SCHEDULE OF LECTURES

Insect Pest Management is concerned with harmful and beneficial insects associated with agricultural crops such as cotton and corn, as well as insects in urban landscapes, turf insects, and common household pests. The lecture portion of the course is concerned with insect pest management (IPM). The labs are designed to introduce students to the scientific aspects of entomology required of IPM personnel to work at a professional level, including insect anatomy, physiology, and identification.

Lecture Topics

General Aspects of Insect Pest Management

Insects are the most numerous animals on the Earth, some species are beneficial to man, most are inconsequential, but a few are serious pests of agriculture.

Insect Pest Management (IPM)

Control of insects in agriculture involves (1) preventing pest infestations (**preventive control**), (2) **population monitoring** to determine action thresholds, and (3) suppression of insect outbreaks with insecticides (**suppressive control**). Integrated control (**integrated pest management**) involves using preventive control, insect monitoring, and suppression tactics in a coordinated program with the purpose of managing insect populations in the most efficient manner possible.

Preventive Control

These are low cost practices that have minimal environmental hazard. Preventive control tactics are designed to keep insect populations at low levels that are not economically damaging. Examples of preventive control procedures include avoiding use of susceptible crops, use of resistant cultivars, cultural control and biological control.

Insect Monitoring and Determination of Action Thresholds

Insect populations are monitored by a variety of methods so that decisions can be made when to apply control measures based on action thresholds.

Suppressive Control

These measures are applied when insect outbreaks occur and threaten to produce severe economic damage to an agricultural commodity. Use of insecticides is the most common method used to suppress insect outbreaks. Knowledge of toxicity, hazard, efficacy and application methods is critical to effective and safe use of insecticides.

Regulatory Control

These are government actions that regulate insect control activities, including quarantine laws and legislation controlling the manufacture and use of pesticides.

Management of Landscape Pests

These commodities are often of high individual value and low amounts of damage and no insects can be present at the time of sale. Insecticides are often used for insect management in these crops.

Management of Vegetable Pests

These are usually annual crops and have many of the same economic concerns as greenhouse and ornamental crops except larger acreages are frequently involved. Insecticides are often used for insect management in these crops.

Management of Fruit and Nut Pests

These are often perennial crops, have high unit value and can tolerate little or no insect damage. Insecticides are often used for insect management in these crops.

Management of Row Crop Pests

These commodities often have a moderate to low unit value and frequently can tolerate moderate levels of insect damage without appreciable economic loss. Use of preventive control practices is frequently a major aspect of pest management programs for row crops.

Management of Cotton Pests

Insect management is one of the most important factors in producing cotton because of the high susceptible of this crop to several pests. Preventive control, good insect monitoring and suppressive control are all important aspects of cotton pest management.

Management of Forage and Small Grain Pests

Preventive control tactics are important because use of insecticides is often not economically feasible because of the low unit value of these crops.

Management of Urban, Stored Product, and Structural Pests

Roaches, ants, carpet beetles, and termites are examples of insects that cause tremendous economic damage to homeowners. Pest management not only involves using proper control methods, but also often involves public relations aspects that can be tricky.

Management of Livestock, Poultry, and Social Pests

Insects can cause irritation, be ectoparasites, or transmit disease in livestock and poultry. Many of these pests also attack humans. Pest management can sometimes be difficult because the control measure may also harm the animals.

Required Texts

A Field Guide to the Insects of America North of Mexico (Peterson Field Guide Series, 19). D. J. Borror and R. E. White. 1998. Houghton Mifflin Co., Boston. ISBN 0395911710.

Use and Management of Insecticides, Acaricides, and Transgenic Crops. J. N. All and M. F. Treacy, eds. 2006. APS Press, St Paul, MN. ISBN 0938522744.

Course Packet from Baxter Street Bookstore.

Supplemental Text

Borror and Delong's Introduction to the Study of Insects. 7th Edition. C. A. Triplehorn and N. F. Johnson. 2005. Thomson Brooks/Cole, Belmont, CA. ISBN 0030968356.

Grading Policy

Collection: 25% of final grade

Fifty species representing 12 orders of insects.

Each specimen should be identified to family and properly pinned and labeled.

Laboratory Quizzes: 25% of final grade

Three quizzes encompassing laboratory materials and assignments covered since the previous quiz and a comprehensive quiz.

Lecture Quizzes: 25% of final grade

The material covered in lecture quizzes will encompass lectures and reading assignments covered since the previous quiz. See the quiz examples in the lab notebook appendix.

Comprehensive Lecture Exam: 25% of final grade

The exam will be inclusive of all lectures and lecture reading assignments covered during the semester.

Insect Pest Management WebCT Address

1. From the UGA homepage at http://www.uga.edu , select *MyUGA* on the top right of the screen.
2. Select *myWebCT*.
3. Select ENTO 3740 (All).

SCHEDULE OF LABORATORIES

Laboratories will not correspond to the lectures. The lecture portion of this course is designed to introduce concepts of insect pest management (IPM) within different commodities and social situations. The laboratory portion of the course is designed to emphasize the science of entomology, including concepts of anatomy, physiology, and classification of insects. These are essential knowledge tools for IPM professionals. The first step in developing an IPM program is correct identification of the pest(s) involved. Major crop pests will be presented within a taxonomic framework of orders and families.

Insect Collection, Preservation, Identification, and Shipping

Insect Anatomy, Physiology, and Development

External Morphology

Growth and Development: Larval & Pupal Types

Insect Classification

Arthropoda - Identification of major invertebrate classes related to insects

Hexapoda - Identification by key characters of the major orders of the class Hexapoda

Major Economic Orders and Families in the Hexapoda

Orthoptera

Acrididae - short-horned grasshoppers
Tettigoniidae - long-horned grasshoppers
Gryllidae - crickets, mole cricket*

Mantodea

mantids

Phasmatodea

walking sticks, leaf insects

Blattodea

American roach*, German roach*, Oriental roach*, smoky brown roach*

Hemiptera

Pentatomidae - harlequin bug*, green stinkbug*, brown stinkbug*
Coreidae - squash bug*, leaf footed bug*
Lygaeidae - chinch bug*, big-eyed bug*
Tingidae - lace bugs
Miridae - plant bugs, tarnished plant bug*
Cimicidae - bed bugs
Reduviidae - assassin bugs
Nabidae - damsel bug*
Cicadidae - cicadas
Membracidae - treehoppers
Cercopidae - spittlebugs
Cicadellidae - leafhoppers
Aleyrodidae - white flies
Aphididae - aphids
Coccidae - scale insects, mealybugs
Psyllidae - psyllids

Coleoptera

Carabidae - ground beetles
Meloidae - blister beetles
Dermestidae - hide beetles, carpet beetles
Buprestidae - flat-headed wood borers
Scolytidae - European elm bark beetle*, Southern pine beetle*
Elateridae - wireworms
Coccinellidae - ladybird beetles, Mexican bean beetle*
Tenebrionidae - red flour beetle*, confused flour beetle*, sawtoothed grain beetle
Scarabaeidae - white grubs, Japanese beetle*
Cerambycidae - round-headed wood borers
Chrysomelidae - leaf beetles, Colorado potato beetle*, Southern corn rootworm*, Western corn rootworm*, Northern corn rootworm*, flea beetles
Bruchidae - seed beetles, pea and bean weevil
Curculionidae - boll weevil*, alfalfa weevil*, vegetable weevil*, plum curculio*, white-fringed beetle*, maize weevil*, pecan weevil*

Lepidoptera

Suborder: Heterocera

Sphingidae - tobacco/tomato hornworm*
Arctiidae - fall webworm*, salt marsh caterpillar*
Noctuidae - corn earworm*, fall armyworm*, cutworms, cabbage looper*, tobacco budworm*, soybean looper*, velvetbean caterpillar*, yellow striped armyworm*
Geometridae - measuring worms, loopers
Lymantriidae - tussock moths, gypsy moth*
Lasiocampidae - Eastern tent caterpillar*
Pyralidae - European corn borer*, lesser cornstalk borer*, pickleworm*
Tortricidae - leaf rollers, budworms
Olethreutidae - codling moth
Psychidae - bagworm moths
Gelechiidae - Angoumois grain moth*
Sesiidae - peachtree borer*, lesser peachtree borer*, squash vine borer*

Suborder: Rhopalocera

Pieridae - imported cabbage worm*

Diptera

Suborder: Orthorrhapha

Culicidae - mosquitoes
Cecidomyiidae - Hessian fly*, sorghum midge*
Simuliidae - black flies
Ceratopogonidae - biting midges
Tabanidae - horse flies, deer flies

Suborder: Cyclorrhapha

Syrphidae - syrphid flies
Tephritidae - fruit flies, apple maggot*, Mediterranean fruit fly*, melon fly*, Oriental fruit fly*
Drosophilidae - vinegar flies
Calliphoridae - blow flies, screwworm*
Muscidae - house fly*, stable fly*, horn fly*, face fly*
Hippoboscidae - sheep ked*
Chloropidae - eye gnats

Hymenoptera

Suborder: Symphyta

Diprionidae - sawflies
Siricidae - horntails

Suborder: Apocrita

Braconidae - parasitic wasps*
Chalcididae - chalcid wasps
Cynipidae - gall wasps
Formicidae - ants
Vespidae - hornets, yellow jackets
Apidae - honeybees
Ichneumonidae - parasitic wasps
Trichogrammatidae - egg parasitic wasps*

***For quizzes, students are required to recognize the major insect pest orders, suborders, families, and the species indicated on the outline with an *.**

Tentative Class Schedule, Fall 2009

DATE	TOPIC
W Aug 19	Lecture - Introduction, Course Requirements, IPM, Cultural Control
F Aug 21	Lecture – Cultural Control / Lab – Collection
W Aug 26	Lecture – Biological Control
F Aug 28	Lecture – Genetic Control / Lab – Collection
W Sept 2	Lecture – Genetic Control, Chemical Control
F Sept 4	Lecture – Chemical Control, **Quiz 1** / LAB – ANATOMY, PHYSIOLOGY
W Sept 9	Lecture – Chemical Control
F Sept 11	Lecture – Chemical Control, Application / Lab – Classification
W Sept 16	Lecture – Sampling, Threshold
F Sept 18	Lecture – IPM / Lab – **Lab Quiz 1**, Classification
W Sept 23	Lecture – Landscape Pests
F Sept 25	Lecture – Landscape Pests, **Quiz 2** / Lab – Economic Orders
W Sept 30	Lecture – Turf Pests
F Oct 2	Lecture – Turf Pests and Landscape Pests / Lab – Economic Orders
W Oct 7	Lecture – Vegetable Pests
F Oct 9	Lecture – Vegetable Pests / Lab – Orthoptera, etc.
W Oct 14	Lecture – Fruit and Nut Pests**, Quiz 3**
F Oct 16	Lecture – Fruit and Nut Pests **/** Lab – **Lab Quiz 2**, Hemiptera
W Oct 21	Lecture – Field Crop Pests: Corn
F Oct 23	Lecture – Field Crop Pests: Corn / Lab Hemiptera
W Oct 28	Lecture – Field Crop Pests: Cotton
F Oct 30	**HOLIDAY, FALL BREAK**
W Nov 4	Lecture – Field Crop Pests: Cotton
F Nov 6	Lecture – Field Crop Pests: Sorghum, Soybean / Lab - Coleoptera
W Nov 11	Lecture – Small Grain Pests
F Nov 13	Lecture – Small Grain, Forage Pests, **Quiz 4** / Lab – Lepidoptera
W Nov 18	Lecture – Urban Pests
F Nov 20	Lecture – Urban, Structural Pests / Lab - **Lab Quiz 3**, Diptera, Hymenoptera
Nov 23-27	**HOLIDAY, THANKSGIVING BREAK**
W Dec 2	Lecture – Livestock, Poultry, Medical Pests
F Dec 4	Lecture – Livestock, Poultry, Medical Pests / Lab - Review for Comprehensive Quiz
Tu Dec 8	(UGA, Fri substitute class day) – **Comprehensive Lab Quiz, Collection Due**
M Dec 14	**Comprehensive Lecture Final Exam - 12:00-3:00**

INSECT COLLECTION

Each student shall submit an insect collection on or before the last day of classes before final exams. This requirement is for any semester during which the course is taken.

Collection Contents

50 specimens of insects, identified to family. Can have more than one species from the same family.

12 Orders of insects, identified to family. These will be represented in the above 50.

Specimens are acceptable from any locality on any date in the year in which the course is taken.

Preservation and Labeling

All insects must be correctly preserved and labeled. Improperly prepared specimens **will not** be accepted. Collections should be arranged in the special containers provided by the instructor.

Killing

Hard-bodied insects may be killed in killing jars (ethyl acetate) or in alcohol. Soft-bodied forms of larvae should be collected alive and either placed in KAAD solution for a few hours or in very hot water (just below boiling) for a few minutes. Transfer the larvae from the killing solution to 70-80% alcohol as a preservative. Either rubbing alcohol or ethyl alcohol is acceptable as a preservative solution.

Mounting and Preservation

Specimens are preserved to facilitate handling and study. Their value increases with retention of natural appearance.

Pinning

Hard-bodied insects are preserved as dry specimens on pins. Pinned specimens are more convenient to study and retain colors, scales and hairs which might be lost when placed in fluid. Standard pinning practices have been designed to avoid injury to the specimens and expedite study. Once specimens have been killed, they dry and become brittle very quickly, thus pinning should be done soon after collection to assure perfect specimens for accurate identification.

The standard methods for pinning some of the more common insects are as follows:

tiny insects: mount on card points on pins.
medium to large insects: pin through the body, slightly to the right of the midline. Spread wings of Lepidoptera.

Each insect should bear two labels, a locality label and an identification label.

The locality label (1/4 by 3/4 inches) should give the locality, date of collection, and name of collector as follows:

Athens, GA
Sept. 22, 2009 or IX-22-09
Coll. I. Bugetta

The locality label is placed on the insect pin approximately 1/4 to 1/2 inch below the specimen.

The identification label should name the order and family of each specimen. The identification label should be pinned to the base of the collection box under the specimen.

All specimens should be arranged in groups by insect order within the collection box.

Preservation in Fluid

Soft-bodied and immature insects are generally preserved in vials of 70% alcohol or isopropyl alcohol.

Aquatic insects are generally preserved in alcohol. Also, many small insects, such as scale, lice, aphids, thrips, and termites are placed in alcohol.

Liquid preservations are labeled by placing a card 1/4 inch x 1 inch **inside** the vial. Locality information is on one side of the card and identification is on the other side. Use fine line pencil or India ink for liquid labels as most ballpoint ink will dissolve in alcohol.

Grading

The emphasis on grading the insect collection is accuracy in identification of orders and families. Misidentified orders and families will be determined and the deductions indicated below will be made from a base of 100%. Thus, students should turn in the 50 insects they are most certain of identification. There will be no additional credit given for extra insects beyond the required 50. It is numerically possible to be deducted more than 100% for a collection, but we won't give a grade less than 0%.

The instructor will discuss the proper manner to pin, label, and arrange insect specimens for the collection. Grade deductions will be made for poorly labeled specimens.

25% of final grade

Missing or misidentified order	-5%
Missing or misidentified family	-4%
Improperly labeled specimen	-1%
Collection appearance (pinning, spreading, and arrangement)	up to -10%

Collection will not be returned.

See instructor for proper handling of immature forms, i.e. caterpillars, maggots, etc.

Lab instructor will provide ethyl acetate for killing jars and special containers for placing specimens in alcohol.

Students must use insect pins for the collection. Sewing pins or other pins are not acceptable. Insect pins can be purchased at the Bookstore or the Entomology Department office ($5.00 cash only).

Field book. Use of the book *A Field Guide to the Insects of America North of Mexico* (Peterson Field Guide Series, 19), D. J. Borror and R. E. White, 1998, Houghton Mifflin Co., Boston, is strongly recommended as an aid in identifying specimens for the collection.

Arrangement of the Collection

The insect collection should be arranged neatly in the collection box provided by the instructor and include a one-page listing of how the specimens are arranged similar to the following example. Specimens need to be arranged in groups according to order.

Example of a one-page listing of specimens for the ENTO 3740 insect collection.

John Doe
Fall 2008
12 Orders
50 specimens identified to family

1. Order Odonata
   - Family Libellulidae #1-#2
   - Family Calopterygidae
2. Order Hemiptera
   - Family Belostomatidae
   - Family Coreidae
   - Family Pentatomidae
   - Family Gelastocoridae
   - Family Lygaeidae
3. Order Phthiraptera
   - Family Pediculidae
4. Order Hymenoptera
   - Family Apidae
   - Family Scoliidae
   - Family Mutillidae
   - Family Sphecidae
   - Family Formicidae
   - Family Halictidae
   - Family Vespidae #1-#4
5. Order Diptera
   - Family Bombyllidae
   - Family Asilidae
   - Family Sarcophagidae
   - Family Stratiomyidae
   - Family Rhagionidae
   - Family Tabanidae
6. Order Neuroptera
   - Family Corydalidae
7. Order Coleoptera
   - Family Lucanidae
   - Family Cerambycidae
   - Family Scarabaeidae #1-#3
   - Family Curculionidae
   - Family Carabidae
   - Family Elateridae
8. Order Orthoptera
   - Family Tettigoniidae
   - Family Acrididae
   - Family Gryllotalpidae
9. Order Lepidoptera
   - Family Satumiidae #1-#2
   - Family Sphingidae
   - Family Geometridae
   - Family Papilionidae
   - Family Nymphalidae
   - Family Danaidae
   - Family Pieridae
10. Order Plecoptera
11. Order Mecoptera
    - Family Panorpidae
12. Order Lepidoptera
    - Family Noctuidae #1-#2
    - Family Pyralidae
    - Family Sphingidae