**Plant-Animal Interactions**

WIS 6943-Section 3632x
Monday, Periods 6-8 (12:50- 3:50)
222 Newins-Ziegler Hall

**Instructor:** Dr. Emilio Bruna
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**Office Hours:** Wednesday 9:00-11:00 am in 380 Grinter Hall or by appointment

**Course Description and Objectives:** The interactions between plants and animals are not only fascinating, but one of the most important forces structuring ecological communities. They are also being altered by human activities in ways whose consequences are not fully understood. This course will (1) review the general principals underlying different types of plant-animal interactions, (2) evaluate cutting-edge research in the field's major subdicsiplines, and (3) investigate the potential consequences of ongoing anthropogenic changes for the dynamics of these interactions. Examples will be drawn from a variety of tropical and temperate ecosystems, both terrestrial and aquatic.

**Textbook:** Herrera, C.M., and O. Pellmyr, eds. 2002. *Plant-animal interactions: an evolutionary approach*. Blackwell Science Ltd., Oxford, UK.

**Additional Readings:** Selected articles from the primary literature (list below)

**Assignments and Grading:** All students will be required to complete the following assignments

Attendance, participation, and leading a discussion section on the weeks reading (10%)
paper draft + annotated bibliography (15%)
review of colleague's paper (10%)
Final paper (25%)
Exam 1 (20%)
Exam 2 (20%)

| **Date** | **Topic** | **Assignment** |
|---|---|---|
| Aug. 23 | Introduction and course overview | |
| Aug. 30 | Evolution & Coevolution of plant-animal interactions | |
| Sept. 6 | No Class: Labor day | |
| Sept. 13 | Herbivory I: Plant Defense | |
| Sept. 20 | Herbivory II: Herbivore Offense | |
| Sept. 27 | Herbivory III: Community level consequences of plant-herbivore interactions | |
| Oct. 4 | **EXAM 1** | |
| Oct. 11 | Frugivory and seed dispersal | |
| Oct. 18 | Granivory | **DRAFT PAPER DUE** |
| Oct. 25 | Pollination: Attraction, Deception | **CRITIQUE DUE** |
| Nov. 1 | Ant-Plant Interactions I: Antagonistic | |
| Nov. 8 | Ant-Plant Interactions I: Mutualistic | |
| Nov. 15 | Linking multiple Plant-Animal Interactions | |
| Nov. 22 | **EXAM 2** | |
| Nov. 29 | Plant-Animal Interactions in a changing world | |
| Dec. 6 | Future Directions in plant-animal interactions | **FINAL PAPER DUE** |

**Aug. 23** **Introduction and course overview**

1) H&P Chapter 1

**Aug. 30** **Evolution & Coevolution of plant-animal interactions**

1) H&P Chapter 2 (note…this is really dense)

2) Pellmyr, O. & J. Leebens-Mack. 1999. Forty million years of mutualism: evidence for an Eocene origin of the yucca-yucca moth association. *Proceedings of the National Academy of Sciences* 96:9178-9183.

3) Pellmyr, O. & J. Leebens-Mack. 2001. Reversal of mutualism as a mechanism for adaptive radiation in yucca moths. *American Naturalist* 156:S62-S76.

**Sept. 6** **No Class: Labor Day**

**Sept. 13** **Herbivory I: Plant Defense;**

1) H&P Chapter 3

2) Agrawal, A.A., In press. Resistance and susceptibility of milkweed to herbivore attack: Consequences of competition, root herbivory, and plant genetic variation. *Ecological Monographs.*

3) Van Zandt, P.A. and A.A. Agrawal. Specificity of induced plant responses to specialist herbivores of the common milkweed, *Asclepias syriaca*. *Oikos* 104: 401-409

4) Agrawal, A. A. and P.A. Van Zandt. Ecological play in the coevolutionary theatre: genetic and environmental determinants of attack by a specialist weevil on milkweed. *Journal of Ecology* 91:1049–1059

**Sept. 20** **Herbivory II: Herbivore Offense**

1) Malcolm, S.B., and L.P. Brower. 1989. Evolutionary and ecological implications of cardenolide sequestration in the monarch butterfly. *Experientia* 45: 284-295

2) Zalucki, M.P., S.B. Malcolm, T.D. Paine, C.C. Hanlon, L.P. Brower and A.R. Clarke. 2001. It's the first bites that count: Survival of first-instar monarchs on milkweeds. Austral Ecology 26: 547-555.

3) Malcolm, S.B. 1995. Milkweeds, monarch butterflies and the ecological significance of cardenolides. *Chemoecology* 5/6: 101-117.

**Sept. 27** **Herbivory III: Community level consequences of P-H interactions**

1) Van Zandt, P.A. and A.A. Agrawal. In press. Community-wide impacts of herbivore-induced plant responses in milkweed (*Asclepias syriaca*). *Ecology.*

**Oct. 4** **EXAM 1**

**Oct. 11** **Frugivory and seed dispersal**

1) H&P Chapter 7

2) Jordano, P. 1994. Spatial and temporal variation in the avian-frugivore assemblage of *Prunus mahaleb*: patterns and consequences *Oikos* 71: 479-491.

3) Jordano, P. and E. W. Schupp. 2000. Determinants of seed disperser effectiveness: the quantity component and patterns of seed rain for *Prunus mahaleb. Ecological Monographs* 70: 591-615.

**Oct. 18** **Granivory**

1) H&P Chapter 5

2) Maron J.L. and Gardner S.N. 2000. Consumer pressure, seed versus safe-site limitation, and plant population dynamics. Oecologia 124:260-269.

3) Maron J.L. and Simms E.L. 1997. Effect of seed predation on seed bank size and seedling recruitment of bush lupine (Lupinus arboreus). Oecologia 111:76-83.

4) Maron J.L. and Simms E.L. 2001. Rodent-limited establishment of bush lupine: field experiments on the cumulative effect of granivory. Journal of Ecology 89:578-588.

**Oct. 25** **Pollination: Attraction and deception**

1) H&P Chapter 6

2) Mitchell, RJ & NM Waser. 1992. Adaptive significance of *Ipomopsis aggregata* nectar production: pollination success of single flowers. Ecology 73:633-638.

3) Mitchell, RJ. 1994. Effects of floral traits, pollinator visitation and plant size on *Ipomopsis aggregata* fruit production. *American Naturalist* 143:870-889

4) Irwin, R.E. and A.K. Brody 2000. Nectar robbing bumblebees disrupt a plant-pollinator mutualism. *Ecology* 81:2637-2643.

5) Irwin, R.E. and A.K. Brody 1998. Nectar robbing in *Ipomopsis aggregata*: effects on pollinator behavior and plant fitness. *Oecologia* 116:519-527

**Nov. 1** **Antagonistic Ant-Plant Interactions**

1) H&P Chapter 8

2) Mueller,U.G., S.A. Rehner & T.R. Schultz. 1998. The evolution of agriculture in ants. *Science* 281:2034-2038.

3) Nichols-Orians C.M. 1991b. Environmentally induced differences in plant traits: consequences for susceptibility to a leaf-cutter ant. *Ecology* 72:1609-1623.

4) Vasconcelos H.L. and J. M. Cherrett. 1997. Leaf-cutting ants and early forest regeneration in central Amazonia: Effects of herbivory on tree seedling establishment. *Journal of Tropical Ecology* 13:357-370.

5) **Optional cool story**: Currie, C.R., J.A.Scott, R.C. Summerbell & D. Malloch. 1999. Fungus-growing ants use antibiotic-producing bacteria to control garden parasites. *Nature* 398:701-704 and accompanying commentary: Schulz, T.R. 1999. Ants, plants andantibiotics. i398:747-748.

**Nov. 8** **Mutualistic Ant-Plant Interactions**
**Model System: *Macaranga* trees**

1) Fiala B., Jakob A., and Maschwitz U. 1999. Diversity, evolutionary specialization and geographic distribution of a mutualistic ant-plant complex: *Macaranga* and *Crematogaster* in South East Asia. Biological Journal of the Linnean Society 66:305-331.

2) Fiala B., Maschwitz U., Pong T.Y., and Helbig A.J. 1989. Studies of a South East Asian ant-plant association: Protection of Macaranga trees by *Crematogaster borneensis*. *Oecologia* 79:463-470.

3) Itioka T., Nomura M., Inui Y., Itino T., and Inoue T. 2000. Difference in intensity of ant defense among three species of *Macaranga* myrmecophytes in a southeast Asian dipterocarp forest. *Biotropica* 32:318-326.

4) Heil M., Koch T., Hilpert A., Fiala B., Boland W., and Linsenmair K.E. 2001. Extrafloral nectar production of the ant-associated plant, Macaranga tanarius, is an induced, indirect, defensive response elicited by jasmonic acid. *Proceedings of the National Academy of Sciences of the United States of America* 98:1083-1088

5) Izzo T. and Vasconcelos H.L. 2002. Cheating the cheater: domatia loss minimizes the effects of ant castration in an Amazonian ant-plant. *Oecologia* 133:200-205.

**Nov. 15** **Linking multiple Plant-Animal Interactions**
**Model *system:* Wild radish**

1) Lehtila K. and Strauss S.Y. 1997. Leaf damage by herbivores affects attractiveness to pollinators in wild radish, Raphanus raphanistrum. *Oecologia* 111:396-403.

2) Strauss S.Y. 1997. Floral characters link herbivores, pollinators, and plant fitness. *Ecology* 78:1640-1645

3) Strauss S.Y., Conner J.K., and Rush S.L. 1996. Foliar herbivory affects floral characters and plant attractiveness to pollinators: Implications for male and female plant fitness. *American Naturalist* 147:1098-1107.

**Nov. 22** **EXAM 2**

**Nov. 29** **Plant-Animal Interactions in a changing world**

1) Snow, A. A., D. Pilson, L. H. Rieseberg, M. J. Paulsen, N. Pleskac, M. R. Reagon, D. E. Wolf, and S. M. Selbo. 2003. A Bt transgene reduces herbivory and enhances fecundity in wild sunflowers. *Ecological Applications* 13:279-286.

2) Veteli, T. O., K. Kuokkanen, R. Julkunen-Tiitto, H. Roininen, and J. Tahvanainen. 2002. Effects of elevated CO2 and temperature on plant growth and herbivore defensive chemistry. *Global Change Biology* 8:1240-1252.

3) Wright, S. J., and H. C. Duber. 2001. Poachers and forest fragmentation alter seed dispersal, seed survival, and seedling recruitment in the palm *Attalea butyraceae*, with implications for tropical tree diversity. *Biotropica* 33:583-595

4) Aizen, M. A., and P. Feinsinger. 1994. Forest Fragmentation, Pollination, and Plant Reproduction in a Chaco Dry Forest, Argentina. *Ecology* 75:330-351.

**Dec. 6** **Future Directions in plant-animal interactions**

1) H&P Chapter 9

2) Bailey J.K., Schweitzer J.A., Rehill B.J., Lindroth R.L., Martinsen G.D., and Whitham T.G. 2004. Beavers as molecular geneticists: A genetic basis to the foraging of an ecosystem engineer. *Ecology* 85:603-608.

3) Schnurr J.L., Canham C.D., Ostfeld R.S., and Inouye R.S. 2004. Neighborhood analyses of small-mammal dynamics: Impacts on seed predation and seedling establishment. *Ecology* 85:741-755.

## University of Florida Policies

*Honesty:*
As a result of completing the registration form at the University of Florida, every student has signed the following statement: "I understand that the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University."

*UF Counseling Services:*
Resources are available on-campus for students having personal problems or lacking a clear career and academic goals which interfere with their academic performance. These resources include:

1. University Counseling Center, 301 Peabody Hall, 392-1575, personal and career counseling;
2. Student Mental Health, Student Health Care Center, 392-1171, personal counseling;
3. Sexual Assault Recovery Services (SARS), Student Health Care Center, 392-1161, sexual counseling; and
4. Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

*Software Use:*
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

*Disabilities Accommodations:*
Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.