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# EVALUATION OF BOTANICALS FOR THE SUPPRESSION OF COWPEA BACTERIAL BLIGHT DISEASE

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Bacterial blight of cowpea is a serious production constraint causing severe yield loss of 2.7- 92.2%. Among the several management options eco-friendly measures such as use of botanicals which are relatively safe, economical and non-hazardous to control this deadly disease was given importance. Studies on *in vitro* evaluation of botanicals tested at different concentration of 5, 7.5 and 10% on the growth of *Xanthomonas axonopodis* pv. *vignicola* causing bacterial blight of cowpea revealed that out of nine botanicals or plant extracts used, only garlic (*Allium sativum)* extract was found effective with an inhibition zone of 1.18 cm at 10 % concentration followed by soapnut (*Sapindus mukorossi*) extract (1.07%). These two botanicals also inhibited the bacteria at lower concentration of 5 and 7.5%. Whereas neem, tulsi and nilgiri found moderately better in inhibition while remaining four botanicals, lantana, durantha, onion and chilli failed to inhibit the growth of cowpea bacteria.

***Key Words :*** Bacterial blight, Botanicals, Cowpea, Garlic.

Cowpea [*Vigna unguiculata* (L.) Walp.] (2n=22) commonly called as Lobia, is one of the most ancient human food sources and short duration multipurpose pulse crop grown extensively in tropical and subtropical countries. It belongs to family Fabaceae. The name cowpea originated from the fact that the plant was an important source of hay for the cows in the south-eastern United States and in other parts of the world (Timko *et al.* 2007). It is native to Africa. It is called as vegetable meat due to high amount of protein in grain with better biological value on dry weight basis. On dry weight basis, cowpea grain contains 23.4 per cent protein, 1.8 per cent fat and 60.3 per cent carbohydrates and it is rich source of calcium and iron (Gupta 1978). In India, cowpea is grown in an area of about 1.5 million hectares with productivity of 567 kg per ha and production of 0.5 million tonnes. The productivity potential of the crop in Karnataka is 420 kg per ha (FAO, 2011).

Among the diseases infecting cowpea, the bacterial disease popularly known as 'bacterial blight' caused by *Xanthomonas axonopodis* pv. *vignicola* is a major production constraint causing yield loss of 2.7 - 92.2 per cent depending on susceptibility of the variety (Kishun, 1989).

The disease was first reported by Burkholder (1944) from USA and in India it was first reported by Patel and Diwan (1950) from Pune. The first symptoms appear on cotyledons of seedlings emerging from infected seed and look reddish and wrinkled. The necrotic lesions are formed on leaves and later the stem is attacked. The pathogen reaches vascular bundles and the disease becomes systemic. The growing tip of the infected plant is killed and the plant ultimately dies. Cankers are often developed on the stem near the union of cotyledons and first leaves. Such stems are unable to bear the load of the plant and easily break in strong winds.

Secondary infection on leaves appeared as light yellow circular spots which are 4 to 10 mm in diameter and scattered on the lamina. The centre of these spots is necrotic and brown. The veins are red in color. On pods, deep green or water-soaked streaks are formed. Such pods become yellow, shrivel and die. The diseased pods produce smaller, wrinkled and infected seeds. These infected seeds serve as the source of primary inoculum. Secondary spread is by rains, insects and implements. The disease is serious in soils with poor drainage.

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Although, 25 to 30 per cent of total cost of production is being spent on plant protection especially chemicals, the disease could not be managed effectively and also there has been a major thrust on residue free organic cowpea production in recent years. Hence, efficient botanicals need to be explored and research on this aspect needs to be triggered to find out the best botanical in bacterial blight suppression. By keeping these things in view, the present investigation aimed at screening some plant extracts/botanicals for their antibacterial properties against cowpea bacterial blight bacteria *Xanthomonas axonopodis* pv. *vignicola.*

## MATERIALS AND METHODS :

**Isolation of cowpea bacterial blight bacteria :** The leaves of cowpea showing typical symptoms of bacterial blight caused by *Xanthomonas axonopodis* pv. *vignicola* were collected during the *Kharif* season of 2011-12 from major cowpea growing areas of northern Karnataka. The bacterium was isolated by extracting the ooze in sterile distilled water taken in test tubes followed by dilution plate technique on nutrient agar. The inoculated plates were incubated at 28$^0$C for three days and observed for the production of typical colonies which are mucoid, round, convex, glistening, slimy and yellow. The suspected colonies were isolated and purified on YDCA (Schaad and Stall, 1988).

**Extraction of botanicals :** The list of botanicals/plant extracts with their concentration is given below.

| Name of the Botanical | Botanical Name | Plant Parts used | Concentration (%) |
|---|---|---|---|
| Neem | *Azadirachta indica* | Leaves | 5,7.5,10 |
| Duranta | *Duranta repens* | Leaves | 5,7.5,10 |
| Nilgiri | *Eucalyptus globules* | Leaves | 5,7.5,10 |
| Lantana | *Lantana camera* | Leaves | 5,7.5,10 |
| Tulsi | *Ocimum sanctum* L. cv. purple | Leaves | 5,7.5,10 |
| Onion | *Allium cepa* | Bulb | 5,7.5,10 |
| Chilli | *Capsicum annum* | Leaves | 5,7.5,10 |
| Garlic | *Allium sativum* | Bulb | 5,7.5,10 |
| Soapnut | *Sapindus mukorossi* | Pulp | 5,7.5,10 |

The fresh plant material were collected and washed first in tap water followed by distilled water; 100 grams of fresh sample was chopped and macerated in a surface sterilized pestle and mortar by adding 100 ml of sterile water (1:1 w/v). The extract was filtered through two layers of muslin cloth, filtrate thus obtained was used as a stock solution. To study the antibacterial mechanism of plant extracts and organics, inhibition zone assay method was followed. The bacterial suspension (72 hr old) of *Xanthomonas*, multiplied in nutrient broth (20 ml) was mixed with molten (50$^0$C) nutrient agar medium (1000 ml) contained in an Erleyenmayer's flask, so as to get the thick growth of bacteria on the medium, 15 to 20 ml of seeded medium was poured onto the sterilized petriplates and allowed to solidify.

Five, 7.5 and 10 per cent each of plant extract was prepared by mixing 5, 7.5 and 10 ml of stock solution with 95, 92.5 and 90 ml of sterilized distilled water, respectively. Filter paper discs (Whatman No. 41) measuring 5 mm in diameter were soaked separately in different plant extracts of desired concentrations for 5 min and then placed onto the surface of seeded nutrient agar medium in the petriplates. Then inoculated plates were incubated at 28$^0$ C for 72 hours. At the end of incubation period, observations were recorded for the production of inhibition zone representing the efficacy of plant extracts in inhibiting the growth of pathogen. The inhibition zone in each plate was measured in terms of centimeter in diameter and data obtained was analyzed statistically.

## RESULTS AND DISCUSSION

*In vitro* evaluation of botanicals was carried out with respect to inhibition zone produced due to inhibition of *Xanthomonas axonopodis* pv. *vignicola* at different concentrations and the data pertaining to the evaluation study is presented in Table 1.

The results indicated that garlic bulb extract at 10% concentration showed highest inhibition of 1.18

cm followed by soapnut extract at 10% concentration with an inhibition of 1.07 cm and they were on par with each other and found significantly superior over other treatments. The interaction effect among the botanicals and concentration indicated that garlic extract was found most effective at 10 per cent concentration with an inhibition zone of 1.18 cm. Neem (0.68 cm), tulsi (0.78 cm) and neelgiri (0.77 cm) extracts were moderately effective and were on par with each other at 10 per cent concentration whereas, lantana, durantha, onion and chilli extracts were ineffective in inhibiting the bacteria. The results of the present investigation are in confirmation with the results obtained by Hannudin and Djantnika (1989) while studying the effect of some plant extracts on the growth of *Pseudomonas solanacearum* causing bacterial wilt of tomato under *in vitro* conditions. They evaluated extracts from onion and garlic bulbs, roots and stems of *Crotalaria* sp. and *Tagetus* sp. for suppression of *P. solanacearum* and found that extracts from garlic bulbs inhibiting the bacterial growth.

Mukesh *et al.* (2008) tested many plant extracts against *Xanthomonas axonopodis* pv. *vignicola* and stated that leaves extract of weed plant Datura and tulsi to be effective against bacterial blight of cowpea supporting the results of the present study with respect to tulsi as it showed moderate inhibition against *Xanthomonas axonopodis* pv. *vignicola*. The antibacterial activity of garlic has been known for a long time. Allicin was initially considered to be the principle compound responsible for inhibitory activity but it was later proved that it is a derivative from alliin-allinase system present in raw garlic. Shah and Mali (2002) have tried the efficacy of different plant extracts against *Xanthomonass axonopodis* pv. *citri* both *in vitro* and *in vivo* and reported that onion bulb, garlic, clove and leaf extract of neem having effective inhibitory action against citrus canker. Similar results obtained in the present investigation confirms the efficacy of garlic and neem extract against the cowpea bacteria *Xanthomonas axonopodis* pv. *vignicola*.

**Table 1: *In vitro* evaluation of botanicals against the growth of *X. axonopodis* pv. *vignicola***

| Name of the Botanical | Botanical name | Plant Part used | Mean diameter of inhibition zone (cm) at different concentrations (%) | | |
|---|---|---|---|---|---|
| | | | 5 | 7.5 | 10 |
| Lantana | *Lantana camera* | leaves | 0.00 (1.00)* | 0.00 (1.00) | 0.00 (1.00) |
| Garlic | *Allium sativum* | bulb | 0.67 (1.29) | 0.83 (1.35) | 1.18 (1.48) |
| Neem | *Azadirachta indica* | leaves | 0.00 (1.00) | 0.00 (1.00) | 0.68 (1.30) |
| Soapnut | *Sapindus mukorossi* | pulp | 0.63 (1.28) | 0.77 (1.33) | 1.07 (1.44) |
| Durantha | *Durantha repens* | leaves | 0.00 (1.00) | 0.00 (1.00) | 0.00 (1.00) |
| Onion | *Allium cepa* | bulb | 0.00 (1.00) | 0.00 (1.00) | 0.00 (1.00) |
| Tulsi | *Ocimum sanctum* L. cv. Purple | leaves | 0.00 (1.00) | 0.55 (1.24) | 0.78 (1.34) |
| Nilgiri | *Eucalyptus globules* | leaves | 0.00 (1.00) | 0.63 (1.28) | 0.77 (1.33) |
| Chilli | *Capsicum annum* | leaves | 0.00 (1.00) | 0.00 (1.00) | 0.00 (1.00) |
| Control | | | 0.00 (1.00) | 0.00 (1.00) | 0.00 (1.00) |
| **Factors** | | | **Botanicals** | **Concentration** | **Interaction** |
| **SEm±** | | | 0.0050 | 0.0188 | 0.0086 |
| **CD at 1%** | | | 0.0027 | 0.0101 | 0.0323 |

*- Figures in the parenthesis are x+1 transformed values.

## CONCLUSION

Based on the studies conducted on the inhibition of cowpea bacteria using botanicals or plant extracts, it can be concluded that out of nine botanicals, garlic (*Allium sativum)* and soapnut (*Sapindus mukorossi*) proved better in inhibiting the growth of *Xanthomonas axonopodis* pv. *vignicola* causing bacterial blight of cowpea at all the three (5, 7.5 and 10%) concentrations used. Whereas neem,

tulsi and nilgiri found moderately better while remaining four botanicals, lantana, durantha, onion and chilli failed to inhibit the growth of cowpea bacteria.

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