



ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАН

1000 София
ул. „Сердика“ № 4
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Basic Information:

Course Title: Plant biotechnologies for preservation of rare and medicinal plant species

Lecturer: Prof. Marina Stanilova, PhD

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Total Teaching Hours: 30

Annotation (up to 150 words)

The course is intended for biotechnologists and botanists, but may also be useful for specialists working in the field of phytochemistry and biomedical sciences.

Biodiversity loss is a global problem. Medicinal plants are particularly vulnerable because of their gathering from nature due to the increasing market demand for phytopreparations. Plant biotechnologies are considered as alternative and complementary means of preservation of rare, endangered and medicinal species alongside the application of *in situ* measures.

The course includes different *in vitro* and hydroponic methods for rapid propagation and cultivation of target plant species. The influence of various factors on the cultures growth and development and *in vitro* biosynthesis of secondary metabolites is considered.

Beside the theoretical course, PhD-students will benefit from the opportunity to gain hands-on experience in the Biotechnology Laboratory for Medicinal Plants. They will plan their experiments with a view to statistical processing and interpretation of the data obtained.

Course content (brief description by topics or modules)

Module 1: *In vitro* cultivation: Choice of method and starting plant material depending on the purpose of cultivation; Initiation of *in vitro* cultures; Stimulation of seed germination in *in vitro* conditions; Clonal micropropagation; *Ex vitro* adaptation and acclimatization; Callogenesis and indirect regeneration; Somatic embryogenesis; Cultivation in temporary immersion systems, etc.

Module 2: Influence of various factors on the growth and development of *in vitro* cultures and *in vitro* biosynthesis of secondary metabolites: biological characteristics of the species, genotype, type of *in vitro* culture, composition of the culture medium, elicitation, cultivation conditions. Advantages and challenges of *in vitro* propagation and biosynthesis of secondary metabolites, examples from our research and from global industrial production.

Module 3: Hydroponic technologies for cultivating target plant species: Feasibility, advantages and disadvantages; Main types of hydroponic systems; Requirements for nutrient solutions, substrate and environment; Model medicinal plant species suitable for hydroponic propagation; Relationship between *in vitro* and hydroponic cultivation.



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Teaching and assessment methods

The training includes a theoretical part and practical classes.

The theory is presented by the lecturer in the form of presentations on individual topics with the opportunity for discussion. Appropriate literature is also indicated for independent preparation if the PhD-student wishes to delve deeper into the subject.

The practical classes provide the opportunity for PhD-students to acquire basic laboratory skills on the topics under consideration and are carried out under the guidance of the lecturer in the Biotechnology Laboratory for Medicinal Plants of the Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences.

The evaluation of PhD-students is based on both discussion of course topics and practical skills acquired.

Competencies acquired as a result of training (3–5 points)

Basic knowledge and skills in *in vitro* and hydroponic plant cultivation.

Ability to set clear goals for a specific study, select appropriate methods to achieve them, properly plan experiments, and adequately interpret the results obtained.

Knowledge of the factors influencing the growth and development of cultures under *in vitro* and hydroponic conditions and correct determination of the factors subject to control.

Literature:

Бобошевска Д., Чавдаров И., Бъчварова Р. 1985. Хидропонно отглеждане на цветя. „Селскостопански знания“, Земиздат, София.

Георгиев Г., Е. Чакалова. 2000. Анатомия и морфология на растенията. Унив. изд. “Св. Кл. Охридски”.

Закон за биологичното разнообразие, Обн. ДВ. бр. 77 от 9 август 2002 г., посл. изм. ДВ. бр. 70 от 20 Август 2024 г. <https://www.lex.bg/laws/ldoc/2135456926>

Закон за защитените територии. Обн. ДВ. бр. 133 от 11 ноември 1998 г., посл. изм. ДВ. бр. 102 от 23 декември 2022 г. <https://www.lex.bg/laws/ldoc/2134445060>

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Симидчиев Х., Каназирска В. 2017. „За хидропониката от А до Я“. ИК “КОТА Принт“, Стара Загора.

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Asker H.M. 2015. Hydroponic technology for lily flowers and bulbs production using rainwater and some common nutrient solutions. African Journal of Biotechnology, 14 (29): 2307-2313. DOI: <https://doi.org/10.5897/AJB2015.14628>



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Baskin J.M., Baskin C.C. 2004. A classification system for seed dormancy. *Seed Science Research*, 14: 1-16. <https://doi.org/10.1079/SSR2003150>

Bhojwani, S., W. Soh. (eds). 2003. Agrobiotechnology and plant tissue culture. Sci. Publishers Inc., Enfield (NH), USA.

George, E. (ed). 1993. Plant propagation by tissue culture, Part 1 & 2.

Giurgiu R., Morar G., Dumitraş A., Boancă P., Duda B. & Moldovan C. 2014. Study regarding the suitability of cultivating medicinal plants in hydroponic systems in controlled environment. *Research Journal of Agricultural Science*, 46 (2): 84-92.

Hvoslef-Eide A. K., W. Preil (eds). 2005. Liquid culture systems for in vitro plant propagation. Springer, The Netherlands.

Kayser O., Quax W.J. (eds). 2007. Medicinal plant biotechnology – from basic research to industrial applications, Vol. 1 & 2, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim

Machackova, I., Romanov, G. 2003. Phytohormones in plant biotechnology and agriculture. Kluwer Academic Publishers. Dordrecht. Pp. 265.

Nourozi E., Hosseini B. Hassani A. A reliable and efficient protocol for induction of hairy roots in *Agastache foeniculum*. *Biologia* 69/7: 870—879, 2014, Section Botany, DOI: 10.2478/s11756-014-0382-8

Ramawat K.G. and J.M. Merillon, (eds.). 1999, Biotechnology – Secondary Metabolites, Science Publishers, U.S. 393.

Moraghebi F. & Mohebbi H. 2011. Effect of three different culture media on some generative and vegetative characters of *Polyanthus tubersa* in hydroponics culture. *Middle East Journal of Scientific Research*, 10 (6): 718-722. [https://www.idosi.org/mejsr/mejsr10\(6\)11/7.pdf](https://www.idosi.org/mejsr/mejsr10(6)11/7.pdf)

Souret F. F. & Weathers P. J. 2000. The Growth of Saffron (*Crocus sativus* L.) in Aeroponics and Hydroponics. *Journal of Herbs, Spices & Medicinal Plants*, 7 (3): 25-35. DOI: https://doi.org/10.1300/J044v07n03_04

Additional information (optional) (e.g., special requirements, laboratory equipment, prior knowledge)

Knowledge of plant anatomy and morphology, as well as plant physiology, will help to learn the material more quickly.

Laboratory work requires concentration and precision.