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APPLICATION OF PHYTOHORMONES IN THE IMPROVEMENT OF AGRICULTURAL AND HORTICULTURAL SPECIES AT *IN VITRO* AND *IN VIVO* CONDITION

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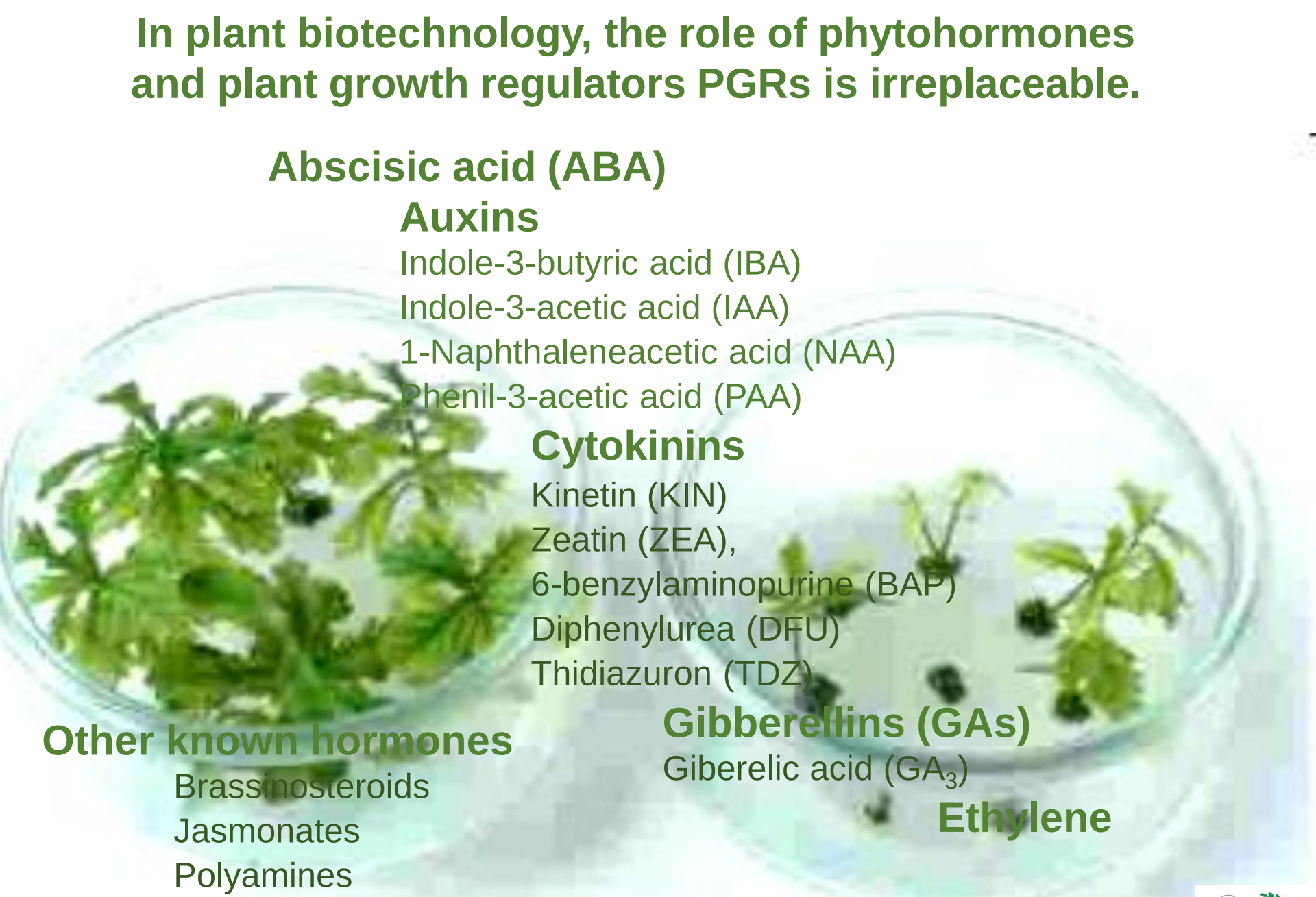
In plant biotechnology, the role of phytohormones and plant growth regulators PGRs is irreplaceable.



Abscisic acid (ABA)

Auxins

Indole-3-butyric acid (IBA)
Indole-3-acetic acid (IAA)
1-Naphthaleneacetic acid (NAA)
Phenil-3-acetic acid (PAA)

Cytokinins

Kinetin (KIN)
Zeatin (ZEA),
6-benzylaminopurine (BAP)
Diphenylurea (DFU)
Thidiazuron (TDZ)

Gibberellins (GAs)

Giberelic acid (GA_3)

Ethylene

Other known hormones

Brassinosteroids
Jasmonates
Polyamines

Powerful methods of plant biotechnology are unusable without the application of phytohormones and plant growth regulators

1950s First used of tissue culture by orchid industry

1970s - 1980s Rapid development of world plant biotechnology
first commercial plant tissue laboratories
mid 1980s – 20 millions plant per year micropropagated

1990s - Macedonian plant biotechnology (University laboratories)

1990s - 2000 PSI Institute of Southern Crops (ISC)
Plant Biotechnology Laboratory

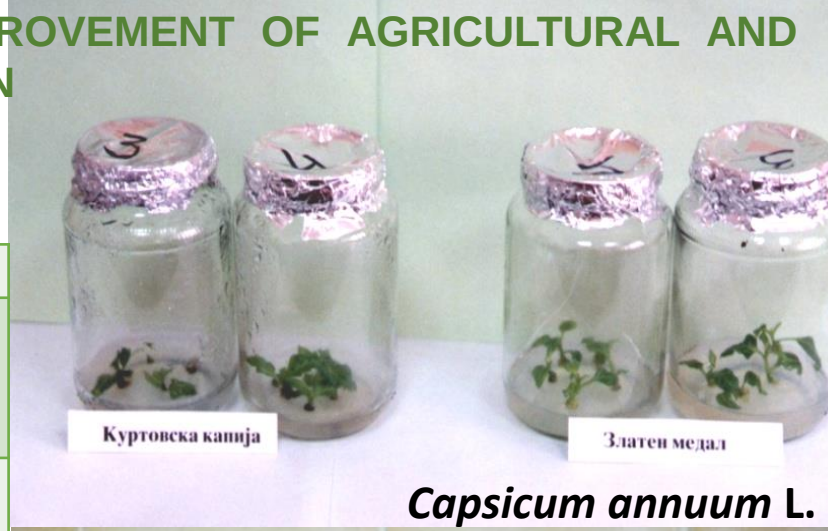
2007 Faculty of Agriculture, Goce Delcev University, Stip

Department of Plant Biotechnology, FA, GDU

APPLICATION OF PHYTOHORMONES IN THE IMPROVEMENT OF AGRICULTURAL AND HORTICULTURAL SPECIES AT *IN VITRPO* CONDITION

1990s - MICROPROPAGATION OF AGRICULTURE SPECIES

Species	Explant	Medium + PGRs $mg \cdot l^{-1}$	Results
Capsicum annuum L.	apical buds	MS + 5.0 BAP + 0.5 NAA MS + 10.0 BAP + 0.5 IAA MS +1.0ZEA	callus shoots
	anthers	CP + 0,01 KIN + 0,01 2,4D R_1 + 0,01 KIN	embryos
	hypocotyls 1/3 cotyledons	MS + 10.0 BAP + 0.5 NAA MS + 30.0 BAP + 1.0 IAA MS + 5.0 ZEA MS + 2.5 2iP	callus
Lycopersicon esculentum Mill.	apical buds	MS + 4.5 BAP + 0.3 IBA MS + 6.0 BAP + 0.4 IBAA MS + 4.5 KIN + 0.3 IAA	shoots
	hypocotyls 1/3 cotyledons	MS + 1.5 BAP + 0.1 IBA MS + 3.0 KIN + 0.1 IAA MS + 6.0 BAP + 0.4 IBA	callus
Cucumis sativus L.	apical buds	MS + 11.0 KIN + 3.5 IBA	shoots
	hypocotyls	MS + 2.0 KIN	callus
	1/3 cotyledons	MS + 6.5 BA+10.0 2,4 D	callus



***Capsicum annuum* L.**

***Lycopersicon esculentum* Mill.**

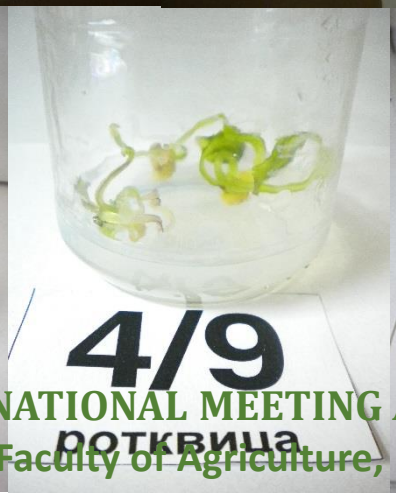
***Cucumis sativus* L.**

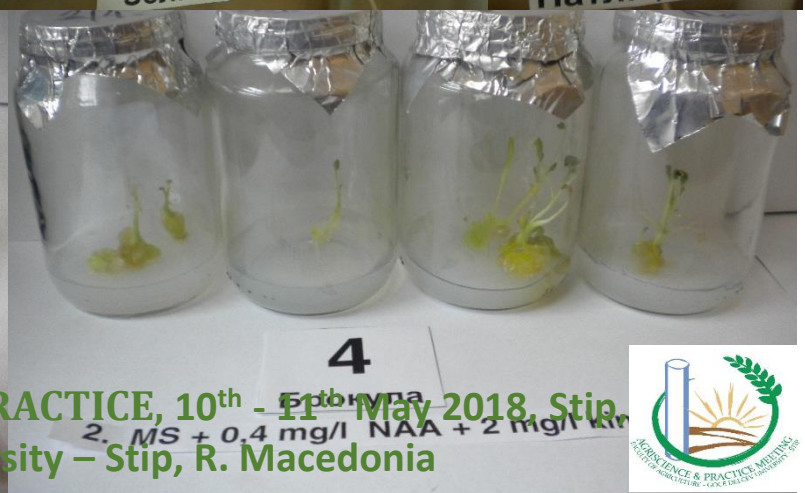
1990s - MICROPROPAGATION OF AGRICULTURE SPECIES

LYCOPERSICON ESCULENTUM MILL.
VAR. *CERASIFORME* (DUNAL)

MS + 2.0mg/l BAP + 2.5mg/l 2.4 D
MS + 2.5mg/l BAP + 1.5mg/l NAA
MS + 2.0mg/l 2iP + 0.5mg/l IAA
MS + 0.5mg/l KIN + 1mg/l IAA

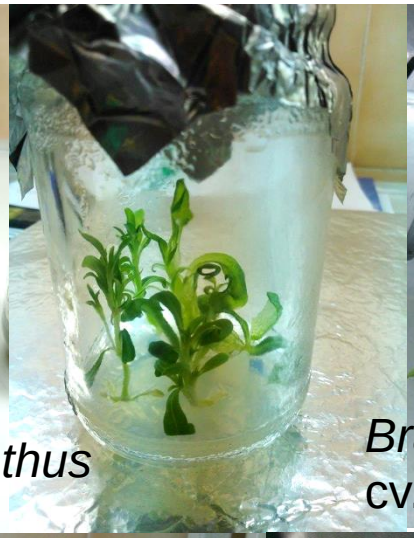
Spacies	Family	Medium + PGRs mg/l
Целер, *Apium graviolens* L.	Apiaceae	
Морков, *Daucus carota* spp. *sativus* L.	Apiaceae	MS + 3 KIN + 3 BAP
Магданос, *Petroselinum sativum*	Apiaceae	MS + 0.4 NAA + 2 KIN
Цвекло, *Beta vulgaris* ssp. *esculenta* L.	Amaranthaceae	NN + 0.8 IAA + 4 KIN
Брокула, *Brassica oleracea* var. *italica*,	Brassicaceae	LS + 2 IAA + 2 IBA + 2KIN
Зелка, *Brassica oleracea* var. *capitata* L.	Brassicaceae	LS + 5 KIN
Ротквица, *Raphanus sativus* var. *radicola*	Brassicaceae	MS + 1 IAA
Модар патлиџан, *Solanum melongena* L.	Solanaceae	MS + 1 NAA
Тиквичка, *Cucurbita pepo* var. *cylindrical*	Cucurbitaceae	





2000s MICROPROPAGATION OF ORNAMELNATAL SPECIES

Dianthus



Brassica oleracea
cv. Kyoto red given

MS + 2mg/l BA + 0.1mg/l IAA + 0.1mg/l GA_3
MS + 2mg/l BA + 0.1mg/l NAA
MS + 2mg/l BA
MS + 5mg/l BA + 5mg/l NAA
MS + 5mg/l BA
MS + 3mg/l BA + 1.5mg/l NAA

ROOTING:
MS + 0.5mg/l IAA + 2.5mg/l IBA.

Ageratum

Petunia

2000s - MICROPROPAGATION OF AROMATIC AND MEDICAL SPECIES

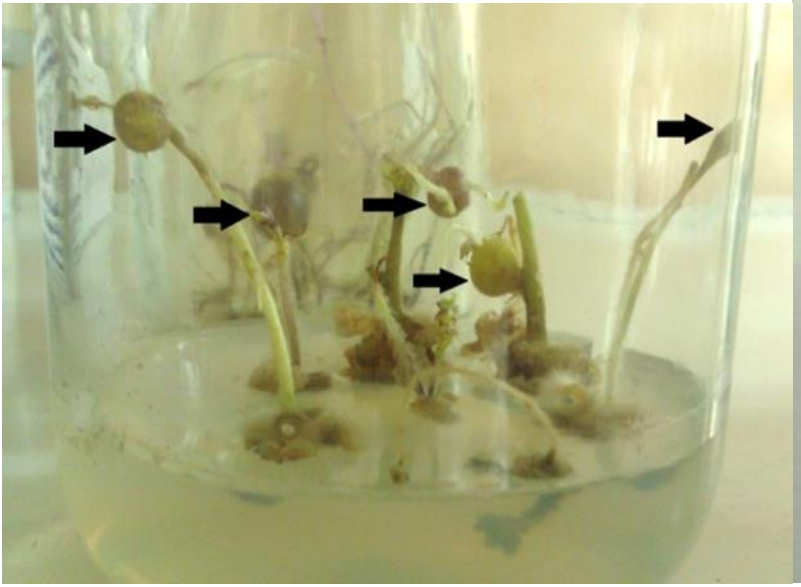
***Eruca sativa* L.**
***Coriandrum sativum* L.**
***Rosmarinus* sp.**
***Origanum vulgare* L.**
***Lavandula vera* L.**
***Melissa officinalis* L.**
***Matricaria chamomilla* L.**
***Saliva officinalis* L.**
***Hypericum perforatum* L.**

Shoots proliferation from hypocotyl explants in salad rocket (*Eruca sativa* L.)

***Melissa officinalis* L.**

***Coriandrum sativum* L.**

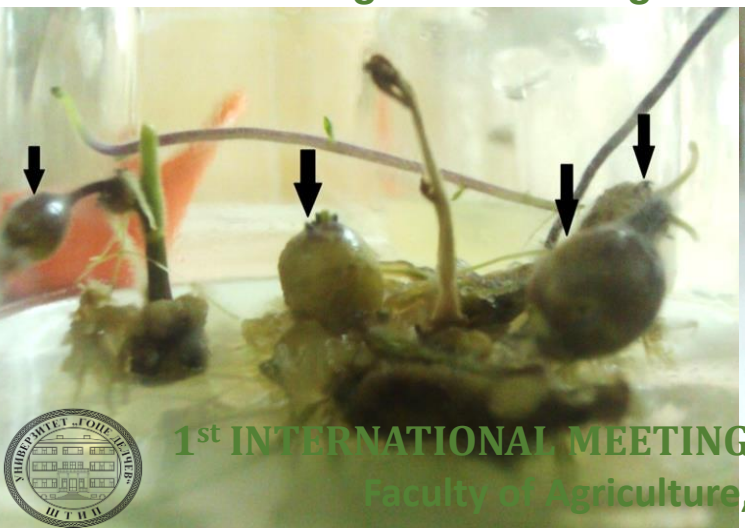
2000s MICROTUBERISATION



2 ppm GA_3,
12 ppm GA_3
22 ppm GA_3

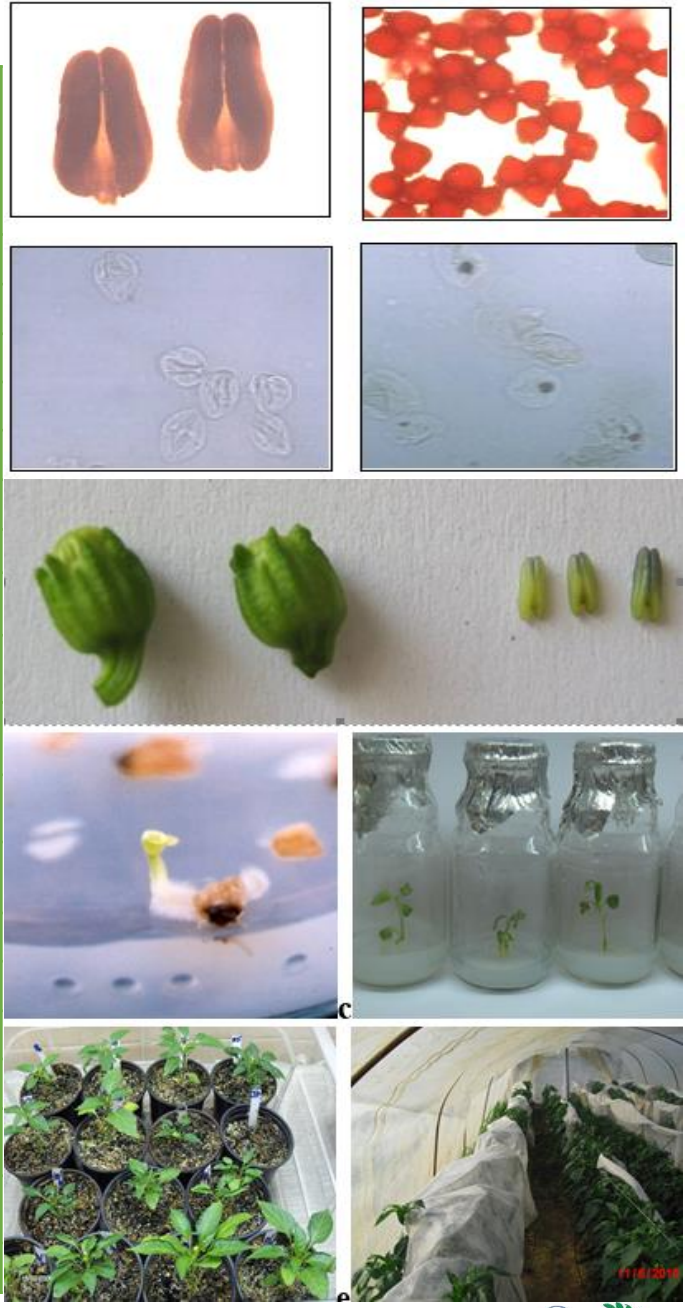
Culture of
- sprouts
- nodules
- tubers

MS + 2mg/L BAP + 2mg/L IAA + 30 g/L sucrose
MS + 1mg/L BAP + 0.5mg/L IAA + 40 g/L sucrose
MS + 1mg/L BAP + 0.5mg/L IAA + 60 g/L sucrose
MS + 4mg/L BAP + 2mg/L IAA + 60 g/L sucrose
MS + 6mg/L BAP + 2mg/L IAA + 90 g/L sucrose



2000s – 2010 ANDROGENESIS *Capsisum annuum* L.

Pepper genotype	Total nr. anthers	Embryogenic anthers (%)	Number of embryos per 100 anthers	Embryogenic response
Féherözön	1502	17.39 a	32.60 bc	Excellent
Tura	300	17.05 a	17.05 ab	Good
Pritavit F1	330	9.23 abc	9.39 abc	Fair
California wonder	151	6.67 abc	5.67 c	Fair
Zlaten medal SR	1031	6.12 abc	8.97 bc	Fair
Majori	330	5.83 abc	6.73 c	Fair
Piran	823	5.03 abc	34.05 ab	Poor
Zlaten medal ŠT	723	4.29 bc	18.57 bc	Poor
Tomato shaped sweet	360	4.17 bc	4.54 c	Poor
Kurtovska kapija BG	620	2.90 bc	50.55 a	Poor
Kurtovska kapija SR	875	2.73 bc	10.20 bc	Poor
Slatko luta	140	2.43 bc	3.33 c	Poor
Feferona	79	0.00 c	0.00 c	No
Vezena luta	83	0.00 c	0.00 c	No
Sivrija	104	0.00 c	0.00 c	No
Rotund	109	0.00 c	0.00 c	No
Kurtovska kapija TU	236	0.00 c	0.00 c	No
Kurtovska kapija MK	122	0.00 c	0.00 c	No
Bonbona	270	0.00 c	0.00 c	No



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Capsaicin - Inhibitory Factor for Somatic Embryogenesis in Pepper Anther Culture

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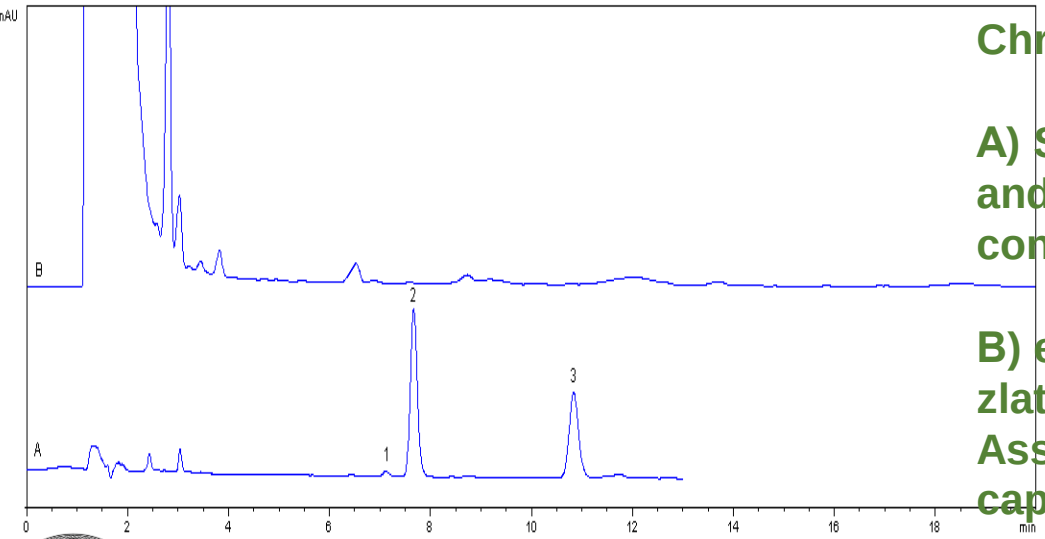
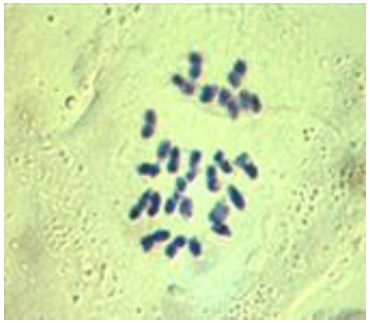


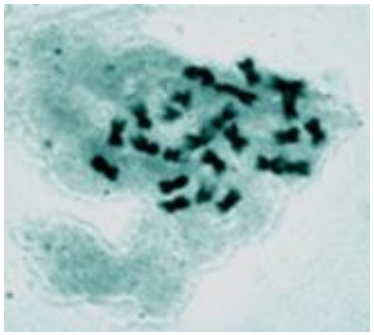
Chromatogram of

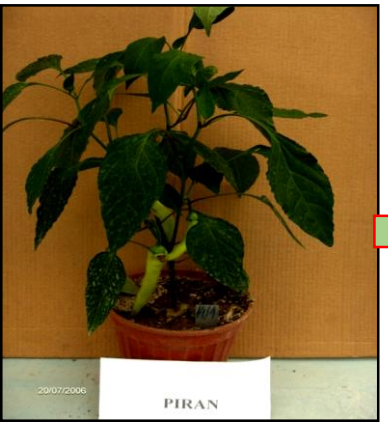
A) Standard solution, a mixture of capsaicin and dihydrocapsaicin (at equimolar concentrations 10 µg/mL),

B) ethanolic extract of pepper, genotype zlaten medal, obtained by Soxlet extraction. Assignation: 1. nordihydrocapsaicin, 2. capsaicin, 3. dihydrocapsaicin.

2010s ANDROGENESIS *Capsisum annuum* L.







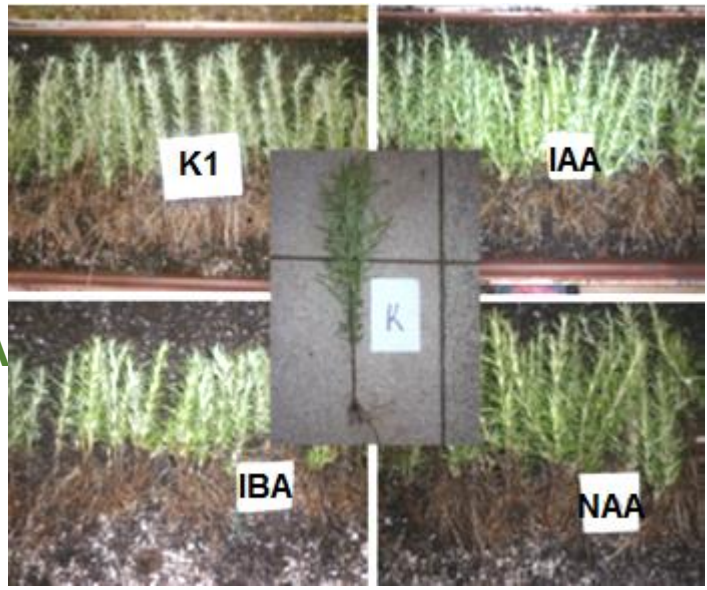
2010s APPLICATION OF PHYTOHORMONES IN THE IMPROVEMENT OF AGRICULTURAL AND HORTICULTURAL SPECIES AT *IN VIVO* CONDITION

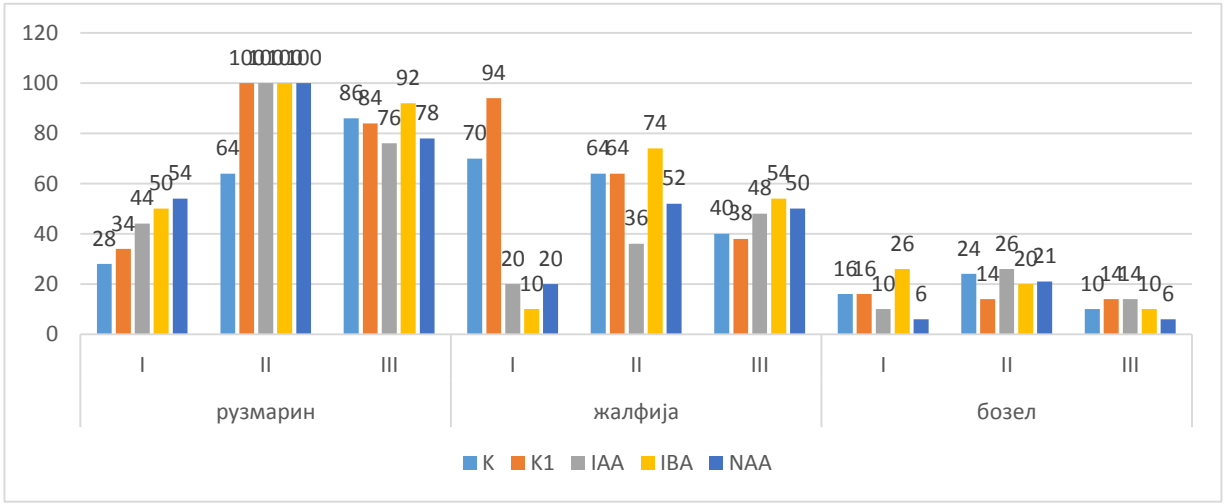
***Rosmarinus officinialis* L.**

***Salvia officinialis* L.**

***Sambucus nigra* L.**

K - Control
K1 - Radicin 0,003% IBA
IAA - 5 ppm
IBA - 5 ppm
NAA - 5 ppm





2010 – PRESENT MISSION OF DEPARTMENT OF PLANT BIOTECHNOLOGY

Project: Application of biotechnological methods for improvement of plant species

Anthura – Kocani
Orhids

SBW Romero Vitro
Vinica
2 000 species


Anthura – Kocani


SBW Romero Vitro - Vinica

APPLICATION OF PHYTOHORMONES IN THE IMPROVEMENT OF AGRICULTURAL AND HORTICULTURAL SPECIES IN THE REPUBLIC OF MACEDONIA?

IMPLEMENTATION OF PLANT BIOTECHNOLOGY IN THE REPUBLIC OF MACEDONIA?

Science can amuse and fascinate us all,
but it is engineering that changes the world.

Isaac Asimov (1920 - 1992)

Thank you!