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MORPHOANATOMICAL CHANGES AT CUCUMBER (*Cucumis sativa L.*) UNDER INFLUENCE OF DIFFERENT 2,4-D CONCENTRATIONS

Suzana Kratovalieva*, Lenka Cvetanovska**

ABSTRACT

Influence of synthetic plant growth regulator 2,4-D to some morphoanatomical parameters at cucumber (*Cucumis sativa L.*) has been researched. In the form of water solution through the soil in the rosette phase 2,4-D has been applied in followed concentrations: 2,0; 4,0 and 8,0 mg/l. Paralleled with those variants has been performed a control plant group treated with equally water volume. Analyze samples have been taken after 15, 30 and 45 day after hormone treatment. Obtained results pointed out that after 15 and 30 days 2,4-D has been influenced stimulate on morphological parameters values while stem elongation has been stimulated under 2,0 mg/l only, but after 45 days only 8,0 mg/l has been influenced stem inchibating; 2,0 as well as 4,0 mg/l have been yet influenced toxically on the rested parameters. Right proportionality with increased 2,4-D concentrations root length has been decreased. After 15 and 30 days under 2,0 and 4,0 mg/l stomata parameters values have been increased than at 8,0 mg/l whereas shown decreasing. At the least sample taking (after 45 days) the stomata number increased under 2,0 and 4,0 mg/l 2,4-D concentration while under 8,0 mg/l this parameter decreased.

Key words: cucumber, morphology, anatomy, stomata.

МОРФОАНАТОМСКИ ПРОМЕНИ КАЈ КРАСТАВИЦАТА (*Cucumis sativa L.*) ПОД ВЛИЈАНИЕ НА РАЗНИ КОНЦЕНТРАЦИИ ОД 2,4-D

Suzana Kratovalieva, Lenka Cvetanovska***

КРАТОК ИЗВАДОК

Во нашите истражувања беа испитувани промените во морфо-анатомските параметри кај краставицата под влијание на

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растителните регулатори на растот како што е 2,4-D. Апликацијата беше направена во форма на воден раствор од 2,4-D во фаза на розета и тоа во следните концентрации: 2,0; 4,0 и 8,0 mg/l. Паралелно беше поставено и контролна група од растенија која беше третирана со ист волумен на вода. Проби за анализа беа земани после 15, 30 и 45 дена од хормоналниот третман. Добиените резултати јасно покажуваат дека после 15 и 30 дена аплицираните концентрации од 2,4-D покажуваат стимулативен ефект на морфолошките параметри, додека елонгацијата на стеблото беше стимулирана само под влијание на 2,0 mg/l, но по 45 дена само концентрацијата од 8,0 mg/l влијаеше инхибиторно. Концентрациите од 2,0 и 4,0 mg/l покажуваат токсично влијание на сите останати истражувани параметри. Правопропорционално со зголемувањето на 2,4-D концентрациите, должината на коренот се намалува. По 15 и 30 дена концентрациите од 2,0 и 4,0 mg/l влијаат стимулативно на стоминиte параметри, додека во присуство на концентрација од 8,0 mg/l истите се намалуваат. По 45 дена од земањето на пробите, бројот на стомите се зголемува во присуство на концентрации од 2,0 и 4,0 mg/l, додека највисоката употребена (8,0 mg/l) предизвикува нивно намалување.

Клучни зборови: краставица, морфологија, анатомија, стоми.

INTRODUCTION

Strict coordinate influence by endogene plant regulators to plant organogenetical and physiological processes is on of actuality and contemporary problem that required a studious as well as biochemical approach in the course of it's solving.

Herbicide activity of 2-chloracetanylides enabled a great applying in agriculture practice. Interest about synthetic regulator synthesis with a strong herbicide activity that caused a certain morph-physiological and anatomical changes increase by the every next day. 2,4-D and atrazyne influence to phosphorous and potassium reception under different pH values (Zsoldos et al. 1979, 1984) as well as jone reception at wheat and rice under the same conditions presented results which pointed out that atrazyn has not manifested a inchibate effect than other investigated herbicides have been caused a remarkable jone reception inchibated by low medium pH values.

Ангелов et al. (1995:81-86) investigations connected to the number and stomata dimensions at tomato (*Solanum lycopersicum L.*). Herbicide negative effect to chlorophyll and carotynoides biosynthesis that conditioned photosynthesis intensity and regulated a plant bioproductivity followed through the changes at certain morphoanatomically parameters (Ivanova 1984, Todorova-Trifonova et al. 1982). Besides above mentioned physiological parameters stem height, root length, leaf length and width as well as width of main leaf nerve and stomata parameters: number, length and width have been the aim of an accurate investigations.

MATERIAL AND METHODS

Cucumber seed material has been picked in plastic vessels with adding of 5-kg air-dry alluvial soil. Per each 5 plants have been brought up on each vessel. Soil retention capacity has been keeped in bounds from 55% to 60 vol. %. In the phase of rosette plants have been supplementary feeding with mineral nutritive solution composed by K_2SO_4 (1,082), K_2HPO_4 (2,082), NH_4NO_3 (3,069).

Influence of 2,4-dichlorphenoxy acetate acid (2,4-D) in 2,0; 4,0 and 8,0 mg/l concentrations than control plant group treated with a same water volume has been investigated. In the form of water solution through the soil in the rosette phase only 2,4-D has been applied. Morph-anatomical changes at performed variants have been considered on every 15 days.

RESULTS AND DISCUSSION

Under 2,4-D concentrations tomato plant variants have been exchanged in the morphological view than the control. After 15 days the applied 2,4-D in all of investigated concentrations has been influenced stimulate on leaf length and width as well as on a leaf nerve width. The stem elongation has been stimulated at low concentrations of 2,0 mg/l, only while a higher concentration of 4,0 and 8,0 mg/l influenced toxically on younger tomato plants.

After 30 days the plant organs have been continued with growth and 2,0 and 4,0 mg/l 2,4-D concentrations influenced stimulate while 8,0-mg/l concentration has been shown a toxic effect, tab.2. At formed tomato plant organs yet (after 45 days) 8,0 mg/l 2,4-D concentration has been inchibated a stem elongation, only than at the rested investigated parameters 2,0 and 4,0 mg/l 2,4-D concentrations have been toxic. Appearance of stimulate plant organs growing under 8,0 mg/l 2,4-D concentration has been resulted by a certain

enzymes activities that participated in a numerously biochemical reactions at tomato plant organs, tab.3.

In all of three measurements (after 15, 30 and 45 days) root growth as well as elongation has been inchibated by 2,4-D applied right proportionality that resulted by more root cells sensitivity on endogene phytochormones as 2,4-D, tab.1, 2 and 3. The considered stem elongation has been resulted by a 2,4-D influence similar with those of indol acetate acid (IAA) that a natural plant growth as well as regulator stimulator.

The average stomata number after 15 days at control plant group have been evaluated 25,17, the stomata length 22,50 μм and stomata width 10,67 μм on face leaf side while at reverse the stomata number has been 31,50, stomata length 21,83 μм and stomata width 9,42 μм. Under 2,0 and 4,0 mg/l stomata parameters values have been increased than at 8,0 mg/l whereas shown decreasing, tab.4.

After 30 days 2,4-D has yet been shown a stimulate influence on stomata parameters under 2,0 and 4,0 mg/l concentration while 8,0 mg/l has been presented as a very toxically consequently on that all of stomata parameters have been decreased. At control plant group stomata number has been evaluated 26,67, length 43,24 μm, width 25,00 μm on face leaf side and 33,44 stomata on mm^2 with dimensions 35,65 μm length and 15,92 μm width, tab.5.

At the least sample taken similar at the previous stomata number increased under 2,0 and 4,0 mg/l 2,4-D concentration while under 8,0 mg/l this parameter decreased. All of applied 2,4-D concentrations after 45-ve days when plant growing has been finished and plant organs have been achieved a definitive size influenced toxically and stomata value parameters decreased. At control plant group stomata number has been evaluated 27,00, length 69.25 μm, width 27,00 μm on face leaf side while on reverse these stomata values have been evaluated 35,10 on mm2, 43,25 μm their length and 20,78 μm width, tab.6.

CONCLUDING REMARKS

Researching the influence of synthetic growth regulator such as 2,4-D at cucumber (*Cucumis sativa L.*) based on obtained results may be considered the following:

- After 15 days the applied 2,4-D in all of investigated concentrations has been influenced stimulate on leaf length, width as well as on a leaf nerve width. The stem elongation has been stimulated at low concentrations of 2,0 mg/l, only while a higher concentration of 4,0 and 8,0 mg/l influenced toxically on younger tomato plants.

- After 30 days 2,0 and 4,0 mg/l 2,4-D concentrations influenced stimulate on plant organs growing, than 8,0-mg/l concentration has been shown as toxically. After 45 days under 8,0 mg/l 2,4-D concentration a stem elongation has been inchibated, only than at the rested investigated parameters even 2,0 and 4,0 mg/l 2,4-D concentrations have been influenced through toxic effect.
- In all of three measurements (after 15, 30 and 45 days) root growth as well as elongation has been inchibated by 2,4-D applied right proportionallity that resulted by more root cells sensitivity on endogene phytochormones as 2,4-D.
- After 15 and 30 days under 2,0 and 4,0 mg/l stomata parameters values have been increased than at 8,0 mg/l whereas shown decreasing.
- After 45 days the stomata number increased under 2,0 and 4,0 mg/l 2,4-D concentration while under 8,0 mg/l this parameter decreased. All of applied 2,4-D concentrations have been influenced toxically on stomata length and width.

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Tab.1. Changes at morphological parameters by cucumber (*Cucumis sativa L.*) plants treated with different 2,4-D concentrations (after 15 days).

Control	**Height of stem (cm)**	**Length of root (cm)**	**Length of leaves (cm)**	**Width of leaves (cm)**	**Width of main leaf nerv**
$\bar{x}$	7.41	7.89	5.83	7.13	1.77
$s_{\bar{x}}$	0.13	0.07	0.14	0.08	0.28
σ^2	1.01	0.56	0.80	0.59	0.50
CV	13.57	7.13	14.04	8.45	28.32
2,0 mg/l					
$\bar{x}$	9.37	7.12	6.45	7.24	1.92
$s_{\bar{x}}$	0.17	0.20	0.17	0.13	0.29
σ^2	1.62	1.43	1.14	0.91	0.54
CV	17.30	20.50	17.42	12.86	28.85
4,0 mg/l					
$\bar{x}$	8.21	6.15	6.77	7.82	1.98
$s_{\bar{x}}$	0.19	0.05	0.18	0.08	0.29
σ^2	1.58	0.58	1.18	0.63	0.54
CV	19.42	5.32	17.80	8.14	28.85
8,0 mg/l					
$\bar{x}$	8.13	5.82	7.99	8.69	2.03
$s_{\bar{x}}$	0.20	0.16	0.07	0.07	0.27
σ^2	1.62	1.41	0.56	0.57	0.48
CV	20.22	16.10	7.08	7.49	26.64

Tab.2. Changes at morphological parameters by cucumber (*Cucumis sativa L.)* plants treated with different 2,4-D concentrations (after 30 days).

Control	**Height of stem (cm)**	**Length of root (cm)**	**Length of leaves (cm)**	**Width of leaves (cm)**	**Width of main leaf nerv (mm)**
$\bar{x}$	7.52	9.22	8.21	8.86	2.42
$s_{\bar{x}}$	0.11	0.07	0.10	0.14	1.54
σ^2	0.84	0.60	0.78	1.25	3.67
CV	11.37	7.43	9.64	14.38	15.34
2,0 mg/l					
$\bar{x}$	9.07	8.29	8.57	11.12	1.80
$s_{\bar{x}}$	0.05	0.05	0.06	0.04	0.14
σ^2	0.47	0.49	0.50	0.39	0.25
CV	5.26	5.34	5.84	4.48	13.98
4,0 mg/l					
$\bar{x}$	9.92	8.00	12.42	8.71	1.68
$s_{\bar{x}}$	0.07	0.05	0.04	0.02	0.15
σ^2	0.59	0.62	0.30	0.17	0.24
CV	6.97	5.17	3.62	2.19	14.61
8,0 mg/l					
$\bar{x}$	8.59	6.07	8.42	8.08	1.90
$s_{\bar{x}}$	0.01	0.04	0.08	0.05	0.11
σ^2	0.13	0.33	0.10	0.52	0.20
CV	1.54	3.75	8.17	4.76	10.87

Tab.3. Changes at morphological parameters by cucumber (*Cucumis sativa L.*) plants treated with different 2,4-D concentrations (after 45 days).

Control	**Height of stem (cm)**	**Length of root (cm)**	**Length of leaves (cm)**	**Width of leaves (cm)**	**Width of main leaf nerv (mm)**
$\bar{x}$	10.77	11.01	7.92	9.15	1.90
$s_{\bar{x}}$	0.03	0.03	0.03	0.07	0.11
σ^2	0.32	0.32	0.26	0.42	0.20
CV	1.02	0.92	1.29	0.98	1.87
2,0 mg/l					
$\bar{x}$	10.99	10.89	7.80	8.40	1.70
$s_{\bar{x}}$	0.04	0.03	0.03	0.03	0.15
σ^2	0.43	0.40	0.26	0.30	0.25
CV	0.92	1.75	1.23	1.49	1.68
4,0 mg/l					
$\bar{x}$	11.98	8.23	6.33	6.39	1.22
$s_{\bar{x}}$	0.04	0.05	0.03	0.06	0.21
σ^2	0.53	0.44	0.16	0.27	0.25
CV	1.41	0.75	0.64	0.92	1.76
8,0 mg/l					
$\bar{x}$	10.08	8.11	9.19	9.71	2.32
$s_{\bar{x}}$	0.03	0.06	0.02	0.03	0.11
σ^2	0.31	0.59	0.16	0.30	0.24
CV	1.05	1.55	0.76	1.15	1.09

Tab.4. Changes at stomata parameters under different 2,4-D concentrations by cucumber (*Cucumis sativa L.*) plants (after 15 days).

	Face leaf side			Reverse leaf side		
Цонтрол	**Number**	**Length**	**Width**	**Number**	**Length**	**Width**
$\bar{x}$ **(μм)**	25.17	22.50	10.67	31.50	21.83	9.42
$s_{\bar{x}}$	0.13	0.09	0.11	0.07	0.05	0.11
σ^2	0.94	2.03	0.82	0.33	0.62	1.07
CV	3.52	9.51	1.64	1.46	1.21	1.87
2,0 mg/l						
$\bar{x}$ **(μм)**	25.50	28.17	11.50	31.83	23.17	11.08
$s_{\bar{x}}$	0.12	0.04	0.11	0.08	0.06	0.11
σ^2	0.94	0.45	0.86	0.45	0.98	0.78
CV	1.12	1.16	1.09	0.77	1,00	1.37
4,0 mg/l						
$\bar{x}$ **(μм)**	33.00	28.25	12.75	43.17	41.83	11.75
$s_{\bar{x}}$	0.10	0.04	0.11	0.08	0.45	0.11
σ^2	0.62	0.32	0.44	0.34	0.98	0.56
CV	1.47	1.03	0.93	0.85	1.84	0.92
8,0 mg/l						
$\bar{x}$ **(μм)**	17.00	23.58	11.50	30.00	26.08	10.50
$s_{\bar{x}}$	0.15	0.04	0.08	0.01	0.05	0.11
σ^2	0.49	0.22	0.24	0.24	0.26	0.24
CV	1.11	0.91	1.61	0.96	0.81	0.93

Tab.5. Changes at stomata parameters under different 2,4-D concentrations by cucumber (*Cucumis sativa L.*) plants (after 30 days).

	Face leaf side			**Reverse leaf side**		
Control	**Number**	**Length**	**Width**	**Number**	**Length**	**Width**
$\bar{x}$ **(μм)**	26.67	43.24	25.00	33.44	35.65	15.92
$s_{\bar{x}}$	0.51	0.07	0.09	0.13	0.07	0.08
σ^2	0.40	0.33	0.91	0.53	0.56	0.62
CV	0.92	0.71	1.67	1.28	0.70	1,17
2,0 mg/l						
$\bar{x}$ **(μм)**	27.35	50.08	29.58	34.75	41.75	19.92
$s_{\bar{x}}$	0.33	0.06	0.06	0.11	0.04	0.08
σ^2	0.84	0.44	0.98	0.56	0.67	0.57
CV	1.52	1.12	1.56	1.07	1.06	0.98
4,0 mg/l						
$\bar{x}$ **(μм)**	36.50	54.50	35.75	44.42	51.42	32.33
$s_{\bar{x}}$	0.14	0.05	0.04	0.14	0.07	0.07
σ^2	0.33	0.74	0.63	0.66	0.39	0.86
CV	0.94	1.06	0.75	1.14	0.79	1,00
8,0 mg/l						
$\bar{x}$ **(μм)**	14.00	40.42	17.00	31.03	36.75	13.58
$s_{\bar{x}}$	0.13	0.07	0.09	0.11	0.07	0.13
σ^2	0.75	0.87	0.52	0.34	0.55	0.57
CV	1.03	1,12	0,89	1.19	0.95	0.86

Tab.6. Changes at stomata parameters under different 2,4-D concentrations by cucumber (*Cucumis sativa L.*) plants (after 45 days).

	Face leaf side			Reverse leaf side		
Цонтрол	**Number**	**Length**	**Width**	**Number**	**Length**	**Width**
$\bar{x}$ **(μм)**	27.00	69.25	27.00	35.10	43.25	20.78
$s_{\bar{x}}$	0.03	0.05	0.10	0.16	0.05	0.10
σ^2	0.35	0.23	0.74	0.22	0.39	0.62
CV	1.14	0.71	1.02	0.77	0.87	1.02
2,0 mg/l						
$\bar{x}$ **(μм)**	29.43	61.42	20.13	37.22	40.02	18.42
$s_{\bar{x}}$	0.44	0.07	0.09	0.10	0.07	0.09
σ^2	0.97	0.29	0.31	0.23	0.82	0.67
CV	1.61	0.57	0.94	0.84	1.09	1.12
4,0 mg/l						
$\bar{x}$ **(μм)**	31.88	56.00	17.71	46.85	39.08	13.00
$s_{\bar{x}}$	0.21	0.05	0.11	0.15	0.05	0.05
σ^2	0.64	0.23	0.28	0.81	0.83	0.59
CV	0.99	0.89	0.63	1.12	1.06	0.94
8,0 mg/l						
$\bar{x}$ **(μм)**	19.55	46.58	11.00	32.70	36.08	11.73
$s_{\bar{x}}$	0.15	0.06	0.11	0.04	0.06	0.02
σ^2	0.52	0.48	0.42	0.31	0.22	0.15
CV	0.94	0.83	1.02	0.76	0.65	1.26