

**Course name:**  
**Physiology of stress in plants**

ECTS	4
Course status	<i>facultative</i>
Course final assessment /evaluation of outcomes	<i>Exam</i>
Prerequisite	knowledge of the basics of plant physiology, plant biochemistry

**Main field of study:**

Agriculture and Horticulture, Biology and Biotechnology (Erasmus+)

Educational profile	General academic
Code of studies and education level	bachelor/engineer (SI) or master of science (SM)
Semester of studies	Winter or summer
Language of instruction	English

**Course offered by:**

Name of faculty offering the course	Faculty of Biotechnology and Horticulture
Name of department offering the course	Department of Botany, Physiology and Plant Protection
Course coordinator	Anna Kolton PhD

**Learning outcomes:**

Symbol of outcome	Description of the learning outcome	Reference to main field of study outcomes	Area symbol*
<b>KNOWLEDGE – student knows and understands</b>			
PSP_W1	concepts of stress factor, oxidative stress, ROS and plant responses	EPB2_W02 EPB2_W04	P,R
PSP_W2	changes in plant metabolism under the influence of stress factors	EPB2_W03 EPB2_W04	P,R
PSP_W3	mechanisms of reactions involving ROS	EPB2_W04	P,R
<b>SKILLS – student is able to</b>			
PSP_U1	perform laboratory experiments using modern techniques and methods	EPB2_U01 EPB2_U03	P,R
PSP_U2	describe and interpret the results of the experiment	EPB2_U01	P,R
PSP_U3	express themselves verbally and in writing	EPB2_U02 EPB2_U03	P,R
<b>SOCIAL COMPETENCIES – student is ready to:</b>			
PSP_K1	formulation of objective assessments regarding stressors and their effects on plants and reaction mechanisms	EPB2_K01 EPB2_K04	P,R
PSP_K2	work in a small team	EPB2_K02	P,R

**Teaching contents**

Lectures	20 hours
Topics	definition of stress factor, general responses to stress, introduction to the topic,

	<p>water stress  temperature stress  radiation stress  stress of excess and deficiencies of minerals  stress of excess heavy metals  mechanical stress  salinity stress  oxidative stress  formation and role of ROS  plant antioxidant system - enzymes and low molecular weight antioxidants</p>
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Accomplished learning outcomes	PSP_W1 PSP_W2 PSP_W3 PSP_K1
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Means of verification, rules and criteria of assessment	The written exam with open questions and attendance and activity during lectures are assessed. The final grade is the weighted average calculated from the grades obtained from the classes and the lectures.
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Classes:	25 hours
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Topics	<p>effect of abiotic stress on the biological membranes permeability  determination of isocoumarin content in carrot roots  proline determination  determination of phenols by the Folin reagent method - under mechanical stress  determination of chlorophyll a fluorescence in leaves under stress  plant respiration under stress  determination of anthocyanins under the influence of stress  effect of hypoxia stress on plants  determination of the ability to neutralize DPPH free radical.  determination of ascorbic acid content  determination of peroxidase activity  determination of catalase activity</p>
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Accomplished learning outcomes	PSP_U1 PSP_U2 PSP_U3 PSP_K1 PSP_K2
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Means of verification, rules and criteria of assessment	Students prepare reports on conducted exercises and a presentation based on the literature, classes attendance and activity is also assessed. The final grade is the weighted average calculated from the grades obtained from the classes and the lectures.
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### References:

Basic	<p>Khan M.I.R., Khan N.A. (eds) <i>Reactive Oxygen Species and Antioxidant Systems in Plants: Role and Regulation under Abiotic Stress</i>, 2017, Springer</p> <p>Ahmad P., Prasad MNV. (eds) <i>Abiotic stress responses in plant: metabolism, productivity and sustainability</i>, 2012, Springer</p> <p>Shabala S. (ed) <i>Plant stress physiology</i>, 2017, Cabi</p>
Supplementary	<p>Czarnocka W., Karpiński S. <i>Friend or foe? Reactive oxygen species production, scavenging and signaling in plant response to environmental stresses</i>, 2018 <i>Free Radical Biology and Medicine</i> 122 (2018) 4–20</p> <p>Mittler R. <i>ROS Are Good</i>, <i>Trends in Plant Science</i>, January 2017, Vol. 22, No. 1</p> <p>Smirnoff N. (ed.) <i>Antioxidants and Reactive Oxygen Species in Plants 2005</i>, Blackwell Publishing</p>

**Structure of learning outcomes**

Area of academic study: R – Agricultural, forestry and veterinary sciences	2	ECTS **
Area of academic study: P – biological sciences	2	ECTS**

**Structure of student activity**

Contact hours	50	hrs.	2	ECTS**
Including:	lectures	20	hrs.	
	classes and seminars	25	hrs.	
	consultations	3	hrs.	
	participation in research	0	hrs.	
	obligatory traineeships	0	hrs.	
	participation in examination	2	hrs.	
e-learning	0	hrs.	0	ECTS**
student own work	50	hrs.	2	ECTS**

\*Areas of academic study in the fields of: H- humanities; S - social studies; P – biological sciences; T – technological sciences; M- medical, sport and health sciences; R – Agricultural, forestry and veterinary sciences; A – the arts

\*\* stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25 - 30 hours of classes