

Effect of Time and Type of Infection of *Xanthomonas axonopodis* pv. *cyamopsidis* on Seedborne Infection in Clusterbean Cultivars

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ABSTRACT Bacterial blight caused by *Xanthomonas axonopodis* pv. *cyamopsidis* is the most destructive disease of clusterbean in Haryana. The field and screen house experiments were conducted during 2001 and 2002 to see the effect of time and type of infection on disease development, per cent infection in seeds and seed yield/plant in three cultivars. The maximum (80%) seed infection was detected in Pusa Navbahar, followed by 21.2% in HG 365 and least 6.2% in HG 75 when plants were inoculated at 20 days after sowing under screen house conditions. High disease severity gave 51.5% infection in seeds of Pusa Navbahar, 11.6% in HG 365 and 3.5% in HG 375 under field conditions. No seed infection was observed in symptomless plants in any genotypes tested. The severe most category of infection caused reduction in seed yield/plant to the tune of 77.2% in Pusa Navbahar, 14.8% in HG 365 and 2.9% in HG 75. In clusterbean, high level of seeds are infected if plants receive infection prior to flowering.

Keywords: *Xanthomonas axonopodis*, *Cyamopsis tetragonoloba*, inoculation, infection, disease severity

In recent years, clusterbean (*Cyamopsis tetragonoloba*) besides an important forage crop, has also acquired the status of an industrial crop due to guar gum. Clusterbean, that is guar, is afflicted by a large number of diseases, which affect the quality and quantity of the crop. Bacterial blight caused by *Xanthomonas axonopodis* pv. *cyamopsidis* is the most destructive disease responsible for big losses in guar seed yield. Under epidemic conditions severe yield losses have been reported [1, 2, 3]. The pathogen infects all above ground plant parts including pods and seeds. The disease manifests in the form of small water soaked lesions on abaxial surface of leaves. Under conducive conditions, these spots become supernumerary and coalesce to form bigger spots which results in blighted appearance. Under severe infection conditions, there are formation of V shaped lesions on leaves, longitudinal streaks on stem, blackening/cracking/breaking of stems and black streaks on pods. When infection becomes systemic, the bacteria become internally seedborne. How much seed become infected by this bacterium with regard to disease severity, time and type of infection in different clusterbean cultivars? Informations regarding it are completely lacking. The present study is an attempt in this direction.

MATERIALS AND METHODS

The experiment was conducted in two sets during 2001 and 2002. In first set a trial was conducted under screen house conditions to see the effect of time of inoculation of *X. axonopodis* pv. *cyamopsidis* on disease development, per cent infection in seeds and seed yield/plant. Three clusterbean cultivars; Pusa Navbahar (highly susceptible), HG 365 (moderately susceptible) and HG 75 (resistant) were taken for this study. Ten pots having three plants each were grown on 20th June in 30 cm earthen pots, constituted a replication and it was replicated thrice with each variety. Forty eight hours old pathogen culture dissolved in sterile water having 5×10^8 CFU/ml water (OD = 0.12 in spectronic 20 at 620 mm) was inoculated by spraying on plants with an atomizer at 20, 40, 60 and 80 days after sowing. Uninoculated plants were kept as control. After inoculation, plants were covered with wet muslin cloth for 48 hrs. to provide high humidity. Frequent water sprays were also given on plants for better disease development. At crop maturity, disease intensity and seed yield/plant were recorded. Bacterial detection was made from these seeds to see per cent infection in the seeds by Agar Plate Method. Ten surface sterilized seeds per plate

Table 1. Effect of time of inoculation of *X. axonopodis* pv. *cyamopsidis* on disease intensity, infection in seeds and seed yield in different clusterbean cultivars

Inoculation at (DAS)	Cultivars								
	Pusa Navbahar			HG 365			HG 75		
	a	b	c	a	b	c	a	b	c
20	78.5	80.0	0.4	39.0	21.2	7.3	10.7	6.2	9.7
40	71.6	61.6	0.8	29.3	10.4	9.0	10.5	3.5	9.8
60	60.0	20.0	1.5	12.7	2.6	10.5	8.3	0.8	10.2
80	41.0	5.2	2.2	4.2	0.0	11.3	1.0	0.0	10.6
Control	0.8	0.0	2.7	0.0	0.0	11.4	0.0	0.0	10.6
CD at 5%	4.2	0.9	0.2	2.6	0.5	0.3	1.1	0.3	0.1

a= disease intensity (%), b=infection in seed (%), c= seed yield/plant (g)

DAS - Days After Sowing

Table 2. Effect of different category of *X. axonopodis* pv. *cyamopsidis* infection on per cent infection in seeds and seed yield/plant in different clusterbean cultivars (Pooled data of 2001 and 2002)

Category of infection (0-5 scale)	Per cent infection in seed		
	Pusa Navbahar	HG 365	HG 75
0	0.0 (2.2)	0.0 (10.8)	0.0 (10.1)
1	7.7 (2.0)	3.5 (10.6)	1.6 (10.0)
2	15.0 (1.7)	7.6 (10.0)	3.3 (9.8)
3	23.1 (1.3)	11.6 (9.2)	-
4	32.0 (0.9)	-	-
5	51.5 (0.5)	-	-
CD at 5%	2.0 0.1	1.3 0.2	0.2 0.1

Figures in parentheses are seed yield/plant (g).

- = Do not exist

(having nutrient dextrose agar medium) were incubated at $30 \pm 1^\circ\text{C}$ for 96 hours. It was replicated five times and bacterial growth was noticed around each seed. Per cent infection in seeds treatment wise in each cultivars was calculated. In second set, a field experiment was conducted to observe the effect of different category of bacterial blight infection on per cent infection in seeds and seed yield per plant in all the three cultivars (Pusa Navbahar, HG 365 and HG 75). Few plots of each variety were spray inoculated by the bacterial suspension to get plants of every category. To get healthy plants (0 scale) disease free seed of each variety were sown separately and repeated sprays of streptomycin 500 ppm + copper oxychloride @ 0.3% were given at weekly intervals. Hundred plants per category of infection (0-5 scale) were randomly selected and

tagged in the field from each cultivars. At the time of crop maturity, these tagged plants were harvested category wise from each cultivar and seed yield per plant and per cent bacterial infection (by Agar Plate Method) were detected and analyzed statistically.

RESULTS AND DISCUSSION

The data presented in Table 1 indicated that when plants of different age were inoculated under screen house conditions, bacterial blight severity ranged from 41.0-75.5% in Pusa Navbahar, 4.2-39.0% in HG 365 and 1.0-10.7% in HG 75. The maximum (80.0%) seed infection was detected in Pusa Navbahar, followed by 21.2% in HG 365 and least 6.2% in HG 75 when plants were inoculated at 20 days after sowing. Minimum bacterial detection in

seeds of HG 75, HG 365 and Pusa Navbahar were observed 1.0, 4.2 and 41.0%, respectively when plants were inoculated at 80 days old crop. When plants were inoculated at 20, 40, 60 and 80 days after sowing, the loss in seed yield per plant were observed 18.5, 44.4, 70.3 and 88.8%, respectively in Pusa Navbahar, 0.8, 7.8, 21.0 and 34.2%, respectively in HG 365 and 0.0, 3.7, 7.5 and 8.4%, respectively in HG 75. Pooled data of 2001 and 2002 presented in Table 2 revealed that seeds from plants with high disease severity gave 51.5% infection in seed in Pusa Navbahar, 11.6% in HG 365 and only 3.3% in HG 75. The least seed infection were observed from 1.6-7.7% in various genotypes in minimum category of infection (1 scale). From symptomless plants (0 scale) no seed infection was detected in any cultivar tested. Results presented in Table 2 also indicated that under field conditions bacterial blight caused loss in seed yield per plant in different proportions depending upon the disease severity. The severe most category of infection caused reduction in seed yield per plant to the tune of 77.2% in Pusa Navbahar, 14.8% in HG 365 and 2.9% in HG 75 in comparison to symptomless plants. Bacterial infection in seeds is related to time of infection, disease severity and host resistance. An infected plant does not necessarily result in seed infection in clusterbean. Different genotypes can react differently to seed infection due to host resistance, environmental conditions during flowering and seed development and inoculum concentration in host tissues. High humidity and high temperature favour seed infection. In guar particularly, high level of seeds are infected if plants are infected prior to flowering. The highest percentage of seed infection was attained by inoculating the plants at 20 days after germination.

The per cent seed infection decreased drastically when inoculation were made after 60 days of sowing in all the genotypes, because developing clusterbean seeds are resistant to infection even in susceptible varieties, whereas if infection takes place during grain maturity, the per cent seed infection is negligible. In HG 75, plants infected 60 days after sowing receive 0.8% seed infection only. HG 365 being early maturing variety receive less disease and hence less seed infection. Time of inoculation and host resistance markedly influence bacterial infection in seeds. Under severe infection conditions even well established crop received 60% damage due to this disease [4]. In Rajasthan, 50-64% loss due to this disease was estimated [5]. High seed infection (83.3%) has also been demonstrated, when 100% bacterial infected seeds of susceptible varieties of clusterbean were sown [6].

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