Study ProgrammeMSc in Biology

Degree level: Second cycle (Master)

Course Title: PLANT CELL REDOX BIOLOGY

Professor: Milan Borišev, Milan Župunski

Required/Elective Course: elective

Number of ECTS: 6

Prerequisites:

Course Objective: The main objective of this course is to get students familiar with plant cell redox biology, maintenance of homeostasis through complementary processes of oxidation and reduction. Redox homeostasis of lant cell plays a crucial role in response to environmental stimulus. The resulting changes may be registered, integrated and converted through diverse signaling pathways whose iniciators, intermediaries and products can be analysed and thus point to specific pathways of inter/intra cellular communications.

Course Outcome: Upon completion of this course students will be able to understand the major functions and drivers in signaling pathways which affects the plant cell redox homeostasis. Lectures will help students to understand the importance of redox environment as a central regulator in a plant cell exposed to stress factor. Involment in practical work through identification of selected stress markers, realization of different assays, data processing and presentation of obtained data will provide knowledge and skills which would be very usefull in future research in the area of plant physiology.

Course Content:

Theoretical part: 1.Redox homeostasis (RH) – the major modulator of cell response in stressful conditions. 2.Reactive oxygen species (ROS). 3.Metabolism redox changes. 4.Oxidative stress and role of peroxisomes in maintanance of ROS. 5.Mitochondrial redox environment. 6.Chloroplast redox environment. 7.Nitric oxide (NO) and oxidative stres. 8.Interaction of NO with proteins, lipids and nucleic acids. 9.Interactions of ROS/NO with phytohormones. 10.Ascorbate/glutathione cycle. 11.Glutathione metabolism in plants exposed to abiotic stres. 12.ROS/NO as signaling molecules. 13.Vacuole and redox homestasis. 14. Nonenzymatic antioxidants and RH. 15.Discussion, dissemination of previous lessons.

Practical part: 1.Extraction of metabolites. 2.Isolation of chloroplasts and mitochondria. 3.Reduced glutathione (GSH) determination. 4.Oxidized glutathione determination. 5.Ascorbate (ASC) determination. 6.Mono-dehydroascorbate determination. 7.Vacuole pH measurements. 8.V-ATPases activity. 9.ASC/GSH enzymes activity(1). 10. ASC/GSH enzymes activity(2). 11. ASC/GSH enzymes activity(3). 12.Protein determination. 13.Data processing. 14.Presentation of obtained results. 15. Discussion.

Reading List:

Stikić, R., Jovanović, Z. (2014). Fiziologija stresa biljaka, odabrana poglavlja. Univerzitet u Beogradu – Poljoprivredni fakultet, Beograd. str. 216. ISBN 978-3-319-10079-1

Gupta, D.K., Palma, J.M., Corpas, F.J. eds. (2016). Redox State as a Central Regulator of Plant-Cell Stress Responses. Springer International Publishing, Switzerland. str. 386. ISBN 978-3-319-44081-1

Gupta, D.K., Palma, J.M., Corpas, F.J. eds. (2015). Reactive Oxygen Species and Oxidative Damage in Plants Under Stress. Springer International Publishing, Switzerland. str. 370. ISBN 978-3-319-20421-5

Gupta, K.J., Igamberdiev, A.U., eds. (2015). Reactive Oxygen and Nitrogen Species Signaling and Communication in Plants. Springer International Publishing, Switzerland. str. 316. ISBN 978-3-319-10079-1

Hayat, S., Mori, M., Pichtel, J., Ahmad, A. eds. (2010). Nitric Oxide in Plant Physiology. WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany. str.210. ISBN: 978-3-527-32519-1

Research papers.