BACTERIAL METABOLITES FROM BACILLUS CEREUS B4 RESPONSIBLE FOR POTATO PLANT GROWTH

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ABSTRACT: *Bacillus cereus* B4 a biocontrol agent, produces three types of metabolites that contribute to its ability to suppress certain plant diseases and promote growth of potato crop. The metabolites were identified as Kanosamine, 3,4-dihydroxy benzoate (also known as 3,4-DOHB), and 2 keto-4 methyl-thiobutyrate. To enhance understanding of biological activity related to plant growth promotion, mode of action of one metabolite namely, 3,4-DOHB was determined. The metabolite improved crop vigour by eliminating free radicals which provided conditions for development of larger and healthier root system.

Introduced plant growth promoting rhizobacteria with antagonistic properties, have long been reported to increase plant vigour as well as yield (Lang and Kammedahl, 1976,). Efficacy of *Bacillus cereus* has been tested against different soil-borne fungal and bacterial pathogens (Berg and Petterson, 1986, Marahiel et al, 1993). The biocontrol agent, *Bacillus cereus* B4, produces certain metabolites that contribute to its ability to suppress certain plant diseases and promote growth of potato crop (Sunaina, 2004). To understand growth promoting activity of the metabolites released by this biocontrol agent B4, identification and mode of action of one of the metabolites was determined.

The metabolites were isolated and identified as per the method suggested by McKeen et al. (1996). The culture broth was filtered through Whatman filter paper and the filterate was extracted with chloroform. The organic layer was separated, dried over anhydrous sodium sulphate and concentrated on a rotary vacuum evaporator. The metabolites were separated by column chrotomography. The separated metabolites were further characterized by nuclear maganistic resonance (NMR) and mass spectroscopy.

Greenhouse assay on potato plant vigour was determined by using crude extract of only one metabolite namely 3,4 DOHB. Different concentrations of this compound were prepared in distilled sterilized water. Tubers, before planting, were dipped for 20 minutes in each dilution. Treated tubers were sown in 10” pots. The experiment consisted of four replications and 10 tubers in each replication. To assess the plant vigour, plant emergence, length of the root, root mass and shoot length of an individual plant were measured at 60 days after growth and comparison was made with control by using ANOVA.

Table 1. Effect of 3-4 dihydroxy benzoate metabolite on growth of potato plant

<table>
<thead>
<tr>
<th>Metabolite extract conc. (ppm)</th>
<th>% Emergence</th>
<th>Shoot length (cm)</th>
<th>Root length (cm)</th>
<th>Root mass (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 ppm</td>
<td>99.50</td>
<td>26.50</td>
<td>14.75</td>
<td>15.50</td>
</tr>
<tr>
<td>50 ppm</td>
<td>99.25</td>
<td>31.25*</td>
<td>20.25*</td>
<td>18.0*</td>
</tr>
<tr>
<td>75 ppm</td>
<td>98.50</td>
<td>34.0*</td>
<td>21.50*</td>
<td>23.25*</td>
</tr>
<tr>
<td>100 ppm</td>
<td>98.50</td>
<td>25.0</td>
<td>13.70</td>
<td>15.50</td>
</tr>
<tr>
<td>Control</td>
<td>99.50</td>
<td>25.50</td>
<td>12.70</td>
<td>13.75</td>
</tr>
<tr>
<td>S.E±CD=0.05%</td>
<td>0.351.09</td>
<td>1.344.13</td>
<td>1.033.19</td>
<td>1.304.00</td>
</tr>
</tbody>
</table>

* Values significant at P=0.05

The crude extract of *B. cereus* B4 culture filterate yielded three compounds. These compounds were identified as Kanosamine, 3,4-dihydroxy benzoate (also known as 3,4-DOHB), and 2 keto-4 methyl-thiobutyrate by methods of NMR and mass spectroscopy.

On the basis of greenhouse assay, the different concentration of the compound 3,4-DOHB did not show any effect on plant emergence. The maximum increase over control was recorded upto 33.33% in shoot length, upto 69.29% in root length and upto 69.09% in root mass at 75 ppm concentration this treatment was next followed by
50 ppm concentration. However, the concentration of 25 ppm was found ineffective in increasing any of the above growth parameter whereas conception 100 ppm recorded reduction in all the plant growth parameters such as shoot length, root length and root mass. The results demonstrated that the compound 3,4-DOHB is effective when used at concentrations between 50 to 75 ppm (Table 1). The results confirm that the compound has got a growth promoting property and once its mode of action is elucidated the compound can be used to enhance the yields not only of potato but also of other crops. These findings confirm the earlier reports where it has been reported that *Bacillus cereus* strain W85 releases secondary metabolites related to fungal disease suppression and plant growth promotion in synthetic culture media (Jocelyn *et al.*, 1996).

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**Literature cited:**


