

**IB444 Insect Ecology**  
Fall 2018

- Instructor: May Berenbaum  
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- TA: TBD  
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- Schedule: Lectures: MWF 9:00-9:50 AM in 2083 Natural History Bldg.  
Laboratory: Th 2:00-3:20 PM, 3:30-4:50 PM in 4072 Natural History Bldg.
- Credit hours: 3 or 4 hours—lecture only, 3 hours; with laboratory, 4 hours. The laboratory section is required for students in entomology advanced degree programs in order to satisfy core course requirements; it is optional for undergraduates and for students in other graduate degree programs.
- Prerequisite: Any two-semester sequence in basic biology or consent of instructor.
- Webpage: 2018 materials available on Compass 2g; previous years are archived at <http://www.life.illinois.edu/ib/444/>

**Course description**

Insect Ecology is a discussion of the conceptual and practical aspects of ecology in relation to insects as individuals, as members of populations, as species in communities and as providers of ecosystem services. Emphasis is on the attributes of insects that differentiate their ecology from the ecology of other, mostly larger, animals and thus includes their spectacular diversification and rapid evolution, their capacity for adapting to an extraordinary variety of challenging environments, and their multifarious interactions with other organisms, including humans.

**Recommended text:** None

**Specific learning objectives are to acquire:**

- an understanding of the ecological constraints and enabling features associated with the basic insect Bauplan
- an appreciation of both the economic costs and the economic benefits associated with ecological interactions between insects and humans
- an ability to analyze, evaluate, and interpret the ecological literature as it relates to insects
- sufficient familiarity with that literature in order to place novel findings into an appropriate context
- mastery of ecological terminology and concepts to provide cogent and comprehensive answers to questions relating to insect ecology

## **COURSE POLICIES**

**Academic integrity:** This course will follow all policies in the *Student Code* as it relates to academic integrity. As stated in the Student Code (1-401, p. 17), “It is the responsibility of each student to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions. Regardless of whether a student has actually read this. . . , a student is charged with knowledge of it. Ignorance is not a defense”. The entire code is here: <http://studentcode.illinois.edu/>.

Note that ignorance of the code is not a defense, so you should become familiar with all of the policies and standards associated with the code. If you found violating the policies in any way, you will be referred to the Committee for Student Academic Integrity; if this body finds you guilty, you will fail the course and be referred to the Dean of your college. Here, by the way, is the campus integrity statement:

*The University of Illinois at Urbana-Champaign expects its faculty, staff, students and guests to conduct themselves in accordance with the community values of civility, respect, and honesty; to maintain the highest level of integrity and exercise critical judgment in all dealings, decisions and encounters; and to maintain and strengthen the public's trust and confidence in our institution.*

**Attendance:** Attendance is mandatory for all class sessions unless prior permission has been obtained from the instructor or the teaching assistant. If you don't attend class, you're still responsible for the material covered and you will still have to make up the work missed. A makeup exam will be offered to accommodate any student with a legitimate reason for missing an exam during its scheduled time period but arrangements for the makeup exam must be made with the instructor; students who miss a laboratory period must arrange to make up the missed work with the teaching assistant.

**Disability accommodations:** If you need disability accommodations or adjustments, please just contact me and the Disability Resources and Educational Services (DRES) at your earliest opportunity so that you can get the assistance you need. To contact DRES, you can go in person to 1207 S. Oak St., Champaign, call 333-4603 (V/TTY), or send an e-mail message to

[disability@illinois.edu](mailto:disability@illinois.edu)

All requests to DRES for accommodation are kept in strict confidence.

**Tentative lecture schedule—Fall 2018, Insect Ecology (IB 444)**

August	27	Introduction
	29	Nodal points in insect evolution
	31	Autecology: physiology of small size
September	3	<i>Labor Day</i> (no classes)
	5	Autecology: macro vs microclimate
	7	Ecosystem: overview
	10	herbivores <b>(Rosh Hashanah)</b>
	<b>12</b>	<b>Population ecology: life history-A. Suarez)</b>
	14	Ecosystem: carnivores and detritivores)
	17	Population ecology: diapause
	19	dispersal
	21	dispersion
	24	population fluctuations
	26	competition I
	28	competition II
<b>October</b>	<b>1</b>	<b>population modeling (B. Allan)</b>
	<b>3</b>	<b>Hour exam</b>
	5	Predation (basics)
	8	Predation (syndrome)
	10	parasites
	12	parasitoids
	15	Evolutionary ecology: natural variation
	<b>17</b>	<b>Evolutionary ecology: speciation (S. Berlocher)</b>
	<b>19</b>	<b>insecticide resistance (M. Demkovich)</b>
	22	coevolution
	24	plant responses to insects
	<b>26</b>	<b>pollination (A. Harmon-Threatt)</b>
	29	insect responses to plants
	31	mimicry
November	2	plant-insect mutualism
	5	sociality
	7	sex and mating systems
	9	Community ecology global patterns
	12	Community ecology historical processes
	14	succession
	<b>16</b>	<b>Hour exam</b>
	19-23	<i>Spring Break</i> (no classes)
	<b>26</b>	<b>island biogeography (T. Harrison)</b>
	<b>28</b>	<b>Human ecology agroecosystems</b>
	30	biocontrol (classical) (L Hanks)
December	3	biocontrol (nonclassical)
	5	biocontrol (weeds)
	7	insects in human environments
	10	deliberate associations with insects
	<b>12</b>	<b>Review</b>
	?	Final exam 7:00 -10:00 pm (take-home)

## Course requirements and grading

	% total grade	
I. Exams:	first hour exam	15
	second hour exam	15
	final exam (take-home)	30
II. Library/laboratory exercise	15	1/5 per semester (of 6)
III. Project report	15	1 per semester (of 6)
IV. Discussion/participation	10	

### NOTE:

- Exams will be based on lecture material
- Students taking the course for 3 hrs (lecture only) will write 1-page critiques of a journal article in five of six areas of insect ecology covered by the course (autecology, ecosystem, population, evolutionary, community, human ecology). Articles may be taken from the bibliographies on lecture handouts, or from appropriate current journals but your article must be no more than two years old.
- Students taking the course for 4 hrs (with lab) will write reports after class laboratory exercises are concluded.
- The project report is a short (5-15) page paper in which students pose a hypothesis and test the hypothesis. Students taking the course lecture-only can base their project on data that have already been published. Examples of such "armchair" studies (now called "meta-analyses") are abundant (see next page). These papers are to be written in standard scientific style, according to the format and specifications of a journal to which the paper could conceivably be submitted. All hypotheses must be approved by MB. Each student taking the class for 4 hrs (with lab) is to devise a hypothesis and design and conduct an experiment to test the hypothesis and then write up the results in scientific style as if for publication. Field projects can also be descriptive (e.g., food web analysis in a particular microhabitat, determination of the membership of a specific guild). All descriptive projects must include properly labeled and identified voucher material (specimens or photographs). Field projects are of course limited by seasonal vagaries; lab projects can involve a tremendous variety of techniques and species. All hypotheses for independent projects must be approved by MB. Check with me or the teaching assistant about experimental design and availability of equipment and/or livestock.

### **IB 444 Lab Information and advice**

Lab grades are based on completion of five laboratory reports, a semester project report and presentation, participation and attendance.

Lab reports: There are six labs conducted over the course of the semester, five of which you need to write up in the format of a suitable journal as if for submission (exemplar lab reports from previous semesters are available upon request). ALL lab students are expected to participate fully in each lab, regardless of whether they intend to write that lab up for credit or not. Data collection is done as a class, with results from the two sections often pooled for analysis. Failure of one student to observe the experiment and collect data will detrimentally affect the experimental results for all other students. Lab reports are due one week after final data are collected for each lab. For example, the first lab, autoecology, will last for one lab period so the report will be due during lab the following week. The population biology lab, on the other hand, lasts as long as the organisms are alive, so the report is due the week after the last insect has died. As stated, there are six potential lab reports. You may write all six and have the lowest score dropped from your grade, or if you are happy with the first five reports you may skip the writing of the sixth report. Lab reports can be handed in to the TA during lab or lecture, placed in the TA's mailbox outside 320 Morrill Hall, or e-mailed.

### Project Report and Presentation:

From the course syllabus:

“The project report is a short (5-15) page paper in which students pose a hypothesis and test the hypothesis. Students taking the course lecture-only can base their project on data that have already been published. Examples of such "armchair" studies (now called “meta-analyses”) are abundant (see next page). These papers are to be written in standard scientific style, according to the format and specifications of a journal to which the paper could conceivably be submitted. All hypotheses must be approved by MB. Each student taking the class for 4 h (with lab) is to devise a hypothesis and design and conduct an experiment to test the hypothesis and then write up the results in scientific style as if for publication. Field projects can also be descriptive (e.g., food web analysis in a particular microhabitat, determination of the membership of a specific guild). All descriptive projects must include properly labeled and identified voucher material (specimens or photographs). Field projects are of course limited by seasonal vagaries; lab projects can involve a tremendous variety of techniques and species. All hypotheses for independent projects must be approved by MB. Check with me or the teaching assistant about experimental design and availability of equipment and/or livestock.”

Every student should turn in a written proposed hypothesis to Dr. Berenbaum for approval before starting a project. A project can be a new idea arising de novo for this class or it can be an extension of current work that you are doing, as long as it is not the main focus of your research. It CANNOT be a project you completed last semester, one for a previous degree, current graduate work directly leading to your degree, or any other project you have already received credit for, or will receive credit for, by the end of this term. We have several insect species that we raise throughout the year that you can use for more laboratory-based projects, or you can conduct an entirely field-based project; it's very open. One thing to keep in mind is that this is an INSECT ECOLOGY project. If your idea has nothing to do with insects or ecology, you are not going to receive credit. Starting your project sooner rather than later is highly recommended, as the rapidly approaching cold weather is going to limit your options severely.

Each lab student will prepare a PowerPoint presentation of his or her project for a ten-minute talk given during the last three weeks of lab. A laptop and projector will be available. The project report is due the last day of class.

By the way, a potentially useful text might be R Karban and M Huntzinger 2006, How To Do Ecology: A Concise Handbook. Princeton: Princeton University Press.

Here are examples of publications in which a hypothesis is tested using data from the literature:

Berenbaum M., 1980. Adaptive significance of midgut pH in larval Lepidoptera. *Amer. Natur.* 115:138-146.

Cole, B.J., 1980. Growth ratios in holometabolous and hemimetabolous insects. *Ann. Ent. Soc. Amer.* 73:489-491.

Cornell H.W. and J.O. Washburn, 1979. Evolution of the richness-area correlation for cynipid gall wasps on oak trees: a comparison of two geographic areas. *Evolution* 33:257-274.

Ehler L. and R. Hall, 1982. Evidence for competitive exclusion of introduced natural enemies in biological control. *Environ. Ent.* 11:1-4.

Futuyma, D.J. 1979. Food plant specialization and environmental predictability in Lepidoptera. *Amer. Natur.* 110:285-292.

Hendrix, S.D. 1980. An evolutionary and ecological perspective of the insect fauna of ferns. *Amer. Natur.* 115:171-196.

Lawton J.H. and P.W. Price, 1979. Species richness of parasites on hosts: agromyzid flies on British Umbelliferae. *J. Anim. Ecol.* 48:619-637.

Niemelä, P., S. Hanhimä and R. Mannila, 1981. The relationship of adult size in noctuid moths (Lepidoptera, Noctuidae) to breadth of diet and growth form of host plants. *Ann. Ent. Fenn.* 47:17-20.

Parker J.D., D.E. Burkepile, and M.E. Hay 2006. Opposing effects of native and exotic herbivores on plant invasions. *Science* 311: 1459-1461.

- Scriber, J.M. 1973. Latitudinal gradients in larval feeding specialization of the world Papilionidae. *Psyche* 80:355-373.
- Steinly BA 1986. Violent wave action and the exclusion of Ephydriidae (Diptera) from marine temperate intertidal and freshwater beach habitats. *Proceedings of the Entomological Society of Washington*. 88: 427-437.
- Stamp, N.E. 1980. Egg deposition patterns in butterflies: why do some species cluster their eggs rather than deposit them singly? *Amer. Natur.* 102:401-403.
- Wasserman S. and C. Mitter, 1978. The relationship of body size to breadth of diet in some Lepidoptera. *Ecol. Entomol.* 3:158-160.
- Wiegmann, B.M., C. Mitter, and B. Farrell, 1993. Diversification of carnivorous parasitic insects: extraordinary radiation or specialized dead end? *Am. Nat.* 142: 737-754.

### Library Exercises

For each subject area in insect ecology, every student not taking the laboratory should hand in a written one-page report on a journal article from the current literature. The article selected is entirely up to each student; it may be taken from the reading lists from lecture or found in Google Scholar or Web of Science. The only requirements are that the article describe original research (no review articles!) and the article must be less than two years old.

In the report, there should be:

1. a brief summary of the results and conclusions of the study
2. a critique of the experimental techniques and statistical analyses used (and an evaluation as to whether the data justify the conclusions)
3. a statement of the overall significance and originality of the research

In brief, you are being asked to review a published article. This exercise is designed to accomplish several ends. First, it introduces you to the many journals in which insect ecology is published; second, it increases the probability of regular Internet searches for current literature; and third, it accustoms one to reading an article with a critical eye.

Peer review is an essential part of the publication practice; those who intend to pursue any science professionally should be prepared to participate. Even for people with no professional interest whatever in insects, ecology, or any other kind of science, reading research findings critically can be important in daily life (e.g., does saccharin really cause bladder cancer in rats? Will polyunsaturated fats make you live longer?).

There's no standard format but the reports must be typed. Be sure to include the bibliographic reference (author, date, title, journal, volume, page #s) and URL if possible.

### Selective list of journals publishing studies in insect ecology:

Agriculture, Ecosystems and the Environment  
 American Midland Naturalist  
 American Naturalist  
 Annals Zoologici Fennici  
 Animal Behavior  
 Arthropod-Plant Interactions  
 Behavioral Ecology and Sociobiology  
 Biochemical Systematics and Ecology  
 Biotropica  
 Canadian Entomologist  
 Chemoecology  
 Ecological Entomology  
 Ecology  
 Ecological Monographs  
 Entomologia Experimentalis et Applicata

Entomologia Generalis  
Environmental Entomology  
Evolution  
Evolutionary Ecology  
Florida Entomologist  
Functional Ecology  
Great Lakes Entomologist  
Insect Science  
Int. J. Tropical Insect Science  
J. Anim. Ecol.  
J. Kansas Ent. Soc.  
J. Chem. Ecology  
J. Econ. Entomol.  
J. Evolutionary Biology  
J. Medical Entomology  
J. Pollination Ecology  
Nature, Science, Proceedings of the National Academy of Sciences  
Oecologia  
Oikos  
Proc. Ent. Soc. Wash.  
Zeitschrift fur Angewandte Ent