Management of charcoal rot of maize with *Trichoderma viride*

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**Key words:** Maize, charcoal rot, *Trichoderma viride*

Maize occupies fifth position in area and third in production in India as it is grown in 6 ma ha having a production of 11.2 mt (1). Annual loss of grain due to the diseases in maize has been estimated to the tune of 13.2 per cent (14). Charcoal rot caused by *Macrophomina phaseolina* (= *Rhizoctonia bataticola*) is one of the economically important diseases of maize. Since, the pathogen is both seed and soil borne, it is very difficult to control by chemical treatment alone as it does not give protection throughout the crop growth period. Hence an effort was made to identify a suitable *Trichoderma viride* isolate for the management of this disease under field conditions. Several toxic metabolites have been reported to be produced by *Trichoderma* spp. *in vitro* and there is an evidence that such metabolites are produced in bits of organic matter in soil (18). Many of them have been isolated and characterized chemically. Anti-fungal metabolites of *Trichoderma* have been grouped into Pentaketiles, Terpenoides, Octaketides and Peptaibols (6). The production of anti-fungal metabolites by *Trichoderma* spp. inhibitory to various pathogens has been reported by several workers (3,7,11,19). The biocontrol agents also improve plant growth in addition to disease control resulting in higher yield. Wells *et al.* (17) first demonstrated the efficacy of *T. harzianum* against *Rhizoctonia* spp. in the field. The seed treatment with *T. viride* and *T. harzianum* reduced the rot incidence in sesamum (4), mungbean (16) and jute (2).

Species of *Trichoderma* were isolated (from rhizosphere of healthy maize plants) using dilution plate technique on *Trichoderma* selective medium (TSM) (Elad and Chet, 1983). Out of the nine isolates only one *T. viride* (MR), was selected using dual plate technique. Seven isolates of *T. viride* were obtained from Indian. Type Culture Collection (ITCC), Division of Plant Pathology, IARI, New Delhi viz., T.v. 2109 (Assam), T.v. 2185 (Solan), T.v. 2211 (New Delhi), T.v. 3235 (Solan), T.v. 3277 (Shandilya), T.v. 3798 (New Delhi and T.v. 4282 (Jammu). The isolate T.v. (TN) was obtained from Tamil Nadu Agricultural University, Coimbatore.

The effect of volatile and non-volatile metabolites was tested in laboratory. The plates were incubated in an incubator at temperature of 28±1°C and radial growth of the pathogen was recorded after 24, 48, 72 and 96 hours of inoculations. Finally, the per cent inhibition of the pathogen was calculated.

In field trials of the nine isolates of *T. viride*, two isolates viz., Maize rhizosphere (NM) and 4282 were selected based on their superior performance in laboratory tests. The trial was conducted in RBD following the eight treatments as given in Table 1.

Maize seeds were treated with talc-based powder formulation of fungal antagonist @ 4, 8 and 12 g/kg and carbendim (Bavistin 50 WP) at 4 g/kg. The treated seeds were kept for 24 hrs and then sown in the field. Seven days after sowing, the per cent germination was calculated. The bio-metric observations were made at post flowering stage. The charcoal rot incidence was recorded after splitting open the stalks longitudinally following the 1 to 10 scale developed by Payak and Sharma (13).

The results of the studies showed that all the nine isolates of *T. viride* were found to produce inhibitory volatile substances *in vitro* as well as all the isolates were found to reduce the radial growth of the pathogen over control.

In field trials as is evident from Table 1, all the treatments showed better growth and dry matter production over the control. The *T. viride* (MR) - 12 g/kg treated plots gave maximum shoot length (180.8 cm), dry matter (624.5 g) and grain weight of 10 cobs (910.5 g), followed by *T. viride* (MR) - 8 g/kg treatment but both were at par statistically. Same trend was evident...
Table 1. Effect of *T. viride* on biometric observations and yield components of maize in field

<table>
<thead>
<tr>
<th>Treatments</th>
<th>% disease index (PDI)</th>
<th>Plant height on 80 DAS (cm)</th>
<th>Dry matter production (g)</th>
<th>Dry weight of 10 cobs (g)</th>
<th>Grain weight of 10 cobs (g)</th>
<th>% increase in grain weight over control</th>
<th>1000 seed weight (g)</th>
<th>% increase in 1000 seed weight over control</th>
<th>Yield (Kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. viride MR-4g kg</td>
<td>19.0</td>
<td>163.5</td>
<td>567.8</td>
<td>1049.9</td>
<td>855.8</td>
<td>68.9</td>
<td>274.0</td>
<td>16.9</td>
<td>4706.9</td>
</tr>
<tr>
<td>T. viride MR-8g kg</td>
<td>3.0</td>
<td>179.5</td>
<td>612.3</td>
<td>1103.8</td>
<td>903.8</td>
<td>78.3</td>
<td>284.8</td>
<td>21.6</td>
<td>4970.9</td>
</tr>
<tr>
<td>T. viride MR-12g kg</td>
<td>12.5</td>
<td>180.8</td>
<td>624.5</td>
<td>1118.3</td>
<td>910.5</td>
<td>79.7</td>
<td>288.5</td>
<td>23.1</td>
<td>5007.8</td>
</tr>
<tr>
<td>T. viride 4282-4g kg</td>
<td>23.1</td>
<td>180.8</td>
<td>544.0</td>
<td>1046.8</td>
<td>854.3</td>
<td>68.6</td>
<td>267.5</td>
<td>14.2</td>
<td>4699.7</td>
</tr>
<tr>
<td>T. viride 4282-8g kg</td>
<td>15.3</td>
<td>173.5</td>
<td>589.6</td>
<td>1089.8</td>
<td>891.8</td>
<td>76.0</td>
<td>275.3</td>
<td>17.5</td>
<td>4904.9</td>
</tr>
<tr>
<td>T. viride 4282-12 g kg</td>
<td>13.9</td>
<td>176.9</td>
<td>608.6</td>
<td>1103.1</td>
<td>897.5</td>
<td>77.1</td>
<td>279.8</td>
<td>19.4</td>
<td>4936.3</td>
</tr>
<tr>
<td>Carbendzim m-4 g kg</td>
<td>29.0</td>
<td>135.5</td>
<td>476.4</td>
<td>889.4</td>
<td>706.8</td>
<td>39.5</td>
<td>262.8</td>
<td>12.2</td>
<td>3887.4</td>
</tr>
<tr>
<td>Control</td>
<td>58.6</td>
<td>119.0</td>
<td>455.1</td>
<td>662.8</td>
<td>506.8</td>
<td>-</td>
<td>234.3</td>
<td>-</td>
<td>2787.4</td>
</tr>
</tbody>
</table>

in case of 1000 grain weight, and yield. Many workers reported similar results. Seed treatment with *T. viride* increased the root length, shoot length, nodulation and yield in mungbean (9) and peanut (8). Raguchander et al. (15) reported that *T. viride* treatment increased the yield of blackgram by 97 per cent through increased root, shoot development and nodulation. The strains of *Trichoderma* were reported to promote growth and biocontrol activity in lettuce (12) and in mungbean (10).

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REFERENCES


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