

1. Raziskovalna organizacija (*Research organisation*):

Univerza v Ljubljani, *Biotehniška fakulteta*

2. Ime in priimek mentorja (*Name and surname of a mentor*):

Alenka Gaberščik

3. Področje znanosti iz šifranta ARRS (*Primary research field*):

1.03 Biologija

4. Kontaktni e-naslov mentorja (*Contact of a mentor*):

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5. Kratak opis programa usposabljanja (*Short description of the program*):

Izhodišče: Silicij (Si) ne sodi med esencialne elemente za rastline, vendar ima pri nekaterih skupinah (trave, ostričevke), zelo pomembno vlogo. Nadomešča ogljik kot strukturni element ter povečuje trdnost rastlin in preprečuje povešanje listov. Raziskave so pokazale tudi ugoden vpliv Si na rastline ob povečani slanosti, suši, visokih in nizkih temperaturah, UV sevanju in ob prisotnosti toksičnih kovin na rastišču ter povečano odpornost rastlin na patogene in učinkovito zaščito proti rastlinojedom. Okremenitve listne površine s Si vplivajo tudi na vodno in energetsko bilanco listov in njihove optične lastnosti. Potencial za kopičenje Si je vrstno specifičen in odvisen od abiotičnih dejavnikov, kot so dostopnost vode na rastišču in glede na nekatere rezultate tudi UV sevanje. Rastline privzemajo raztopljen Si skozi korenine in ga odlagajo v obliki fitolitov (Si telesca) v povrhnjici, prevajalnem sistemu in endodermu korenin ter medceličnih in znotrajceličnih prostorih. Proces nalaganja Si struktur v celicah nadzorujejo geni, ki nadzorujejo odlaganje lignina. Količina odloženega Si je lahko od 0,1 do 10% rastlinske suhe mase. Si je tudi zelo pomemben sestavni element različnih žit, ki lahko vsebujejo tudi več kot 1% Si v rastlinskem tkivu. Zaradi prepoznanih pozitivnih vlog, lahko Si pomembno doprinese k blaženju negativnih učinkov globalnega spreminjanja okolja na rast in razvoj pomembnih poljščin.

Cilji in hipoteze: Namen našega dela je ugotoviti, kako količina vode na rastišču in UV sevanje vplivajo na privzem Si pri izbranih žitih in drugih travah ter raziskati nekatere fizikalne, fiziološke in biokemijske odzive rastlin glede na vsebnost Si. Predvidevamo, da je v sušnih razmerah zaradi manjšega transpiracijskega toka privzem Si nižji, ter da Si lahko delno nadomesti flavonoide, ki ščitijo rastline pred UV sevanjem.

Metode dela: Modelne rastline bodo izbrana žita in druge trave. Raziskave bodo potekale pod delno nadzorovanimi razmerami (žito), kjer bomo rastline izpostavili različnim ravnem UV-sevanja in dostopnosti vode. Raziskave bodo potekale tudi v naravnem okolju, kjer bomo preučevali trave rastoče v habitatih na hidrološkem gradientu. Koncentracije Si bomo določali z uporabo XRF. Za merjenje fizikalnih, fizioloških in biokemijskih lastnosti rastlin, bomo uporabili ustrezne aparature in preverjene, pogosto citirane metode.

Predvideni rezultati: V okviru raziskave bomo ugotovili, kako količina vode na rastišču in UV sevanje in njuna kombinacija vpliva na privzem Si, dodatno osvetliti vlogo silicija v življenju rastlin ter njegov pomen pri odpornosti na stresne razmere.

Vpetost v projekte in programe: Raziskave se neposredno navezujejo na raziskovalni program Biologija rastlin P1-0212.

Theoretical positions: Silicon (Si) is deemed as a non-essential element for plants, but it exerts

many important effects in some plant groups (grasses, sedges) by mitigating stress and preventing abnormalities in plant development. Si can substitute carbon as a structural element, enhancing plant strength and preventing lodging and shading of leaves. It mitigates stress condition i.e. salinity, drought, high and low temperatures, as well as negative effects of UV radiation by promoting the increased production of antioxidants and metal toxicity by co-precipitating metal ions. The presence of Si also increases plant resistance to pathogens and herbivores. Si incrustations of leaves also impact their water and energy balance and their optical properties. The potential of Si accumulation in plant tissue is species-specific and depends on abiotic factors such as the availability of water and UV radiation. Plants take up dissolved Si through the roots and deposit it as phytoliths (silica bodies) in epidermis, vascular system and root endodermis in inter and intracellular spaces. As Si reaches root xylem, it shifts to the above-ground parts of plants *via* transpiration flow. The process of Si deposition in cells is controlled by the genes that control the deposition of lignin. The amount of Si accumulated in plant tissue range from 0.1 to 10% of plant dry mass. The majority of cereals contain more than 1% of Si in plant tissue. Due to multiple positive roles, Si can mitigate negative effects of global changes of environment on the growth and development of important crop species.

Aims and hypotheses: The purpose of present research is to examine the effect of water availability and UV radiation on uptake of Si in selected cereals and other grasses and to explore some physical, physiological and biochemical responses of plants in relation to Si content. We hypothesise that drought, due to reduction of transpiration, negatively affects the deposition of Si, and that Si can to some extent substitute flavonoids, which protect plants against UV radiation.

Research methods: Model plants in the proposed research will be selected cereals and other grasses. Research will be carried out under partly controlled conditions (cereals), where plants will be exposed to different levels of UV radiation and water availability. Research will also be carried out in a natural environment, where we will study grasses growing in different the habitats with different water regime. Si concentration will be determined using XRF. For measuring physical, physiological and biochemical properties of plants, we will use frequently cited methods and different instruments for ecophysiological measurements.

Expected results: The study will evaluate the effects of water regime, UV radiation and their combination on uptake of Si, and further highlight the role of Si in the plant life and its contribution to plant resistance to stress conditions.

Embedment of the contents in existing programmes and projects: The research is related to the research programme Plant Biology P1-0212.