Charakteristika predkladaného výstupu tvorivej činnosti / Characteristics of the submitted research/ artistic/other output

Tlačivo VTC slúži na predkladanie výstupov tvorivej činnosti podľa metodiky hodnotenia tvorivých činností (časť V. Metodiky na vyhodnocovanie štandardov) / The form is used to submit the research/artistic/other outputs according to the evaluation methodology of research/artistic/other activities (part V. The Methodology for Standards Evaluation).

ID konania/ID of the procedure: [1] Kód VTC/Code of the research/artistic/other output (RAOO):[1]	

OCA1. Priezvisko hodnotenej osoby / Surname awarded to the assessed person [2]		Gerši (rod. Gregorová)
OCA2. Meno hodnotenej osoby / Name awarded to the assessed person [2]		Zuzana
OCA3. Tituly hodnotenej osoby / Degrees awarded to the assessed person [2]		RNDr., PhD.
OCA4. Hyperlink na záznam osoby v Registri zamestnancov vysokých škôl / Hyperlink to the entry of the person in the Register of university staff [3]		https://www.portalvs.sk/regzam/detail/29480
OCA5. Oblasť posudzovania / Area of assessment [4]		3. Biológia/ 3. Biology
OCA6. Kategória výstupu tvorivej činnosti / Category of the research/ artistic/other output *Výber zo 6 možností (pozri Vysvetlivky k položke OCA6) / Choice from 6 options (see Explanations for OCA6).*		*Vedecký výstup/ scientific output*
OCA7. Rok vydania výstupu tvorivej činnosti / Year of publication of the research/artistic/other output		2022
OCA8. ID záznamu v CREPČ alebo CREUČ *(ak je)* / ID of the record in the Central Registry of Publication Activity (CRPA) or the Central Registry of Artistic Activity (CRAA) [5]		1002858
OCA9. Hyperlink na záznam v CREPČ alebo CREUČ / Hyperlink to the record in CRPA or CRAA [6]		https://app.crepc.sk/?fn=detailBiblioForm&sid=D4E1A2C7A0DFD9B77EAA2CC5BD7A
Charakteristika výstupu, ktorý nie je registrovaný v CREPČ alebo CREUČ / Characteristics of the output that is not registered in CRPA or CRAA	OCA10. Hyperlink na záznam v inom verejne prístupnom registri, katalógu výstupov tvorivých činností / Hyperlink to the record in another publicly accessible register, catalogue of research/ artistic/other outputs [7]	
	OCA11. Charakteristika výstupu vo formáte bibliografického záznamu CREPČ alebo CREUČ, ak výstup nie je vo verejne prístupnom registri alebo katalógu výstupov / Characteristics of the output in the format of the CRPA or the CRAA bibliographic record, if the output is not available in a publicly accessible register or catalogue of outputs	Fischerová L, Gemperlová L, Cvikrová M, Matušíková I, Moravčíková J, **Gerši Z**, Malbeck J, Kuderna J, Pavlíčková J, Motyka V, Eliášova K, Vondráková Z (2022) The humidity level matters during the desiccation of Norway spruce somatic embryos. *Frontiers in Plant Science*. 13: e68982. DOI 10.3389/fpls.2022.968982.

	OCA12. Typ výstupu (ak nie je výstup registrovaný v CREPČ alebo CREUČ) / Type of the output (if the output is not registered in CRPA or CRAA) *Výber zo 67 možností (pozri Vysvetlivky k položke OCA12) / Choice from 67 options (see Explanations for OCA12).*	*Článok/article*
	OCA13. Hyperlink na stránku, na ktorej je výstup sprístupnený (úplný text, iná dokumentácia a podobne) / Hyperlink to the webpage where the output is available (full text, other documentation, etc.)	https://www.frontiersin.org/articles/10.3389/fpls.2022.968982/full
	OCA14. Charakteristika autorského vkladu / Characteristics of the author's contribution	[8,333 %] Spoluriešiteľka bilaterálneho projektu na základe výskumnej spolupráce s AV ČR. Spoluriešiteľka experimentov - extrakcia proteínov, detekcia chitináz a glukanáz pomocou SDS-PAGE, osvojenie metodík - izolácia polyamínov a degradačných enzýmov. Vyhodnotenie experimentov a príprava grafov pre prípravu rukopisu. [8.333 %] Co-investigator of a bilateral project based on research cooperation with the Academy of Sciences of the Czech Republic. Co-author of the experimental methodology, protein extraction, detection of chitinases and glucanases using SDS-PAGE, acquisition of methodologies - isolation of polyamines and degradation enzymes. Evaluation of experiments and preparation of graphs for the manuscript preparation.
	OCA15. Anotácia výstupu s kontextovými informáciami týkajúcimi sa opisu tvorivého procesu a obsahu tvorivej činnosti a pod. / Annotation of the output with contextual information concerning the description of creative process and the content of the research/artistic/other activity, etc. [8]*Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in SlovakRozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	
OCA16. Anotácia výstupu v anglickom jazyku / Annotation of the output in English [9]*Rozsah do 200 slov / Range up to 200 words*		In Norway spruce, as in many other conifers, the germination capacity of somatic embryos is strongly influenced by the desiccation phase inserted after maturation. The intensity of drying during desiccation eminently affected the formation of emblings (i.e., seedlings developed from somatic embryos). Compared to non-desiccated embryos, the germination capacity of embryos desiccated at 100% relative humidity was about three times higher, but the reduction of relative humidity to 95 and 90% had a negative effect on the subsequent embryo development. The water loss observed in these embryos did not lead to an increase in lipid peroxidation, as shown by malondialdehyde levels. Another metabolic pathway in plants that mediates a response to abiotic stresses is directed toward the biosynthesis of polyamines (PAs). The activities of PA biosynthetic enzymes increased steadily in embryos during desiccation at 100% relative humidity, whereas they decreased at lower humidity. The total content of free PAs in the embryos gradually decreased throughout desiccation. The increase in free putrescine (Put) and perchloric acid-insoluble Put conjugates was observed in embryos desiccated at lower humidity. These changes were accompanied to some extent by the transcription of the genes for the PA biosynthesis enzymes. Desiccation at 100% relative humidity increased the activity of the cell wall-modifying enzymes β-1,3-glucanases and chitinases; the activities of these enzymes were also significantly suppressed at reduced humidity. The same pattern was observed in the transcription of some β-1,3-glucanase and chitinase genes.
OCA17. Zoznam najviac 5 najvýznamnejších ohlasov na výstup / List of maximum 5 most significant citations corresponding to the output *Rozsah do 200 slov / Range up to 200 words*		Publikácia zatiaľ nemá ohlasy.

OCA18. Charakteristika dopadu výstupu na spoločensko-hospodársku prax / Characteristics of the output's impact on socio-economic practice *Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak* *Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	Dehydratácia vyvolaná vysychaním je spojená s produkciou reaktívnych foriem kyslíka (ROS), ktoré sú potenciálne škodlivé pre všetky bunkové zložky a negatívne ovplyvňujú metabolické procesy v bunke. Zaujímalo nás skúmanie možných indikátorov osmotického stresu pri vysychaní embryí pri zníženej vlhkosti, ako je rýchlosť membránovej peroxidácie a akumulácia kyseliny abscisovej (ABA), ale najmä metabolizmus PA a aktivity β-1,3-glukanáz a chitináz modifikujúcich bunkovú stenu. Tiež nás zaujímalo, akej úrovni je regulovaná predpokladaná stresová reakcia, a preto sme sledovali expresiu relevantných génov. Vystavenie zrelých somatických embryí zníženým hladinám vlhkosti viedlo k zmenám v homeostáze PA vyvolaným stresom, ako aj obsahu ABA a jej metabolitov. Vysušenie pri nízkej vlhkosti tiež výrazne potlačilo aktivity enzýmov β-1,3-glukanáz a chitináz modifikujúcich bunkovú stenu, ako aj expresiu génov β-1,3-glukanázy a chitinázy triedy IV. Väčšina sledovaných enzýmových aktivít bola dočasne utlmená nízkou relatívnou vlhkosťou, ale po odznení podmienok nedostatku vody sa obnovila. Zdá sa, že vysychanie pri nižšej relatívnej vlhkosti bráni procesom vedúcim k fyziologickej zrelosti a následnej schopnosti vývinu embrya. Získané znalosti vedú k lepšiemu pochopeniu fyziologických a molekulárnych procesov v embryách v podmienkach dehydratácie a môžu predstavovať odrazový mostík pre hlbšie analýzy. Dehydration induced by desiccation is associated with the production of reactive oxygen species (ROS), which are potentially harmful to all cellular components and negatively affect cellular metabolic processes. We were interested in investigating possible indicators of osmotic stress during desiccation of embryos at reduced humidity, such as membrane peroxidation rate and accumulation of abscisic acid (ABA), but especially metabolism of PAs and activities of cell wall-modifying β-1,3-glucanases and chitinases. We were also interested in uncovering the level at which the presumed stress response is regulated and therefore we monitored the expression of relevant genes. Exposure of matured somatic embryos to decreased humidity levels resulted in stress-induced changes in PA homeostasis as well as the content of ABA and its metabolites. Low-humidity desiccation also markedly suppressed the activities of cell wall-modifying enzymes β-1,3-glucanases and chitinases, as well as the expression of β-1,3-glucanase and class IV chitinase genes. Most of the monitored enzyme activities were temporarily attenuated by low relative humidity, but were restored after the water deficit conditions passed away. Desiccation at lower relative humidity appears to impede the processes leading to physiological maturity and subsequent ability of the embryo development. The acquired knowledge leads to a better understanding of the physiological and molecular processes in embryos under dehydration conditions and can represent a springboard for deeper analyses.
OCA19. Charakteristika dopadu výstupu a súvisiacich aktivít na vzdelávací proces / Characteristics of the output and related activities' impact on the educational process *Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak* *Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	Výstup je orientovaný na molekulárnu biológiu rastlín a je viazaný na výučbu biologických predmetov v rámci študijného programu Aplikovaná biológia. Do vzdelávacieho procesu budú z tohto výstupu implementované použité metodické postupy, poznatky ako aj laboratórne skúsenosti s cieľom podporiť výučbu predmetov s biologickým a molekulárno-biotechnologickým obsahom. The output is oriented towards the molecular biology of plants and is linked to the teaching of biological subjects within the study program Applied Biology. The methodological procedures, knowledge and laboratory experience will be implemented from this output into the educational process with the aim of supporting the teaching of subjects with biological and molecular-biotechnological content.

Charakteristika predkladaného výstupu tvorivej činnosti / Characteristics of the submitted research/ artistic/other output

Tlačivo VTC slúži na predkladanie výstupov tvorivej činnosti podľa metodiky hodnotenia tvorivých činností (časť V. Metodiky na vyhodnocovanie štandardov) / The form is used to submit the research/artistic/other outputs according to the evaluation methodology of research/artistic/other activities (part V. The Methodology for Standards Evaluation).

ID konania/ID of the procedure: [1] Kód VTC/Code of the research/artistic/other output (RAOO):[1]	

OCA1. Priezvisko hodnotenej osoby / Surname awarded to the assessed person [2]		Gerši (rod. Gregorová)
OCA2. Meno hodnotenej osoby / Name awarded to the assessed person [2]		Zuzana
OCA3. Tituly hodnotenej osoby / Degrees awarded to the assessed person [2]		RNDr., PhD.
OCA4. Hyperlink na záznam osoby v Registri zamestnancov vysokých škôl / Hyperlink to the entry of the person in the Register of university staff [3]		https://www.portalvs.sk/regzam/detail/29480
OCA5. Oblasť posudzovania / Area of assessment [4]		3. Biológia/ 3. Biology
OCA6. Kategória výstupu tvorivej činnosti / Category of the research/ artistic/other output *Výber zo 6 možností (pozri Vysvetlivky k položke OCA6) / Choice from 6 options (see Explanations for OCA6).*		*Vedecký výstup/ scientific output*
OCA7. Rok vydania výstupu tvorivej činnosti / Year of publication of the research/artistic/other output		2021
OCA8. ID záznamu v CREPČ alebo CREUČ *(ak je)* / ID of the record in the Central Registry of Publication Activity (CRPA) or the Central Registry of Artistic Activity (CRAA) [5]		240657
OCA9. Hyperlink na záznam v CREPČ alebo CREUČ / Hyperlink to the record in CRPA or CRAA [6]		https://app.crepc.sk/?fn=detailBiblioForm&sid=376FCAEA43ECD92AE16AE3DC06
Charakteristika výstupu, ktorý nie je registrovaný v CREPČ alebo CREUČ / Characteristics of the output that is not registered in CRPA or CRAA	OCA10. Hyperlink na záznam v inom verejne prístupnom registri, katalógu výstupov tvorivých činností / Hyperlink to the record in another publicly accessible register, catalogue of research/ artistic/other outputs [7]	
	OCA11. Charakteristika výstupu vo formáte bibliografického záznamu CREPČ alebo CREUČ, ak výstup nie je vo verejne prístupnom registri alebo katalógu výstupov / Characteristics of the output in the format of the CRPA or the CRAA bibliographic record, if the output is not available in a publicly accessible register or catalogue of outputs	Zielinski K, Dubas E, **Gerši Z**, Krzewska M, Janas A, Nowicka A, Matušíková I, Zur I, Sakuda S, Moravčíková J (2021) beta-1,3-Glucanases and chitinases participate in the stress-related defence mechanisms that are possibly connected with modulation of arabinogalactan proteins (AGP) required for the androgenesis initiation in rye (*Secale cereale* L.). *Plant Science*. 302: e10700. DOI 10.1016/j.plantsci.2020.110700.

	OCA12. Typ výstupu (ak nie je výstup registrovaný v CREPČ alebo CREUČ) / Type of the output (if the output is not registered in CRPA or CRAA) *Výber zo 67 možností (pozri Vysvetlivky k položke OCA12) / Choice from 67 options (see Explanations for OCA12).*	*Článok/article*
	OCA13. Hyperlink na stránku, na ktorej je výstup sprístupnený (úplný text, iná dokumentácia a podobne) / Hyperlink to the webpage where the output is available (full text, other documentation, etc.)	https://www.sciencedirect.com/science/article/pii/S016894522030306X
	OCA14. Charakteristika autorského vkladu / Characteristics of the author's contribution	[20 %] Spoluriešiteľka bilaterálneho projektu na základe výskumnej spolupráce s IFR-PAN v Poľsku. Spoluautorka, riešiteľka experimentov - extrakcia proteínov z rastlinného materiálu, kvantifikácia aktivity (spektrofotometricky/fluorimetricky) a SDS-PAGE detekcia obranných enzýmov (chitinázy a beta-1,3-glucanázy), RNA izolácia, reverzná transkripcia RNA do cDNA, kvantitatívna analýza expresie génov pre gény vybraných chitináz a glukanáz. Vyhodnotenie experimentov, príprava grafov a konceptu k výsledkom práce do rukopisu. [20 %] Co-investigator of a bilateral project based on research cooperation with IPP-PAS in Poland. Co-author, researcher of experiments - extraction of proteins from plant material, quantification of activity (spectrophotometrically/fluorimetrically) and SDS-PAGE detection of defense enzymes (chitinases and beta-1,3-glucanases), RNA isolation, reverse transcription of RNA into cDNA, quantitative analysis of gene expression of selected chitinase and glucanase genes. Evaluation of experiments, preparation of graphs and concept of the manuscript.
	OCA15. Anotácia výstupu s kontextovými informáciami týkajúcimi sa opisu tvorivého procesu a obsahu tvorivej činnosti a pod. / Annotation of the output with contextual information concerning the description of creative process and the content of the research/artistic/other activity, etc. [8]*Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in SlovakRozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	
OCA16. Anotácia výstupu v anglickom jazyku / Annotation of the output in English [9]*Rozsah do 200 slov / Range up to 200 words*		This work presents the biochemical, cytochemical and molecular studies on two groups of PR proteins, β-1,3-glucanases and chitinases, and the arabinogalactan proteins (AGP) during the early stages of androgenesis induction in two breeding lines of rye (Secale cereale L.) with different androgenic potential. The process of androgenesis was initiated by tillers pre-treatments with low temperature, mannitol and/or reduced glutathione and resulted in microspores reprogramming and formation of androgenic structures what was associated with high activity of β-1,3-glucanases and chitinases. Some isoforms of β-1,3-glucanases, namely several acidic isoforms of about 26 kDa; appeared to be anther specific. Chitinases were well represented but were less variable. RT-qPCR revealed that the cold-responsive chitinase genes Chit1 and Chit2 were expressed at a lower level in the microspores and whole anthers while the cold-responsive Glu2 and Glu3 were not active. The stress pre-treatments modifications promoted the AGP accumulation. An apparent dominance of some AGP epitopes (LM2, JIM4 and JIM14) was detected in the androgenesis-responsive rye line. An abundant JIM13 epitopes in the vesicles and inner cell walls of the microspores and in the cell walls of the anther cell layers appeared to be the most specific for embryogenesis.
OCA17. Zoznam najviac 5 najvýznamnejších ohlasov na výstup / List of maximum 5 most significant citations corresponding to the output *Rozsah do 200 slov / Range up to 200 words*		Record 1 of 5 Hromadova D, Soukup a, Tylova E (2021) Arabinogalactan Proteins in Plant Roots - An Update on Possible Functions. *Frontiers in Plant Science*. 12: e674010. DOI 10.3389/fpls.2021.674010. Times Cited in Web of Science Core Collection: 17 Total Times Cited: 29 Accession Number: WOS:000656126700001 Record 2 of 5 Perrot T, Pauly M, Ramirez V (2022) Emerging Roles of beta-Glucanases in Plant Development and Adaptative Responses. *Plant-Basel*. 11(9): e1119. DOI 10.3390/plants11091119. Times Cited in Web of Science Core Collection: 13

	Total Times Cited: 20 Accession WOS:000794650900001 Record 3 of 5 Hale B, Ferrie AMR, Chellamma S, Samuel JP, Phillips *GC (2022) Androgenesis-Based Doubled Haploidy: Past, Present, and Future Perspectives. Frontiers in Plant Science*. 12: e751230. DOI 10.3389/fpls.2021.751230. Times Cited in Web of Science Core Collection: 8 Total Times Cited: 9 Accession Number: WOS:000319358000008 Record 4 of 5 Bednarek PT, Orlowska R, Mankovski DR, Zimny J, Kowalczyk K, Nowak M, Zebrowski J (2022) Glutathione and copper *ions as critical factors of green plant regeneration efficiency of triticale in vitro anther culture. Frontiers in Plant Science*. 13: e926305. DOI 10.3389/fpls.2022.926305. Times Cited in Web of Science Core Collection: 3 Total Times Cited: 3 Accession Number: WOS:000841026700001 Record 5 of 5 Orlowska R (2022) Triticale doubled haploid plant regeneration factors linked by structural equation modelling. *Journal of Applied Genetics*. 63 (4): 677-690. DOI 10.1007/s13353-022-00719-7. Times Cited in Web of Science Core Collection: 2 Total Times Cited: 2 Accession Number: WOS:000844917100001
OCA18. Charakteristika dopadu výstupu na spoločensko-hospodársku prax / Characteristics of the output's impact on socio-economic practice *Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak* *Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	Raž (*Secale cereale* L.) je významnou obilninou v severných častiach strednej a východnej Európy. Produkcia DH (double haploid) v raži ukázala, že mali nízku účinnosť v porovnaní s jačmeňom a pšenicou a napriek niektorým sľubným úspechom sa raž vo všeobecnosti považuje za rekalcitrantný druh. Štúdie plodín odolných voči androgenéze vzbudzujú veľký záujem z vedeckého aj komerčného hľadiska. Akýkoľvek pokrok v našom chápaní mechanizmu indukcie androgenézy je veľmi dôležitý a mohol by rozšíriť možnosť začlenenia technológie DH do základného výskumu a programov šľachtenia plodín. V práci sme sledovali zmeny v aktivite β-1,3-glukanáz, chitináz a arabibogalaktanu v skorom štádiu indukcie androgenézy v dvoch líniach raže. Rye (*Secale cereale* L.) is an important cereal in the northern parts of Central and Eastern Europe. The production of the DHs in rye showed they had a low efficiency compared to barley and wheat, and despite some promising achievements, rye is generally considered to be a recalcitrant species. Studies on androgenesis-recalcitrant crops raise big interest both from scientific and commercial point of view. Any progress in our understanding of the mechanism of androgenesis induction is of great importance and could widen the possibility of DH technology incorporation into basic research and crop breeding programmes. In this work, we monitored changes in the activity of β-1,3-glucanases, chitinases and arabibogalactan in the early stage of androgenesis induction in two rye lines.
OCA19. Charakteristika dopadu výstupu a súvisiacich aktivít na vzdelávací proces / Characteristics of the output and related activities' impact on the educational process *Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak* *Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	Tento výstup je zameraný na biochemickú a molekulárnu štúdiu dôležitých obranných proteínov v rastlinách. Vzhľadom na použité metodické postupy je možné efektívne naviazať na výučbu biologicky orientovaných predmetov v študijnom programu Aplikovaná biológia. Do vzdelávacieho procesu môžu byť zavedené metodiky experimentov, poznatky aj skúsenosti *in vitro* postupov ako aj detekcie významných proteínov a expresie génov pre tieto obranné proteíny. Dopady spomínaných aktivít na vyučovací proces je možné implementovať do výučby predmetov s molekulárno-biologickým, proteomickým a transkriptomickým obsahom. This output is focused on the biochemical and molecular study of important defense proteins in plants. Due to the used methodological procedures, it is possible to effectively connect to the teaching of biologically oriented subjects in the study program Applied Biology. The experiment methodologies, knowledge and experience of *in vitro* procedures as well as detection of important proteins and gene expression of these defense proteins can be introduced into the educational process. The impact of the mentioned activities on the teaching process can be implemented in the teaching of subjects with molecular-biological, proteomic and transcriptomic content.

Charakteristika predkladaného výstupu tvorivej činnosti / Characteristics of the submitted research/ artistic/other output

Tlačivo VTC slúži na predkladanie výstupov tvorivej činnosti podľa metodiky hodnotenia tvorivých činností (časť V. Metodiky na vyhodnocovanie štandardov) / The form is used to submit the research/artistic/other outputs according to the evaluation methodology of research/artistic/other activities (part V. The Methodology for Standards Evaluation).

ID konania/ID of the procedure: [1] Kód VTC/Code of the research/artistic/other output (RAOO):[1]	

OCA1. Priezvisko hodnotenej osoby / Surname awarded to the assessed person [2]		Gerši (rod. Gregorová)
OCA2. Meno hodnotenej osoby / Name awarded to the assessed person [2]		Zuzana
OCA3. Tituly hodnotenej osoby / Degrees awarded to the assessed person [2]		RNDr., PhD.
OCA4. Hyperlink na záznam osoby v Registri zamestnancov vysokých škôl / Hyperlink to the entry of the person in the Register of university staff [3]		https://www.portalvs.sk/regzam/detail/29480
OCA5. Oblasť posudzovania / Area of assessment [4]		3. Biológia/ 3. Biology
OCA6. Kategória výstupu tvorivej činnosti / Category of the research/ artistic/other output *Výber zo 6 možností (pozri Vysvetlivky k položke OCA6) / Choice from 6 options (see Explanations for OCA6).*		*Vedecký výstup/ scientific output*
OCA7. Rok vydania výstupu tvorivej činnosti / Year of publication of the research/artistic/other output		2015
OCA8. ID záznamu v CREPČ alebo CREUČ *(ak je)* / ID of the record in the Central Registry of Publication Activity (CRPA) or the Central Registry of Artistic Activity (CRAA) [5]		658335
OCA9. Hyperlink na záznam v CREPČ alebo CREUČ / Hyperlink to the record in CRPA or CRAA [6]		https://app.crepc.sk/?fn=detailBiblioForm&sid=345650353AF6788BF0EDB706D7
Charakteristika výstupu, ktorý nie je registrovaný v CREPČ alebo CREUČ / Characteristics of the output that is not registered in CRPA or CRAA	OCA10. Hyperlink na záznam v inom verejne prístupnom registri, katalógu výstupov tvorivých činností / Hyperlink to the record in another publicly accessible register, catalogue of research/ artistic/other outputs [7]	
	OCA11. Charakteristika výstupu vo formáte bibliografického záznamu CREPČ alebo CREUČ, ak výstup nie je vo verejne prístupnom registri alebo katalógu výstupov / Characteristics of the output in the format of the CRPA or the CRAA bibliographic record, if the output is not available in a publicly accessible register or catalogue of outputs	**Gregorová Z,** Kováčik J, Klejdus B, Maglovski M, Kuna R, Hauptvogel P, Matušíková I (2015) Drought-induced responses of physiology, metabolites, and PR proteins in *Triticum aestivum*. *Journal of Agricultural and Food Chemistry*. 63(37): 8125-8133. DO I10.1021/acs.jafc.5b02951.

	OCA12. Typ výstupu (ak nie je výstup registrovaný v CREPČ alebo CREUČ) / Type of the output (if the output is not registered in CRPA or CRAA) *Výber zo 67 možností (pozri Vysvetlivky k položke OCA12) / Choice from 67 options (see Explanations for OCA12).*	*Článok/article*
	OCA13. Hyperlink na stránku, na ktorej je výstup sprístupnený (úplný text, iná dokumentácia a podobne) / Hyperlink to the webpage where the output is available (full text, other documentation, etc.)	https://pubs.acs.org/doi/abs/10.1021/acs.jafc.5b02951
	OCA14. Charakteristika autorského vkladu / Characteristics of the author's contribution	[16 %] Prvá autorka, komplexná experimentálna činnosť – príprava a spracovanie rastlinného materiálu, meranie fyziologických a biochemických parametrov, izolácia proteínov a nukleových kyselín, SDS-PAGE detekcia izoforiem chitináz a glukanáz pri strese suchom a stanovenie relatívnej expresie génov pre chitinázy, glukanázy a akvaporíny pomocou qRT-PCR. [16 %] First author, complex experimental activity – preparation and processing of plant material, measurement of physiological and biochemical parameters, isolation of proteins and nucleic acids, SDS-PAGE detection of chitinase and glucanase isoforms under drought stress and determination of the relative expression of chitinase, glucanase and aquaporin genes using qRT-PCR.
	OCA15. Anotácia výstupu s kontextovými informáciami týkajúcimi sa opisu tvorivého procesu a obsahu tvorivej činnosti a pod. / Annotation of the output with contextual information concerning the description of creative process and the content of the research/artistic/other activity, etc. [8]*Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in SlovakRozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	
OCA16. Anotácia výstupu v anglickom jazyku / Annotation of the output in English [9]*Rozsah do 200 slov / Range up to 200 words*		The impact of severe drought stress (13% soil moisture) on the physiological responses, metabolic profile, and pathogenesis-related (PR) proteins in wheat above- and below-ground biomass after 20 days of treatment was studied. Drought depleted growth, assimilation pigments, and majority of free amino acids in the shoots (but proline increased considerably, +160%). On the contrary, root growth parameters were elevated, and free amino acids did not decrease, indicating investment of metabolites into the growth of roots under water deficiency. Mineral nutrients were only slightly influenced. Profiling of pathogenesis-related (PR) proteins revealed that chitinases (EC 3.2.1.14) and glucanases (EC 3.2.1.39) were activated in wheat by drought. Individual isoforms and their activity were rather stimulated under drought, especially in shoots. The expression of selected genes is in agreement with enzymatic data and suggests an organ (tissue) specific- and opposing behavior of these two types of defense components in drought-stressed wheat. Metabolic analyses at the level of phenolics showed an increase in the free and bound fraction of phenolic acids almost exclusively in the shoots and flavonoid isoorientin increased considerably: protective action against oxidative stress and dehydration of the leaves seems to be the main reason for this finding. The role of PR proteins and phenolics in drought-stressed tissue is discussed.
OCA17. Zoznam najviac 5 najvýznamnejších ohlasov na výstup / List of maximum 5 most significant citations corresponding to the output *Rozsah do 200 slov / Range up to 200 words*		Record 1 of 5 Gargallo-Garriga A, Preece C, Sandras J, Oravec M, Urban O, Penuelas J (2018) Root exudate metabolomes change under drought and show limited capacity for recovery. *Scientific Reports*. 8: e12696. DOI 10.1038/s41598-018-30150-0. Times Cited in Web of Science Core Collection: 149 Total Times Cited: 156 Accession Number: WOS:000442530600002 Record 2 of 5 Guo Q, Wang Y, Zhang HR, Qu G, Wang TC, Sun QH, Liang DL (2017) Alleviation of adverse effects of drought stress on wheat seed germination using atmospheric dielectric barrier discharge plasma treatment. *Scientific Reports*. 7: e16680. DOI 10.1038/s41598-017-16944-8. Times Cited in Web of Science Core Collection: 86

	Total Times Cited: 89 Accession Number: WOS:000416891400082 Record 3 of 5 Zalila-Kolsi I, Ben Mahmoud A, Ali H, Sellami S, Nasfi Z, Tounsi S, Jamoussi K (2016) Antagonist effects of Bacillus spp. strains against *Fusarium graminearum* for protection of durum wheat (*Triticum turgidum* L. subsp *durum*). *Microbiological Research*. 192: 148-158. DOI 10.1016/j.micres.2016.06.012. Times Cited in Web of Science Core Collection: 59 Total Times Cited: 64 Accession Number: WOS:000392563200016 Record 4 of 5 Kim J, Liu YM, Zhang XZ, Zhao BY, Childs KL (2016) Analysis of salt-induced physiological and proline changes in 46 switchgrass (*Panicum virgatum*) lines indicates multiple response modes. *Plant Physiology and Biochemistry*. 105: 203-212. DOI 10.1016/j.plaphy.2016.04.020. Times Cited in Web of Science Core Collection: 38 Total Times Cited: 41 Accession Number: WOS:000380415900021 Record 5 of 5 Prinsi B, Negri AS, Failla O, Scienza A, Espen L (2018) Root proteomic and metabolic analyses reveal specific responses to drought stress in differently tolerant grapevine rootstocks. *BMC Plant Biology*. 18: e126. DOI 10.1186/s12870-018-1343-0. Times Cited in Web of Science Core Collection: 38 Total Times Cited: 39 Accession Number: WOS:000436118600002
OCA18. Charakteristika dopadu výstupu na spoločensko-hospodársku prax / Characteristics of the output's impact on socio-economic practice *Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak* *Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	Sucho je hlavným abiotickým stresovým faktorom obmedzujúcim produktivitu plodín. Pšenica je dôležitým zdrojom potravy pre ľudí na celom svete a v posledných rokoch je výnosnosť vplyvom nedostatku vody výrazne limitovaná. Napriek intenzívnemu výskumu si štúdium sucha stále vyžaduje pozornosť. Preto sme v práci analyzovali rast a fyziologické reakcie (tvorba biomasy, fotosyntetické pigmenty, minerálne živiny), profil metabolitov (aminokyseliny, fenoly) ako aj aktivitu a expresiu génov pre glukanázy a chitinázy v novej slovenskej odrode pšenice po dlhotrvajúcom strese zo sucha. V práci sme zistili, že chitinázy a glukanázy boli aktivované v pšenici vplyvom sucha. Priamo ako súčasti obranných mechanizmov alebo v morfofyziologických úpravách buniek počas nedostatku vody prispievajú k schopnosti rastlín prežiť. Presné kvantifikovanie fenolových metabolitov odhalilo ich zvýšenie vo voľných a viazaných frakciách takmer výlučne vo výhonkoch, čo naznačuje ochranný účinok pri nedostatku vody. Drought is the major abiotic stress factor limiting crop productivity worldwide. Wheat is an important source of food for people worldwide, and in recent years the yield has been significantly limited due to the water deficiency. Despite the intensive research, the study focused on the drought still needs attention. Therefore, we analysed growth and physiological responses (biomass, photosynthetic pigments, mineral nutrients), metabolite profile (aminoacids, phenolics), as well as the activity and gene expression of glucanases and chitinases in a new Slovak wheat line after long-term drought stress. In this work, we found that chitinases and glucanases were activated in wheat under drought. Directly as components of defense mechanisms or in morpho-physiological adjustments of cells during water shortage they contribute to plant capability to survive. Detailed quantification of phenolic metabolites revealed their increase in the free and bound fraction almost exclusively in the shoots, indicating protective action under water deficiency.
OCA19. Charakteristika dopadu výstupu a súvisiacich aktivít na vzdelávací proces / Characteristics of the output and related activities' impact on the educational process *Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak* *Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	Výstup je orientovaný na fyziológiu, biochémiu a molekulárnu biológiu rastlín a je viazaný na výučbu biologicky zameraných predmetov v rámci študijného programu Aplikovaná biológia. Do vzdelávacieho procesu budú z tohto výstupu implementované metodické postupy, poznatky ako aj laboratórne skúsenosti s cieľom podporiť výučbu predmetov s biologickým a molekulárno-biotechnologickým obsahom s presahom do proteomiky. The output is oriented towards the physiology, biochemistry and molecular biology of plants and is linked to the teaching of biological subjects within the study program Applied Biology. The methodological procedures, knowledge and laboratory experience will be implemented from this output into the educational process with the aim of supporting the teaching of subjects with biological and molecular-biotechnological content with an overlap into proteomics.

Charakteristika predkladaného výstupu tvorivej činnosti / Characteristics of the submitted research/ artistic/other output

Tlačivo VTC slúži na predkladanie výstupov tvorivej činnosti podľa metodiky hodnotenia tvorivých činností (časť V. Metodiky na vyhodnocovanie štandardov) / The form is used to submit the research/artistic/other outputs according to the evaluation methodology of research/artistic/other activities (part V. The Methodology for Standards Evaluation).

ID konania/ID of the procedure: [1] Kód VTC/Code of the research/artistic/other output (RAOO):[1]	

OCA1. Priezvisko hodnotenej osoby / Surname awarded to the assessed person [2]		Gerši (rod. Gregorová)
OCA2. Meno hodnotenej osoby / Name awarded to the assessed person [2]		Zuzana
OCA3. Tituly hodnotenej osoby / Degrees awarded to the assessed person [2]		RNDr., PhD.
OCA4. Hyperlink na záznam osoby v Registri zamestnancov vysokých škôl / Hyperlink to the entry of the person in the Register of university staff [3]		https://www.portalvs.sk/regzam/detail/29480
OCA5. Oblasť posudzovania / Area of assessment [4]		3. Biológia/ 3. Biology
OCA6. Kategória výstupu tvorivej činnosti / Category of the research/ artistic/other output *Výber zo 6 možností (pozri Vysvetlivky k položke OCA6) / Choice from 6 options (see Explanations for OCA6).*		*Vedecký výstup/ scientific output*
OCA7. Rok vydania výstupu tvorivej činnosti / Year of publication of the research/artistic/other output		2017
OCA8. ID záznamu v CREPČ alebo CREUČ *(ak je)* / ID of the record in the Central Registry of Publication Activity (CRPA) or the Central Registry of Artistic Activity (CRAA) [5]		683264
OCA9. Hyperlink na záznam v CREPČ alebo CREUČ / Hyperlink to the record in CRPA or CRAA [6]		https://app.crepc.sk/?fn=detailBiblioForm&sid=C86326FDA0F2CD5B355347CDFB
Charakteristika výstupu, ktorý nie je registrovaný v CREPČ alebo CREUČ / Characteristics of the output that is not registered in CRPA or CRAA	OCA10. Hyperlink na záznam v inom verejne prístupnom registri, katalógu výstupov tvorivých činností / Hyperlink to the record in another publicly accessible register, catalogue of research/ artistic/other outputs [7]	
	OCA11. Charakteristika výstupu vo formáte bibliografického záznamu CREPČ alebo CREUČ, ak výstup nie je vo verejne prístupnom registri alebo katalógu výstupov / Characteristics of the output in the format of the CRPA or the CRAA bibliographic record, if the output is not available in a publicly accessible register or catalogue of outputs	Maglovski M, **Gregorová Z**, Rybanský Ľ, Mészáros P, Moravčíková J, Hauptvogel P, Adamec L, Matušíková I (2017) Nutrition supply affects the activity of pathogenesis-related β-1,3-glucanases and chitinases in wheat. *Plant Growth Regulation*. 81(3): 443-453. DOI 10.1007/s10725-016-0222-7.

	OCA12. Typ výstupu (ak nie je výstup registrovaný v CREPČ alebo CREUČ) / Type of the output (if the output is not registered in CRPA or CRAA) *Výber zo 67 možností (pozri Vysvetlivky k položke OCA12) / Choice from 67 options (see Explanations for OCA12).*	*Článok/article*
	OCA13. Hyperlink na stránku, na ktorej je výstup sprístupnený (úplný text, iná dokumentácia a podobne) / Hyperlink to the webpage where the output is available (full text, other documentation, etc.)	https://link.springer.com/article/10.1007/s10725-016-0222-7
	OCA14. Charakteristika autorského vkladu / Characteristics of the author's contribution	[10 %] Spoluautor. Spolupráca pri experimentoch – spracovanie rastlinného materiálu, meranie forosyntetických a biochemických (obsah prolínu a MDA) parametrov, extrakcia proteínov. [10 %] Co-author. Cooperation in experiments – processing of a plant material, measurement of a phorosynthetic and biochemical (proline and MDA content) parameters and protein extraction process.
	OCA15. Anotácia výstupu s kontextovými informáciami týkajúcimi sa opisu tvorivého procesu a obsahu tvorivej činnosti a pod. / Annotation of the output with contextual information concerning the description of creative process and the content of the research/artistic/other activity, etc. [8]*Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in SlovakRozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	
OCA16. Anotácia výstupu v anglickom jazyku / Annotation of the output in English [9]*Rozsah do 200 slov / Range up to 200 words*		Nitrogen (N) is an essential mineral for plants and both its deficiency and excess causes serious problems in agriculture. As stress-inducible defense is costly, N conditions likely affect the trade-off between the growth and defense. Previous studies identified a few defense-related enzymes dependent on N nutrition. Chitinases (EC 3.2.1.14) and glucanases (EC 3.2.1.39) are typical plant defense enzymes belonging to the group of pathogenesis-related (PR) proteins with multiple functions in plants. Since a comprehensive study on the impact of N nutrition on their activity is missing, we studied their profiles and activities at isoforms level in wheat plants grown hydroponically at N doses corresponding to limited (0, 0.75 and 5.25 mM N), optimal N (7.5 mM N) as well as excess (15, 30 and 35 mM N) N supply in the form of nitrate. Our results show that several isoforms of both enzymes in wheat leaves and/or shoots clearly depended on N supply, while their activities rather depended on organ type. Furthermore, glucanases and chitinases appeared to be regulated in an opposite way. The activities of particular chitinases and glucanases correlated with a proline content that has multiple functions in plants. Proline typically accumulated with increasing the N supply when certain excessive N doses induced the gene for proline synthase (P5CS) in shoots and that for ornithine aminotransferase (OAT) in roots. This work points to a N-dependent activity of several defense-related compounds suggesting the possibly of altered plant defense potential under various N regimes.
OCA17. Zoznam najviac 5 najvýznamnejších ohlasov na výstup / List of maximum 5 most significant citations corresponding to the output *Rozsah do 200 slov / Range up to 200 words*		Record 1 of 5 Yostova E, Dobrikova A, Stefanov M, Misheva S, Bardáčova M, Matušíková I (2020) Effects of cadmium on two wheat cultivars depending on different nitrogen supply. *Plant Physiology and Biochemistry*. 155: 789-799. DOI 10.1016/j.plaphy.2020.06.042. Times Cited in Web of Science Core Collection: 19 Total Times Cited: 19 Accession Number: WOS: WOS:000581918000077 Record 2 of 5 Chen YE, Mao HT, Wu N, Ma J, Yuan M, Zhang Z, Yuan S, Zhang HY (2020) Effects of Stripe Rust Infection on the Levels of Redox Balance and Photosynthetic Capacities in Wheat. *International Journal of Molecular Sciences.* 21(1): e268. DOI 10.3390/ijms21010268. Times Cited in Web of Science Core Collection: 7 Total Times Cited: 8 Accession Number: WOS:000515378000268

	Record 3 of 5 Rajninec M, Frátriková M, Boszorádová E, Jopčík M, Bauer M, Libantová J (2021) Basic beta-1,3-Glucanase from Drosera binata Exhibits Antifungal Potential in Transgenic Tobacco Plants. *Plants-Basel*. 10(8): e1747. DOI 10.3390/plants10081747. Times Cited in Web of Science Core Collection: 2 Total Times Cited: 2 Accession Number: WOS:000690115200001 Record 4 of 5 Li L, Liu QL, Yue HL, Bi Y, Raza H, Zhang R, Carelle JK, Peng H, Long HT, Prusky D (2022) Acetylsalicylic acid (ASA) suppressed Fusarium rot development and neosolaniol (NEO) accumulation by activating phenylpropane metabolism in muskmelon fruit. *European Journal of Plant Pathology.* 163(3): 625-639. DO I10.1007/s10658-022-02502-0. Times Cited in Web of Science Core Collection: 1 Total Times Cited: 1 Accession Number: WOS:000778077600001
OCA18. Charakteristika dopadu výstupu na spoločensko-hospodársku prax / Characteristics of the output's impact on socio-economic practice *Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak* *Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	Táto práca je zameraná na stanovenie úrovne nutričného stresu v pšenici na základe sledovaných fyziologických (obsah chlorofylu) a biochemických parametrov (obsah malondialdehydu a prolínu ako dôkazy oxidačného stresu v rastlinných bunkách) ako aj na detekcii špecifických obranných enzýmov. Rastliny pšenice boli pestované hydroponicky pri optimálnych nutričných podmienkach, pri nedostatku aj nadbytku dusíka v médiu. Údaje o fyziologických a rastových parametroch naznačujú, že reakcie rastlín nie sú lineárne závislé od dávok dusíka v rastovom médiu. Navyše dostupnosť výživy ovplyvnila aktivitu niektorých izoforiem chitináz a glukanáz, čo znamená, že tieto obranné enzýmy reagovali na extrémne dávky dusíka orgánovo špecifickým spôsobom. Možné úlohy týchto enzýmov pri adaptácii na dodávku dusíka sú do značnej miery neznáme a ich úloha ako obranných zložiek zostáva ešte objasnená. Komplexnejšia štúdia o účinkoch rôznych režimov hnojenia na aktivitu týchto obranných enzýmov pri dodatočných stresoch by mohla priniesť cenné poznatky pre efektívne hnojenie a stratégie ochrany rastlín. This work is focused on the determination of the of nutritional stress level in wheat based on monitored physiological (chlorophyll content) and biochemical parameters (malondialdehyde and proline content as evidence of oxidative stress in plant cells) as well as the detection of specific defense enzymes. Wheat plants were grown hydroponically under optimal nutritional conditions, a deficiency and uptake of nitrogen in medium. Data on physiological and growth parameters indicate that plant responses are not linearly dependent on nitrogen doses in the growth media. Moreover, this nutrition availability affected the activities of several chitinase and glucanase isoforms responded to extreme nitrogen regimes in an organ-specific manner. The possible roles of these enzymes in the adaptation to nitrogen supply are largely unknown, and their role as defense components remains to be elucidated. A more complex study on the effects of different fertilization regimes on activity of these defense enzymes under additional stresses might bring valuable knowledge for efficient fertilization and plant protection strategies.
OCA19. Charakteristika dopadu výstupu a súvisiacich aktivít na vzdelávací proces / Characteristics of the output and related activities' impact on the educational process *Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak* *Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	Výstup je orientovaný na detekciu fyziologických a biochemických parametrov v rastlinách ovplyvnených stresovým faktorov počas rastu v médiu, čím je viazaný na výučbu biologických predmetov v rámci študijného programu Aplikovaná biológia. Metodické prístupy z experimentálnej časti tohto výstupu budú implementované do laboratórnych cvičení. Jedná sa o nenáročné a cenovo dostupné metodiky. Na základe tohto si študenti môžu rozšíriť experimentálne zručnosti v rámci predmetu Laboratórne cvičenia z aplikovanej biológie II. The output is oriented to the detection of physiological and biochemical parameters in plants affected by stress factors during growth in the medium, thus it is tied to the teaching of biological subjects within the Applied Biology study program. Methodological approaches from the experimental part of this output will be implemented in laboratory exercises. Base of this, students can expand their experimental skills within the subject Laboratory Exercises in Applied Biology II.

Charakteristika predkladaného výstupu tvorivej činnosti / Characteristics of the submitted research/ artistic/other output

Tlačivo VTC slúži na predkladanie výstupov tvorivej činnosti podľa metodiky hodnotenia tvorivých činností (časť V. Metodiky na vyhodnocovanie štandardov) / The form is used to submit the research/artistic/other outputs according to the evaluation methodology of research/artistic/other activities (part V. The Methodology for Standards Evaluation).

ID konania/ID of the procedure: [1] Kód VTC/Code of the research/artistic/other output (RAOO):[1]	

OCA1. Priezvisko hodnotenej osoby / Surname awarded to the assessed person [2]		Gerši (rod. Gregorová)
OCA2. Meno hodnotenej osoby / Name awarded to the assessed person [2]		Zuzana
OCA3. Tituly hodnotenej osoby / Degrees awarded to the assessed person [2]		RNDr., PhD.
OCA4. Hyperlink na záznam osoby v Registri zamestnancov vysokých škôl / Hyperlink to the entry of the person in the Register of university staff [3]		https://www.portalvs.sk/regzam/detail/29480
OCA5. Oblasť posudzovania / Area of assessment [4]		3. Biológia/ 3. Biology
OCA6. Kategória výstupu tvorivej činnosti / Category of the research/ artistic/other output *Výber zo 6 možností (pozri Vysvetlivky k položke OCA6) / Choice from 6 options (see Explanations for OCA6).*		*Vedecký výstup/ scientific output*
OCA7. Rok vydania výstupu tvorivej činnosti / Year of publication of the research/artistic/other output		2021
OCA8. ID záznamu v CREPČ alebo CREUČ *(ak je)* / ID of the record in the Central Registry of Publication Activity (CRPA) or the Central Registry of Artistic Activity (CRAA) [5]		435976
OCA9. Hyperlink na záznam v CREPČ alebo CREUČ / Hyperlink to the record in CRPA or CRAA [6]		https://app.crepc.sk/?fn=detailBiblioForm&sid=EA86E0589BCC28B194CA0FA9BF
Charakteristika výstupu, ktorý nie je registrovaný v CREPČ alebo CREUČ / Characteristics of the output that is not registered in CRPA or CRAA	OCA10. Hyperlink na záznam v inom verejne prístupnom registri, katalógu výstupov tvorivých činností / Hyperlink to the record in another publicly accessible register, catalogue of research/ artistic/other outputs [7]	
	OCA11. Charakteristika výstupu vo formáte bibliografického záznamu CREPČ alebo CREUČ, ak výstup nie je vo verejne prístupnom registri alebo katalógu výstupov / Characteristics of the output in the format of the CRPA or the CRAA bibliographic record, if the output is not available in a publicly accessible register or catalogue of outputs	Dubas E, Zur I, Moravčíková J, Fodor J, Krzewska M, Surowa E, Nowicka A, **Gerši Z** (2021) Proteins, Small Peptides and Other Signaling Molecules Identified as Inconspicuous but Possibly Important Players in Microspores Reprogramming Toward Embryogenesis. *Frontiers in Sustainable Food Systems.* 5: e745865. DOI 10.3389/fsufs.2021.745865.

	OCA12. Typ výstupu (ak nie je výstup registrovaný v CREPČ alebo CREUČ) / Type of the output (if the output is not registered in CRPA or CRAA) *Výber zo 67 možností (pozri Vysvetlivky k položke OCA12) / Choice from 67 options (see Explanations for OCA12).*	*Článok/article*
	OCA13. Hyperlink na stránku, na ktorej je výstup sprístupnený (úplný text, iná dokumentácia a podobne) / Hyperlink to the webpage where the output is available (full text, other documentation, etc.)	https://www.frontiersin.org/articles/10.3389/fsufs.2021.745865/full
	OCA14. Charakteristika autorského vkladu / Characteristics of the author's contribution	[10 %] Spoluautorka. Príprava konceptu review rukopisu zaoberajúceho sa problematikou proteínov súvisiacich so stresom v rastlinách. [10 %] Co-author. Preparation of a draft for review manuscript dealing with the stress-related proteins in plants.
	OCA15. Anotácia výstupu s kontextovými informáciami týkajúcimi sa opisu tvorivého procesu a obsahu tvorivej činnosti a pod. / Annotation of the output with contextual information concerning the description of creative process and the content of the research/artistic/other activity, etc. [8]*Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in SlovakRozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	
OCA16. Anotácia výstupu v anglickom jazyku / Annotation of the output in English [9]*Rozsah do 200 slov / Range up to 200 words*		In this review, are described and integrated the latest knowledge on the signaling role of proteins and peptides in the stress-induced microspore embryogenesis (ME) in some crop plants with agricultural importance (i.e., oilseed rape, tobacco, barley, wheat, rice, triticale, rye). Based on the results received from the most advanced omix analyses, we have selected some inconspicuous but possibly important players in microspores reprogramming toward embryogenic development. We provide an overview of the roles and downstream effect of stress-related proteins (e.g., β-1,3-glucanases, chitinases) and small signaling peptides, especially cysteine—(e.g., glutathione, γ-thionins, rapid alkalinization factor, lipid transfer, phytosulfokine) and glycine-rich peptides and other proteins (e.g., fasciclin-like arabinogalactan protein) on acclimation ability of microspores and the cell wall reconstruction in a context of ME induction and haploids/doubled haploids (DHs) production. Application of these molecules, stimulating the induction and proper development of embryo-like structures and green plant regeneration, brings significant improvement of the effectiveness of DHs procedures and could result in its wider incorporation on a commercial scale. Recent advances in the design and construction of synthetic peptides–mainly cysteine-rich peptides and their derivatives–have accelerated the development of new DNA-free genome-editing techniques. These new systems are evolving incredibly fast and soon will find application in many areas of plant science and breeding.
OCA17. Zoznam najviac 5 najvýznamnejších ohlasov na výstup / List of maximum 5 most significant citations corresponding to the output *Rozsah do 200 slov / Range up to 200 words*		Record 1 of 5 Bednarek PT, Orlowska R, Mankovski DR, Zimny J, Kowalczyk K, Nowak M, Zebrowski J (2022) Glutathione and copper ions as critical factors of green plant regeneration efficiency of triticale in vitro anther culture. *Frontiers in Plant Science*. 13: e926305. DOI 10.3389/fpls.2022.926305. Times Cited in Web of Science Core Collection: 3 Total Times Cited: 3 Accession Number: WOS:000841026700001
OCA18. Charakteristika dopadu výstupu na spoločensko-hospodársku prax / Characteristics of the output's impact on socio-economic practice *Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*		V súčasnosti mnoho faktorov zvyšuje dopyt po potravinách na celom svete. Konvenčné šľachtenie je pracovne a časovo náročný proces, ktorý je potrebné doplniť modernými biotechnologickými prístupmi, aby sa zvýšila jeho efektivita. Tieto problémy poukazujú na potrebu dodať nové odrody rastlín so zvýšenou produktivitou a zlepšenou adaptáciou na abiotické a biotické stresy. Na tento účel sa zdá byť mikrospórová embryogenéza (ME), známa aj ako androgenéza, bezkonkurenčným biotechnologickým nástrojom na urýchlenie postupu šľachtenia rastlín.V tomto prehľadovom článku prinášame nové poznatky o signalizačnej úlohe proteínov a peptidov v embryogenéze mikrospór (ME) indukovanej stresom v niektorých plodinách s poľnohospodárskym významom. Pre šľachtiteľov a pestovateľov sú tiež dôležité informácie o účinkoch potenciálnych modulácií

	(vrátane úpravy genómu) syntetických dráh, ktoré sú základom reakcií na abiotický stres v plodinách. Na tieto účely možno syntetizovať a testovať na rastlinách najsľubnejšie z identifikovaných peptidov pôsobiacich ako regulátory rastu zmierňujúce stresy. Toto nové riešenie pomocou natívnych malých syntetických peptidov aplikovaných ako povlaky mikrospór nám pomôže zvýšiť novú zárodočnú plazmu súbežne s úsporou času a nákladov. Nowadays, many factors increases the demand for food supply worldwide. Conventional breeding is labor intensive and time-consuming process, which needs to be complemented with modern biotechnological approaches to improve its efficiency. These problems point to the necessity to deliver new plant varieties with enhanced productivity and improved adaptation toward abiotic and biotic stresses. For this purpose, microspore embryogenesis (ME), known also as androgenises, seems to be an unrivaled biotechnological tool to speed up the progress of plant breeding. In this review, we bring new knowledges about signalling role of proteins and peptides in the stress-induced microspore embryogenesis (ME) in some crop plants with agricultural importance. Information about the effects of potential modulations (including genome-editing) of synthetic pathways that underlies abiotic stress responses in crops is also important for breeders and farmers. For these purposes, the most promising among identified peptides acting as growth regulators alleviating stresses and altering plant development, can be synthesized and tested on plants, with goals of extending and strengthening responsiveness to ME in DH technology. This novel solution, by using native small synthetic peptides applied as microspore coatings, will help us to increase new germplasm in parallel with saving time and costs.
OCA19. Charakteristika dopadu výstupu a súvisiacich aktivít na vzdelávací proces / Characteristics of the output and related activities' impact on the educational process *Rozsah do 200 slov v slovenskom jazyku / Range up to 200 words in Slovak* *Rozsah do 200 slov v anglickom jazyku / Range up to 200 words in English*	Prehľadový článok je orientovaný na aktuálne molekulárne a biotechnologické možnosti zlepšenia kvality úrody a jej ochrany pred abiotickými faktormi. Tento rukopis predstavuje vhodnú vedeckú literatúru pre študentov študijného programu Aplikovaná biológia s cieľom prepojiť získané informácie s vedomosťami z predmetov Vybrané kapitoly z molekulárnej biológie alebo Laboratórne cvičenia z aplikovanej biológie II, ktoré sú zamerané na detekciu proteínov a enzýmov. Publikované informácie môžu mať uplatnenie aj vo vyučovacom procese ďalších predmetov ako napríklad *In vitro* systémy rastlín, Pokročilá proteomika, Vplyv stresových faktorov na biotu. This review article is oriented towards the current molecular and biotechnological possibilities of improving the quality of the crop and its protection against abiotic factors. This manuscript represents relevant scientific literature for students of the study program Applied Biology in order to connect the acquired information with knowledgies from the subjects Selected Chapters in Molecular Biology or Laboratory Exercises in Applied Biology II, which are focused on the detection of proteins and enzymes. The published information can be also used in the teaching process of other subjects such as *In vitro* plant systems, Advanced proteomics, The influence of stress factors on biota.