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## Studies on foliar disease *Alternaria blight* of Indian mustard (*Brassica juncea* (L.): A comprehensive review

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### Abstract

Oilseed brassicas, sometimes referred to as rapeseed-mustard, are a significant class of oilseed crops worldwide. These crops are vulnerable to a variety of biotic and mesobiotic pathogen-caused illnesses. The most damaging disease to affect oilseed brassica species on all continents is *Alternaria* leaf blight, commonly known as *Alternaria* dark spot. It is recognised that the fungi *Alternaria brassicae*, *Alternaria brassicicola*, and *Alternaria raphani*, either alone or in combination, can cause this disease. Necrotrophic diseases such as *Alternaria* leaf spot cause lesions on leaves, stems, and siliquae that are surrounded by chlorotic regions. These symptoms include a reduction in the area used for photosynthesis, defoliation, and the early onset of senescence. The amount and quality of harvested brassica products are significantly reduced as a result of *Alternaria* blight. Indian mustard is the popular name for *Brassica juncea* (L.) Czern. & Coss., which is used all over the world as an oilseed, vegetable, and condiment. The infection that causes the most damage to oilseeds is *Alternaria brassicae*. Five plant extracts and five fungicides were applied in the current experiment under *in vitro* settings using the poison food method (PFT) and Standard Blotter Test (SBT), as well as under *in vivo* conditions using seed application, foliar application, and seed + foliar application. The results of the current study showed that captan + hexaconazole and mancozeb + carbendazim were the two fungicides that were most successful in boosting seed germination and vigour index by lowering pre- and post- emergence mortality against *Alternaria brassicae*.

**Keywords:** Oilseeds, SBT, emergence, mortality

### Introduction

The production of oilseeds from Brassica species is the highest in the world, followed by that from peanut (*Arachis hypogaea* L.) and sunflower (*Helianthus annuus* L.). Rapeseed-mustard is farmed throughout India under a variety of agroclimatic conditions, from north-eastern/north-western highlands to the lowlands. These crops must have a chilly growing season and a constant temperature, hence they are sown in northern India from November 1 to November 15. (Das *et al.*, 2009)<sup>[6]</sup>.

Indian mustard (*Brassica juncea* L. Czern. Coss) is also known as Rai, Raya or Laha belong to family *Brassicaceae* (Cruciferae) and it's Centre of origin mediterranean. Indian mustard is largely self pollinated (*Brassica juncea* L. czern & Coss) (n = 18) is an amphi diploid species derived from inter specific crosses between *B. nigra* (n = 9) and *B. rapa* (n = 10). (U 1935). Can be used as live stock feed. It produces 9 k cal energy from 1gm of oil per unit in comparison with other diets (carbohydrate and Protein). Mustard seeds have relatively high protein content (28- 36%). Until now mustard seeds have been used mainly for condiment production. (Gadei *et al.*, 2012)<sup>[9]</sup>. The second-largest indigenous oilseed crop in India is rapeseed-mustard, which is grown throughout a variety of agro-climates and accounts for 32% of the country's overall oilseed output (Gupta *et al.*, 2017)<sup>[14]</sup>. One of the major diseases affecting rapeseed-mustard that can result in yield losses of up to 47% is *Alternaria* blight. Development of eco-friendly, economically and viable approaches for the management of disease problem through the integration of bio-pesticides and agro chemicals

### *Alternaria* blight Disease of mustard review

Godika *et al.*, (2001)<sup>[13]</sup>. concentrated on that splash of rovaral at a timespan days when applied on 40 days old plants decreased the rate of curse sickness. Viability of different fungicides were additionally considered in contrast to scourge illness of mustard and tracked down that shower with antracol showed least seriousness.

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Kumar *et al.*, (2006) <sup>[18]</sup> concentrated on the illness protection from *Alternaria* scourge in nine genotypes of Indian mustard (*Brassica juncea*) under field conditions. Two genotypes *viz.*, PR 8988 and PR 9024 displayed sluggish scourging and had most minimal number of spots/10 cm<sup>2</sup> leaf region, diminished spot size, least number of conidia per spot and least infection file on leaf and unit. The greatest illness advancement was recorded during 62 to 72 DAS on leaves and from 100 to 110 DAS on cases.

Singh *et al.* (2006) <sup>[28]</sup> saw that six seed dressing fungicides, for example Metalaxyl, Carbendazim, Mancozeb, Thiophanate-methyl, Iprodione and BAS 38601 F (a seed dressing fungicide containing 40% Carbendazim + 32% Mancozeb), in blend with splash of Mancozeb (0.25%) were tried for the control of foliar sicknesses, *Alternaria* leaf spot (*Alternaria brassicae*) and white rust (*Albugo candida*) of Indian mustard. All the seed therapies further developed germination and decreased illness force. Seed treatment with Mancozeb and shower of same fungicide was best against *Alternaria* leaf spot controlling up to 58.8 to 74.7% infection. The best return was recorded with Iprodione (16.0-17.36 q/ha) and Mancozeb (26.0-31.12 q/ha).

Khan, *et al.*, (2007) <sup>[17]</sup>, revealed that the scourge sickness by a few fungicides with shifting level of progress has prior been Mancozeb was again demonstrated to a superior choice when tried among every one of the accessible therapies and decreased greatest seriousness on mustard leaves.

Danielsson *et al.*, (2007) <sup>[4]</sup>. Certain *Bacillus* strains were found to have defensive impacts which make them profoundly compelling as bio control specialists in *Brassica* development. In a trial two *B. amyloliquefaciens* strains safeguarded the plant against every one of the tried parasitic microorganisms. *Bacillus* strains are normally demonstrated to hinder the contagious development *in vitro* conditions however not for each situation.

Schnitzer *et al.*, (2011) <sup>[25]</sup>. Accordingly, accentuation is presently moved towards mix of microorganisms (biocontrol growths with PGPR) against plant microbes. Rhizosphere soil is wealthy in assorted microorganisms which straightforwardly and by implication impact the efficiency of normal plant local area.

Tilak *et al.*, (2011) <sup>[29]</sup>. The microbial consortium functions admirably as biopesticides, in treating an extensive variety of plant microorganisms which is somewhat hard to be satisfied utilizing a solitary biocontrol specialist. Bio control specialists separately or in consortium assault microorganisms through hostility impact. They act better and all the more successfully when joined while having a place with a similar environment. The similarity between microorganisms to foster a consortium is the premier significant. Indispensable and future promising up-and- comers of the microbial consortium can be *Trichoderma* spp., *Pseudomonas* spp. furthermore, *Bacillus* spp.

Benali *et al.* (2011) <sup>[1]</sup> announced that the sub-atomic methodologies have been utilized progressively in scientific categorization and systematics of filamentous growths including phyto-microorganisms at the species and subspecies level.

DRMR (2011) <sup>[8]</sup> evaluated rapeseed-mustard cultivars for protection from *Alternaria* scourge sicknesses. None of the genotype showed safe response to *Alternaria* curse. Notwithstanding, EC 338997, EC 339000, EC 414293, NPJ 154 and RH 345 were seen as modestly impervious to

*Alternaria* scourge.

Parikh and Jha, (2012) <sup>[22]</sup>. Fruitful organic control of foliar illnesses has been accomplished by various scientists under nursery conditions as well as in field preliminaries utilizing contagious and bacterial.

Cumagun, (2012) <sup>[3]</sup> expressed that types of *Trichoderma* have generally being acknowledged as biocontrol against various phytopathogens. Development advancement movement of *Trichoderma* has likewise been accounted for.

Mukherjee *et al.*, (2012) <sup>[21]</sup>. Microbe by delivering chemotropism which is additionally trailed by lysis of microorganism's phone wall by utilizing cell wall-corrupting catalysts (CWDEs) and peptaibols initiated by heterotrimeric G-proteins and Guide (mitogen-activated protein kinases) and afterward parasitizing on microbe's phone wall contents.

Glick, (2012) <sup>[12]</sup>. The complete component of PGPR isn't known however couple of studies detailed recommend that they display advantageous exercises for plant development advancement PGPR advances plant development in two ways straightforwardly and by implication

Sasode *et al.*, (2012) <sup>[24]</sup>. expressed that botanicals to be specific Neem, Eucalyptus, *Datura*, *Pudina*, *Tulsi*, *Lantana* were considered under rough and bubbled structures in contrast to *A. brassicae* under *in-vitro* condition Synthetics are by and large effectively utilized in controlling the sickness Non-substance strategies for infectious prevention might incorporate utilization of natural specialists, botanicals, change in social practices and so on. In any case, utilizing extreme synthetics is deterred as it is hurtful for the climate and the lingering impact can make rot human wellbeing. Non-substance strategies for infectious prevention might incorporate utilization of natural specialists, botanicals, change in social practices and so on.

Gajera *et al.*, (2013) <sup>[10]</sup>. *Trichoderma* spp. are viewed as great makers of optional metabolites and fills in as a significant biocontrol against various plant sicknesses Anti-microbials and some low- sub-atomic weight compounds are delivered by *Trichoderma* when they come in direct contact with the microorganism that eventually brings about hindrance of phytopathogens.

Giri *et al.*, (2013) <sup>[11]</sup> concentrated on the *Alternaria* scourge of starting disease processes including conidium germination and method of entrance was comparative in the two cultivars, albeit significantly late in 'PAB 9511' clearly because of resistance. In any case, obvious contrasts between the two cultivars were observable by 1 dpi. At the plant surface, obstructed contagious development, less multiplication of spores and dynamic concealment of the thick hyphal molds are the elements associated with the statement of resistance against *Alternaria brassicae* in cultivar PAB 9511. Our discoveries have outstandingly progressed how we might interpret the component of resilience in this patho-framework.

Sharma *et al.*, (2013) <sup>[26]</sup>. Development of chlamydospores is accounted for in *A. brassicae* and *A. raphani*, while microsclerotia are viewed as delivered by the previous. Albeit the utilization of speciesgroup assignment doesn't determine authoritative species limits inside *Alternaria*, benefits of its utilization are that it coordinates at the subgeneric level the morphologically assorted collection of *Alternaria* species and licenses the summed up conversation of morphologically comparable species without becoming over confined due to nomenclatural vulnerability. Social, morphological, pathogenic, Bisht *et al.* (2015) <sup>[2]</sup> led an examination,

screening of Brassica germplasm uncovered that among 240 Brassica germplasm none was seen as profoundly safe against *Alternaria* scourge just 08 Brassica germplasm viz. IC-255498, IC-296685, IC-326253, IC-335847, IC339589, IC-339597, IC-360723, and IC-417020 were viewed as modestly safe with 11-25% illness seriousness against *Alternaria* scourge, IC-296705, IC-328316 and IC-338523, were defenseless and showed 26-half infection seriousness while 234 were seen as profoundly vulnerable with over half sickness seriousness.

Kamal *et al.*, (2015) [15] Co-immunization of *Streptomyces labedae*, *Streptomyces flavofuscus* and *Pseudomonas fluorescens* increment the plant development of finger mill operator in any event, when applied in dry season conditions improvement of biocontrol adequacy is to join the bacterial detaches chose for controlling *P. Consortia* of *Paenibacillus polymyxa* otherwise called *Bacillus polymyxa* and *Rhizobium tropici* when applied on dark bean plant altogether expanded the plant level.

Das *et al.*, (2016) [5] concentrated on the 134 sections were screened against *Alternaria* scourge of the rapeseed-mustard. None of the passages was viewed as safe or exceptionally safe or safe. Just five sections i.e., RSPN-29, CNH-13-2, AKGS-1, RSPN-28 and CNH-13-1 were viewed as respectably safe.

Meena *et al.*, (2016) [19] (A) concentrated on that *Alternaria* scourge (Stomach muscle) brought about by *Alternaria brassicae* (Berk.) Sacc. is a staggering illness of oilseed Brassicas everywhere, and liable for critical seed yield misfortunes up to 47%. No solid, safe germplasm is accessible to foster Stomach muscle safe cultivars. Different screening strategies have been accounted for up to this point, yet cotyledonary leaf technique isn't yet announced. Three techniques were tried utilizing one powerless cultivar (Varuna): immunization of seed, vaccination of cotyledons, and vaccination of both seed and cotyledons. Parasitic conidia were vaccinated straightforwardly onto the seedlings with  $1.5 \times 10^5$ ,  $2.5 \times 10^5$ ,  $4 \times 10^5$  and  $5 \times 10^5$  conidia ml<sup>-1</sup> fixations for normalization. Rate Stomach muscle seriousness expanded with the expansion in conidial focus, subsequently the most noteworthy fixation was utilized for definite screening. Among the three screening techniques, vaccination of both seed.

Meena *et al.*, (2016) [20] (B) revealed that cotyledon technique was tracked down exceptionally compelling where mean Stomach muscle seriousness on cotyledon was 84.6% in contrast with 49.3% in the immunization of seed and 62.5% in the vaccination of cotyledon strategies. The procedure was approved by screening helpless and putative lenient genotypes. The seriousness of Stomach muscle was 54% of defenseless cultivar and 16.4%-21.2% of open minded genotypes. The conidia number per minute field was 21.5 in putative open minded and 43.5 in defenseless genotypes. Along these lines, *in vitro* screening of Stomach muscle utilizing immunization of both seed and cotyledon technique was seen as best and could be utilized for fast separating beginning phases of plant development. Another 0-7 rating scale was likewise concocted to notice the Stomach muscle microorganism collaboration aggregate at the cotyledonary phase of oilseed Brassica.

According to Didwania *et al.* (2019) [7], integrated management for *Alternaria* blight in crops that produce oil. According to current studies on the microbial consortium, combining bacterial and fungal strains with an effective

PGPR as one of the components is preferable to using single inoculums to control disease.

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According to Didwania *et al.* (2019) [7], integrated management for *Alternaria* blight in crops that produce oil. Recent research on the microbial consortium suggests that combining bacterial and fungal strains can be successful.

Rayanothala, (2021) [23]. concentrated on that among illnesses, leaf scourge of Indian mustard, prompted by *Alternaria brassicae* and *A. brassicicola* is a significant danger to mustard development in India and is liable for yield decrease of up to 70% under positive circumstances The sickness improvement is subject to various variables, viz., time of plant, soil supplements, natural elements like temperature, relative moistness and precipitation and so on the job of ecological elements in illness improvement as well as reasonable substance measures for infectious prevention have been recently concentrated on by numerous laborers.

Singh *et al.*, (2021) [27]. concentrated on that the because of the way that temperature, moistness and precipitation significantly affects spore germination, development, infiltration, disease and spore creation. Further, wind speed has been known to impact spore freedom, dispersal, testimony which thus decides the power of the sickness, especially for air borne microorganisms.

According to Karthikeyan *et al.* (2021) [16], the development of spots on leaves, stems, and siliquae are the characteristic symptoms of *Alternaria* blight disease. The resulting concentric black spots were typically grey in colour, and the characteristics of the spots changed depending on the host and the environment. symptoms first developed on the lowest leaves.

From the present study, it was observed that In the process for resistance against a certain disease, a proper understanding of the variance in the pathogen population is absolutely essential. Given the aforementioned information, a study was conducted to determine the morphological and molecular differences between several isolates of *Alternaria* spp.

The main goal of the current investigation was to identify differences between the different *Alternaria* isolates. The severity of the mustard disease in chosen survey regions, as well as the effectiveness of chosen botanical and chemical treatments, as well as their combined impact on the management of the *Alternaria blight* disease of mustard caused by *Alternaria* spp.

## Conclusion

Based on the findings of the in-vivo investigation to assess the chosen treatments, it can be said that *Trichoderma viride* @ 1ml/gm performed best among chemical fungicides and that lantana leaf extract performed best among botanical treatments. The therapies' combined effects produced manageable outcomes for the *Alternaria* blight disease of mustard. Regarding yield qualities, treatments produced the best results. The therapy *Trichoderma viride* @ 1ml/gm their combined treatment can be utilised in subsequent field experiments and then may be advised for management of *Alternaria* blight mustard based on the findings on the many

parameters evaluated. The molecular characterization of *Alternaria* isolates linked to the mustard illness *Alternaria* blight and its integrated management should get the utmost attention.

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