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Incidence of *Colletotricum* spp. on Horsegram – A Critical Review

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ABSTRACT

Horsegram is known to be susceptible to the infection of wide range of Colletotrichum species (Sharma, 1976., Murthy, 1997 and Brink and Belay, 2006). It also acts as an alternate host to the Colletotrichum isolates that attack soybean, bean and urdbean genotypes as their isolates were found infecting horsegram. Earlier, several researchers reported the incidence of anthracnose infection to an extent of 68 per cent in horsegram (Rangaswami et al.1991). Saharan (1979) reported that the disease is responsible for reduced seed germination and crop stand upto 65 per cent in Himachal Pradesh, India. The causal organism responsible for anthracnose disease was coined differently by various workers all over the world as Glomerella lindemuthianum (Butler, 1918), Colletotrichum dematium (Neergaard, 1977), C. truncatum (Holliday, 1995) and C. lindemuthianum (Brink and Belay, 2006) etc. In India, C. lindemuthianum (Sharma, 1976), C. capsici (Pangtey and Sinha, 1980), C. dematium f.sp. truncatum (Bharadwaj and Singh, 1986), C. dematium (Murthy,1997) etc. were identified as pathogens responsible for anthracnose disease by different workers. Udayasankar et al. (2012) studied seed-borne nature of C. dematium using component plating technique described by Maden et al.(1975) and noticed C. dematium infection in all parts of the horsegram seed, i.e., seed coat, endosperm (cotyledons) and embryo with varied levels of intensity. Seed coat infection was the highest, ranged from 62-100%, followed by cotyledonary infection (36-72%) and embryo infection (30%). Chahota et al. (2005) evaluated 63 landraces of horsegram collected from different parts of Himachal Pradesh against 12 morpho-agronomical characters. Disease reaction against C. truncatum under field conditions revealed that the lines, viz., HPKC-39, HPKC-57 and HPKC-33 were found free from the disease and thus considered as potential.

Key words: *Horsegram, French bean, Agar plates, Mycoflora.*

INTRODUCTION

Horsegram (*Macrotyloma uniflorum* (Lam.) Verde. Syn. *Dolichos biflorus*), commonly known as kulthi, is one of the hardiest and drought tolerant crops, grown extensively in peninsular India as poor man's pulse crop. It is an under exploited grain legume with great potential in sustainable agriculture as it enriches soil considerably by fixing atmospheric nitrogen and increasing the organic matter of soil. It is the only choice crop of the farmers for delayed sowing due to late receipt of rains.

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Horsegram seeds are rich in protein (23%) and its nutritional value is comparable with other pulses. Fodder of horsegram contains 10.5% protein, 44.8% crude fibre and is widely used as a feed to animals, especially horses. Besides its nutritional importance, it has several medicinal values and the medicinal potency of the crop was well reviewed by Prashanthi *et al.*[13]. Horsegram lipids were shown to be protective and promote healing effects on acute gastric ulceration produced by alcohol[6] and also known to dissolve and dislocate the kidney stones in human beings[4]. Anthracnose is one of the most important diseases in various leguminous crops, *viz*., cowpea, soybean, french bean, faba bean etc including horsegram. The pathogen is known to infect leaves, stems and pods and can cause considerable yield losses. Earlier, several researchers reported the incidence of anthracnose infection to an extent of 68 per cent in horsegram[15]. Saharan[16] reported that the disease is responsible for reduced seed germination and crop stand upto 65 per cent in Himachal Pradesh, India. Although horsegram anthracnose is a disease of minor importance as of now, it may attain major status within no time due to the effects of global warming and climate change.

The literature available on anthracnose disease incidence on horsegram and related crops, isolation of pathogen and proving its pathogenicity, location of pathogen on different seed parts, extent of seed transmission and varietal screening for disease resistance was reviewed and compiled in this article.

Pathogen diversity

The causal organism responsible for anthracnose disease was coined differently by various workers all over the world as *Glomerella lindemuthianum*[3], *Colletotrichum dematium*[11], *C. truncatum*[5] and *C. lindemuthianum*[2] etc. In India, *C. lindemuthianum*[17], *C. capsici*[12], *C. dematium* f.sp. *truncatum*[1], *C. dematium*[10] etc. were identified as pathogens responsible for anthracnose disease by different workers.

Butler[3] reported the occurrence of anthracnose disease on horsegram (*Dolichos biflorus*) for the first time and identified *Glomerella lindemuthianum* (Sacc. & Magn) as responsible pathogen. Sharma[17] also found *Colletotrichum lindemuthianum* causing anthracnose disease on *D. biflorus* in Himachal Pradesh, India.

Neergaard[11] reported that *Dolichos biflorus* was susceptible to anthracnose disease caused by *Colletotrichum dematium* (Pers. ex Fr.) Groove. Saharan[16] studied the seed borne nature of *Colletotrichum truncatum* on horsegram seeds collected from Solan and Kangra districts of Himachal Pradesh. Both apparently healthy and abnormal seeds (wrinkled, shrivelled, discoloured with fungal growth, deformed and small sized) of horsegram were plated separately on moist blotters and on Potato dextrose agar plates to record the incidence of seed mycoflora. Apparently healthy seeds yielded higher counts of *C. truncatum* and some other fungi as compared to those abnormal seeds when placed both on potato dextrose agar (PDA) and blotter.

Pangtey and Sinha[12] reported that *Colletotrichum capsici* (Syd.) Butler and Bisby was responsible for leaf spot disease on horsegram in Kumaun hills of Uttar Pradesh, India.

Bharadwaj and Singh[1] conducted a disease survey of pulse crops in Kangra valley of Himachal Pradesh and recorded the incidence of leaf spot on horsegram due to *C. dematium* f. sp. *truncatum.* The symptoms appeared as water soaked circular spots with a greenish tinge. Later these spots turned into reddish brown with dark brown margins. The acervuli, which form abundantly were visible to naked eye and appeared mostly on lower surface.

Udayasankar *et al.*[18] collected horsegram leaves with anthracnose symptoms

from fields of Rajendranagar and the fungal pathogen was isolated and identified as *Colletotrichum dematium*.

Isolation and proving pathogenicity

Saharan[16] studied different methods of seed health testing *viz.,* standard blotter method, standard agar plate method, deep freezing method and potato dextrose agar technique for the detection of seedborne pathogens on horsegram seeds. He found that standard blotter method was more useful in detecting pathogens.

Pangtey and Sinha[12] studied the symptoms caused by *C. capsici* on horsegram that were evident as reddish brown, irregular leaf spots that were mostly confined to the upper surface of leaflets. The centre of the spots became yellowish brown and later turned necrotic. A large number of acervuli with long setae appeared on the under surface of leaflets in areas corresponding to the spots on the upper surface. Pathogenicity tests were conducted by sowing the naturally infected seeds in open field and glasshouse conditions. Also, the artificially inoculated seeds were sown in sterilized soil under glasshouse conditions. It was reported that under all the three conditions, the pathogen caused infection and the per cent disease incidence of 24.84, 10.26 and 7.18, respectively was recorded.

Kumaraswamy[8] isolated *Colletotrichum* spp. from infected leaves of horsegram in Karnataka by using single spore isolation method. He described the conidia and setae of *Colletotrichum* spp. as curved or sickle shaped, hyaline, having guttule at the centre. Setae production was high, moderately longer, sparse, with a bulbous base and tapering ends, walls dark and thick with 3-5 septa and measured 20.5-33.8 x 4.7- 4.8 µm. in size. Pathogenicity test was conducted by inoculation of spore suspension on horsegram leaves and the inoculated plants were covered with polythene bags to provide more humidity and kept at room temperature for 15 days..

Bharadwaj and Singh[1] conducted cross pathogenicity tests with four isolates of *C. dematium* f. sp. *truncatum* isolated from mungbean, horsegram, urdbean and soybean on the above hosts including cowpea (*Vigna unguiculata*) and adzuki bean (*Vigna umbellata*) in Himachal Pradesh. The results showed that all isolates differed from each other in their pathogenic behaviour. Horsegram and mungbean were found susceptible to all the four isolates and cowpea was found resistant to all the isolates. This differential pattern in the pathogenicity could be attributed to the existence of different pathogenic variants of *C. dematium* f. sp. *truncatum* in nature and their specific adaptation to the host species.

Kulkarni[7] also conducted cross pathogenicity tests with *C. truncatum* isolate from greengram on eight other pulse crops including horsegram. It was revealed that only horsegram and blackgram showed positive reaction to the fungal isolate and all the remaining crops exhibited negative reaction indicating the host specificity nature of the isolate.

Rangaswamy *et al.*[15] revealed that standard blotter method was an ideal option for detecting *Colletotrichum* spp. on horsegram and also to determine the seed health.

Udayasankar *et al.*[18] proved the pathogenicity of *C. dematium* in horsegram by following seed inoculation, detached leaf technique and pot culture studies. In all the three methods the pathogenicity of the *C. dematium* was proven successfully.

Seed-borne nature and transmission of pathogen

Pangtey and Sinha[12] observed seed infection upto 16-55 per cent in horsegram, while Murthy[10] recorded seed infection up to 12.25 per cent in seeds collected from Karnataka.

Udayasankar *et al.*[18] studied seed-borne nature of *C. dematium* using component plating technique described by Maden *et al.*[9] and noticed *C. dematium* infection in all parts of the horsegram seed, i.e., seed coat, endosperm (cotyledons) and embryo with varied levels of intensity. Seed coat infection was the highest, ranged from 62-100%, followed by cotyledonary infection (36-72%) and embryo infection (30%). This indicates

that the pathogen is both externally and internally seed borne.

Udayasankar *et al.*[18] also studied seed to seedling transmission of *C. dematium* in horsegram using paper towel, sand and grow-out test methods. All the three methods successfully proved the seed transmission nature of the fungus, *C. dematium*, which was evident with poor germination, seed rot and seedling decay symptoms. In Paper towel method, germination of infected seeds was reduced to 42%, while sand and grow-out tests recorded a germination of 30% in each method. In sand method, maximum of 12% seed rot recorded which was lower than the paper towel result of 34% and slightly higher than grow-out test result of 10%. Seedling decay symptoms observed in sand (20%) and paper towel (18%) methods, while nil report of seedling decay symptoms found in grow-out test method.

Source of resistance

Murthy[10] screened 40 horsegram cultivars against *C. dematium* under field conditions in Karnataka and identified three cultivars AK-21, PHG-9 and CODB-2 as source of resistance to anthracnose. He also reported that 24 cultivars found moderately resistant, 12 cultivars showed as susceptible and one cultivar, D-634 as highly susceptible.

Rajan Sharma and Kaushal[14] conducted host range studies on 11 isolates of *C. truncatum*, isolated from anthracnose infected urdbean (*Vigna mungo*) leaves from different areas of Himachal Pradesh. Of the two cultivars of horsegram tested, HPK 4 was found moderately susceptible to four isolates of the pathogen, while the local horsegram cultivar (Paharikulth) was moderately susceptible to all the isolates. Owing to the highly non specialized nature of pathogen, it was opined that there is a need to look for resistance not only in wide array of urdbean germplasm but also in other related legumes, which fall within the virulence spectrum of *C. truncatum*.

Chahota *et al.*[4] evaluated 63 landraces of horsegram collected from different parts of Himachal Pradesh against 12 morpho-agronomical characters. Disease reaction against *C. truncatum* under field conditions revealed that the lines, *viz.*, HPKC-39, HPKC-57 and HPKC-33 were found free from the disease and thus considered as potential.

Udayasankar *et al.*[18] screened 25 horsegram accessions against *C. dematium* under greenhouse conditions in Andhra Pradesh. Among the 25 accessions tested, it was observed that 4, 44, 32 and 20% of the accessions were grouped under immune, moderately resistant, susceptible and highly susceptible categories, respectively based on their PDI values. He identified one immune accession, IC 470275, with zero Percent disease index (PDI) and it was found completely free from the disease in all the three replications despite the usage of high inoculum concentration (5×10^6 conidia per ml). He also reported that the above immune accession possesses morphological traits like more 100 seed weight and smooth leaf unlike other accessions. The author opined that we may consider more 100 seed weight as a positive trait for breeding resistant varieties to anthracnose in future.

CONCLUSION

Horsegram is known to be susceptible to the infection of wide range of *Colletotrichum* species[2,10,17]. It also acts as an alternate host to the *Colletotrichum* isolates that attack soybean, bean and urdbean genotypes as their isolates were found infecting horsegram. So the present compilation of all findings pertaining to anthracnose of horsegram would help in future for conducting major studies on this crop.

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