Experimental aspects concerning in vitro growing of the chilli pepper (*Capsicum annuum L.*)

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Abstract The study proposed to establish the existent interrelations and phytohormones influence and its concentration in the culture medium on plantlets growing of chilli pepper (*Capsicum annuum L.*). The plantlets of chilli pepper, local population Buteni were obtained in vitro conditions through the culture of axillary shoots. It were added in the base culture medium (Murashige-Skoog) three classes of phytohormones (auxins, cytokinins and gibberelins) in five concentrations (0.1; 1.0; 1.5; 2.0; 2.5 mg·L⁻¹). Generally, the auxins and gibberellic acid, in combination with big concentrations significantly favored the plantlets growing. The biggest values of the characters were registered in combinations: NAA/2.5 mg·L⁻¹, IAA/2.5 mg·L⁻¹, GA₃/2.5 mg·L⁻¹. The growing regulators influence, indifferently the concentrations had been applied in the culture medium, it regularly manifested, on the plantlets growing, as it followed (from the biggest to the smallest values): IAA, NAA, GA₃, KIN, 2IP. Under exclusive influence of growing regulators, the plantlets height oscillated between 25.0 and 42.1 mm.

Key words axillary shoots culture, chilli pepper, *Capsicum annuum L.*

The genus *Capsicum* has a wide genetic diversity, consist of about 27 species, being five domesticated and 22 semi-domesticated and wild ones [1]. Of the domesticated species, *Capsicum annuum* L. is the most economically important and includes both mild and pungent fruit types. Chillies contain numerous chemicals including steam-volatile oil, fatty oils, capsaicinoids, carotenoids, vitamins, protein, fibre and mineral elements [2] and are variously used for different purposes because of their nutritional value, flavour, aroma, texture, pungency and color in a wide assortment of foods, drugs, and cosmetics, while some are cultivated ornamentally, especially for their brightly glossy fruits with a wide range color, shape and size [3].

Biological Material and Methods

The biologic material used in experiment, was represented by local population of chilli pepper of Buteni. The plantlets chilli pepper, were obtained in vitro conditions through axillary bud culture.

For rooting induction of chilli pepper plantlets, in environment base of Murashige-Skoog [4] were added five phytohormones from three classes of phytohormones, such as: auxins:- 1-naphthaleneacetic acid (NAA), indole-3-acetic acid (IAA); cytokinins:- 2-izopentenil-adenin (2IP), kinetin (KIN) and gibberellins:- gibberellic acid (GA₃).

An experimental factor analyzed in our experiences was the phytohormones concentration, using for every phytohormones the following concentrations: 0.5; 1.0; 1.5; 2.0; 2.5 mg·L⁻¹.

Results and Discussions

Chilli pepper plantlets growing in vitro culture conditions, it was appreciated in function of its intension, the main element of the intension in the experience were the plantlets height.

The results obtained concerning the regulators effect combined and its concentrations in vitro multiplication of the local populations of chilli pepper Buteni, on the plantlets height were presented in table 1.
The available interaction between growing regulators and its concentrations manifested through an entire variability regarding the plantlets height, with variability limits between 17 mm (at variant 2IP/0.5 mg) and 46 mm (at variant NAA/2.5 mg · L⁻¹).

The average height of the plantlets, calculated for all the 25th experimental variants represented by the combinations among the five increasing regulators with five concentrations, it was of 28 mm.

Comparative with that average height considered the testifier variant, after making statistical calculations through variance analysis, it were been obtained statistical differences assured for the average height of the plantlets at the 13th experimental variants. Among those seven experimental variants presented superior deviations and six inferior deviations towards the average, with different levels of statistical assurance.

The biggest height growing of the plantlets registered to the variants IAA/2.5 mg · L⁻¹, NAA/2.5 mg · L⁻¹ and GA3/2.5 mg · L⁻¹, to those variants, the differences face to the experience average being very superior significant. Those were followed by the variants IAA/2.0 mg · L⁻¹ and NAA/2.0 mg · L⁻¹, and the differences concerning the plantlets intension of growing were distinct significant.

Also, the differences superior significant comparative with the experience average, had been obtained at the combinations IAA/1.5 mg · L⁻¹ and GA3/2.0 mg · L⁻¹, to which the plantlets average height was of 38 mm.

The low results concerning the plantlets height were obtained outside the variant with limit values, 17 mm, to combination 2IP/0.5 mg · L⁻¹ and to the variants: 1, 11, 12, 17 and 21, all the experimental variants being registered with a value of that character comparative with the experience average.

The results obtained in experience concerning the average height of the plantlets to the local populations of chilli pepper Buteni had been demonstrated a strong influence of growing regulators and its concentrations on plantlets growth inside of the same populations in function of interaction of growing regulators with its concentration and growing regulators with its concentrations manifested through an entire variability.

Regarding the influence of regulators on the growth as in data presented in table 2 and fig. 1, the growing in plantlets height to the local populations of
chilli pepper Buteni was significantly influenced by the regulator growing type used.

### Table 2

<table>
<thead>
<tr>
<th>No.</th>
<th>Regulator growing type</th>
<th>Plantlets height (%)</th>
<th>Relative value face to the average (%)</th>
<th>Difference from the average (± mm)</th>
<th>Difference signification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>IAA</td>
<td>33</td>
<td>114,2</td>
<td>5</td>
<td>**</td>
</tr>
<tr>
<td>2.</td>
<td>NAA</td>
<td>33</td>
<td>117,0</td>
<td>5</td>
<td>**</td>
</tr>
<tr>
<td>3.</td>
<td>KIN</td>
<td>22</td>
<td>78,4</td>
<td>-6</td>
<td>○○○</td>
</tr>
<tr>
<td>4.</td>
<td>2IP</td>
<td>23</td>
<td>80,1</td>
<td>-5</td>
<td>○○</td>
</tr>
<tr>
<td>5.</td>
<td>GA3</td>
<td>31</td>
<td>110,3</td>
<td>3</td>
<td>(*)</td>
</tr>
<tr>
<td></td>
<td>Average (Blank)</td>
<td>28</td>
<td>100,0</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Average (Blank) 28 100,0 - -

LSD 5 % = 4  LSD 1 % = 5  LSD 0,1% = 6

The differences obtained for the average height of the plantlets in case of five growing regulators used, it had presented statistical deviation assured, comparative with the average value of the experiment.

The highest values concerning the height growing the auxins had been assured, both for indole-3-acetic acid and 1-naphthaleneacetic acid determining an average height of the plantlets with 33 mm with differences superior distinct significant to experience average.

Besides auxins, a good extension of growing was induced also by gibberellic acid that having a positive effect on growing in height of the local population Buteni (31 mm), with accession of growing, that could be significant face to the experience average.

The lowest results concerning the plantlets height were obtained through kinetin usage (22 mm) to which the height differences of the plantlets were inferior to the average per experience in very significant way. Also, the other cytokinin tested in experience, 2-izopentenil-adenin determined increases in the height of the inferior experience average, distinct significant (23 mm).

In base of data obtained we concluded that the growing regulators on the growth of chilli pepper plantlets expressed through its height, was obviously, indifferently its type was, on the chilli pepper plantlets height Buteni, it were presented in table 3 and figure 3.

![Graph of Plantlets Height](image)

**Fig. 1. The influence of regulator growing type used on the plantlets height**
The effect of regulator growing concentration from the culture medium on chilli pepper plantlets height

<table>
<thead>
<tr>
<th>No.</th>
<th>Regulator growing concentration (mg·L(^{-1}))</th>
<th>Plantlets height (%)</th>
<th>Relative value face to the average (%)</th>
<th>Difference from the average (±)</th>
<th>Difference signification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0,5</td>
<td>19</td>
<td>67,4</td>
<td>-9</td>
<td>○○○</td>
</tr>
<tr>
<td>2.</td>
<td>1,0</td>
<td>22</td>
<td>78,2</td>
<td>-6</td>
<td>○○○</td>
</tr>
<tr>
<td>3.</td>
<td>1,5</td>
<td>29</td>
<td>101,1</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>2,0</td>
<td>34</td>
<td>118,2</td>
<td>5</td>
<td>**</td>
</tr>
<tr>
<td>5.</td>
<td>2,5</td>
<td>38</td>
<td>135,1</td>
<td>10</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>Average (Blank)</td>
<td>28</td>
<td>100,0</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

LSD 5 % = 4   LSD 1 % = 5   LSD 0,1% = 6

Fig. 2. The influence of regulator growing concentration used on plantlets height of chilli pepper

Analyzing the experimental data obtained, it was observed that the plantlets height progressively increased in the same time with the concentration, obtaining average values of the character from the value 19 mm, (to the treatment with the smallest concentration, of a 0.5 mg ·L\(^{-1}\)) until 38 mm (to the treatment with the biggest concentration of 2.5 mg ·L\(^{-1}\)).

In experiment the differences obtained for the plantlets height in the variants represented by the five concentrations used, it was statistical assured in four cases.

The inferior differences very significant it was registered to the concentrations of 0.5 mg ·L\(^{-1}\) and 1.0 mg ·L\(^{-1}\) to the others concentrations obtaining values of the average height of the plantlets about 19 mm and respectively, 22 mm.

The biggest growth in height were assured by the superior concentrations of 2.0 mg ·L\(^{-1}\) and 2.5 mg ·L\(^{-1}\), with values of the character of 34 mm and 38 mm both being assured from statistical point of view.

The conclusion of analysis data obtained, was not only the growing regulators used but it had really been influenced the plantlets height to the local populations of chilli pepper Buteni, and also its concentrations. The greatest values regarding the height of chilli pepper plantlets were obtained to big concentrations during small doses determined the smallest values of plantlets height.

Conclusions

The plantlets height was a strong characteristic influenced by the interaction between the increasing regulators and its concentrations. Generally, the auxins and gibberellic acid, in combination with big concentrations significantly favored the plantlets growing. The biggest values of the characters were registered in combinations: NAA 2.5 mg ·L\(^{-1}\), IAA/2.5 mg ·L\(^{-1}\), GA3/2.5 mg ·L\(^{-1}\).

The growing regulators differently activated on plantlets growing: to all species the auxins determined significantly increases of the plantlets height during the cytokinins had been determined inferior values to the experience average.

The growing regulators influence, indifferently the concentrations had been applied in the culture medium, it regularly manifested, on the plantlets growing, as it followed (from the biggest to the smallest values): IAA, NAA, GA3, KIN, 2IP.
Under exclusive influence of growing regulators, the plantlets height oscillated between 25.0 and 42.1 mm.

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