

Research Article

PHYTOPATHOLOGICAL EFFECTS AND DISEASE TRANSMISSION IN CLUSTER BEAN SEEDS GROWN IN RAJASTHAN

Vikas Pareek and Rashmi Varma*

Department of Botany, Government College, Kota, Rajasthan-324001

**Author for Correspondence*

ABSTRACT

Guar (*Cyamopsis tetragonoloba*) is known to suffer many diseases, which are responsible for its quality and low yield resulting in severe economic losses. In petriplate and water agar seedling symptom test incidence of pathogen was high in symptomatic seeds as compared to the asymptomatic seeds of both the seed samples. It was 85%, 79% (SBM) and 83%, 73% on 8th day of sowing in both the samples respectively. Where as in pot experiment germination started after 3rd day of sowing. The infection of *Fusarium solani* affected the emergence and growth of seedling. It was 89%, 91% in control and 65% - 40% in all the categories of symptomatic seeds of both the seed samples respectively. Infected seedlings show brown to black streaks on collar region of the stem and brown to black necrotic patches on leaves, Root tip portion showed the rotting and small in size. In pot experiment seedlings obtained from symptomatic seeds, pods and seed setting are very few. On incubation these infected parts showed the presence of pathogen. Control by drip irrigation is very effective.

Keywords: *Cyamopsis tetragonoloba*, Disease Transmission, *Fusarium solani*, Phyto-Pathological Effect, Seeds

INTRODUCTION

Cluster bean drought hardy crop of the arid and semi-arid zones and cultivated under rain fed conditions of kharif season.

It is used mainly as feed, fodder and vegetable purposes. It is a rich source of protein and galactomannose gum which is stored in endosperm and utilized in wide range of industrial processes.

Guar is known to suffer many diseases which are responsible for its quality and low yield resulting in severe economic losses to the country as it is an important cash crop with a great potential for foreign exchange (Chand and Gandhi, 1978). The major disease causing low planting value of the crop includes fungal, bacterial and viral diseases. Among the different pathogens attacking the crop *F. solani* is the most common fungus causing considerable yield losses. The pathogen caused wilt of seedlings. At later stages of plant growth, the infected plants exhibit rot near the soil which results in wilting of host plant. In present study sequential transmission studies were made using blotter method, water agar seedling symptom test and pot experiment.

MATERIALS AND METHODS

For the phytopathological effects and disease transmission was carried out by using naturally infected seeds of Sikar (CB-70) and Jaipur (CB-29). Asymptomatic seeds of the same sample were used as control. The study was carried out by employing following methods.

1. Petriplate method
2. Water agar seedling symptom test
3. Pot experiment

In petriplate method two replicates of 100 seeds per category per sample pretreated with aqueous solution of sodium hypochlorite with 0.5% available chlorine were spaced on moistened blotters and incubated at 20± °c under 12 h of alternating cycles of light and darkness. Data were recorded at 24 hr intervals up to 8 days.

Research Article

In water agar seedling symptom test 100 seeds per category per sample were sown on 1% sterilized water agar medium in test tube (1 seed/test tube) under aseptic conditions and incubated at $26 \pm 2^\circ \text{C}$. the observations were taken daily up to 15 days and data were recorded.

In pot experiment 100 seeds per category per sample (5 seeds/ pot) were sown in 12" size earthen pots containing sterilized soil in end of the month July 2013, 2014. The pots were watered on every alternate day and data recorded weekly to 15 day intervals up to the maturity. For isolation and presence of the pathogen in different parts of seedling / plant, both symptomatic and healthy looking seedlings/ plants were uprooted at regular intervals, washed in running water and each split longitudinally into two halves. One half surface sterilized with 0.5% available chlorine was sown on moistened blotters and incubated for 7 days, while other half was cleared by boiling for 5-10 min. in 10% aqueous solution of KOH washed with distilled water stained with cotton blue and mounted in PVA. Hand cut sections of root and stem were also made and stained with cotton blue.

RESULTS AND OBSERVATIONS

The performance of seed samples of guar carrying natural infection of *Fusarium solani* was studied in the sample ac.no.CB-29 (Jaipur) and CB-70 (Sikar) (Figure 2.A). Effect of pathogen on the seed germination, seedling survival, mortality and disease transmission was studied in petriplate (Figure 1.A-B), water agar (Figure 1.C-D) and pot experiments (Figure 1.E-F). Sequential observations were made on the percent germination, seed rot, seedling/ plant survival and incidence of the pathogen.

In petriplate and water agar seedling symptom test the germination started after 24 hr of sowing and maximum germination was 94%, 97% and 89%, 87% on 8th day in control seeds, where as in symptomatic seeds it was 27%, 18%, 7%; 35%, 30%, 22% and 34%, 26%, 9%; 37%, 35%, 22% in both the samples respectively. The ungerminated seeds of both the samples were covered with fungal growth and showed seed rot (Figure 2.B-C). Initial disease symptoms appeared as pale- yellow discolouration on the hypocotyl region on 3rd to 5th day (SBM and Water agar test). Irregular necrotic spots were on the cotyledons and browning of radicle. Symptoms were later turn yellow and seedlings fell prematurely (Figure 2.D). Finally whole shoot turned yellow to brown, pulpy and show wilting. These seedlings finally rotted between the 8th to 10th day of sowing in both the seed samples. On incubation infected seedling show microconidia and profuse growth of fungal mycelium on hypocotyl and necrotic spots on cotyledons along with the browning of radicle. Some seedlings obtained from asymptomatic seeds or weakly infected seeds showed discrete black streaks.

In pot experiment germination started after 3rd day of sowing. On 8th day it was maximum. The infection of *F. solani* affected the emergence and growth of seedlings it was 89%, 91% in control and 65%, 68% ; 46%, 50%; 37%, 40% in categorized seeds of both the seed samples, where as in heavily infected seeds very few seeds are germinate. Seedlings show symptoms after 20 day of sowing seeds in pot (Figure 2.E). Total losses was 4%, 7% in control and 27%, 31%; 43%, 54%; 75%, 82% in categorized symptomatic seeds. Some seedlings obtained from asymptomatic seeds or weakly infected seeds showed discrete black streaks on hypocotyls and necrotic spots on cotyledons along with the browning of radicle. Seedlings from weakly infected seeds showed wilting (after 20 days), drying and drooping off of leaves and ultimately died (Figure 2.F). Very few plants attained maturity showing black streaks on collar region of the stem and brown to black necrotic patches on leaves, stem and pods (Figure 2.G). Symptomatic leaves are small in size. Such plants produced symptomless or symptomatic pods, whereas seedlings obtained from moderately to heavily infected seeds, flowering and seed setting in pods are very few or infected (Figure 2.H). Presence of the pathogen is on the stems (Figure 2.I) and also in the pith region of the stem (Figure 2.J). On incubation these stem and leaves showed the presence of pathogen, while cleared and microtome preparation revealed the presence of inter and intra cellular mycelium in the cortical cells, pith and vascular region. Necrotic cells were quite evident in cleared preparations of leaves whereas in stems and roots brown discolouration with fungal growth was observed. Presence of conidia and mycelium were also seen in split half of the stem and roots. Control by drip irrigation is very useful at the time of flowering and fruit setting. Use of certified seeds is very useful to get high yield of seeds.

Research Article

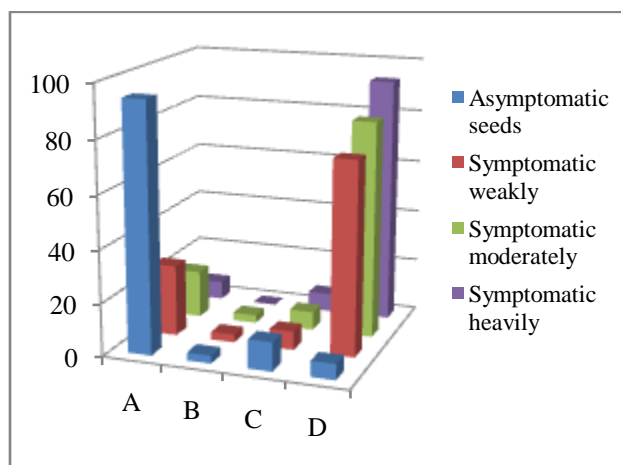


FIGURE : (A) CB29

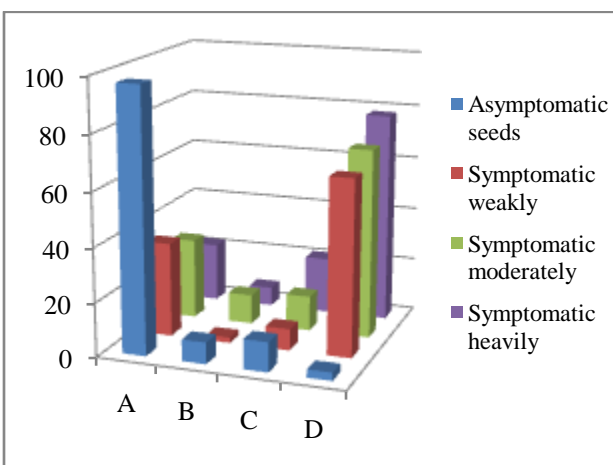


FIGURE : (B) CB70

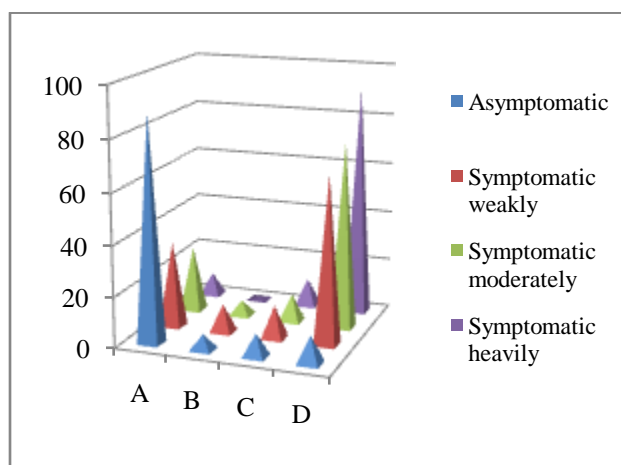


FIGURE : (C) CB29

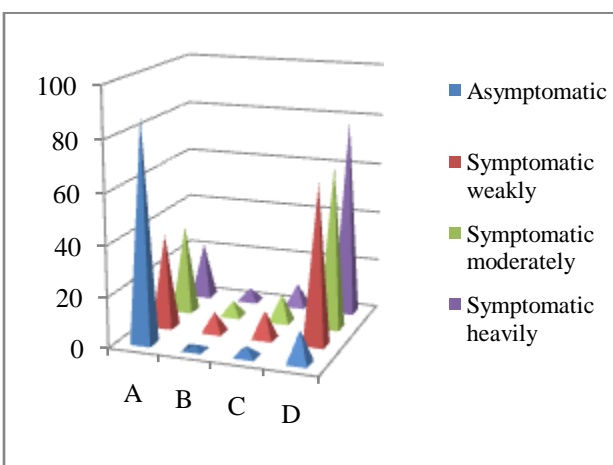


FIGURE : (D) CB70

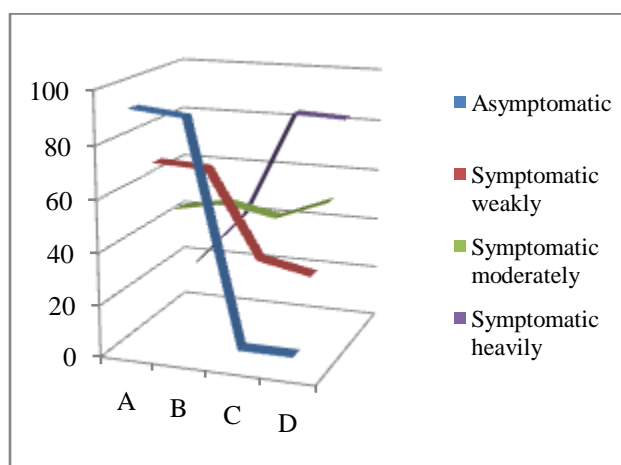


FIGURE : (E) CB29

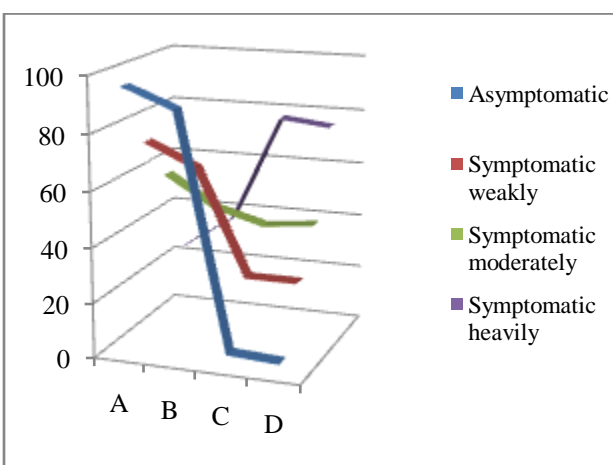


FIGURE : (F) CB70

A-Germination

B-Surviving seedling with Symptoms

C-Seedling Mortality

D-Total loss

Figure 1 (A- F): Phytopathological effect of *Fusarium solani* on 8th day in SBM (A-B) and 15th day in water AGAR (C-D) and after 60 days in pot experiment (E-F)

Research Article



Figure 2A-J: Phytopathological Effects of *Fusarium solani* in SBM, Water agar Test and Pot Experiment

- A.** White mycelial growth in dry seed inspection
- B.** Heavily infected seeds covered with pathogen in standard blotter method
- C.** Test tube showing healthy (Right), symptomatic seedlings (Left) on 14th day in water agar test tube seedling symptom test
- D.** Symptomatic seedlings
- E.** Symptomatic plant in Pot experiment
- F.** White brown Necrotic Patches on leaves
- G.** Symptomatic pods
- H.** Pods showing brown black patches
- I.** Stem infected with *F. solani*
- J.** Split half of the stem showing infection of *F. solani*

Research Article

DISCUSSION

Prasad and Desai (1951), observed blight due to *F. moniliforme*. Satyaprasad and Rama Roa (1981) and Mathur and Sekhawat (1988) recorded root rot by *Fusariumsolani*. The seed borne inoculum of *F. solani* caused damping off in guar seeds (Dwivedi *et al.*, 1991) and wilt caused by *F. oxysporum* in lentil seeds (Singh 2012).

During the present study seed borne infection of *F. solani* resulted in pre and post emergence of losses. Pre emergence mortality was higher than post emergence mortality. The failure of seed germination and incidence of seedling mortality are correlated with degree and nature of infection. Heavily infected seeds failed to germinate. In pot experiment plants under went wilting shows the brown patches on leaves, leads to the shredding and roting. Collar region of the stem shows the brown- black streaks. Such plants failed to produce flowers and pods. Satyaprasad and Rama Rao (1981) observed similar symptoms caused by *F. solani* in guar seeds. Rot symptoms are induced by *M. phaseolina* in guar seeds was observed by Lodha (1998), Lodha *et al.*, (2002) and also pre and post emergence of mortality in comparison to control in guar seeds (Jaiman and Jain 2004). However wilt caused by *Fusariumoxysporum* in ground nut seeds showed similar symptoms (Awurum and Uwajimgba, 2013), Bhatia (1995) in guar seeds and in lentil seeds by Singh (2012). Control by drip irrigation was studied in *Luffa* seeds (Sadda, 2012).

The present study provides enough evidences of effects of seed borne inoculum of *F. solani*. Heavy to moderate infection causes failure of seed germination and wilting of surviving seedlings/ plants. Weak infections results in plants which reach maturity and have infection confirmed to basal parts only. Seeds harvested from such plants were found free of infection.

ACKNOWLEDGEMENT

One of the author RashmiVarma is thankful to the Department of Sciences and Technology, Jaipur (Raj.) for providing facilities and encouragement.

REFERENCES

- Awurum AN and Uwajimgba J (2013).** Varietal screening and comparative toxicology of some plant extracts for control of *Fusariumwilt* of ground nut. *Continental Journal of Agricultural Science* **7**(1) 11-6.
- Bhatia A (1995).** Studies on important field and storage seed borne fungi of guar (*Cyamopsistetragonoloba* (L.)Taub.) A thesis submitted to University of Rajasthan, Jaipur.
- Chand JN and Gandhi SK (1978).** Diseases of guar and their control. *Forage Research* **4A** 49-66.
- Dwivedi SK, Dubey NK and Dwivedi RS (1991).** Damping off of *Cyamopsis tetragonoloba* (L.)Taub., due to seed borne inoculum. *National Academy Science Letters* **14** 371-373.
- Jaiman RK and Jain SC (2004).** *Macrophominaphaseolina* in cluster bean (*Cyamopsistetragonoloba*) seeds and it's control. *Journal of Mycology and Plant Pathology* **34**(3) 833-835.
- Lodha S (1998).** Effect of sources of inoculum on population dynamics of *Macrophominaphaseolina* and disease intensity in cluster bean. *Indian Phytopathology* **51**(2) 175-179.
- Lodha S, Sharma SK and Agrawal RK (2002).** Inactivation of *Macrophominaphaseolina* propagules during compositing and effect of composts on dry root rot severity and on seed yield of cluster bean. *European Journal of Plant Pathology* **108**(3) 253-261.
- Mathur K and Shekhawat KS (1988).** *Fusarium* root- rot of guar. *Indian Journal of Mycology and Plant Pathology* **17** 237.
- Prasad N and Desai MV (1951).** *Fusarium* blight of cluster beans. *Current Science* **21** 17-18.
- Sadda N (2012).** Studies on Anthracnose and Root rot disease of smooth gourd (*Luffacylindrica*) and Rough gourd (*Luffaacutangula*) grown in Kota district of Rajasthan. A thesis submitted to University of Kota, Kota (Rajasthan).
- Satyaprasad K and Rama Rao P (1981).** Root -rot of guar caused by *Fusariumsolani*. *Indian Phytopathology* **34** 523-524.
- Singh A (2012).** Studies on Wilt and Rot disease of lentil (*Lens culanaris* Medic.) grown in Rajasthan. A thesis submitted to University of Kota, Kota (Rajasthan).