Int.J.Curr.Microbiol.App.Sci (2018) *7*(8): 1727-1732

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 08 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.708.197

Efficacy of Fungicides, Biocontrol Agents and Botanicals on Severity of *Cercospora* Leaf Spot of Pigeon Pea

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Keywords

Pigeon pea, Leaf spot, Fungicides, Botanicals

Article Info

Accepted:
10 July 2018
Available Online:
10 August 2018

A B S T R A C T

Cercospora leaf spot caused by *Cercospora cajani* Henningsis one of the most important fungal diseases of Pigeon pea [*Cajanus cajan* (L.) Millsp.]. The disease is more destructive during *kharif* season. Laboratory and field experiments were conducted during *kharif* seasons 2011 at Pantnagar. Prophylactic spray of fungicides, bioagents and plant extracts significantly reduced disease severity and enhanced yield as well as thousand grain weight. Among the fungicides Roko sprayed plots showed lowest disease severity and higher yield and thousand grain weight followed by Bavistin. Among biocontrol agents lowest disease severity was recorded in *Trichoderma harzianum* followed by *T. harzianum* + *P. fluorescens*, through it was considerably higher in comparison to disease severity in fungicide sprayed plots. While in case of plant extracts minimum disease severity and increase in yield was observed in Neem leaf extract, followed by Kaner leaf extract.

Introduction

Cercospora leaf spot caused by *Cercospora indica* Singh and *Cercospora cajani* Hennings is one of the most important fungal diseases of Pigeonpea in many parts of the world. The disease is more destructive in humid climate, particularly during *Kharif* season in India. Leaf spot of pigeonpea caused by *Cercospora indica* was first reported from India (Pavgi and singh, 1965). Four species viz. *Cercospora cajani, C. indica, C. thirumalacharii* and *C. arachidicola* in establish are known to infect Pigeonpea, but leaf spot due to *C. cajani*is most important in South Asia (Mew *et al.,* 1975). Kandhar *et al.,* (1986) reported that Benlate (benomyl) inhibited spore germination best followed by Dithane Z-78 (zineb), Blitox (Copper oxychloride), Bavisfin (carbendazim) and Deconil 2787 (chlorothalonil). Mycelial growth was completely checked by Benlate, Bavistin and Difolatan (captafol). Jamadar and Padaganur (1992) tested the efficacy of fungicides *in vitro* against growth of *Cercospora cajanai* Henning's using eight fungicides. Mishra and Bhattacharyya (2001) tested *in vitro* sensitivity against *C. cajani* using nine fungicides Among the nine different systemic and non-systemic fungicides, Bavistin, Bentale, Calaxin, Emisan-6, Thiram and Captan were highly inhibitory to the fungus and no growth was observed in the culture media amended with

the fungicides. Aage *et al.*, (2003) tested efficacy of ten plant extracts against tikka disease of groundnut caused by *Cercospora arachidicola* Hori, among them aqueous leaf extract of Neem *(Azadirachta indica)* and Kaner *(Neriumodorum)* were found superior over other extracts on the bases of inhibition of spore germination and infectivity leaf test.

Materials and Methods

Field experiments were conducted during *kharif* 2011 crop seasons to observe the efficacy of fungicides, biocontrol agents and plant extracts applied as prophylactic spray on disease severity, grain yield and thousand grain weight of Pigeonpea. Ten fungicides viz. M-Guard-45 (0.2%), Bavistin (0.1 "and 0.05%), Roko (0.05%), Kavach (0.01%), Hexol (0.05%), Score "(0.01%), Opus (0.01%), Calaxin (0.02%), Dinocap (0.02%) and Tilt (0.01%), eight plant extracts viz. Lentana leaf extract, Eucalyptus leaf extract, Neem leaf extract, Kaner leaf extract, Ginger rhizome extract, Onion bulb extract, Garlic clove extract and Turmeric rhizome extract all @ 5 per cent and three bio-control agents viz. *T. harzianum*, *P. fluorescens* and *T. harzianum* + *P. fluorescens* each separately at (10 g/l) were evaluated as prophylactic spray (Table 2).

Antifungal activity of plant extracts

The screening of the different parts of the plant for their antifungal activities was ascertained for the distribution of the inhibiting principles, so that the part showing the maximum activity could be used in further investigations. The plant parts tested for antifungal activity are given below (Table 1).

Preparation of plant extracts

The collected plant parts were thoroughly washed with sterilized distilled water. These washed parts were kept into oven at 38°C for drying. Material was examined time to time. The drying depends on the water content of the plant part.

After drying plant part was crushed with mortar and pastel for preparing dry powder.

Plant extracts were prepared with the help of soxlate assembly and methanol, which is highly polar solvent.

Extra methanol of plant extracts was evaporated by keeping the plants extracts in the oven at 35°C.

After the evaporation of methanol, paste of plant extract was divided. Weight was recorded and kept inside the refrigerator prior to use.

Preparation of botanical concentration

The desired amount of plant extract was mixed in sterilized distilled water to make the desired concentration (w/v).

Desired concentration of 0.5, 1.0, 2.0 and 5.0 per cent was derived by dissolving 0.5, 1.0, 2.0 and 5.0g of plant extract in 100 ml sterilized distilled water. For bioassay double strength botanical concentrations were prepared.

Yield components

Observation recorded on yielding ability as given below:

Thousand grain weight
Yield (kg/hectare)

The per cent increase in grain yield due to different fungicide was calculated by using following formula:

$$\text{Per cent increase in yield} = \frac{\text{Yield in treatment} - \text{yield check plot}}{\text{yield in check plot}} \times 100$$

Results and Discussion

Disease severity

The data revealed that (Fig. 1) three spray of Roko at 10 day interval resulted in lowest disease severity (13.13 %) followed by three spray of Bavistin @ 0.1 and 0.05 per cent, the disease severity was 15.90 and 16.46 per cent, respectively.

Among biocontrol agents lowest disease severity was observed with three spray of *T. harzianum* (42.95%) followed by *T. harzianum* + *P. fluorescens* (43.12%), while in case of plant extracts minimum disease severity was observed in Neem leaf extract sprays (33.29%) followed by Kaner leaf extract (34.03%). All the treatments were significant in comparison to check (71.22%).

Thousand grain weight

The data revealed that all the tested treatments results significantly higher thousand grain weight in comparison to check, except foliar sprays of *T. harzianum*, lentana, eucalyptus and onion extracts. In fungicides Roko @ 0.05 percent, Bavistin @ 0.1 and 0.05 per cent resulted significantly higher thousand grain weight in comparison to check plot (26.82 g). The grain weight in above plot was 32.39, 32.20 and 32.26 g, respectively (Fig. 1).

Among biocontrol agents maximum grain weight was achieved in *T. harzianum* + *P. fluorescens* (28.85 g) @ 10 g/l, followed by *P. fluorescens* alone (28.15 g) while in case of plant extracts highest grain weight was recorded in Neem leaf extract (29.55 g), followed by Kaner leaf extract (29.0 g). The data revealed that all the treatments resulted significantly higher grain yield over check (242.23 kg/ha), except turmeric and onion extract sprays where the yield was *at par* with check.

Highest grain yield

Among fungicides sprayed plots the highest grain yield (453.7 kg/ha) was recorded in Roko (3 sprays/plot, followed by Bavistin (448.26 kg/ha) with corresponding yield increase over check (242.23 kg/ha). Three spray of *T. harzianum* plots recorded higher yield 341.84 kg/ha, with 41.12 per cent increase in yield over check, followed by *T. harzianum* + *P. flourecens* sprays resulted 335.5 kg/ha yield and 38.5 per cent increase over check. Among botanicals highest yield was in Neem extract spray plots followed by Kaner leaf extract spray. The yield in both treatment was 389.6 kg/ha and 351.04 kg/ha, respectively (Fig. 1).

Prophylactic spray of fungicides, bioagents and plant extracts significantly reduced disease severity and enhanced yield as well as thousand grain weight.

Among the fungicides Roko sprayed plots showed lowest disease severity and higher yield and thousand grain weight followed by Bavistin. Among biocontrol agents lowest disease severity was recorded in *Trichoderma harzianum* followed by *T. harzianum* + *P. fluorescens*, through it was considerably higher in comparison to disease severity in fungicide sprayed plots. While in case of plant extracts minimum disease severity and increase in yield was observed in neem leaf extract, followed by Kaner leaf extract.

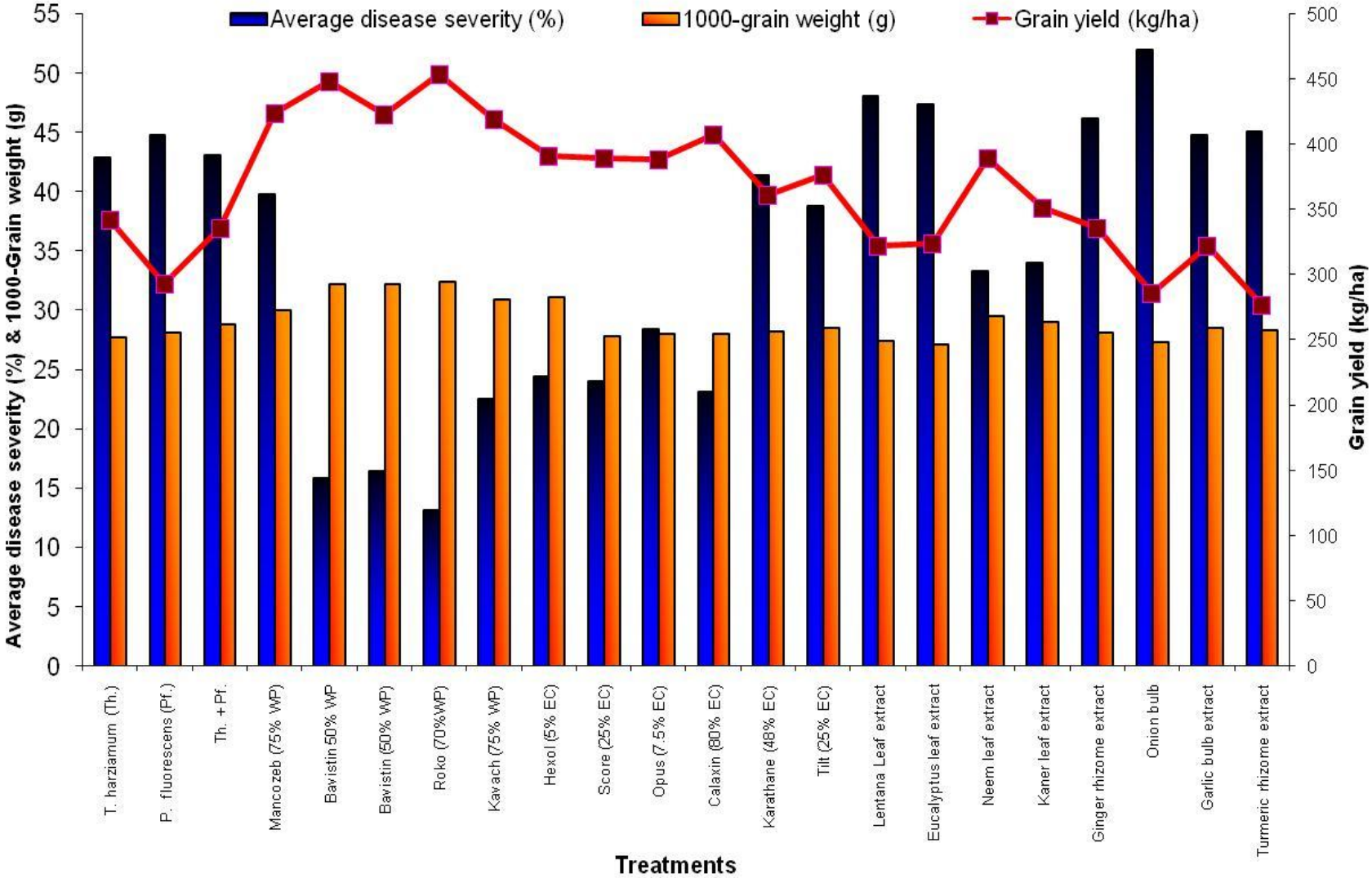
Table.1 Plant extracts tested for antifungal activity against pathogen

Sl. No.	Common name/ English name	Botanical name	Family	Parts
1.	Lantana	*Lantana camera*	Verbenaceae	Leaves
2.	Eucalyptus	*Eucalyptus globules*	Myrtaceae	Leaves
3.	Neem	*Azardirachtaindica*	Meliaceae	Leaves
4.	Kaner/Oleander	*Neriumodorum*	Apocynaceae	Leaves
5.	Adarakh/Ginger	*Zingiberofficinale*	Zingiberaceae	Rhizome
6.	Piaz/Onion	*Allium cepa*	Liliaceae	Bulb
7.	Lahsun/ Garlic	*Allium sativum*	Zingiberaceae	Bulb
8.	Haldi/Turmeric	*Curcuma domestica*	Zingiberaceae	Rhizome

Table.2 Different treatment applied in field experiments during Kharif 2011

Symbol	Treatment	Doses
T_1	*Trichoderma harzianum*	1 %
T_2	*Pseudomonas fiuorescens*	1 %
T_3	*Trichoderma + Pseudomonas*	1 %
T_4	M Guard-45 (Mancozeb)	0.2%
T_5	Bavistin (Carbendazim)	0.1%
T_6	Bavistin (Carbendazim)	0.05%
T_7	Roko (Thiophanate methyl)	0.05%
T_8	Kavach (Chlorothalonil)	0.01%
T_9	Hexol (Hexaconazole)	0.05%
T_{10}	Score (Difenconazole)	0.01%
T_{11}	Opus (Epoxiconazole)	0.01%
T_{l2}	Calaxin (Tridemorph)	0.02%
T_{13}	Karathane (Dinocap)	0.02%
T_{14}	Tilt (Propiconazole)	0.01%
T_{15}	Lentana leaf extract	5.0%
T_{16}	Eucalyptus leaf extract	5.0%
T_{17}	Neem leaf extract	5.0%
T_{18}	Kaner leaf extract	5.0%
T_{19}	Ginger rhizome extract	5.0%
T_{20}	Onion bulb extract	5.0%
T_{21}	Garlic bulb extract	5.0%
T_{22}	Turmeric bulb extract	5.0%
T_{23}	Check	--

Fig.1 Efficacy of fungicides, plant extracts and biocontrol agent on *Cercospora* leaf spot, disease severity (%), grain yield and 1000-grain weight during *Kharif* 2011



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How to cite this article:

Chanda Ram, Ladhu Ram and Kushwaha, K.P.S. 2018. Efficacy of Fungicides, Biocontrol Agents and Botanicals on Severity of *Cercospora* Leaf Spot of Pigeon Pea. *Int.J.Curr.Microbiol.App.Sci.* 7(08): 1727-1732. doi: https://doi.org/10.20546/ijcmas.2018.708.197