Effect of gibberelllic acid (GA3) foliar on some physiological traits and mount of pigments in *Vigna radiate* L

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**Key words:** Mungbean, Gibberellic acid, Chlorophyll, Seedling length.

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**Abstract**

In order to study the effects of Gibberellic acid (GA3) foliar on *Vigna radiata* L. the experiment was carried out in Research Laboratory and research field of Islamic Azad University of shahr-e-Qods in 1390 randomized completely design and randomized completely block design with 3 replications and 3 treatments such as: 1: control (water), 2: (GA3, 0.0001 molar), and 3: (GA3, 0.001 molar) which seeds were foliar at 45 minutes in GA3 during these solutions. The result showed that between treatments of chlorophyll (a), chlorophyll (b), chlorophyll (t), carotenoids measure, there are significant differences at 1% level that highest said adjective was related to treatment 3. But between treatments there are not significant differences of measure in anthocyanin. In addition, said treatment increased lengths shoot and proportion length root to length shoot. However, between treatments there are not significant differences of length root. Also, the resumed result of field section showed that there was not significant distinction among treatment such as final emergence percentage but about shoot length there was significant difference at 5% level and enhance of shoot length too.

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Introduction
Mungbean is dicotyledonous plant that is of Legume sp. Family which contains greatest protein and carbohydrate that author foots with high value alimentary. The use of priming method is one of the proper methods for increasing seed quality in unsuitable environments (Basra et al., 2004). Which increases the seed germination and emergence of seedling (Akeson and Henson, 1980). Seed can be treated with different physical and chemical components such as gibberellic acid, Cytokinin, Hydrochloric acid, chloride sodium, potassium nitrate, and sulfuric acid seed cracking (soltan.and kochaki, 2007). Priming is simple, cheap and safe for environment (Igbal and Ashraf, 2006). It is well known that hydrolyzed enzymes are produced at germination time that can autolysis the fatty acid and carbohydrate storage and protein tissues (Moore et al., 2011). Researchers reported that foliar of gibberllic acid increased the vigor of rice seeds, corn, pea seeds and that make the establishment quick, early flowering and high yield (Rashid et al., 2006). It is now generally accepted that gibberllins have provocative role in germination and breaking of seed dormancy (Fathi and Esmailpour, 2000). Gibberellic acid causes increase of cell division and increase of elastic properties of the cell wall (Brown and T-H, 1986) Developing seeds are sources of gibberellic acid and are highly active in the biosynthesis of this component(Moore et al., 2011). (Khan, 1971) has reported that gibberellins, Cytokinins and inhibitors are necessary growth regulators for dormancy or germination on seed and presence and absence of one of the three hormones determinat germination on physiologically active concentrations. Gibberellic acid is a plant growth regulator that has great role on growth of nodules (Hooley, 1994; Ross, Murfet & Reid. 1997; Sawin & Olszewski Neil, 1996).

Gibberlic acids are made in seed at germination time (Bewley and Black, 1982) and caused hydrolyze of storage components for seedling development (Kepczynski and Groot, 1989). Haberland, (1890)has reported that aleurone layer in Secale cereal L. can produce substances that could analyze starch of seeds. Brown and Escombe (1998) had similar results in Hordeum vulgare L. (Moore et al., 2011).

paleg in Australia and yomo in Japan as a separate research, showed that when gibberellic acid is added to section of endosperm hordeum vulgareL. Seeds start to produce amilolaze enzymes inclusive Alfa amylase and sugars abandon is stimulator growth (paleg, 1965). Briges at 1963 added several hydrolyze enzymes to these observations (protease, Phosphatase, Beta Glucanase) (Moore et al., 2011). The chlorophyll of standpoint absorbent and use of light energy in the photosynthesis have basic role. In addition, regulators growth plant efficacy on biosynthesis and analyze chlorophyll are effective as a straight on photosynthesis (Fahimi, 1953). Chlorophyll content in plants is one important factor to retain biosynthesis capacity (Jiang and Huang, 2001). Use of Chlorophyll fluorescence is a suitable method for discussion of photosynthesis and situation of plant’s physiological traits (Sthapit, Witco be and Wilson, 1995; Rizza et al., 2001).

The main objective of this study was to evaluate the effects of Gibberellic acid (GA3) foliar on seed germination, amount of pigments and early growth of Vigna radiate L.

Materials and methods
In order to study the effects of Gibberellic acid (GA3) foliar on Vigna radiate L. experimental as a randomized complete design and randomized completely block design with 3 replication and 3 treatment as a treatment1: control (general water), treatment 2: (0.0001 m GA3), treatment 3: (0.001 m GA3) in the Research Laboratory and research field of Islamic azad university shahr-e-Qods Branch in 1390 was performed.

Experiment method
In start seeds soaked in said treatment solution for duration 45 minute, therefore in each replication put 100 number seed between two layers of leach paper, and then irrigated with general water for all treatment for duration 8 days after germination.
Therefore, from each replication selected 10 normal seedlings and their shoot length, root length and proportion root length to shoot length measured. Also, the amount of samples chlorophyll (a), chlorophyll (b), chlorophyll (t), anthocyanin, carotenoids has been measured.

In addition, in the field section the mounts of final emergence percentage and shoot length were measured.

**Statistical analysis**

Finally, information is analyzed by static software's SPSS16 and SAS and instance scrutiny and comparison with Duncan test.

**Results and discussion**

The Result resumed of trial showed that between treatments of shoot length there are significant differences at 1% level (table 1). That Pursuant to comparison of means (table 2) highest shoot length was related to treatment 3 (0.001 m) and least was related to treatment control (general water). That showed Gibberellic acid (GA3) has high effect on shoot growth and its cause may be known in stimulating of more cell division and cell enlargement. Also judging from resumed Result of Proportion root length to shoot length there was significant distinctions at 5% level (table 1), that lease was related to treatment 3 (0.001 molar) (table 2) but between treatments of root length, there was not significant differences (table 1).

**Table 1.** Analysis of variance for effect of Gibberellic Acid (GA3) foliar on some physiological features in Mungbean.

<table>
<thead>
<tr>
<th></th>
<th>MS</th>
<th>df</th>
<th>S.O.V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root/shoot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0512*</td>
<td>ns 2.190</td>
<td>41.203**</td>
<td>2</td>
</tr>
<tr>
<td>0.0057</td>
<td>0.896</td>
<td>0.4755</td>
<td>9</td>
</tr>
<tr>
<td>16.34</td>
<td>15.86</td>
<td>5.12</td>
<td>C.V %</td>
</tr>
</tbody>
</table>

**Table 2.** Comparison of mean effect of Gibberellic Acid (GA3) foliar on some physiological features in Mungbean.

<table>
<thead>
<tr>
<th></th>
<th>Root length</th>
<th>Shoot length</th>
<th>Treatment Gibberellic acid (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.530 A</td>
<td>5.42 A</td>
<td>10.16 C</td>
<td>1 Control</td>
</tr>
<tr>
<td>0.550 A</td>
<td>6.95 A</td>
<td>12.72 B</td>
<td>2 (0.0001M)</td>
</tr>
<tr>
<td>0.314 B</td>
<td>5.52 A</td>
<td>17.47 A</td>
<td>3 (0.001M)</td>
</tr>
</tbody>
</table>

Mean followed by similar in each column are not significantly different.

The hormones of plant like Gibberellic acid have the important role in growth of plants (Ritchie and Gilroy, 1998). In one trial that performed in bean seedling (Phaseolus) it was found that both parameters, cell division and cell enlargement, are stimulated by external GA3 but it is assumed that has been highest effect on cell enlargement (Moore et al., 2011). In general stem enlargement in all plants that was treated by external GA3 dependency to hormone effects on cell division and cell enlargement that effects one, is more than effect two (Moore et al., 2011).
Table 3. Analysis of variance for effect of Gibberellic Acid (GA3) foliar on some physiological features in Mungbean.

<table>
<thead>
<tr>
<th>Mean square (MS)</th>
<th>Shoot length</th>
<th>Final emergence</th>
<th>df</th>
<th>Sources of variation (SOV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.11444444 * ns</td>
<td>12.0 * ns</td>
<td>2</td>
<td>Replication</td>
<td></td>
</tr>
<tr>
<td>0.15444444 *</td>
<td>61.0 * ns</td>
<td>2</td>
<td>GA</td>
<td></td>
</tr>
<tr>
<td>0.02111111</td>
<td>44.5</td>
<td>4</td>
<td>Error</td>
<td></td>
</tr>
<tr>
<td>4.60</td>
<td>7.04</td>
<td>CV (%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at 5% level , ns, non Significant.

Cell division does not cause growth lonely and cell division stimulation may be with normal speed or more speed of cell enlargement speed than growth done back external gibberellic acid. Be meant to that gibberellic acid is not necessary for roots growth. Do not turn out that gibberellic acid is stimulating roots growth or inhibits or whereas gibberellic acid is effective on cell division or cell enlargement in root (Moore et al., 2011). Seed pre treatment before germination is said to let the seeds establish root, but not appears (Basra, Pannu and Afzal, 2003) The Use of external gibberellic acid in plants species is that plants has rather early growth and also has shorter growth period that this affair become to economize in expenditures especially in greenhouse plants and also better weed control that these consideration coincide with trial that is performed by Jones, and Hanks, (1985), they by soaking bulb of chilling tulips in different gibberellic acid consistency concluded that treatment with gibberellic acid can decrease greenhouse period 7-11 days than bulbs untreated.

In addition, in other trial that is performed (Hasanpoorasil, Roien and Rabie, 2010) in daffodil German digit cultivate gibberellic acid treatment effect caused boughs growth and (quality of leaf and stem) and shorter growing period. Lockhart at 1957 volunteered early document about station of gibberellic acid biosynthesis with the use of potato seedling, he showed that used GA3 can be replaced with shoot apex as a perfect in pea below stem station enlargement and the result is that has produced natural gibberellic acid product in stem apex (Lockhart, 1957). In 1961, researchers used halfed seeds without embryo hordeum that showed added gibberellic acid causes increase in Alfa amylase activity (Moore et al., 2011).

Table 4. Comparison of mean effect of Gibberellic Acid (GA3) foliar on some physiological features in Mungbean.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Shoot length (cm)</th>
<th>Final emergence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>control</td>
<td>2.90 b</td>
<td>90.0 a</td>
</tr>
<tr>
<td>GA (0.0001 M)</td>
<td>3.25 a</td>
<td>99.0 a</td>
</tr>
<tr>
<td>GA (0.001 M)</td>
<td>3.33 a</td>
<td>95.0 a</td>
</tr>
</tbody>
</table>

Mean followed by similar in each column are not significantly different.

Inter cellular biosynthesis dependent gibberellic acid submitted for protease, Alfa amylase and 1&3-βGlucanase and Ribonuclease and nearly 1&3,4-β Glucanase , Acid phosphatase and Dnase(Brown and T-H. 1986).

Also, of the amount of chlorophyll (a), chlorophyll (b), chlorophyll (t) and carotenoids, judging from Result resumed of statically analyzed among treatments observation significant differences at 1% level (table 5)were monitored, that Pursuant to comparison of means (table 6) highest was related to treatment 3(0.001 molar) and least was related to treatment1, control (general water).
In addition in this trial the amount of anthocyanin was measured that there was no significant difference among treatments (table 5). Chlorophylls are macromolecules that vulnerability in stress conditions and are the most important light absorbent pigment in Chlorophylls Tilakoid membrane. In addition, Chlorophylls Tilakoid membranes have secondary light absorbent pigments (tributary pigments) mean Karotenoids. Karotenoid pigments absorbs light in wavelength that is not absorbed by other pigments also Karotenoids are complementary light receiver (Hopkins, 1999).

<table>
<thead>
<tr>
<th>Table 5. Analysis of variance for effect of pre treatment Gibberellic Acid (GA3) on amount of pigments in Mungbean.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>anthocyanin</strong></td>
</tr>
<tr>
<td>1.2633 ns</td>
</tr>
<tr>
<td>0.8713</td>
</tr>
<tr>
<td>7.75</td>
</tr>
</tbody>
</table>

**Significant at 1% level , ns, non Significant.

Abdel wahid and Sweify, (2009) on Beaucarnea recurvata showed the effective role of gibberellic acid in increasing Karotenoid content.

In one trial that was performed by majidian.m et al, pre treatment of calla lily corms, white flower digit with gibberellic acid causes the increase in leaves of Chlorophyll content and is significant in 1 percent (Majidian et al., 2009).

In one examination, it is showed that there are very high and significant correlation between chlorophyll a, chlorophyll b and chlorophyll t (Enferad, 204). There are acceptable explanations for presence of anthocyanins in plants. Even so, production of anthocyanins in result of environmental stress (Chalker-Scott, 1999) existence of red leaves at foregone time of year and in special leaves growth phase and also special environmental condition (Lee, Lowry and Stone, 1979) some of researchers coerced that in order to determinate leaves anthocyanin roles, performed necessary examinations. In recent years provided concepts of anthocyanin function in plant that may mention to: 1-balance of quantity and quality light reception 2- protection of UV-B destroying effects 3- protection of plant to herbivore animals 4- protection of light stay and 5- Broomer of oxygen actives radicals in environmental stress condition. Also any one of suggested functions does not exclude anthocyanins. Other materials in leaves may carry out these functions as efficiency. For example presence of Karotenoids and chlorophylls distribution may compensate light catch of outstanding and terpen and other secondary metabolites do as anti Herbivores defensive materials in a few of plants.

<table>
<thead>
<tr>
<th>Table 6. Comparison of mean effect of pre treatment Gibberellic Acid (GA3) on amount of pigments in Mungbean.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>anthocyanin</strong> [mg/g (FW)]</td>
</tr>
<tr>
<td>12.52 A</td>
</tr>
<tr>
<td>12.17 A</td>
</tr>
<tr>
<td>11.42 A</td>
</tr>
</tbody>
</table>

Mean followed by similar in each column are not significantly different.

Therefore it is possible that anthocyanins haven’t special function in leaves, but researches show that anthocyanins may be in coordination with protection molecules in plant tissues does self function and for defect reparation in molecules density during stress period get to work.
So there are concepts that says, anthocyanins in special station in leaves can cause improvement in efficiency of plant to get to work. Accumulation of anthocyanins is possible by implantation of different environmental motivations like UV (Reddy et al., 1994), low temperature (Christie, Alfenito and Walbot, 1994), Pathogenic ingredients attack (Harrison, and R.G, 1980; Heim et al., 1983; Hipkinsk, Wood and Nicholson, 1996) and a regulator growth like Cytokinin (Deikman and Hammer, 1995), gibberellins (Mealem et al., 1997), ethylene (Woltering and Somhorst, 1990), gibberellic acid (Akinwunmi, 2001).

Of course these metabolites like Karotenoids and anthocyanins by Broom of free radicals Broom bring protection of plant to oxidative stresses (Sairam, Deshmukh and Saxena, 1998; Woodson and Lawton, 1988). Karotenoids may catch high energy of short wavelength, change only singularity to triplet and by catching oxygen radicals produces and performs its anthocyanin role (Qinghua and Zhujun, 2008).

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