**In vitro evaluation of botanicals against Colletotrichum graminicola causing Anthracnose of sorghum**

KA Rewale, RW Deshmukh, GJ Kale, AM Kadam, RP Bhosale

**Abstract**

Effect of aqueous extracts (leaf, rhizome and bulb) of nine botanicals were tested evaluated *in vitro* (each @ 10 and 20%) against Anthracnose of sorghum caused by *Colletotrichum graminicola* under *in vitro* condition. Among the nine botanicals tested were found fungistatic against *C. graminicola* and the results obtained on its mycelial growth and inhibitions. Results revealed that all the nine botanicals evaluated were found fungistatic against *C. graminicola* and recorded significantly reduced mycelial growth and increased mycelial inhibition of the test pathogen over untreated control. The mycelial growth was found to be decreased and its inhibition was increased with increase in concentrations of the botanicals tested. However, significantly highest average growth inhibition was recorded with *A. indica* (70.73%), followed by *Z. officinale* (62.58%), *A. cepa* (54.43%), *P. hystrophorus* (49.81%) and *P. pinnata* (42.95%).

**Keywords:** Colletotrichum graminicola, A. indica, P. pinnata, P. hystrophorus

**Introduction**

Sorghum (*Sorghum bicolor* (L.) Moench, is an important cereal crop in India popularly known as ‘Jowar’ and large size of among other grain millets is called ‘Great millet’. In India the production is concentrated in the four states Maharashtra, Karnataka, Andhra Pradesh and Gujarat; it is next in importance to rice and wheat and is planted on nearly 5.84 million hectares with an annual production of 5.90 million tones (Anonymous, 2013). Maharashtra contributes 23.81 lakh hectares and 8.82 lakh hectares areas with production of 11.19 and 13.25 lakh tonnes in Rabi and Kharif respectively (Anonymous, 2013). Powell *et al.* (1977) reported that grain yield was reduced by 70% and more than half the yield loss resulted from incomplete grain fill as verified by 42% decrease in 1000-seed mass and 17.2% decrease in seed density. Uttarakhand has been identified as hot spot for the anthracnose disease (Singh and Singh 2008). Anthracnose of sorghum was first reported from Togo in 1902 (Mughogho, 1988).

**Materials and Methods**

Aqueous extracts of nine botanicals were evaluated *in vitro* against *C. graminicola*, applying Poisoned food technique. Aqueous extracts of the test botanicals were prepared by grinding with mixture-cum grinder. The 100 gm. washed leaves/bulbs/rhizomes of each of the test botanicals were macerated in 100 ml distilled water (w/v) separately and the macerates obtain were filtered through double layered muslin cloth. Each of the filtrate obtained was further filtered through Whatman No. 1 filter paper using funnel and volumetric flasks (100 ml cap.). The final clear extracts/filtrates obtained formed the standard aqueous extract of 100 per cent concentration. These were evaluated (@ 10 and 20% each) *in vitro* against *C. graminicola*, applying Poisoned food technique (Nene and Thapliyal, 1993) and using Potato dextrose agar (PDA) as basal culture medium.

An appropriate quantity of each test aqueous extract (100%) was separately mixed thoroughly with autoclaved and cooled (40°C) PDA medium in conical flasks (250 ml cap.) to obtain desired concentrations (@ 10 and 20%). The PDA medium amended separately with the test aqueous extract was then poured (20 ml/plate) into sterile glass Petri plates (90 mm dia.) and allowed to solidify at room temperature. For each test botanical extract and their respective concentrations, three plates/treatment/replication were maintained and all the treatments were replicated thrice. Upon solidification of the PDA (amended), all the treatment plates were aseptically inoculated by placing in the center a 5 mm mycelial disc obtained from a week old actively growing pure culture of *C. graminicola*. Plates containing plain PDA without any botanical extract and inoculated with mycelial disc of the test pathogen served as untreated control. All these plates were then incubated at 28±2°C temperature for a week or till the...
untreated control plates were fully covered with mycelial growth of the test pathogen.

Observations on radial mycelial growth/colony diameter of the test pathogen were recorded treatment wise at 24 hours interval and continued till mycelial growth of the test pathogen was fully covered in the untreated control plates. Percent inhibition of mycelial growth of the test pathogen over untreated control was calculated (Vincent, 1927)

**Results and Discussion**

Results (Table-I) revealed that all the nine botanicals evaluated were found fungistatic against *C. graminicola* and recorded significantly reduced mycelial growth and increased mycelial inhibition of the test pathogen over untreated control (PLATE-I). The mycelial growth was found to be decreased and its inhibition was increased with increase in concentrations of the botanicals tested.

**Radial mycelial growth**

At 10 per cent concentration, radial mycelial growth of the test pathogen was ranged from 32.00 mm (*A. indica*) to 70.00 mm (*M. oleifera*). However, significantly least mycelial growth was recorded with *A. indica* (32.00). This was followed by the botanicals *viz.*., *Z. officinale* (36.33 mm). The botanicals *A. cepa* (44.33 mm), *P. hydroporus* (50.00 mm), *P. pinnata* (56.66 mm) and *B. spectabilis* (59.66 mm) record moderate mycelial growth. Whereas, the botanicals *viz.*., *S. bicolor* (root extract), *S. bicolor* (leaf extract) and *M. oleifera* recorded comparatively maximum mycelial growth 65.33, 67.33 and 70.00 mm, respectively.

At 20 per cent concentration, radial mycelial growth of the test pathogen was ranged from 20.66 mm (*A. indica*) to 62.33 mm (*M. oleifera*). However, significantly least mycelial growth was recorded with *A. indica* (20.66 mm) This was followed by the botanicals *viz.*., *Z. officinale* (31.00 mm). The botanicals *A. cepa* (36.66 mm), *P. hydroporus* (40.33 mm), *P. pinnata* (46.00 mm) and *B. spectabilis* (46.66 mm) both were at par, record moderate mycelial growth which. Whereas, the botanicals *viz.*., *S. bicolor* (root extract), *S. bicolor* (leaf extract) and *M. oleifera* recorded comparatively maximum mycelial growth 50.33, 54.66 and 62.33 mm, respectively.

Average radial mycelial growth of the test pathogen was ranged from from 26.33 mm (*A. indica*) to 66.16 mm (*M. oleifera*). However, significantly least mycelial growth was recorded with *A. indica* (26.33 mm). This was followed by the botanicals *viz.*., *Z. officinale* (33.66 mm). The botanicals *A. cepa* (40.49 mm), *P. hydroporus* (45.16 mm), *P. pinnata* (51.33 mm) and *B. spectabilis* (53.66 mm) record moderate mycelial growth. Whereas, the botanicals *viz.*., *S. bicolor* (root extract), *S. bicolor* (leaf extract) and *M. oleifera* recorded comparatively maximum mycelial growth 57.83, 60.99 and 66.16 mm, respectively.

### Table 1. In vitro bioefficacy of plant extracts against *C. graminicola*

<table>
<thead>
<tr>
<th>Tr. No.</th>
<th>Treatments (Botanicals)</th>
<th>Plant part used</th>
<th>Concentrations used (%)</th>
<th>Av. (% inhibition) @ 10 %</th>
<th>Av. (% inhibition) @ 20 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>Bougainvillea (<em>B. spectabilis</em>)</td>
<td>Leaves</td>
<td>10</td>
<td>90.00</td>
<td>100.00</td>
</tr>
<tr>
<td>T₂</td>
<td>Garlic (<em>Z. officinale</em>)</td>
<td>Leaves</td>
<td>10</td>
<td>90.00</td>
<td>100.00</td>
</tr>
<tr>
<td>T₃</td>
<td>Neem (<em>A. indica</em>)</td>
<td>Leaves</td>
<td>10</td>
<td>90.00</td>
<td>100.00</td>
</tr>
<tr>
<td>T₄</td>
<td>Onion (<em>A. cepa</em>)</td>
<td>Bulb</td>
<td>10</td>
<td>90.00</td>
<td>100.00</td>
</tr>
<tr>
<td>T₅</td>
<td>Karanj (<em>P. pinnata</em>)</td>
<td>Leaves</td>
<td>10</td>
<td>90.00</td>
<td>100.00</td>
</tr>
<tr>
<td>T₆</td>
<td>Drumstick (<em>M. oleifera</em>)</td>
<td>Leaves</td>
<td>10</td>
<td>90.00</td>
<td>100.00</td>
</tr>
<tr>
<td>T₇</td>
<td>Parthenium (<em>P. hydroporus</em>)</td>
<td>Leaves</td>
<td>10</td>
<td>90.00</td>
<td>100.00</td>
</tr>
<tr>
<td>T₈</td>
<td>Sorghum leaf (<em>S. bicolor</em>)</td>
<td>Stem</td>
<td>10</td>
<td>90.00</td>
<td>100.00</td>
</tr>
<tr>
<td>T₉</td>
<td>Sorghum root (<em>S. bicolor</em>)</td>
<td>Root</td>
<td>10</td>
<td>90.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

*Mean of three replications, Dia.: Diameter, Av.: Average, Conc.: Concentration, Figures in parentheses are angular transformed values

### 2 My celial inhibition

Results obtained on mycelial growth inhibition of the test pathogen with the botanicals tested at various concentrations are presented in the Table-I and depicted in the (Table-1, PLATE-I and Fig.-1).
concentration of the botanicals tested (PLATE-1). At 10 per cent, mycelial growth inhibition ranged from 22.22 (M. oleifera) to 64.44 (A. indica) per cent. However, significantly highest mycelial growth inhibition was recorded with the botanicals A. indica (64.44%). This was followed by the botanicals viz., Z. officinale (59.62%), A. cepa (50.73%), P. hystrophorus (44.44%), P. pinnata (37.03%) and B. spectabilis (33.70%). Botanical S. bicolor (root extract), S. bicolor (leaf extract) and M. oleifera were less effective with significantly less mycelial growth inhibition of 26.49, 25.18, 22.22 per cent, respectively. However, significantly highest mycelial growth inhibition was recorded with the botanicals A. indica (77.03%), A. cepa (54.43%), P. hystrophorus (49.81%) and P. pinnata (42.95%).

In vitro efficacy of the botanicals against mycelial growth and inhibition of C. graminicolia

| T1: Bougainvillea (B. spectabilis) | T5: Drumsick (M. oleifera) |
| T2: Garlic (A. sativum) | T6: Parthenium (P. hystrophorus) |
| T3: Neem (A. indica) | T7: Sorghum leaf (S. bicolor) |
| T4: Onion (A. cepa) | T8: Sorghum root (S. bicolor) |
| T9: Karani (P. pinnata) | T10: Control |

**Fig. 1: In vitro efficacy of different bioagents on mycelial growth and inhibition of C. graminicolor**

**Conclusions**

Anthracnose of sorghum has been reported as a serious threat to bean production in a major sorghum growing region of India and therefore serves as a guide for further field testing in the future. In vitro all the nine botanicals tested were found fungistic against C. graminicolor. However, significantly highest average growth inhibition was recorded with A. indica (70.73%), followed by Z. officinale (62.58%), A. cepa (54.43%), P. hystrophorus (49.81%) and P. pinnata (42.95%.

**References**
