Medicinal Plants
Vol. 16 (3), September 2024, 379-384

doi :

Research Article

Survey on alternaria leaf blight of isabgol incited by *Alternaria alternata* in major growing areas of Rajasthan

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Received: March 28, 2024; Accepted: August 14, 2024

ABSTRACT

The Alternaria leaf blight disease of Isabgol is the new emerging plant disease, causing significant damage to crops. Recognizing its impact, a survey was conducted in the major growing areas of Isabgol in Rajasthan during *rabi* season 2022-23 and 2023-24. The survey conducted in various districts of Rajasthan revealed an average disease intensity of 24.03%, with Bikaner reporting the highest intensity (22.82%) followed by Jaisalmer (19.30%), and the lowest recorded in Barmer (11.67%). Further examination in Bikaner district during the Rabi seasons of 2022-23 and 2023-24 indicated fluctuating disease intensity ranging from 23.86% to 21.77%. Maximum disease intensity (29.07%) occurred in Isabgol fields in Ridi village, Shri Dungargarh tehsil, Bikaner, while minimum intensity (17.63%) was observed in Barsingsar village, Bikaner. In Jaisalmer, disease intensity ranged from 20.28% to 18.32%, with Moolana village reporting the highest (23.20%) and Keeta village the lowest (14.96%). Barmer exhibited an average disease intensity of 12.46% to 10.87%, with Gadario ki Dhani village (14.67%) in Gudha Malani tehsil showing the highest intensity at Nosar village (8.68%) in Baytoo tehsil the intensity was recorded lowest.

Keywords: *Alternaria alternata,* disease intensity, isabgol, leaf blight, survey

INTRODUCTION

"*Plantago ovata*" commonly known as 'Psyllium' in English and 'Isabgol' in Hindi belongs to the family of *Plantaginaceae*. It has gained a reputation as a naturally occurring medicinal herb. It is believed to have originated in Persia and was introduced in India. It is predominantly grown in India, Pakistan, Bangladesh, Persia, Mexico and Mediterranean regions due to its seed mucilage, pharmaceutical, cosmetics and food grade properties. Notably, India ranks first in Isabgol production (98%) and is the sole supplier of seeds and husk in the international market (Maiti, 2000). Among medicinal plants, Isabgol is the top ranked foreign exchange earner for the country amounting to Rs. 30 million annually.

India dominates the world market in production and export of psyllium husk powder. It provides approximately 80% of psyllium husk powder in the world market. About 90-95% of India's isabgol production is exported. According to Department of Commerce, Ministry of Commerce and Industry, GoI (2023), India exported Isabgol husk worth Rs. 265.8 crores and seed worth Rs. 36.8 crores during 2022-23. The area under isabgol cultivation in India is 4.5 lakh hectare with a production of 4.32 lakh metric tonnes (Anonymous, 2023).

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Psyllium is a natural polysaccharide and containing a high percentage of hemicelluloses. It is used as an ingredient in the making of chocolate, jellies, and has also been reported for its use with curds, rosewater and in sherbets as a thickening agent. Psyllium has also been found helpful in preventing autointoxication (Morita *et al.,* 1998), which results in the re-absorption of toxins into the bloodstream. When used regularly, it helps to relieve the problem by removing the toxins from body. It can assist with any disease by protecting the colon and preventing toxins from being absorbed into the blood (Morita *et al.,* 1999; Yu *et al*., 2008; Madgulkar, 2015). The necrotrophic nature of *Alternaria* species typically leads to damage to the plant and harvest product, with seedlings seldom surviving an attack (Humpherson-Jones, 1985, Rimmer and Buchwaldt, 1995; Mamgain *et al.*, 2013). *Alternaria* is easily identified by the shape of their conidia, which are large, ovoid to obclavate, dark-colored (melanized), multicellular with longitudinal and transverse septations (Barnett, 1998). *A. alternata* also causes heavy losses in several other crops (Choudhary, 2021; Choudhary *et al.,* 2024).

Given the destructive nature of the disease, this study is designed to investigate the epidemiological aspects and propose an effective management strategy for leaf blight of psyllium. However, not much research has been done in Rajasthan. Given the prevalence of Alternaria leaf blight in Isabgol cultivation areas of Rajasthan and its speculated role as a significant contributor to diminished productivity, the urgent need for assessing disease severity becomes apparent. Compounded by the challenging environmental conditions characterized by hot temperatures and compounded by the notable absence of prior research on Isabgol in this region, the lack of reports regarding disease severity and the causal agent of Alternaria blight is conspicuous. Therefore, this study endeavors to fill this critical gap by undertaking a comprehensive assessment of disease severity and identification of the pathogen responsible for Alternaria blight in the principal growing areas of Rajasthan.

MATERIALS AND METHODS

Survey of leaf blight of isabgol in major isabgol growing areas of Rajasthan

Survey for the occurrence of leaf blight of Isabgol was conducted to assess the prevalence and incidence in major isabgol growing areas of Rajasthan. Survey was conducted in Barmer, Jaisalmer and Bikaner districts of Rajasthan. Three tehsils under each district and four villages under each tehsil were included. Under each village four farmer's fields were assessed. In each field, five spots of one square meter area were marked diagonally at randomly to cover entire field. The per cent disease intensity (PDI) were assessed for each plot on a disease rating scale of 1-9 (Gugino *et al*., 2007) based on the percentage of leaf area symptomatic (1= 0% tissue symptomatic, 2= up to 1%, 3= 2-5%, 4= 6-10%, 5= 11-20%, 6= 21-30%, 7= 31-40%, 8= 41-50%, and 9= over 50%). The intensity was calculated by using the formula of Wheeler (1969).

Observation

The per cent disease intensity (PDI) was calculating using the following formula:

$$\text{Percent disease intensity} = \frac{\text{Sum of all individual disease rating}}{\text{Total no. of plants assessment x max. rating}} \times 100$$

Infected samples were collected from surveyed field. These samples were brought to laboratory for isolation of pathogens and further studies.

RESULTS

Survey of Alternaria leaf blight of isabgol in major isabgol growing areas of Rajasthan

Survey was conducted in major Isabgol growing districts of Rajasthan during *Rabi* season 2022-23 and 2023-24 which showed the Alternaria leaf blight disease caused by *Alternaria alternata* is an imperative pathological problem, mostly in Bikaner, Jaisalmer and Barmer districts. Average disease intensity was 17.93 per cent recorded in surveyed districts of Rajasthan. Highest average disease intensity (22.82%) was reported in Bikaner followed by Jaisalmer (19.30%) while lowest in Barmer (11.67%) district. Data pertaining to the intensity of Alternaria leaf blight disease of Isabgol at different locations is presented in Table 1, Plate 1 & 2 and Figure 1.

Bikaner

The survey in Bikaner district was conducted in twelve villages of three *tehsils, viz*., Bikaner, Nokha and Shri

Table 1: Per cent disease intensity of alternaria leaf blight of isabgol in major isabgol growing areas of Rajasthan

District	Tehsil	Village	Disease intensity (%)*		Mean PDI	Range of PDI in Tehsil
			2022-23	2023-24		
Bikaner	Bikaner	Deshnok	19.54	17.38	18.46	17.63-21.15
		Himtasar	21.43	20.88	21.15	
		Barsingsar	18.83	16.43	17.63	
		Lalamdesar	19.41	17.39	18.40	
	Nokha	Rasisar	21.69	20.26	20.97	20.97-26.66
		Parwa	25.48	23.49	24.48	
		Bhamatsar	23.86	21.71	22.78	
		Manyana	28.11	25.21	26.66	
	Shri Dungargarh	Sheruna	24.65	22.51	23.58	23.11-29.07
		Sanwatsar	28.33	26.73	27.53	
		Ridi	30.66	27.49	29.07	
		Punrasar	24.39	21.83	23.11	
		Average	23.86	21.77	22.82	
Jaisalmer	Jaisalmer	Amar Sagar	18.39	17.38	18.39	16.65-22.93
		Ramgarh	22.75	21.86	22.75	
		Chandhan	16.56	15.33	16.56	
		Sonoo	22.93	21.64	22.93	
	Pokaran	Chhayan-ii	16.51	15.87	16.51	16.51-21.64
		Gomat	20.29	19.42	20.29	
		Eka	17.67	16.91	17.67	
		Sankra	21.64	20.53	21.64	
	Fatehgarh	Satto	19.24	17.88	19.24	14.96-23.20
		Moolana	23.20	21.92	23.20	
		Keeta	14.96	14.49	14.96	
		Rasla	17.45	16.62	17.45	
		Average	20.28	18.32	19.30	
Barmer	Dhorimana	Bhardrai	10.44	09.39	09.91	09.15-09.91
		Khari	13.90	11.83	12.86	
		Kothala	09.78	08.53	09.15	
		Aakli	11.02	10.49	10.75	
	Baytoo	Sawau Padamsingh	13.07	11.52	12.29	08.68-13.76
		Baytoo Bhopjii	12.12	10.48	11.30	
		Nosar	08.88	08.49	08.68	
		Loonara	13.64	11.38	12.51	
	Gudha Malani	Aalpura	14.62	12.91	13.76	11.66-14.67
		Gadario ki Dhani	15.55	13.79	14.67	
		Sili	13.45	11.49	12.47	
		Ratanpura	13.13	10.19	11.66	
		Average	12.46	10.87	11.67	
		Total Average	18.87	16.99	17.93	

*Average of four fields in each village

Plate: 1: Survey of alternaria leaf blight in major isabgol growing areas of Rajasthan

Plate 2: Alternaria leaf blight infected leaf of isabgol

Dungargarh. The average disease intensity ranged from 23.86% to 21.77% was recorded during the *Rabi* 2022-23 and 2023-24. The maximum per cent disease intensity was observed in Isabgol fields at Ridi village of Shri Dungargarh *tehsil* that is upto 29.07% and minimum (17.63%) in Barsingsar village of Bikaner *tehsil*. In the Bikaner *tehsil*, the average disease intensity was highest in Himtasar village (21.15%) followed by Deshnok village (18.46%), Lalamdesar village (18.40%) and lowest in Barsingsar village (17.63%). In the Nokha *tehsil*, the average disease intensity was highest in Manyana village (26.66%) followed by Parwa village (24.48%), Bhamatsar village (22.78%) and lowest in Rasisar village (20.97%). In the Shri Dungargarh *tehsil*, the average disease intensity was highest in Ridi village (29.07%) followed by Sanwatsar village (27.53%), Sheruna village (23.58%) and lowest in Punrasar village (23.11%). The average disease intensity of the district was recorded 22.82 per cent.

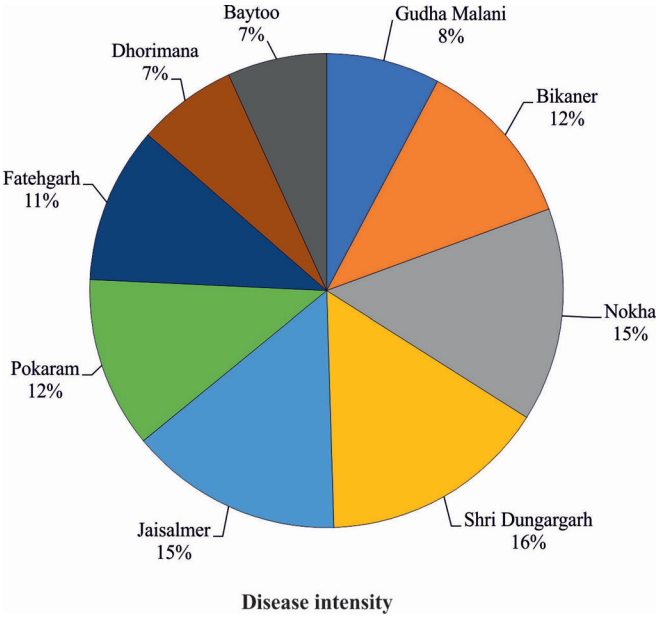

Figure 1: Percent disease intensity of alternaria leaf blight of isabgol in major growing districts of Rajasthan

Jaisalmer

The survey in Jaisalmer district was conducted in twelve villages of three *tehsils*, *viz*., Jaisalmer, Pokaran and Fatehgarh. The average disease intensity ranged from 20.28 to 18.32 per cent was recorded during the *rabi* 2022-23 and 2023-24. The highest per cent disease intensity was observed at Moolana (23.20%) village of Fatehgarh *tehsil* and minimum per cent disease intensity in Keeta (14.96%) village of Fatehgarh *tehsil*. In the Jaisalmer *tehsil*, the average disease intensity was highest in Sonoo village (22.93%) followed by Ramgarh village (22.75%), Amar Sagar village (18.39%) and minimum in Chandhan village (16.56%). In the Pokaran *tehsil*, the average disease intensity was highest in Sankra village (21.64%), followed by Gomat village (20.29%), Eka village (17.67%) and lowest in Chanyan-ii village (16.51%). In the Fatehgarh *tehsil*, the average disease intensity was highest in Moolana village (23.20%), followed by Satto village (19.24%), Rasla village (17.45%) and lowest in Keeta village (14.96%). The average disease intensity of the district was recorded 19.30 per cent.

Barmer

The survey in Barmer district was conducted in twelve villages of three *tehsils*, *viz*., Barmer, Baytoo and Gudha Malani. The average disease intensity ranged from 12.46 to 10.87 per cent was recorded during the *Rabi* 2022-23 and 2023-24. The highest per cent disease intensity was observed at Gadario ki Dhani (14.67%) village of Gudha Malani *tehsil* and minimum per cent disease intensity in Nosar (08.68%) village of Baytoo *tehsil*. In the Dhorimana *tehsil*, the average disease intensity was highest in Khari village (12.86%), followed by Aakli village (10.75%), Bhardrai village (9.91%) and minimum in Kothala village (09.15%). In the Baytooo *tehsil*, the average disease intensity was highest in Loonara village (12.51%), followed by Sawau Padamsingh village (12.29%), Baytoo Bhopjii village (11.3%) and lowest in Nosar village (8.68%). In the Gudha Malani *tehsil*, the average disease intensity was highest in Gadario ki Dhani village (14.67%), followed by Aalpur village (13.76%), Sili village (12.47%) and lowest in Ratanpur village (11.66%). The average disease intensity of the district was recorded 11.67 per cent.

DISCUSSION

Survey for occurrence and distribution of disease was necessary because there are no reports and records on this disease. However, Bajaya *et al.* (2021) have been carried out field survey in Nagaur district of Rajasthan. The disease intensity was found maximum (36.00%) at village Bhadwa in Parbatsar and minimum (16.00%) in Dhankoli Village of Moulasar Tehsil in Nagaur during *rabi*, 2016-17.

The observed variations in disease intensity among the surveyed districts underscore the geographical impact on Alternaria leaf blight. Bikaner exhibited the highest average disease intensity at 22.82%, indicating a heightened susceptibility to *Alternaria alternata*. Jaisalmer followed closely with a disease intensity of 19.30%, while Barmer recorded the lowest intensity at 11.67%. These disparities may be attributed to diverse environmental conditions, agronomic practices (Meynard *et al.,* 2003), amount of inoculum and crop management strategies across the regions (Castro, 2001).

The prevalence of Alternaria leaf blight is often influenced by environmental factors such as temperature, humidity, and precipitation (Ganie *et al*., 2015; Yadav *et al*., 2021; Dhaka *et al*., 2022). The higher disease intensity in Bikaner and Jaisalmer could be linked to specific

climatic conditions favoring the proliferation of *Alternaria alternata*. Further investigations into these climatic parameters could provide valuable insights into the disease dynamics in these regions. In conclusion, the findings of this survey shed light on the regional dynamics of Alternaria leaf blight in major Isabgol growing districts of Rajasthan. This knowledge is foundational for devising region-specific strategies to manage and mitigate the impact of *Alternaria alternata* on Isabgol crops, thereby fostering sustainable agricultural practices in the region (Vennila *et al.,* 2022).

Conflicts of interest

Authors declare that there is no conflict of interest.

REFERENCES

Anonymous (2024). Rajasthan agricultural statistics at a glance 2022-23. Commissionerate of Agriculture, (CSO Cell) Rajasthan, Jaipur, Government of Rajasthan, 67.

Bajaya T, Ahir RR, Ghasolia RP, Bajya M and Choudhary M (2017). Effect of environmental factors on alternaria leaf spot of isabgol (*Plantago ovata*). *J. Pharmacogn. Phytochem.*, 6(4): 600-601.

Barnett HL and Hunter BB (1998) Illustrated genera of imperfect fungi, (4th edtn). Minnesota, USA: *The American Phytopathological Society Press*.

Castro A (2001). Cultivar mixtures. *The plant health instructor. DOI: 10.1094*. PHI-A-2001-1230-01.

Choudhary A, Verma JR, Ram D, Kumar M, Jangir H and Bairwa PK (2021). Identify the Source of Resistant against Early Blight of Tomato Caused by *Alternaria solani*. *Int. J. Agr. Envir. Biotech.,* 14(4): 15-18.

Choudhary A, Yadav AL, Sharma S, Ram D, Saran MK and Choudhary S (2024). Screening of rhizosphere micro-organisms for antagonism against *Alternaria alternata* (Fr.) Keissler causing Alternaria leaf blight of Isabgol (*Plantago ovate*). *IJMFM & AP*, 10(1): 143-148.

Dhaka S, Choudhary A and Bhatt J (2022). Effects of depth levels of burial on the survival of *Alternaria solani* causing early blight of tomato. *Agrica.*, 11(2): 127-130.

Ganie SA, Ghani MY, Lone AH, Razvi SM, Mir MR and Hakeem KR (2015). Role of weather factors on early blight of potato under Kashmir Valley conditions. *Mol. Plant Breed.*, 6(4): 1-5

Gugino BK, Carroll JE, Widmer TL, Chen P and Abawi GS (2007). Field evaluation of carrot cultivars for susceptibility to fungal leaf blight diseases in New York. *Crop Prot.,* 26(5): 709-714.

Humpherson Jones FM (1985). The incidence of *Alternaria spp*. and *Leptosphaeria maculans* in commercial brassica seed in the United Kingdom. *Plant Pathology*, 34(3): 385-390.

Madgulkar AR, Rao MR and Warrier D (2015). Characterization of psyllium (*Plantago ovata*) polysaccharide and its uses. *Polysaccharides*, pp 871-890.

Maiti S (2000). Cultivation of isabgol (*Plantago ovata* Forssk). Bulletin: national research centre for medicinal and aromatic plants. Boriavi, Anand, Gujarat. pp 1.

Mamgain A, Roychowdhury R and Tah J (2013). Alternaria pathogenicity and its strategic controls. *Res. J. Biol.*, 1: 1-9.

Meynard JM, Doré T and Lucas P (2003). Agronomic approach: cropping systems & plant diseases. *C.R. Biol.*, 326(1): 37-46.

Morita A, Meyer FB and Laws ER (1998). Symptomatic pituitary metastases. *J Neuro.,* 89(1): 69-73.

Morita T, Kasaoka S, Hase K and Kiriyama S (1999). Psyllium shifts the fermentation site of high-amylose cornstarch toward the distal colon and increases fecal butyrate concentration in rats. *The J. Nutri.*, 129(11): 2081-2087

Rimmer SR and Buchwaldt H (1995). Diseases. In: Brassica oilseeds-production and utilization [Kimber D and McGregor DI (eds.)], CAB International, Allingford, UK. pp 111-140.

Vennila S, Bhat MN, Kumari DA, Yadav SK and Sharma VK (2020). Effect of climatic variability and weather factors on development of tomato early blight in a hot semi-arid region of Southern India. *Indian J. Hort.*, 77(2): 333-338.

Wheelar BEJ (1969). An introduction to plant diseases. John Willey and Sons Ltd., London, pp 301.

Yadav P, Choudhary A, Verma JR, Ram D and Yadav PD (2021). Assessment of disease incidence of leaf blight (*Alternaria alternata*) disease of carrot in Jodhpur District of Rajasthan. *Agrica.*, 10(2): 135-139.

Yu LL, Lutterodt H and Cheng Z (2008). Beneficial health properties of psyllium and approaches to improve its functionalities. *Adva. Food Nutrition Res.*, 55: 193-220.