Universitat Autònoma de Barcelona

2019/2020

Botany

Code: 100840
ECTS Credits: 8

Degree	Type	Year	Semester
2500251 Environmental Biology	OB	2	2

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Javier Lopez Alvarado

Prerequisites

There are no official prerequisites.

It will facilitate the follow-up of the subject having basic knowledge of evolution, biology of the reproduction and functioning of the plants as well as botanical and geographical knowledge of the natural environment. At the time of imparting the subject, it will be considered that the students have a minimum level of knowledge of plant biology acquired in the subject of the first course "Prospecting of the Natural Environment".

Objectives and Contextualisation

The study of the biodiversity of photoautotrophic organisms (algae and plants) is addressed. The student must be able to understand and even develop a phylogenetic scheme where to locate the different elements of this plant biodiversity. This objective is closely related with both aspects of plant evolution and the study of techniques and knowledge that allow us to classify living beings (morphology, anatomy, molecular indicators, biogeographical aspects, etc.).

In addition, biodiversity will be studied not only from a systematic and phylogenetic perspective but also from a more ecological perspective (plant communities and biomes).

On the other hand, special emphasis will be given to the main biological processes (life cycles, reproduction, development, etc.), evolutionary (phylogenetic relationships, evolutionary trends, coevolution, etc.), ecological (limiting factors, habitats, adaptations to the environment, etc.) and applications by man (industry, territorial management, etc.) of the main groups studied.

This subject is complementary to other subjects such as "Prospecting the natural environment", "Analysis of environmental cartography" and "Analysis of vegetation", as well as those that make up the path of plant biology in the fourth year but always from an integrating point of view in the inseparable set formed by the environment.

Competences

- Describe, analyse and interpret the vital adaptations and strategies of the principal groups of living beings.
- Develop self-directed learning.
- Develop strategies of analysis, synthesis and communication in order to teach biology and environmental studies.
- Focus on quality.
- Identify and interpret the diversity of species in the environment.
- Identify organisms and recognise the different levels of biological organisation.
- Integrate knowledge of different organisational levels of organisms in their functioning.
- Obtain, observe, handle, cultivate and conserve specimens.
- Recognise and analyse phylogenetic relations.
- Recognise and interpret the development, growth and biological cycles of the principal groups of living beings.

Learning Outcomes

1. Collect, determine and conserve specimens and collections of cryptogams and phanerogams.
2. Develop self-directed learning.
3. Focus on quality.
4. Interpret and recognise the different stages in the biological cycles of phanerogams and cryptogams.
5. Interpret the causes and the functioning of adaptation to the environment on the part of cryptogams and phanerogams.
6. Interpret the distribution and the interactions in the environment of plant species and their impact on plant diversity.
7. Interpret the evolutionary processes that have led to the diversity of cryptogams and phanerogams.
8. Interpret the origin and functioning of cell and tissue structures in the different groups of cryptogams and phanerogams.
9. Recognise the basic principles of botany that must be conveyed in the field of secondary education.
10. Recognise the characteristics that differentiate the principal groups of phanerogams and cryptogams.

Content

1. The science of botany. Definition. What is a plant? The modern classification systems. Biodiversity. How many species are there on the planet? Definition of species. Genera, subspecies and varieties. Systematics, Evolution, Taxonomy and Phylogeny. Phylogenetic or Cladistic Systematics. Monophyly, paraphyly and polyphyly.

2. Resources for Systematics in Botany. Linnaeus's "Species Plantarum" and the binomial system. Scientific names and vulgar names. Taxonomical categories (taxa) and hierarchy. International Code of Botanical Nomenclature. Dichotomous keys. Herbaria.

3. Morphological Organization. Prokaryotes and Eukaryotes. Protophytes: unicellular, colonies, aggregation consortiums. Thallophytes: siphonal, filamentous, pseudoparenchyma, tissue. Bryophytes. Cormophytes.

4. Reproduction and biological cycles. Asexual and sexual reproduction. Asexual: bipartition, fragmentation, by mitospores, by propagules. Sexual: isogamy, anisogamy, oogamy, spermatization, conjugation. Spores and sporangia. Gametes and gametangia. Biological cycles: haploid, diploid and diplohaploid.

5. Photosynthetic bacteria: cyanobacteria. Type of nutrition: according to the carbon source, according to the source of energy and according to the electron donor. Photosynthesis. Photosynthetic pigments. Cell structure of cyanobacteria. Movement ("gliding"). Sheath. Filament and Trichoma. Akinets and heterocysts. Asexual reproduction: hormogonia and baeocytes. Symbiosis. Diversity. Ecology. Importance of stromatolites for the interpretation of the origin of life. Cyanotoxins. Uses.

6. Introduction to Algae. Phylogeny of algae. Origin and evolution of the chloroplast. Lines green, red and brown. Classification criteria.

7. Rhodophytes (red algae). General characteristics. Cell structure. "Pit connections" or synapses. Reproduction and cycles: the trigenetic cycle. Diversity-Morphology. Uses: nori, agar and carrageenan.

8. Euglenophytes. General characteristics. Cell structure. Pellicle.Movement. Diversity. Ecology.

9. Dinophytes (dinoflagellates). General characteristics. Cell structure. Teca. The flagella. Life cycle. The red tides. Bioluminescence. Zooxantela-Symbiosis. Diversity.

10. Heteroconts: Diatoms. Stramenopiles, Chromista or Heteroconts. Diatoms. General characteristics. The frustule. Life cycle of pennal diatoms. Movement. Blooms. Applications. Diversity.

11. Heterocontss: Phaeophyceae (brown algae). General characteristics. Morphology. Growth. Systematics. Dictyotales: Dictyota dichotoma (morphology and life cycle), Padina pavonica. Laminariales ("kelps"): morphology, diversity and cycle. Fucales: Fucus spp. (Morphology and life cycle), Cystoseira spp. Uses of the brown algae: wakame, kombu, alginates, fucoidan.

12. The Plants (Green Plants or Viridiplantae). Chlorophytes (green algae). Definition of Viridiplantae. Phylogeny. Position of the Chlorophytes. General characteristics of Chlorophytes. Characteristics used to distinguish large groups of chlorophytes. The flagelar roots. Type of mitosis. Phragmoplast and phycoplast. Phylogeny. Diversity. Chlorophyceae: Chlamydomonas (life cycle) and other volvocales. Trebouxiophyceae: Chlorella and other Clorellales, Trebouxia. Ulvophyceae: Ulotricales, Ulvales (Ulva, life cycle), Cladoforales, Dasicladales, Caulerpales (Caulerpa and Codium -vital cycle-). "Streptophytes" - Charophyceae: phylogenetic location; Zygnematales, Charales and Coleocaetales.

13. The Terrestrial Plants (Embryophyta). The origin. Adaptations to the terrestrial environment. Vegetative and reproductive structures.

14. Bryophytes. Phylogeny. General characteristics. Life cycle. Gametophyte: Stems and leaves. Antheridia and Archaegonia. Differential characters among the three groups. Liverworts (Marchantiophyta): gametophytes, talose and foliose, characteristics of gametophyte and sporophyte, biological cycle, diversity. Mosses (Bryophyta): biological cycle, spores, protonema, characteristics of the gametophyte and sporophyte. Acrocarpic and pleurocarpic, diversity, environments rich in mosses. Hornworts (Antocerotophyta).

15. The Vascular Plants (Tracheophytes). Phylogenetic situation. Apomorphies of Vascular Plants. The corm: root, stem and leaves. Evolution of the leaves: microphylls and megaphylls. Lignin. Cuticle and stomata. Vascular tissue: xylem and phloem.

16. The Vascular Cryptogams ("Pteridophytes"). Phylogenetic situation. The origin: the Rhynie Chert. The fossil vascular plants. Systematics: the "Pteridophytes", the Lycophytes, the Monilophytes.

17. Pteridophyta I: Lycopodiophytina and Psilophytina. General characteristics of the Pteridophyta. Life cycles: Homospory and Heterospory. Sporangia on leaves or stems. Eusporangia and Leptosporangia. Lycopodiophytina: General characteristics. Extinct forms. Isoëtes. Selaginella: model of a heterospòric cycle. Euphyllophyta. Monilophyta. Psilophytina (Psilotum).

18. Pteridophta II: Equisetophyta ("Horse tails"). General characteristics. Extinct forms. Structure of the aerial stems and fertile stems. Gametophyte. Biological Cycle. Diversity.

19. Pteridophyta III: Pterophytina ("Ferns"). General characteristics. Phylogeny. Sporophyte:leave, sporophylles, trophosporophylles, trophophylles, sporangia, sori, indusium. Gametophyte. Biological Cycle. Diversity. Aquatic ferns..

20. Plants with seed: Spermatophytes. What is the seed? What are the steps that have led to the evolution of the seed? Heterospory, endospory, reduction of the number of megaspores, retention of megaspore, evolution of integuments. The grain of pollen. The seed. Comparison of spermatophytes with vascular cryptogams. Origins of plants with seed. Pteridosperms and Progimnosperms.

21. Gymnosperms I: Cycadopsida and Ginkgopsida. Phylogeny. Origin. Cycadopsida: General characteristics. Cycas revoluta. Ginkgopsida: General characteristics. Ginkgo biloba

22. Gymnosperms II: Coniferopsida. Pinaceae. Phylogeny. Distribution. General characteristics. Pinaceae: General characteristics. Vegetative elements: the leaves. Reproductive elements: male cones and female cones, seeds. Life cycle of Pinus sp. Details of the pollen grain and the ovule. Diversity: Abies, Pinus, Picea, Pseudotsuga, Larix, Cedrus.

23. Gymnosperms III: Coniferopsida. Cupressaceae and Taxaceae. Cupressceae: General characteristics. Phylogeny. Vegetative elements: the leaves. Reproductive elements: male cones and female cones, woody strobili or fleshy galbules. Diversity: Juniperus, Cupressus, Thuja, Sequoia, Sequoiadendron. Taxaceae: General characteristics. Phylogeny. The yew (Taxus baccata). Taxol.

24. Gymnosperms IV: Gnetopsida. General characteristics. Ephedra, Gnetum, Welwitschia.

25. Plants with flowers: Angiosperms. Apomorphies of the Angiosperms. The flower. Inflorescences. The Stamens. Male Gametophyte. The Carpels. The Ovule or Seminal Primordium. Life cycle of Angiosperms. Microsporogenesis. Megasporogenesis. Pollination. Embryogenesis. The seed. The fruits. Dispersion of seeds and fruits.

26. Angiosperms I: Introduction. Basal and Magnolidae groups. Comparative Gymnosperms-Angiosperms. Phylogeny of Angiosperms or Magnoliopsida. From the classical to the current systematic. The basal or protoangiosperm groups: Nymphaeaceae. Magnolids: Lauraceae, Magnoliaceae.

27. Angiosperms II: Monocots. General characteristics. Liliaceae. Smilacaceae. Orchidaceae. Asphodelaceae. Asparagaceae. Ruscaceae. Amaryllidaceae. Arecaeae. Juncaceae. Cyperaceae. Poaceae.

28. Angiosperms III: Eudicots I. Phylogeny. General characteristics. Papaveraceae. Ranunculaceae. Amaranthaceae Cactaceae. Caryophyllaceae. Polygonaceae. Saxifragaceae.

29. Angiosperms IV: Eudicots II. Geraniaceae. Rutaceae. Brassicaceae. Malvaceae. Cistaceae Fabaceae (legumes). Rosaceae. Fagaceae. Betulaceae Cucurbitaceae. Euphorbiaceae. Salicaceae

30. Angiosperms V: Eudicots III. Ericaceae Boraginaceae Gentianaceae. Rubiaceae Lamiaceae Scrophulariaceae. Plantaginaceae. Convolvulaceae. Solanaceae. Apiaceae. Asteraceae.

Methodology

Face-to-face sessions

A part of the knowledge of this subject will be transmitted from the lectures where in addition to giving explicit information will highlight the key points of each teaching unit to facilitate and encourage self-learning of the student. Subsequently, the student from the scheme made will be able to complement it with bibliographic information and a good support of graphic material (PPT) from their non-contact work.

This subject presents an important practical component inseparable from theoretical botanical knowledge.

We will distinguish between laboratory and field practices. In the first case, the students will have a script of practices that will include both the methodologies of observation of the plant material and the main structures to identify and their terminology. In the second case, the student will have a dossier which will include the environmental and landscape characteristics of the itineraries visited as well as the list of species that we intend to be recognized.

Preparation of works

We consider that the elaboration of works is a necessary element as long as they are well defined, supervised and allow the work in group with other students and the interaction with the professors.

Activities

Title	Hours	ECTS	Learning Outcomes

Type: Directed			
Field practices	11	0.44	4, 6, 5, 1, 9, 10
Laboratory practices	24	0.96	2, 3, 7, 4, 8, 6, 5, 1, 9, 10
Theoretical classes	36	1.44	3, 7, 4, 8, 6, 5, 10
Type: Autonomous			
Elaboration of works	55.75	2.23	2, 3, 7, 4, 8, 6, 5, 1, 9, 10
Study	67	2.68	2, 7, 4, 8, 6, 5, 10

Assessment

This subject will be evaluated based on two eliminatory partial theory examinations, the corresponding recovery if applicable, a practice exam and a work. The conditions and characteristics are:

I. Written exam of the first partial of Theory, eliminatory, with questions of type and short answer. The weight is 30% in the final grade of the subject. Only the subject is eliminated if the grade is equal to or greater than 5.

II. Written exam of the second part of Theory, eliminatory, with questions of type and short answer. The weight is 30% in the final grade of the subject. Only the subject is eliminated if the grade is equal to or greater than 5.

III. Written exam of Final Recovery of Theory, only by examining the partial / s pending / s. With the same test structure as the partial ones, and keeping the weight of 30% for each partial. If someone with the partial exams passed wants to submit to the final recovery to make a note can do so, previously advising the teacher and accepting in writing the resignation of the first one (which could be higher than the new one).

See the section "Not-Appraising".

The I-III evaluations correspond to the Theory block, with a weight of 60% of the final mark. In order to pass this block you have to have the partial ones passed with a mark equal to or greater than 5 (the partial ones do not compensate each other).

IV. Written examination of practices, consists of the identification and morphological description of vegetal organisms seen during the sessions of laboratory practices and field trips. Weight of 20% in the final note.

V. Work, Presentation of a herbarium of a number to identify wild plants identified with the scientific name, some of which must incorporate a complete description. Weight of 20% in the final note.

The IV-V evaluations correspond to the Practices block, with a weight of 40% of the final mark. To pass the block of internships, the two assessments (IV and V) must be compensated, each with a mark equal to or greater than 4.

For the calculation of the final note we have to take into account that the activities evaluate two blocks of the subject: the theory and the practices, and that they must approve the two separately with a mark equal or superior to 5. For So much, there are no compensations between the notes of Theory and Practices. If one of the two is suspended, the whole course must be repeated the following course.

Not-Appraising

To participate in the recovery, the students must have previously been evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject or module. Therefore, students will obtain the "Non-Valuable" qualification when the assessment activities carried out have a weighting of less than 67% in the final grade.

Attendance at all practical sessions (or field trips) is mandatory. The students will obtain the "Non-Valuable" qualification when the absence exceeds 20% of the programmed sessions.

Attendance and use of practices

The attendance to the practices is obligatory and will be controlled passing list. See the "Not-Appraising" section above.

For each student, the use of a unique and exclusive note book for laboratory and field practice will be required.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Evaluation of the herbarium	20%	0.75	0.03	2, 3, 6, 1, 10
Examination of practices (individual assessment)	20%	0.5	0.02	1, 10
First eliminatory partial exam (individual assessment)	30%	2.5	0.1	2, 3, 7, 4, 8, 6, 5, 9, 10
Second eliminatory partial exam (individual assessment)	30%	2.5	0.1	2, 3, 7, 4, 8, 6, 5, 9, 10

Bibliography

RECOMMENDED THEORY BIBLIOGRAPHY

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CARRIÓN, J.S. 2003. Evolución vegetal. DM. Murcia.

IZCO, J. et al. 2004. Botánica. McGraw-Hill-Interamericana. Madrid.

JUDD, W.S. et el. 2002. Plant Systematics. A phylogenetic approach. 2ª ed. Sinauer Associates Inc. Sunderland.

LEE, R.E. 2008. Phycology. 4th ed. Cambridge University Press. Cambridge. UK.

LLIMONA, X. (ed.) 1985. Plantes inferiors. Història Natural dels Països Catalans. Vol. 4. Enciclopèdia Catalana. Barcelona.

MASALLES, R.M. et al. (ed.) 1988. Plantes superiors. Història Natural dels Països Catalans. Vol. 6. Enciclopèdia Catalana. Barcelona.

MAUSETH, J. D. 1998. Botany. An Introduction to Plant Biology, 2ª ed. Multimedia enhanced edition. Jones & Bartlett Publ. Boston, Toronto, London, Singapur.

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RAVEN, P.H., EVERT, R.F. & EICHHORN, S.E. 1992. Biología de las plantas. Vols. 1 i 2. Ed. Reverté.

SCAGEL, R.F. et al. 1987. El Reino Vegetal. Omega. Barcelona.

SIMPSON, M.G. 2006. Plant Systematics. Elsevier. Academic Press.

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RECOMMENDED BIBLIOGRAPHY OF PRACTICES

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BOLÒS, O. de; VIGO, J. 1984-2001. Vols. I-IV. Flora dels Països Catalans. Ed. Barcino. Barcelona.

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BONNIER, G.; DE LAYENS, G.1990. Claves para la determinación de plantas vasculares. Ed. Omega. Barcelona.

CASTROVIEJO,S. (ed.). 2001. Claves de Flora Ibérica. Plantas Vasculares de la Península Ibérica e Islas Baleares. Vol. 1. Real Jardín Botánico - CSIC. Madrid.

FONT i QUER, P. 1963. Diccionario de Botánica. Labor. Barcelona.

HEYWOOD, V.H. 1985. Las plantas con flores. Ed. Reverté.

LLISTOSELLA, J.; SÀNCHEZ-CUXART, A. 2003. L'herbari. Arbres, arbusts i lianes. Ed. Universitat de Barcelona.

LLISTOSELLA, J.; SÀNCHEZ-CUXART, A. 2015. Guia il·lustrada per a conèixer els arbres. Ed. Universitat de Barcelona.

LÓPEZ GONZÁLEZ, G. 2001. Los árboles y arbustos de la Península Ibérica e Islas Baleares. Tomos I y II. Ed. Mundi-Prensa.

MASCLANS, F. 1990. Guia per a conèixer els arbres. 9ª ed. Ed. Montblanc-CEC. Barcelona.

MASCLANS, F. 1990. Guia per a conèixer els arbusts i les lianes. 8ª ed. Ed. Montblanc-CEC. Barcelona.

SALVO TIERRA, E. 1990. Guía de helechos de la Península Ibérica y Baleares. Ed. Pirámide. Madrid.

NOTA.- Hi ha publicades una gran quantitat de guies, impossible de ser totes incloses en aquesta llista.

INTERNET

http://www.unex.es/botanica/LHB

http://www.aulados.net/Botanica/Curso_Botanica/Curso_Botanica.htm

http://tolweb.org/tree/

http://biodiver.bio.ub.es/biocat/homepage.html

http://herbarivirtual.uib.es/cat-med/index.html

http://blogs.uab.cat/herbari/

http://www.floraiberica.org/

http://www.anthos.es/

http://www.biologia.edu.ar/botanica/