



Univerza v Mariboru



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Fakulteta za naravoslovje in
matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Izbrana poglavja iz fiziološke ekologije rastlin
Course title:	Selected Chapters of Physiological Plant Ecology

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Biologija in ekologija z naravovarstvom, 2. stopnja	/	1/2	Poletni/ Zimski
Biology and Ecology with Nature Conservation, 2 nd Level	/	1/2	Summer/ Winter

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
15	15		15		135	6

Nosilec predmeta / Lecturer:

Jeziki / Languages:	Predavanja / Lectures:	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

Vsebina: **Content (Syllabus outline):**

V predmetu je podrobneje izpostavljen vpliv naravnih in antropogenih stresnih dejavnikov na fiziološke procese v rastlini.

Pomanjkanje in prekomerna svetloba. UV žarčenje. Pomanjkanja in prebitek vode. Ekstremne temperature. Pomanjkanje in problem prekomernih koncentracij soli. Mehanske poškodbe. Onesnaževanje z atmosferskimi oksidanti in ksenobiotiki. Vpliv radioaktivnosti v okolju na rastline.

Funkcijske motnje celičnega metabolizma:

- Toksični efekti kisika na rastline
Tvorba prostih kisikovih radikalov, reakcije v celici
- Motnje v metabolizmu ogljika
Vplivi okoljskih dejavnikov na fotosintezo, fotorespiracijo, dihanje ter pretok in porabo ogljikovih hidratov v rastlini
- Motnje v mineralni prehrani
Vpliv okolja na presnovo mineralov; motnje v preskrbi; vpliv na simbiozo z rizofernimi mikroorganizmi; podrobneje so izpostavljene motnje v privzemu, asimilaciji ter transportu žvepla, amonija in nitrata ter vgradnja v ogljikove spojine

Odzivi rastlin na stresne dejavnike

Obrambni in reparaturni mehanizmi, detoksifikacija prostih kisikovih radikalov z antioksidanti in encimi; aktualna dognanja o vlogi glutationa, askorbinske kisline, tokoferola in karotinoidov v obrambi pred oksidativnim stresom

Bioindikacija onesnaževanja okolja

Reakcijski in akumulacijski indikatorji, kazalci in testni organizmi, metode biomonitoringa

The lecture focuses on the impact of natural and anthropogenic stress factors on physiological processes in plants.

The following chapters are discussed:

Deficiency and excess of light. UV radiation. Deficiency and excess of water. Extreme temperatures. Deficiency and high concentrations of minerals. Mechanical effects. Pollution with atmospheric oxidants and xenobiotics. The impacts of environmental radioactivity on plants.

Functional disturbances of cell metabolism

- Toxic effects of oxygen on plants
Formation of reactive oxygen species and reactions in the cell
- Disturbances in carbon metabolism
The influence of external factors on photosynthesis, photorespiration, respiration, the translocation and utilization of photosynthates in plants
- Disturbances in mineral nutrition
Habitat-related aspects of mineral metabolism; the disturbances in supply; the impact on symbiosis with the microorganisms in rhizosphere; the chapter focuses on the disturbances in the uptake, assimilation and transport of sulphur, ammonium ions and nitrate and their incorporation into carbon compounds

The response of plants to stress factors

Defense and reparatory mechanisms, detoxification of reactive oxygen species with antioxidants and enzymes; recent advances in the role of glutathione, ascorbate, tocopherol and carotenoids in defense against oxidative stress

Bioindication of pollution impacts

Response and accumulation indicators, indicators and test organisms, biomonitoring methods

Temeljni literatura in viri / Readings:

- Brunold, Ch., A. Rügsegger, R. Brändle, 1996: Stress bei Pflanzen. Verlag Paul Haupt, Stuttgart.
- Grill, D., M. Tausz, L. J. De Kok, 2001: Significance of glutathione to plant adaptation to the environment. Kluwer academic publishers, Dordrecht.
- Inzé, D., M. Van Montagu, 2002: Oxidative stress in plants. Taylor & Francis, Inc., New York.
- Larcher, W., 2003: Physiological Plant Ecology. Springer, Heidelberg.
- Taiz, L., E. Zeiger, 2010: Plant Physiology. Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts.
- Varma, A., R. P. Beckett, I. Kranner, 2002: Protocols in Lichenology: Culturing, Biochemistry, Ecophysiology, and Use in Biomonitoring. Springer, Heidelberg.

Cilji in kompetence:

- Posebna pozornost je posvečena aktualnim dognanjem o odzivu rastlin na izbrane okoljske dejavnike
- Ponazoritev toksičnih učinkov kisika
- Predstavitev funkcijskih motenj celičnega metabolizma
- Ponazoritev simptomov poškodb na nivoju celic in celega organizma
- Vpogled v obrambne in reparativne mehanizme
- Seznanjanje z rastlinsko bioindikacijo onesnaževanja okolja
- Predstavitev analitičnih metod v ekofiziologiji in stresni fiziologiji rastlin

Objectives and competences:

- Special attention is paid to the recent advances in the response of plants to stress factors
- Illustration of toxic effects of oxygen
- Introduction to functional disturbance in cell metabolism
- Illustration of injury patterns and symptoms on cell and whole plant level
- An insight into the defense and reparatory mechanisms
- Introduction of plant bioindication of pollution
- Introduction to the analytical measurements in ecophysiology and stress physiology of plants

Predvideni študijski rezultati:

Znanje in razumevanje:

- Znanje in razumevanje odziva rastlin na izbrane okoljske dejavnike
- Razumevanje toksičnih učinkov kisika
- Poznavanje stresnih faktorjev, prepoznavanje simptomov poškodb in osnovnih obrambnih in reparativnih mehanizmov
- Usvojitev metod bioindikacije onesnaževanja okolja z rastlinami
- Pridobitev znanja o principih in metodah v ekofiziologiji in stresni fiziologiji rastlin ter uporaba le tega v praksi

Intended learning outcomes:

Knowledge and understanding:

- Knowledge and understanding of the response of plants to stress factors
- Understanding of toxic effects of oxygen
- Knowledge of stress factors, identification of injury patterns and symptoms, understanding the basic defense and reparatory mechanisms
- Qualification of bioindication of pollution impacts with plants
- Achieving knowledge about the principles and methods in ecophysiology and stress physiology for good practice

Metode poučevanja in učenja:

- Predavanja
- Fitofiziološke raziskave z uporabo biokemijskih in fizioloških metod laboratoriju in na terenu s poudarkom na morfologiji in funkciji rastlin pod vplivom okolja
- Samostojno delo

Learning and teaching methods:

- Lectures
- Phytophysiological research using biochemical and physiological methods in laboratory and in field with special attention to environmental impacts to plant morphology and functions
- Independent work

Delež (v %) /

Weight (in %)

Načini ocenjevanja:**Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt)	Delež (v %) / Weight (in %)	Type (examination, oral, coursework, project):
<ul style="list-style-type: none"> • Pisni izpit • Seminarska naloga • Ocena izdelave in predavitve poročil s laboratorijskih vaj 	50 %	<ul style="list-style-type: none"> • Written examination
	30 %	<ul style="list-style-type: none"> • Seminar work
	20 %	<ul style="list-style-type: none"> • Examination of preparation and presentation of laboratory exercises reports

Reference nosilca / Lecturer's references:

- URBANEK KRAJNC, Andreja, IVANUŠ, Anja, KRISTL, Janja, ŠUŠEK, Andrej. Seaweed extract elicits the metabolic responses in leaves and enhances growth of pelargonium cuttings. *European journal of horticultural science*, 2012, letn. 77, št. 4, str. 170-181. [COBISS.SI-ID 3355436]
- URBANEK KRAJNC, Andreja, KRISTL, Janja, IVANČIČ, Anton. Application of salicylic acid induces antioxidant defense responses in the phloem of *Picea abies* and inhibits colonization by *Ips typographus*. *For. Ecol. Manage.*. [Print ed.], 2011, letn. 261, št. 3, str. 416-426, doi: 10.1016/j.foreco.2010.10.027. [COBISS.SI-ID 3066156]
- IVANČIČ, Anton, ROUPSARD, Olivier, QUERO, Garcia José, ŠIŠKO, Metka, URBANEK KRAJNC, Andreja, LEBOT, Vincent. Topology of thermogenic tissues of *Alocasia macrorrhizos* (Araceae) inflorescences. *Botany*. [Tiskana izd.], 2009, letn. 87, št. 12, str. 1232-1241. [COBISS.SI-ID 2900524]
- URBANEK KRAJNC, Andreja. A Temporal analysis of antioxidative defense responses in the phloem of *Picea abies* after attack by *Ips typographus*. *Tree physiol.*, 2009, vol. 29, issue 8, str. 1059-1068. <http://treephys.oxfordjournals.org/content/29/8/1059.full.pdf+html>, doi: 10.1093/treephys/tpp041. [COBISS.SI-ID 2877740]
- CAMLOH, Marjana, AMBROŽIČ-DOLINŠEK, Jana. In vitro regeneration systems of *Platycerium*. V: FERNÁNDEZ, Helena (ur.), KUMAR, Ashwani (ur.), REVILLA, María Ángeles (ur.). *Working with ferns : issues and applications*. New York [etc.]: Springer, cop. 2011, str. 111-125.