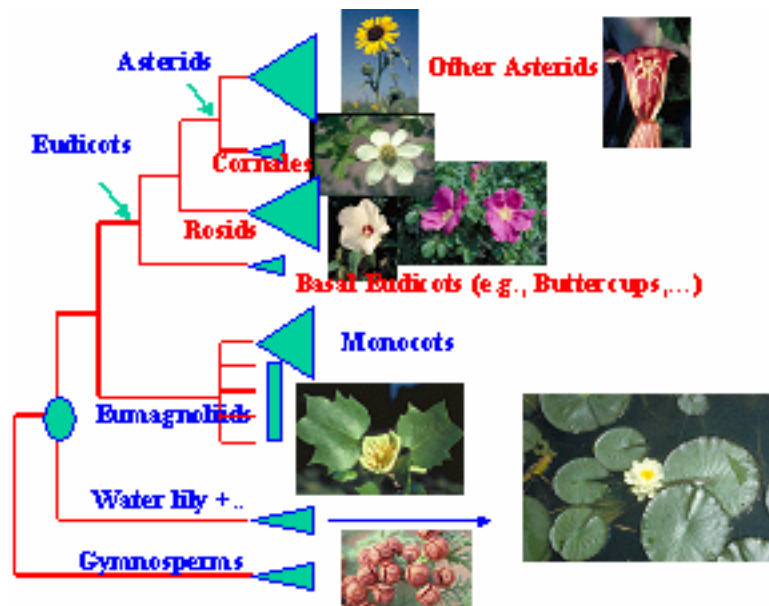

Syllabus for PB 403/503: Systematic Botany – Fall 2007



1. Course Information

- a. Credit: 4CR HRS
- b. Meeting Time and Place: Tuesday and Thursday, 10:15 – 1:00 –Lecture followed by lab; Rm: BOS 4707

2. Instructor:

- a. Dr. Jenny Qiuyun Xiang
- b. Office Location: Gardner Hall 4209
- c. Phone: 515-2728
- d. E-mail: jenny_xiang@ncsu.edu
- e. Office Hours: Drop in or make an appointment

3. Course Description

Basic and contemporary systematic principles and methods as applied to vascular plants. Classification, identification, phylogenetics, molecular approaches, and surveys of important families representing major groups of flowering plants.

4. Course Objectives

After completion of the course, students should be able to:

- a. Describe a plant using botanical terms.
- b. Identify a plant using the key mechanics
- c. Demonstrate knowledge in naming and publishing a new species
- d. Recognize large and common families of flowering plants
- e. Describe plant relationships depicted on phylogenetic trees with proper terms
- f. Exhibit basic knowledge in molecular approaches applied to systematics
- g. Demonstrate knowledge in the current understanding of angiosperm phylogeny and evolution.

5. Course Prerequisites

- a. BO 200, BO 250, BIO 183, or equivalent; Junior standing.

6. Course Requirements and Grading

a. Books required:

Vascular Plant Taxonomy, 5th edition, by Dirk R. Walters, David J. Keil, and Zack E. Murrell 2006, Kendal/Hunt Publishing Company. - Text book

Plant Identification Terminology By J. G. Harris and M. W. Harris, Spring Lake Publishing, Spring Lake, UT. (a very useful book with illustrations!). – For Lab

Other references:

Books available in the lab, websites. Most important ones include:

“Floras of the Carolinas” by Radford – for keying practice; provided in the lab.

Plant family descriptions: <http://biodiversity.bio.uno.edu/delta/angio/>

Angiosperm phylogeny website: <http://www.mobot.org/MOBOT/research/APweb/welcome.html>

Important notes: You should bring your textbook and the terminology dictionary to each class. General tools for plant dissection are provided in the lab. **Lecture and lab notes in power point slides and word documents will be sent via email to students, generally prior to the class. Therefore, make room in your mailbox! Grades and additional reference links are available at WebVista of NCSU.**

b. Grading:

Term exams: 3 X 100 = 300 pts. (50 pts from lecture + 50 pts from lab practical)

Final exam: 100 pts.

Plant collection and identification project: 200 pts.

Homework: 5 x 10 = 50 pts.

Term Project/paper (**BO 503 only**): 500 pts.-letter grade

BO 403 Final grade (based on total points earned/ **650 points**):

BO 503 Final grade (based on total points earned/**600 points & grade from term paper**):

A+ = 97.5 - 100%

A = 91.5-97.4%

A- = 89.5 –91.4%

B+ = 87.5-89.4%

B = 81.5-87.4%

B- = 79.5-81.4%

C+ = 77.5 –79.4%

C = 71.5-77.4%

C- = 69.5-71.4%

D+ = 67.5-69.4%

D = 61.5-67.4%

D- = 59.5-61.4%

F = < 59.5%

c. Exams

Lecture part: Each term exam consists of two parts, a written part covering materials from lectures, and a practical part covering materials from labs. Each exam covers about one-fourth of the material in the course. However, the final exam will be comprehensive requiring knowledge learned in the first three-fourths of the semester to answer some of the questions. For each term exam, the questions from the lecture part are based on materials covered in lectures, readings, and homework (if any). There will be a combination of questions including filling in blanks, matching, comparing and contrasting (including making keys), drawing structures, or labeling structures, and short essays. The lecture part of the term exams will be closed book taken in classroom. **The final exam is open book and a take-home exam.**

Lab part: The lab part of the term exams follows the lecture part and is practical. In the first exam, the lab part will be identifying/describing plant morphology using botanical

terms. It is closed book. For the 2nd and 3rd exam, there will be identification of unknown plant(s) using the keying mechanism, in addition to stations or slides of plants for identification of families and related family characteristics on sight. The exams are closed book except for keying for which all reference books may be used.

d. Plant Collection and Identification:

1. Collect **15** plant specimens of **NATIVE flowering plants** from the field (not cultivated) of Carolinas. – Keyable in Radford manual.
 - a. Not more than **THREE** from the same family, except for some large families such as Asteraceae, Fabaceae, Poaceae. For these families, up to **FOUR** specimens are allowed. **Each specimen should be a different species.**
 - b. Each specimen should contain sufficient **vegetative** (with leaves and stems) and **reproductive structures** (w/ flowers or fruits or both), and should be the size fitting in a regular mounting sheet.
2. Identify the specimens to family, genus and species correctly.
3. Press and dry the specimens – press specimens in a way to show the most features. Dry specimens in a dryer oven. Plant presses and dryer are provided by the lab.
4. Produce a label for each specimen. The label should be typed and provide the following information:
 - family name, species name, common names
 - location of collecting (county, state, country; hwy number, directions, etc. so that the plant may be found again based on the information),
 - name of collector, date of collection, collection number,
 - habitat,
 - plant traits; color of flower/fruits, habit of plant (tree/shrub/vine/herb).
5. Make a list of the species in order following family names alphabetically. – **Collections with list missing and in incorrect order will not be graded.**
6. Submit the collection with the list in a folder **on Nov. 1. Specimens should be arranged in the order of the list when submitted. You may submit your specimens for approval on any dates prior to making labels. Collect specimens early so you have more choices to replace any unsatisfactory/unqualified ones before the season gets too late.**
7. Each specimen counts **10 points**. The points are distributed as follows:
 - a. Adequacy of the specimen (i.e. with leaves, stem, flowers/fruits) = 2 pt.
 - b. Pressed appropriately = 2 pt.,
 - c. Correct identification to family and genus = 2 pt.,
 - d. Correct identification to species = 2 pt.,
 - e. Complete typed information on labels = 2 pt.

Important notes: Students are encouraged to work in pairs in collecting and identifying the plants. They can share some specimens with identical species names, but at least **FIVE** of them have to be different between the two students.

e. Homework: There will be five homework assignments: Each counts for 10 points.

- 1) Construction of taxonomic keys.
- 2) Compare vegetative morphology of selected plant samples
- 3) Dissection and description of flowers using floral diagram and formula.
- 4) Describing a “new” species
- 5) Construction of phylogenetic trees using morphological data and parsimony method.

f. Field Trips and Safety Issues:

- 1) There will be two nearby field trips to the J. C. Raulston Arboretum and UNC Botanical Garden on two **Saturdays**. Transportation will be provided for these trips using university vans or buses.

- 2) General safety training will be given to students at the beginning of the semester in the first lab. Special safety issues related to particular labs and field trips will be discussed before those labs and field trips.

g. Term Project for BO 503 Students:

A term project is required only for students of BO 503. The project could be a phylogenetic analysis of a particular plant group of the student's interest, or other team projects applying modern phylogenetics to test evolutionary hypotheses. Students could develop a project related to their thesis research. The end product of the project should be a 10-15 page term paper in a scientific journal format. **Students in BO 503 should discuss with me during the first a few weeks of the semester to develop his/her project.**

7. Attendance

Attendance is mandatory. Students who have to miss a class should notify the instructor ahead of time, if possible, via email with explanation for the absence. Class will start promptly at 10:15 a. m. **You should make every effort to arrive on time to avoid disturbing the class with a late arrival.** You should sign your attendance each time you come to the class. *Students who miss a class are responsible for making up the lab with any plant materials left-over, and obtaining missed handouts and notes from a classmate.* **Make-up exams will be given with a well-documented excuse, and must be completed within one week from the scheduled exam/quiz date. Make-up exams will be different from the regular exams, but at a similar level of difficulty.** NCSU Attendance Regulations are available at http://www.ncsu.edu/policies/academic_affairs/pols_regs/REG205.00.4.php.

8. Students With Special Needs

All students registered with the NCSU Office of Disability Services for Students (DSS) will provide the instructor with an accommodating letter. If you have not registered with the DDS and have a learning disability, you should visit the web site http://www.ncsu.edu/provost/offices/affirm_action/dss/ and register in Suite 1900, Student Health Center. If you have a documented disability, please see the instructor to discuss academic accommodations.

9. Academic Integrity

Students are expected to be familiar with and honor the NCSU Code of Student Conduct. University policies on Academic integrity are published at <http://www.fis.ncsu.edu/ncsulegal/41.03-codeof.htm>.

10. Calendar

The scheduled topics and reading assignments for each class meeting are provided in separate pages and are considered part of this syllabus. For each class meeting, lab exercises follow the lecture to reinforce the learning of materials covered in the lecture. **For most labs, there are unknown plants to practice identification using the keying mechanism.**

11. Caveat

The above information and course calendar are subject to change in the event of extenuating circumstances.

PB 403/503 –Scheduled Topics

WK	Date(s)	Lecture Topic – Bring the powerpoint slide notes to class	Lab – lab worksheets will be sent prior to class	Reading* (incl. the exercises at end of the chapter)
		MORPHOLOGY, IDENTIFICATION, Principles, & Methods		
1	Aug. 23	Course Introduction; What is Syst. Bot.; Plant classification Hierarchy	Plant Identification: Using & constructing botanical keys; Into to Radford lab manual; lab safety training; Hw 1	Ch1, 5. Lab handout
2	Aug. 28	Angiosperm morphology – Variation in forms of roots, stems, & leaves	Observing & describing variation in vegetative morphology using botanical terms; Hw 2	Ch 3 and exercises
	Aug. 30	Angiosperm morphology – Variation in form and structure of Flowers	Dissecting flowers & describing floral forms and structures using terms, floral formula, & diagram; Homework 3; Hw1 & 2 due	Ch 11; pp187-198 & lab handout
3	Sept 4	Continue on Floral Morphology	Continue on practice of dissecting & describing floral variation. Techniques in collecting and preserving plant specimens ; Herbarium tour.	Ch 7 + readings for Aug. 30
	Sept. 6	Angiosperm morphology – Major types of flower arrangement - Variation in Inflorescence architectures	Identification & understanding inflorescence types; safety on fieldtrip; Hw3 due	Ch 11; pp198-201 & lab handout
	Sept. 8	SATURDAY FIELD TRIP TO J. C. ARBORETUM & GREENHOUSE CONSERVATORY; 9:00 –12:00		
4	Sept. 11	Angiosperm morphology – Classification of fruits	Identification of fruit types	Ch 11; pp202-207 & lab handout
	Sept. 13	Phylogenetic classification approaches; constructing phylogeny using cladistics and parsimony method	Practicing constructing phylogeny with hypothetical data by hand and computer program; Hw 4	Ch 4
5	Sept. 18	Current understanding of angiosperm phylogeny & evolution in comparison to historical classification systems	Naming and describing species in live - nomenclature & reviewing terminology; Hw 5; Hw4 due	Ch 2, 6; Soltis et al. 1999-paper in Nature; APG 2003
	Sept. 20	EXAM I		
		SURVEY OF ANGIOSPERM FAMILIES		
6	Sept 25	Basal Angiosperms & Magnolias	Identifying characters of the studied families;	Ch 8, Ch12, pp221-

			keying unknown plants; Tips for studying families	235, 243-246 (exercise questions)
	Sept 27	Basal Eudicots – Buttercups and Poppies;	Keying and studying plants from basal Eudicot families; HW 5 due	In Ch 12, 236-246
7	Oct. 2	Caryophyllids - Carnations, buckwheats, Chenopods	Keying unknown plants; studying the diversity of plant families from basal the Caryophyllids clade	In Ch 13, pp247-256, 259-260, 268-269
	Oct. 4	Eurosids I – Cucumbers & Euphorb; Evening primrose	Studying plants from Eurosids I clade; keying unknown plants	In Ch 14, pp275-286, 306-310, 332-333
8	Oct. 9	Eurosids I – Legumes & Roses	Identifying subfamilies of Legume and Rose families; keying unknown plants	In Ch 14, pp317-324
	Oct. 11	Fall Break		
9	Oct. 16	Eurosids I – Catkin bearers (Beeches, Birches, walnuts, willows, elms, nettles, and figs); Origin of N ₂ –fixing in flowering plants;	Observing and comparing plant materials from these families.	In Ch 14, pp315-316, 327-331, 334-338; Soltis et al. 1999
	Oct. 18	Eurosids II – Mustards, mellows, , and poison ivy	Constructing a morphological matrix for the plant materials provided in the lab & build a key for them; keying practice; safety issues on fieldtrip	In Ch14, pp339-345
	Oct. 20	SATURDAY FIELD TRIP TO UNC BOTANICAL GARDEN		
10	Oct. 23	EXAM II		
	Oct. 25	Lower Asterids –Blueberries & Dogwoods Euasterids I: Potatoes	Studying the variation within each of these families; comparing families in the Euasterid clade; keying unknown plants	In Ch 15; pp359-364, 370, 385-387, 402-403;
11	Oct. 30	Euasterids I – Mints and Snapdragons		In Ch 15; pp366, 392-401
	Nov. 1	Euasterids II – Carrots, ginsengs, and asters.	Identifying the carrot and ginseng families; examining morphological variation within Asteraceae; tribal classification of Asteraceae; keying unknown plants	In Ch 15; pp371-378, 406-410
12	Nov. 6	Origin and Diversity of Monocots; Lilies and Orchids	Examining the diversity of monocots, orchid flower structures; diversity of the lily group	In Ch 16; pp421-425, 436-443
		Grasses, sedges, and rushes	Dissecting grass flowers; understanding characteristics of these families	Ch 16; pp426—428, 425-463

	Nov. 8	NON-FLOWERING VASCULAR PLANTS		
13	Nov. 13	Gymnosperms: diversity and detates on relationships	Examining materials from diverse gymnosperm families; Plant collection is due	Ch 10; pp165-185
	Nov. 15	Ferns and Allies: Major groups & current understanding of phylogenetic relationships	Studying materials from these taxa; making a key for the different groups	Ch 9; pp137-153, 159-161
14	Nov. 20	Exam III		
	Nov. 22	Thanksgiving holidays		
15	Nov. 27	Molecular systematics – type of molecular markers for phylogenetic analyses; using molecular data to elucidate evolutionary history of hybrids and polyploids	DNA extraction and electrophoresis; HW 6-Bonus.	Ch 17 & Ch from Judd et al. 2002; lab handout
	Nov 29	Molecular systematics-continued	PCR amplification of genomic markers and DNA regions; phylogenetic analyses of generated DNA data	
16	Dec. 4	Application of molecular phylogeny to biogeographic puzzles – origin of discontinuous distributions	No lab; Hw6 due; campus tour if time and weather permit.	Tiffney & Manchester 2001; Donohgue & Smith 2004
	Dec. 6	Application of phylogeny to understanding the origin and character evolution of angiosperms	Brief review of the course; Course evaluation	Chapter from Solits et al. 2005
17	Dec. 11	Final exam –Comprehensive; Take home		

Reading* - The assigned reading materials in the textbook are relevant to families discussed in the lectures. For more information on families discussed, see description at <http://biodiversity.bio.uno.edu/delta/angio/>