 2 insects/or closely related arthropods of Horticultural importance (pest or an important biological control agent), for which you will gather the following information for each:

1. Common Name
2. Scientific name: Order, Family, *Genus species*
3. Identifying characteristics for the adult and immature stages (and which stage is damaging)
4. Host range
5. Description of the damage it does, symptoms associated with the damage
6. Summary of its life cycle
7. Distribution in the U.S., or country where it is found (use a map of you prefer)
8. Procedures for assessing (sampling) populations
9. Economic thresholds (if any)
10. Discussion of feasible management methods/control measures (chemical and non-chemical).
11. Up to date References (at least 3)

You may include pictures. There are several sources for images that are not copyrighted or use is granted for educational purposes, others you can email and often they will give you permission to use.

Font doesn't matter to me, but please use a 1-inch margin on the left, and limit the entire paper to no more than 3 pages.

Each summary should be written in your own words, and with public education in mind. Each will be worth 50 points.

	Possible Points
Common Name	1
Scientific name	1
Identification	10
Host range	3
Description of damage	5
Life cycle	10
Distribution	3
Sampling	5
Economic thresholds	-
Management	10
References	2


# Appendix 4. Example of Online Insect Identification Quiz.

6/1/14%

**Identification Quiz 1**

Answer Sheet is on the blackboard site  
Due by midnight, February 27, 2014


ENTO 403/803




1.



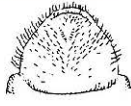
2.



University of Minnesota  
Department of Entomology



use rastral pattern to identify



3.





4.



USDA 190032

5.

use rastral pattern to identify







## Appendix 5. Example of Online Identification Quiz Answer Sheet.

ENTO 403/803  
Identification Quiz 2

Due by midnight (cst), April 8, 2014

Email to [tweissling2@unl.edu](mailto:tweissling2@unl.edu)

Total: 20 points

Name: \_\_\_\_\_XXXXXXXXXXXXX\_\_\_\_\_

Identification. View slides "Turf ID Quiz" on blackboard. Provide appropriate answer below. (20 points)

1. Common Name (1 pt.):  
Colorado potato beetle  
Scientific Name (Genus species) (2 pts.)  
*Leptinotarsa decemlineata*
2. Common Name (1 pt.):  
Corn rootworm
3. Common Name (1 pt.):  
Mexican bean beetle  
Scientific Name (Genus species) (2 pts.)  
*Epilachna varivestis*
4. Common Name (1 pt.):  
Bean leaf beetle  
Scientific Name (Genus species) (2 pts.):  
*Cerotoma trifurcata*
5. Common Name (1 pt.):  
Diamondback moth  
Scientific Name (Genus species) (2 pts.):  
*Plutella xylostella*
6. Common Name (1 pt.):  
Squash bug
7. Common Name (1 pt.):  
Green clover beetle  
What life stage is causing damage to horticultural crops? (1 pt.)  
Larvae
8. Common Name (1 pt.):  
Tomato hornworm
9. Common Name (1 pt.):  
Imported cabbage worm
10. Common Name (1 pt.):  
Wireworm larvae  
Where would you find the larvae of this insect? (1 pt.)  
Larvae may damage seed pieces and young root systems, commonly tunnel in the tuber.

## Appendix 6. Example of a Low Score, Quiz 1.

### ENTO 403 Horticultural Entomology Quiz 1 UNDERGRADUATE VERSION

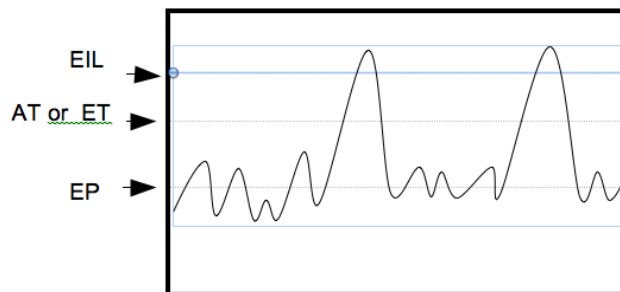
Name: XXXXXXXXXXXX

50 points total

**-9 41 points**

#### Short Answer:

1. Define ecosystem: (2 pts)  
-Any area of nature that includes living organisms and non-living substances interacting to produce an exchange of materials between the living and non-living components.
2. Define population: (2 pts)  
- group of organisms of the same species occupying a particular space at a particular time.
3. Define community: (2 pts)  
- groups of populations living together in a particular environment.
4. Define niche: (2 points)  
-A place in the habitat where a species is in its natural place in nature.
5. The figure listed below depicts the population dynamics of a periodic insect pest.



- a. What does "ET" or "AT" mean? (1 pt.)  
- Economic Threshold, the pest density at which some management decision must be made to prevent an increasing pest population from reaching damaging levels.
- b. What does "EP" mean? (1 pt.)  
- Equilibrium Position, the average density of an insect population over a considerable time period in the absence of permanent environmental change.
- c. What does "EIL" mean? (1 pt.)  
- Economic Injury Level, the lowest density at which economic losses occur.
- d. When would you take action to control this pest? (1 pt)  
- when it goes over the EIL **When it crosses the AT -1**
- e. Why would you take action to control the pest at this particular time? (2 pt)

- because it would continue to rise at that level and do economical damage.

6. Match the appropriate term on the left with the proper description on the right. (1 pt. each)

- C-1 B\_ Parasitoid            a. Requires more than one host to complete its life cycle
- B-1 A Parasite                b. Requires one host, does not kill it
- A-1 C Predator                c. Requires one host, kills it

7. What is meant by stability and diversity and how do these ecological parameters help us to develop pest management programs? (5 points)

- Stability is keeping a even amount of species and diversity is the amount species present. They both increase together. The more stability the more diverse the population can become. It has allowed us to develop pest management programs because if we can make the environment unstable for one pest it is likely we will be able to disrupt it for the rest of the pest. Plus we are targeting a bad pest, the diversity will allow us to maybe keep the good pest around.

8. How can stability and diversity be promoted in horticultural sytems? (5 points)

- The are many good pest out there and are helpful to many horticultural systems. If we can understand how to promote the stability for these helpful insect we can gain a return from them in the system we are creating. **Yes, but how can they be promoted? -5**

9. Define the term "Aesthetic threshold", and explain how this parameter can influence pest management decisions (see paper aesthetic thresholds) (10 points)

- Aesthetic threshold is when management of a pest is decided based on appearance rather than then health, economic and structural damage. This will influence the person judgement on how bad the damage actually is. Sometimes damage will not reach an economical threshold but just by appearance, a person will or should take control of the pest.

10. What other causal agents can cause plants to have symptoms similar to those seen with insect feeding? (5 points)

- herbicide damage, hall damage and wind damage.

11. For each of the following images, use one - two words to describe the symptom, for example...bronzing, and what kind of insect may have caused the symptom. (2 pts. each)



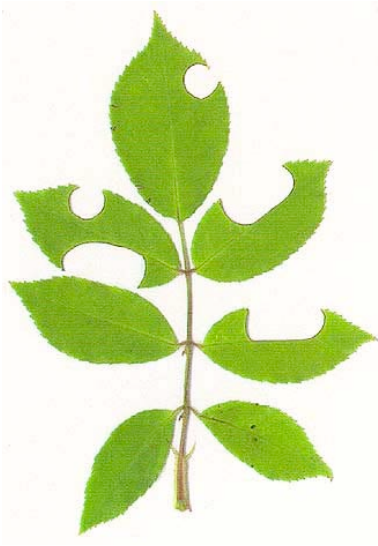
Wilt, Strawberry root weevil



Distortion, Eriophyid mite



c. Galls. Cynipid gall wasp.



d. Leaf Notching. European snout beetle.

## Appendix 7. Example of a High Score, Quiz 1

### ENTO 403 Horticultural Entomology Quiz 1 UNDERGRADUATE VERSION

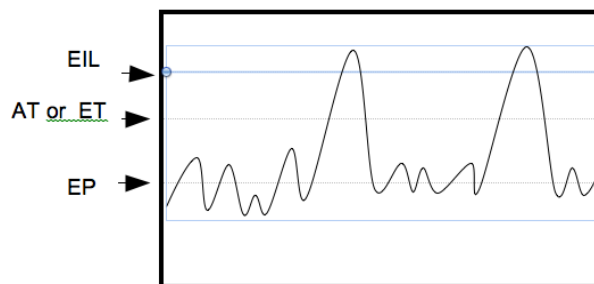
Name: XXXXXXXXXXXX

50 points total

**-0 50 points**

#### Short Answer:

1. Define ecosystem: (2 pts)  
A biological community of interacting, networking organisms within their physical environment.
2. Define population: (2 pts)  
A group of organisms of the same species occupying a particular space at a particular time.
3. Define community: (2 pts)  
Groups of populations living together in a particular environment.
4. Define niche: (2 points)  
A place in a habitat where a species hangs out and completes its job or place in nature.
5. The figure listed below depicts the population dynamics of a periodic insect pest.



- a. What does "ET" or "AT" mean? (1 pt.)  
Economic Threshold is the population level of an insect and the amount of damage a crop receives from that insect, where at a certain point the amount of crops destroyed exceeds the cost of controlling the pest.  
Action Threshold is when levels of pest populations are reaching a point at which control should be implemented to avoid significant damage to the crop.
- b. What does "EP" mean? (1 pt.)  
Equilibrium Position- The average density of an insect population over a considerable time period in the absence of permanent environmental change.
- c. What does "EIL" mean? (1 pt.)  
Economic Injury Level- The lowest pest density at which economic losses will occur.
- d. When would you take action to control this pest? (1 pt)  
I would take action when the population of the insect reaches the AT point for the first time on the graph.



- e. Why would you take action to control the pest at this particular time? (2 pt)  
Control implemented here would hopefully wipe out the majority of the pest population and would decrease the chance of the second increase in population showed on the graph. If the second population increase did occur after the first control was implemented, I would check the return of the crop deducting the cost of the first control measure along with other costs and decide if another control would be economically feasible.

6. Match the appropriate term on the left with the proper description on the right. (1 pt. each)

  C   Parasitoid

a. Requires more than one host to complete its life cycle

  B   Parasite

b. Requires one host, does not kill it

  A   Predator

c. Requires one host, kills it

7. What is meant by stability and diversity and how do these ecological parameters help us to develop pest management programs? (5 points)

Stability measures the evenness of a species present in a community, which could be unstable if the majority of the species present is that of only one species, it is stable if there are many species in a community and they make up somewhat equal percentages of the species present creating a more balanced system. Diversity is the number of species present in a community. The two terms work together; as diversity increases so will the amount of stability (from unstable to stable). When developing pest management programs it is important to observe the insect community that is targeted. How will the removal of a certain insect affect the stability of the community if it is diverse, will it remove an insect that is the food source for another insect? This could be damaging to the community present and these are questions that must be addressed when developing a plan. Careful consideration of chemicals should be used to make sure non-target insects are being unaffected by the pest management program.

8. How can stability and diversity be promoted in horticultural systems? (5 points)

Stability is increased by diversity, so providing a community with more diverse selections of plant species would be ideal for increasing stability in an insect community. The more diverse the system is; the fewer amounts of insect outbreaks would occur. Using good cultural practices like crop rotation or intercropping is a way to increase the diversity of an insect community by adding a more diverse selection of plants the insect community should become more stable. The truth is that none of our public gardens, city landscapes, or our farmlands will be as stable as a natural environment (one that has not been affected by man). Our horticulture/agricultural settings are constantly being changed and modified with crop selection and use of insecticides, which makes them unstable. It takes time to form a natural stable environment and real creative thinking for us to create an artificial stable and diverse environment. Knowing the ecology and particular niche that an insect fills is key to creating a stable environment.

9. Define the term "Aesthetic threshold", and explain how this parameter can influence pest management decisions (see paper aesthetic thresholds) (10 points)

Aesthetic threshold is when management of a pest is initiated based on appearance rather than the potential for health, economic and structural damage. It is usually administrated when dealing with sales though it can be used more as a guide for growers; it is the lowest amount of injury levels to a crop that would affect the sale of it to a customer. It is usually determined by what people see as unsightly damage or evidence of a pest that would prevent them from purchasing a plant. When it comes to influencing pest management decisions, a grower will have to identify what the aesthetic threshold is of a certain plant. If there is minor enough evidence of pests or damage on the plant then use of a pest management plan is unnecessary. If there is enough

evidence, enough to surpass the aesthetic threshold then there should be some form of pest management. It should be thought of as the lowest amount of pest evidence and/or damage that can affect a crop; almost the opposite of the economic threshold point, but it is important to remember it deals with appearance rather than production.

10. What other causal agents can cause plants to have symptoms similar to those seen with insect feeding? (5 points)

There are a variety of things that could be happening to a plant, which could present similar symptoms to insect injury. If a plant is wilting, one may think that there may be a problem with the soil mix such as pH or E.C. or they may think that the plant is receiving a lack of water. Where the actual problem could be that fungus gnat larvae are feeding upon the roots. Insects with certain mouthparts leave marks or damage to the foliage, which could become chlorotic. Someone may think that this is a fungus, bacteria, or even a virus that has infected the plant. The chlorotic marks may lead somebody to think that there is possibly a nutrient deficiency. Damage to foliage that may look like some insect was munching on it could actually be from the weather, hail is a big one here in Nebraska. Identifying actual signs, things that provide us with clear evidence are how we can properly diagnose something in a horticultural system. This is why we horticulturists are trained to be observant though sometimes it is challenging.

11. For each of the following images, use one - two words to describe the symptom, for example...bronzing, and what kind of insect may have caused the symptom. (2 pts. each)



a. Wilting, chlorotic, this is probably caused by a root feeding insect, or an insect that is disrupting vascular flow



b. Leaf curling, hard telling but probably an insect disrupting vascular flow, possibly a canker



probably some sort of wasp made them

c. Red/Pink Leaf Galls, might be larvae in the galls



chewing mouthparts.

d. Circular/Oval leaf cuts, probably caused by an insect with

## Appendix 8. Example of a fact sheet by an Undergraduate Student.

### American Serpentine Leafminer

By XXXXX



**Common Name:** American Serpentine Leafminer

**Scientific Name:** *Liriomyza trifolii*. The American Serpentine Leafminer is in the order Diptera. These leafminers are in the family Agromyzidae.

**Identifying Characteristics:** Adults measure about 2mm in length with a wing length of 1.25mm to 1.9mm. The head is yellow with red eyes. The thorax and abdomen are predominately black and grey. The ventral surface and legs are yellow. Wings are transparent. Compared with the Pea Leafminer, this species is smaller. Pea Leafminers have a wing length of 1.7 to 2.25mm. Eggs are white and oval shaped. Larvae are bright yellow measuring 1/6<sup>th</sup> inch in length. The larval stage is the damaging stage. Pupae are yellow-brown and distinctly segmented. (*Left: larvae, Right: pupae*)



**Distribution & Host Range:** The American Serpentine Leafminer has been found in the eastern United States and Canada, the Caribbean, and northern South America. In recent years, this species has been introduced to California and Europe as well as other locations such as Ethiopia, Israel, Japan, Kenya, Marianas, Philippines, and Senegal. Susceptible crops include: bean, carrot, celery, Chinese wax gourd, chives, cucumber, edible gourds, eggplant, Hibiscus, hyotan, lettuce, onion, pea, pepper, potato, pumpkin, spinach, squash, togan, tomato, and watermelon.

**Damage:** Although the major form of damage is caused by larvae, adult females can cause a stippled appearance on foliage during oviposition. Larvae cause leaf mining. The pattern of leaf mining is irregular. Leaf mining depresses the level of photosynthesis and excessive leaf mining can cause premature leaf drop. However, tomatoes can withstand considerable leaf damage.

Leafminers are most damaging to floricultural crops since they have a low threshold to insect damage.



**Life Cycle:** The length of a life cycle varies with host and temperature, but on average leaf miners live between 15 and 21 days. Females lay eggs singly in punctures made in the leaf epidermis. Eggs hatch in 2 to 4 days. There are three larval stages; each larval instar completed in 2 to 3 days. A fourth instar occurs between puparium formation and pupation, but is a non-feeding stage. The pupae stage does no feeding damage and lasts 5 to 12 days. Depending on environmental conditions, adults live for 10 to 20 days.

**Sampling Techniques:** Place trays beneath foliage to collect larvae as they evacuate mines. To capture adults, use an adhesive applied to yellow cards or stakes.

**Management:** Insecticide resistance is a major problem. Insecticide susceptibility differs greatly among populations. To delay development of resistance, rotation among classes of insecticides is recommended. Destruction of weeds and deep plowing of crops are recommended as cultural practice. Adults have difficulty emerging from deep within the soil. Parasitoids and natural enemies have proven to be highly effective in controlling pest populations. For chemical control, Cyromazine (Trigard) and abamectin (Avid) are highly effective against the American Serpentine Leafminer.

#### References:

Capinera, John L. University of Florida, Entomology. 2007. American Serpentine Leaf Miner. [http://entomology.ifas.ufl.edu/creatures/veg/leaf/a\\_serpentine\\_leafminer.htm](http://entomology.ifas.ufl.edu/creatures/veg/leaf/a_serpentine_leafminer.htm)

Mau, Ronald F. L. and Kessing, Jayma L.M. University of Hawaii, Department of Entomology. 2007. *Liriomyza trifolii*. [http://www.extento.hawaii.edu/kbase/crop/Type/liriom\\_t.htm](http://www.extento.hawaii.edu/kbase/crop/Type/liriom_t.htm)

University of Queensland, Department of Agriculture, Fisheries, and Forestry. 2008. *Liriomyza trifolii*. [http://keys.lucidcentral.org/keys/v3/leafminers/key/Polyphagous%20Agromyzid%20Leafminers/Media/Html/Liriomyza\\_trifolii.htm](http://keys.lucidcentral.org/keys/v3/leafminers/key/Polyphagous%20Agromyzid%20Leafminers/Media/Html/Liriomyza_trifolii.htm)

## Appendix 9. Learning Improvement Survey

### ENTO 403/803 Learning Improvement Survey.

Please take a few minutes to complete the following. Email to Jeri Cunningham when completed JCUNNINGHAM1@unl.edu

1. Are you an entomology major?

- Yes  
 No

2. Are you an:

- Undergraduate student  
 Graduate student

3. The level of this class was:

- Too difficult  
 About right  
 Too easy

4. How would you prefer this class to be offered?

- Online  
 On-Campus

5. Following are a list of practices that are part, or could be part of the class. For each, please state if I should **Keep** (it benefits your learning), **Stop** (hinders your learning), or **Start** (something that would benefit learning).

- \_\_\_\_\_ Identification quizzes  
\_\_\_\_\_ Lecture style  
\_\_\_\_\_ Powerpoint format  
\_\_\_\_\_ Course layout (intro, Module 1, 2, etc.)  
\_\_\_\_\_ Use of videos  
\_\_\_\_\_ My enthusiasm  
\_\_\_\_\_ Discussion board  
\_\_\_\_\_ Fact Sheets  
\_\_\_\_\_ Lecture pace  
\_\_\_\_\_ Subject quizzes  
\_\_\_\_\_ Covering more material  
\_\_\_\_\_ Providing feedback for missed identifications and chance to correct  
\_\_\_\_\_ Use of case studies

6. Your suggestions on how to improve the course or enhance learning: