

Opis modułu kształcenia / przedmiotu (sylabus)

Rok akademicki:		Grupa przedmiotów:		Numer katalogowy:	
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Nazwa przedmiotu <sup>1)</sup> :	Plant Adaptation to Environmental Stresses			ECTS <sup>2)</sup>	4
Tłumaczenie nazwy na jęz. angielski <sup>3)</sup> :					
Kierunek studiów <sup>4)</sup> :	<b>Environment Protection</b>				
Koordinator przedmiotu <sup>5)</sup> :	<b>prof. dr hab. Helena Gawrońska</b>				
Prowadzący zajęcia <sup>6)</sup> :	<b>prof. dr hab. Helena Gawrońska, dr inż. Arkadiusz Przybysz</b>				
Jednostka realizująca <sup>7)</sup> :	<b>Faculty of Horticulture and Landscape Architecture, Laboratory of Basic Research In Horticulture</b>				
Wydział, dla którego przedmiot jest realizowany <sup>8)</sup> :	<b>Faculty of Civil and Environmental Engineering</b>				
Status przedmiotu <sup>9)</sup> :	a) przedmiot <b>major</b>	b) stopień II rok I	c) stacjonarne / niestacjonarne		
Cykl dydaktyczny <sup>10)</sup> :	<b>spring semester</b>	Jęz. wykładowy <sup>11)</sup> <b>English</b>	<b>Day study</b>		
Założenia i cele przedmiotu <sup>12)</sup> :	<p>Providing knowledge on: (i) the extent of stressful conditions and type of stressors for plants in natural environment, (ii) stress factors generated by antropopresure including greenhouse gases and global climate change, (iii) plant responses to stressors and mechanisms involved in coping with stresses, (iv) plant tolerance to environmental stresses and (vi) possibility of increasing plants ability to get over with stressors that should be useful in improving/restoring damaged environment</p>				
Formy dydaktyczne, liczba godzin <sup>13)</sup> :	<p>a) <b>Lectures</b> .....; liczba godzin <b>15</b>;                  b) <b>Laboratory practicum</b> .....; liczba godzin <b>29</b>;                  c) <b>Auditorium on project referring to selected topic of practicum</b> ; liczba godzin <b>1</b>;</p>				
Metody dydaktyczne <sup>14)</sup> :	<p>a) lectures , audio- visual method;                  b) laboratory practicum - preparatory work for running experiments individually or in sub-groups, measurements; of selected plant processes/ parameters, using specific for particular experiments modern methods and apparatus tabulation, analysis, interpretation, discussion with active participation of students regarding; received results, concluding and solving problems if occur;                  c) introduction to rules provided by lecturer on methodology for reporting project on selected topic of practice written individually by student;                  d) consulting for students</p>				
Pełny opis przedmiotu <sup>15)</sup> :	<p><b>Aim of the subject is to introduce students to basic knowledge on environmental stresses affecting plants, responses to stressors and mechanism involved in acclimation/adaptation to environmental stresses with underlying interactions taking place in natural environment on various levels of biological organization and importance of biodiversity in environment that are covered in following lectures and laboratory practicum</b></p> <p><b><u>Lectures:</u></b>                  1/ Introduction, historical approach, biodiversity in natural environment, terminology, sources of stressors: abiotic and biotic, effects of stressors in agro- and natural ecosystems, global scale.                  2/ Avoidance and tolerance strategies of survival under stresses, protective responses, mechanisms of acclimation/ adaptation. 3/Stresses affect every level of biological organisation I (canopy, plant, organ, tissue).                  4/Stresses affect every level of biological organisation II (cell, organelle, genome, structure and functions, functional genomics).                  5/Signal perception and transduction pathways, local, systemic, specific and non-specific responses to stressors.</p>				

	<p>6/ Phytohormones mediate plant response to stressors and regulate homeostasis under stresses.</p> <p>7/Light stress: high and low irradiance levels, light spectrum.</p> <p>8/Antropopressure I: agrotechnology, heavy metal and salinity stress: osmotic and toxic effects, osmoregulation.</p> <p>9/ Antropopressure II: PAHs, (NO)<sub>x</sub>, N<sub>H4</sub>, SO<sub>2</sub>, acid rains, particulate matter.</p> <p>10 / Antropopressure:III: Greenhouse effects.</p> <p>11/ Greenhouse gases as stressors to plants: CO<sub>2</sub>, O<sub>3</sub>, UV.</p> <p>12/High temperature stress.</p> <p>13/ Water stress: drought and flood.</p> <p>14/ Biotic stresses: allelopathy, competition, invasive and parasite plant species.</p> <p>15/ Possibility of increasing plants ability to cope with stressors that should be useful in improving/restoring polluted and damaged environment.</p> <p><b>Laboratory practicum:</b></p> <p>1/Plant cell membranes structure and environmental factors affecting membrane integrity.</p> <p>2/ Chlorophyll properties and efficiency of photosynthetic apparatus as influenced by stressors</p> <p>3/Plant water status under differing environmental conditions.</p> <p>4/ Effects of water status and salt stress on of selected plant species.</p> <p>5/ Plants under heavy metal stress: identification of genes coding for metallothioneins, isolation of genomic DNA.</p> <p>6/ Amplification and visualization of genomic DNA of genes coding for metallothioneins by PCR technique and electrophoresis.</p> <p>7/ Germination and early seedling growth under allelopathy and salt stresses</p> <p>8/ Germination and early seedling growth under allelopathy and salt stresses II.</p>	
Wymagania formalne (przedmioty wprowadzające) <sup>16</sup> :	Plant physiology, Biochemistry, General ecology and Technologies of phytoremediation	
Założenia wstępne <sup>17</sup> :	1/Students have basic knowledge on plant physiology, plant biochemistry, general ecology and technologies of phytoremediation and 2/ Students are able to conduct simple experiments	
Efekty kształcenia <sup>18</sup> :	<p>Students should</p> <p>01-acquire knowledge on stress origin in environments, plant responses to stresses, strategies of surviving under stresses in natural environment, understand mechanisms of acclimation and adaptation to environmental stresses, effects of particular stressors, global climate change, possibility to increase plants ability to cope with stresses</p> <p>02-have experience for stress factors identification based on symptoms recognition, changes in plant community and in main, modern analytical methods/ techniques used in assessments of stress effects on plants</p>	<p>03- know-how on rules and work out protocol for repairing /restoring polluted or degraded site including knowledge in plant species/cvs suitable for restoration of given sites</p> <p>04- possess ability for individual and cooperative work with team on observation, collecting data, analysis, interpretation, concluding, solving and presenting problems using actual scientific literature</p> <p>05- act in full consciousness to comply with security rules</p> <p>06- have knowledge on activities aiming at risk and foreseeing of operations effects on broad meaning of safe agriculture and environmental protection</p>
Sposób weryfikacji efektów kształcenia <sup>19</sup> :	<p>- continuous individual evaluation of student activity on lab practicum and ability to cooperate in team</p> <p>- individual valuation of written report in a form of mini-publication on selected topic of lab practicum</p> <p>- examination from practicum program</p> <p>- examination from lecture program</p>	
Forma dokumentacji osiągniętych efektów kształcenia <sup>20</sup> :	personal card of student examination records	
Elementy i wagi mające wpływ na ocenę końcową <sup>21</sup> :	<p>In case of practicum three elements of evaluation contribute for pass: (i) examination based on provided theoretical introduction to topics and instruction for run experiments (0,5), (ii) written report on topic chosen from lab practicum (0,2) and (iii) activity on practicum (0,3). In each of these elements at least 50 % of maximal knowledge is required to pass.</p> <p>In case of lecture during examination student must demonstrate at least 50 % of provided, during lecture, knowledge.</p>	
Miejsce realizacji zajęć <sup>22</sup> :	Lecture hall, laboratories, growth cabinet of Laboratory of Basic Research in Horticulture and greenhouses of Faculty of Horticulture and Landscape Architecture	
Literatura podstawowa i uzupełniająca <sup>23</sup> :	<p>1. 1. Kopcewicz J., Lewak S.: Fizjologia roślin, PWN, Warszawa, 2005</p> <p>2. Kozłowska M. Fizjologia roślin PWRiL. 2007.</p>	

3. Bartosz G.: *Druga twarz tlenu*. PWN, Warszawa, 1995
4. Gwóźdź E.A.: *Odporność na czynniki abiotyczne*. W: *Biotechnologia roślin pod redakcją Malepszy S.* PWN Warszawa, 2004
5. Starck Z., Chołuj, D. Niemyska B.: *Fizjologiczne reakcje roślin na niekorzystne czynniki środowiska*, Wyd. SGGW, Warszawa 1993
6. *Przewodnik do ćwiczeń z fizjologii roślin. Praca zbiorowa, wydawnictwo SGGW 1998*
7. *Materials provided by lecturer referring to theoretical basis and practical instruction for Laboratory Practicum*

Lista publikacji tematycznie powiązanych z wykładanym przedmiotem

**AUTORSTWO ROZDZIAŁU W MONOGRAFII LUB PODRĘCZNIKU W JEZYKU ANGIELSKIM DO 10 STRON:**

1. Gawroński S.W., Greger M., Gawrońska H. 2011. Plant taxonomy in metal phytoremediation. In: Eds. Sherameti I., Varma A. 2011. *Detoxification of Heavy Metals*, Springer-Verlag: 91-110.
2. Gawrońska H., Przybysz A., Szalacha E., Słowiński A. 2008. Physiological and molecular mode of action of Asahi SL biostimulator under optimal and stress conditions. In: ed. H. Gawronska. *Biostimulators in modern agriculture*, monograph series *Biostimulators in modern agriculture, General Aspects*, Wieś Jutra, 54-76, Warsaw, Poland
3. Wrochna M., Łata B., Borkowska B., Gawrońska H., 2008: Effect of Asahi SL biostimulator on ornamental amaranth (*Amaranthus spp.*) plants exposed to salinity in growing medium. In ed. Łukaszewska A., *Ornamental and species plants*, monograph series *Biostimulators in modern agriculture*, Wieś Jutra, 54-76, Warsaw, Poland : 15-32
4. Gawronska H., Ciarka D., Bernat W., Gawronski S.W. 2007. Sunflower – desired allelopathic crop for sustainable and organic agriculture? In: Fujii Y., Hiradate S. (eds) *New Concepts and Methodology in Allelopathy*. Science Publishers, Inc. Enfield, NH, USA.: 185-210
5. Gawrońska H., Golisz A. 2006. Allelopathy and biotic stress. In: Reigosa M.J., Pedrol N., Gonzales L. (eds.) *Allelopathy: A Physiological Process with Ecological Implications*. Springer-Verlag: 211-227

**PEER REVIEWED ORIGINAL SCIENTIFIC PAPERS:**

1. Ciarka D, Gawrońska H., Szawłowska U., Gawroński S.W. 2009: Allelopathic potential of sunflower. I Effects of genotypem, organs and biomass partitioning. *Allelopathy Journal* 23 (1): 95-110
2. Ciarka D, Gawrońska H., Małecka M., Gawroński S.W. 2009: Allelopathic potential of sunflower. II. Allelopathic Activity of plants compounds released in environment. *Allelopathy Journal* 23 (2):243-254
3. Dzierżanowski K., Popek R., Gawrońska H., Sæbø A., Gawroński S.W., 2011. Deposition of particulate matter of different size fractions on leaf surfaces and in waxes of urban forest species. *International Journal of Phytoremediation* 13: 1037-1046
4. Przybysz A, Janowiak F., Słowiński A, Gawrońska H. 2011. Protective role of Asahi SL against drought stress. *Zeszyty Problemowe Postępów Nauk Rolniczych PAN*, 545: 199-223
5. Wrochna M., Małecka-Przybysz M., Gawrońska H. 2010: Effect of road de-icing salts with anticorrosion agents on selected plant species. *Acta Scientiarum Polonorum, Hortorum Cultus*, 9(4) 2010, p.171-182
6. Przybysz A., Wrochna M., Słowiński A., Gawrońska H. 2010. Stimulatory effect of Asahi SL on selected plant species. *Acta Scientiarum Polonorum, Hortorum Cultus* 9 (2): 53-64.
7. Wrochna M., Gawrońska H., Gawroński S.W., 2008: Wpływ chlorku sodu w podłożu na kiełkowanie nasion oraz biomasa roślin ozdobnych z rodzin komosowatych i szarłatowatych. – *Annales UMCS sec. Horticultura* vol. XVIII/2008, p 1-8
8. Wrochna M., Gawrońska H., Borkowska B., Gawroński S.W., 2007: Wpływ zasolenia na akumulację biomasy i fluorescencję chlorofilu u roślin trzech odmian szarłatu ozdobnego. *Roczniki Akademii Rolniczej w Poznaniu, Ogrodnictwo* 41, 235-239
9. Wrochna M., Gawrońska H., Gawroński S.W., 2006: Wytwarzanie biomasy i akumulacja jonów Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>2+</sup>, Mg<sup>2+</sup>, Cl<sup>-</sup> w warunkach stresu solnego, przez wybrane gatunki roślin ozdobnych. *Acta Agrophysica*, 134, 775-785

**PREZENTACJE KONFERENCYJNE Z PUBLIKACJĄ MATERIAŁÓW W FORMIE ARTYKUŁU:**

1. Gawrońska H. , Przybysz A. 2011. *Biostimulatory : mechanizmy działania i przykłady zastosowań*. Materiały konferencyjne, Targi Sadownictwa i Warzywnictwa. Warszawa 5-6 stycznia, 2011: 7-13

Wskaźniki ilościowe charakteryzujące moduł/przedmiot<sup>25)</sup> :

Szacunkowa sumaryczna liczba godzin pracy studenta (kontaktowych i pracy własnej) niezbędna dla osiągnięcia zakładanych efektów kształcenia <sup>18)</sup> - na tej podstawie należy wypełnić pole ECTS <sup>2)</sup> :	<b>110h (4,4ECTS)</b>
Łączna liczba punktów ECTS, którą student uzyskuje na zajęciach wymagających bezpośredniego udziału nauczycieli akademickich:	<b>2,26ECTS</b>
Łączna liczba punktów ECTS, którą student uzyskuje w ramach zajęć o charakterze praktycznym, takich jak zajęcia laboratoryjne, projektowe, itp.:	<b>3 ECTS</b>

**\*For details in man-hours calculation see attachment #1**

Tabela zgodności kierunkowych efektów kształcenia efektami przedmiotu<sup>26)</sup>

Nr /symbol efektu	Wymienione w wierszu efekty kształcenia:	Odniesienie do efektów dla programu kształcenia na kierunku
<b>01</b>	<b>Knowledge on stress origin in environments, plant responses to stresses, strategies of surviving under stresses in natural environment, understand mechanisms of acclimation and adaptation to environmental stresses, effects of particular stressors, global climate change, possibility to increase</b>	<b>K_WO1+++ , K_WO4++ , K_WO6++</b>

	<b>plants ability to cope with stresses</b>	
<b>02</b>	<b>Experience with stress factors identification based on symptoms recognition, changes in plant community and in main, modern analytical methods/ techniques used in assessments of stress effects on plants</b>	<b>K_WO7+++ , K_UO1++</b>
<b>03</b>	<b>Knowledge on rules and know-how for work out protocol for repairing /restoring polluted or degraded site including knowledge in plant species/cvs suitable for restoration of given sites</b>	<b>K_WO\$+++ , K_U10-+</b>
<b>04</b>	<b>Ability for individual and cooperative work with team on observation, collecting data, analysis, interpretation, concluding, solving and presenting problems using actual scientific literature</b>	<b>K_UO9+++ , K_SO2++</b>
<b>05</b>	<b>Competence to act in full consciousness to comply with security rules</b>	<b>K_SO4+++</b>
<b>06</b>	<b>Skilful in activities aiming at risk reduction and foreseeing of operations effects on broad meaning of safe agriculture and environmental protection</b>	<b>K_SO5+++</b>