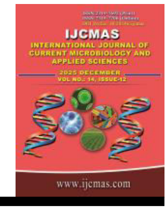
Int.J.Curr.Microbiol.App.Sci (2025) *14*(12): 197-203

EXCELLENT PUBLISHERS

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 14 Number 12 (2025)**
Journal homepage: http://www.ijcmas.com



Original Research Article https://doi.org/10.20546/ijcmas.2025.1412.020

Ecofriendly Management of Foliar Blight (*Alternaria triticina*) of Wheat (*Triticum aestivum* L.)

Abhinav Thakur[1], Sweta Pathania[2*], Sobita Simon[1], Shiv Kumar Saini[2] and Priya Mehta[2]

[1]*Department of Plant Pathology, Sam Higginbottom University of Agricultural Technology and Science, Prayagraj U. P. (India) 211007*
[2]*Department of Plant Pathology, Dr. Yashwant Singh Parmar University of Horticulture & Forestry, Nauni, Solan H.P. (India) 173230*

**Corresponding author*

Keywords

Wheat, *Alternaria triticina*, micro algae, mycorrhiza

Article Info

Received: 10 October 2025
Accepted: 24 November 2025
Available Online: 10 December 2025

A B S T R A C T

Alternaria leaf spots of wheat, caused by *Alternaria triticina,* has attained importance in north-eastern and north-western plain zone of Asia during recent years due to significant losses. The Survey was conducted in the district Prayagraj to find out the occurrence and distribution of the foliar blight disease of wheat. Efficacy of different bio-resource amendments was evaluated on disease incidence, plant growth and yield parameters of wheat under field condition at maximum plant height (cm) at 90 DAS (88.8), maximum numbers of grains per spike (60), maximum test weight (43.56), maximum dry weight (22.1) and maximum grain yield (35.83) was recorded in T_7 the combination of Microalgae + Phosphate Rich Organic Manure. Minimum disease intensity (%) at 50 DAS (7.13), 70 DAS (9.84) and 90 DAS (10.94) was recorded with the application of combination of Microalgae + Phosphate Rich Organic Manure followed by Microalgae + Mycorrhiza showing significant results compared with other treatments including control (N.P. K).

Introduction

Wheat, the versatile cereal crop is also described as the king of cereals. It supplies more nutrients particularly essential amino-acids than any other cereal crop. Wheat contains more protein than other cereal and has a relatively high content of niacin ad thiamine, and providing the characteristics substance "Glutin" which is essential for bakers[1]. It provides edible grain which forms staple food for a large number of people across the world. Even today, it occupies a primary position among all cereal crops due to its role in feeding mankind. The importance of wheat as a staple food of south Asia is well known. Its enhanced productivity in the post Green Revolution period played a key role in ensuring food security in the thickly populated part of the world, which comprises of India, Pakistan, Nepal and Bangladesh[2].

A huge proportion of farms around the world produce one commodity: wheat. Almost every house hold on the planet now consumes some form of wheat from flour and bread to multiple types of pasta, wheat is an essential product to maintain food security. In the marketing year 2023-2024, approximately 789 million metric tons of wheat were produced on a global scale. This represented a drop of around four million tons compared to the previous period (statista.com).

Wheat production is an essential part of world agricultural, helping to ensure food security and combat poverty. Changing weather patterns contribute to fluctuation in wheat production, while pandemics and conflicts stimulate global panic buying due to supply chain disruptions. By 2027, the wheat market is expected to reach US $169.1 billion as a result of increased global consumption and demand from the food and beverage processing industries.

Alternaria triticina cause leaf blight in wheat, leading to significant yield losses and reduced grain quality. The disease, prevalent in India, can cause upto 60% yield reduction due to infected grains experiencing weight reductions of 46%-75%[3]. *A. triticina* is a major concern in wheat production, particularly in regions like the northern states of India. The fungus is primarily seed-borne, overwinters as spores and spreads though the soils and splashed water, infecting leaves and leading to reduced growth parameters and grains yield. The fungus spreads within the leaf tissue, but not into the vascular system.

The disease manifests as oval, discolored lesions on leaves, which enlarge and coalesce as the disease progresses, severely affected leaves may dry up prematurely, and in some cases, the infection can spread to the leaf sheaths, stems, and even the spikes, affecting grain developments[4].

Chemical fungicides have been effective against foliar blight caused by *Alternaria triticina*, but their overuse has raised concerns due to negative impacts on human health and the environment. This has led to increased demand for sustainable and eco-friendly alternatives. Approaches such as the use of beneficial microbes, plant-based by-products, and microalgae aim to reduce chemical inputs while enhancing natural processes and biodiversity.

Cyanobacteria and green microalgae aid in nutrient mobilization and produce bioactive compounds like growth hormones and antimicrobials, making them effective as biofertilizers and biocontrol agents[5-7]. They improve chlorophyll content, root-shoot development, and soil microbiome health[8].

Similarly, organic farming relies on soil microflora such as arbuscular mycorrhizal fungi (AMF) and plant growth-promoting rhizobacteria (PGPR), which enhance nutrient uptake, boost stress tolerance, and act as natural bioprotectants. AMF also help manage diseases like yellow rust and foliar blight by strengthening plant resilience[9].

In view of these benefits, promising eco-friendly alternatives to chemical control were tested against *Alternaria triticina* in wheat.

Materials and Methods

The present investigation, "Ecofriendly approaches for management of foliar blight caused by *Alternaria triticina* of wheat (*Triticum aestivum* L.)" was undertaken by carrying out survey in the different regions of Prayagraj district with a motive to record disease severity in the different rice growing field by collecting the diseased sample. The experiment was conducted in the Central Research farm of Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.).

Survey

Survey was conducted during *Rabi* season to find out the occurrence and distribution of the foliar blight diseases in wheat from ten villages of Prayagraj district *viz*., Chaka, Dhanuka, Mahewa, Dandi, Marauhauparhar, Ghatwa, Babrawan, Kandhi, Karchana and Amba. Eight farmer's field were selected in each village with plot size (10 m). Five diseased samples were collected from each plot for isolation and identification of leaf blight incidence according Saari and Prescott[10].

Symptomology

The disease appears when wheat plants are 7-8 weeks old and becomes severe when the crop is mature, infection as small, oval, discolored lesions, irregularly scattered on the leaves and as the lesions enlarge, they become dark-brown to grey and irregular in shape. Some are surrounded by a bright-yellow marginal zone. The lesions vary in size, reaching a diameter of 1 cm or more (Fig.1).

Field preparation

The selected field was ploughed and cleared of weeds, after which it was divided into 24 sub-plots. Various bio-resources viz. microalgae, mycorrhiza, mustard seed cake, and PROM (phosphate-rich organic manure) were applied alone and in combination through irrigation water at 21-day intervals, for a total of four applications. These treatments aimed to assess their effects on *Alternaria triticina* and wheat growth parameters. Each treatment was replicated three times using microplots of 4 × 2 m², following a Randomized Block Design (RBD). Wheat seeds (var. Arjun) were sown at a rate of 100 kg/ha in lines according to the respective treatments.

Observations were recorded from five randomly selected plants in each plot. Disease intensity was assessed at 50, 70, and 90 days after sowing (DAS) by following the scale of Saari and Prescott[10]. Plant growth parameters such as plant height, number of spikes per plant, spike length, and number of grains per spike were also recorded. Additionally, test weight was determined for each individual plot by measuring the weight of 1,000 grains in grams.

Percent disease index (PDI) was calculated by using the following formula:

$$PDI = \frac{Sum\ of\ all\ numerical\ rating}{Total\ number\ of\ plants\ graded \times Maximum\ grade} \times 100$$

Results and Discussion

The systematic survey was conducted in 10 wheat growing villages *viz.* Chaka, Dhanuka, Mahewa, Dandi, Marauhauparhar, Ghatwa, Babrawan, Kandhi, Karchana and Amba on leaf blight of wheat disease (*Alternaria triticina*) on different locations in major wheat growing areas of Prayagraj district in Uttar Pradesh to get the precise information of the disease. The data on survey revealed the severity varied from locality to locality, because of type of variety grown, environmental conditions, cropping pattern and build-up of inoculum. The leaf blight disease was observed in all the locations surveyed. Maximum disease incidence was observed in Babrawan (44.2%) while minimum was obtained in Chaka (24.9 %) followed by Kandhi (26.5%), Karchana (29.02%), Dhanuka (29.72), Mahewa (31.3%), Amba (32.2%), Dandi (33.8%), Marauhauparhar (38.24%) and Ghatwa (40.8%) (Table 1).

Per cent Disease Intensity at 50, 70, and 90 DAS

Among all treatments (Table 2), T7 (Microalgae + PROM) consistently recorded the lowest leaf blight intensity at all stages—7.13% at 50 DAS, 9.84% at 70 DAS, and 10.94% at 90 DAS—and was significantly more effective than the control (T0) which showed 10.86%, 12.31%, and 18.50%, respectively. At 70 DAS, T7 was followed by T5 (10.02%), T6 (10.21%), T1 (10.33%), T2 (10.79%), T4 (11.46%), and T3 (11.99%). A similar trend was observed at 90 DAS, where T5, T6, and T1 showed reduced disease intensity (11.55%, 11.64%, and 12.05%, respectively), while T3 and T0 recorded the highest disease levels (15.88% and 18.50%, respectively). While, T7 was followed by T5 (10.02%), T6 (10.21%), T1 (10.33%), T2 (10.79%), T4 (11.46%) and T3 (11.99%).

The above results are in agreement with Wahab[11], who reported that foliar application of algae extract at a rate of 0.5 ml/L combined with inoculation of arbuscular mycorrhizal fungus (*Glomus* sp.), applied twice at 15 and 30 days after planting, significantly reduced disease intensity caused by *Alternaria brassicae* in *Lactuca sativa*. It also improved plant height, number of leaves per head, and head diameter in both tested seasons compared to the control.

Similar findings were also reported by Kumar *et al.,*[12]. Edra *et al.,*[13] also found that the brown algae *Lessonia trabeculata* inhibited bacterial and fungal growth and reduced both the number and size of necrotic lesions in tomato leaves infected with *Botrytis cinerea*. Marine algae are considered a rich source of diverse bioactive compounds and offer great potential for plant protection against pathogen-induced stress. Additionally, aqueous and ethanolic extracts from the red alga *Gracilaria chilensis* were found to suppress the growth of *Phytophthora cinnamomic*[14].

Deka *et al.,*[15] also reported that an integrated approach using *Trichoderma*, *Pseudomonas*, neem extract, and essential oils under diverse agroclimatic conditions significantly reduced the incidence of *Alternaria triticina*.

Plant height

The data presented in table 3. reveals the response of different amendments on plant height of wheat at 30, 60, 90 DAS under field condition.

Fig.1 Typical symptoms of alternaria leaf blight, conidia and mycelium of Alternaria triticina of wheat

Details of Treatments are given in the following table-

Treatment Name	Dosage
Control (N. P. K.)	80 Kg/ha, 40 Kg/ha, 25Kg/ha
Microalgae	6 Kg/ha
Mycorrhiza	8 Kg/ha
Mustard seed cake	50 Kg/ha
Phosphate rich organic manure (Prom-CEF Organics)	50 Kg/ha
Microalgae + Mycorrhiza	3 Kg/ha + 4 Kg/ha
Microalgae + Mustard seed cake	3 Kg/ha + 25 Kg/ha
Microalgae + Phosphate rich organic manure	3 Kg/ha + 25 Kg/ha

Table.1 Disease incidence of *Alternaria* leaf blight in and around Prayagraj district

Name of village	No. of field	No. of diseased plants in each field	Per cent disease intensity of *A. triticina* (Mean of five fields)					Mean Disease incidence (%)
			F1	F2	F3	F4	F5	
Chaka	5	5	21.5	26.8	25.4	23.8	27.0	24.9
Dhanuka	5	5	28.7	31.0	29.2	29.5	30.2	29.7
Mahewa	5	5	31.0	30.5	31.2	34.3	29.5	31.3
Dandi	5	5	33.5	34.0	35.0	33.0	33.5	33.8
Marauhauparhar	5	5	36.2	39.4	39.2	38.7	37.7	38.4
Ghatwa	5	5	42.0	41.0	41.0	40.0	40.0	40.8
Babrawan	5	5	45.0	44.0	44.0	45.0	43.0	44.2
Kandhi	5	5	30.3	24.7	27.3	23.4	26.8	26.5
Karchana	5	5	29.3	27.8	30.5	28.4	29.1	29.2
Amba	5	5	30.2	33.3	34.5	31.0	32.0	32.2

Table.2 To evaluate the effect of bio-resources on leaf blight (*Alternaria triticina*) Disease intensity % of wheat at different days of intervals.

S. No.	Treatments	Disease intensity %		
		50 DAS	70 DAS	90 DAS
T_0	Control (N. P. K.)	**10.86**	**12.31**	**18.50**
T_1	Microalgae	9.39	10.33	12.05
T_2	Mycorrhiza	8.92	10.79	12.67
T_3	Mustard Seed Cake	9.93	11.99	15.88
T_4	Prom (Phosphate Rich Organic Manure)	9.18	11.46	13.75
T_5	Microalgae + Mycorrhiza	8.22	10.02	11.55
T_6	Microalgae + Mustard Seed Cake	9.65	10.21	11.64
T_7	Microalgae + Phosphate Rich Organic Manure	7.13	9.84	10.94
CD (5%)		0.89	1.20	1.69
Sed ± 1		0.41	0.55	0.78

Table.3 Evaluation of bio-resources on plant height (cm)of wheat at different days of interval.

S. No.	Treatments	Plant height in cm		
		30 DAS	60DAS	90DAS
T_0	Control (N. P. K.)	**18.6**	**49.8**	**73.8**
T_1	Microalgae	20.4	52.3	82.9
T_2	Mycorrhiza	20.1	51.2	82
T_3	Mustard Seed Cake	19.4	50.93	79.5
T_4	Phosphate Rich Organic Manure	19.7	50.3	81.1
T_5	Microalgae + Mycorrhiza	21	54.5	84.8
T_6	Microalgae + Mustard Seed Cake	20.9	52.5	83.1
T_7	Microalgae + Phosphate Rich Organic Manure	21.5	55.1	88.8
CD (5%)		1.27	2.23	3.58
SEd ± 1		0.59	1.04	1.67

Table.4 Evaluation of bioresources on spikes, grains/ spike, test weight of wheat

S. No.	Treatments	Mean of three replicates			
		Number of spikes	Spike length (cm)	No. of grains per spike	Test weight (gm)
T_0	Control (N. P. K.)	4	10.50	47	38.23
T_1	Microalgae	5	12.10	55	40.93
T_2	Mycorrhiza	5	11.90	54	40.83
T_3	Mustard Seed Cake	4	10.90	49	38.90
T_4	Phosphate Rich Organic Manure	5	11.20	53	39.80
T_5	Microalgae + Mycorrhiza	7	13.80	56	42.60
T_6	Microalgae + Mustard Seed Cake	6	12.96	56	41.26
T_7	Microalgae + Phosphate Rich Organic Manure	8	14.60	60	
CD (5%)		**1.26**	**1.17**	**6.80**	**1.88**
SE.d ± 1		**0.58**	**0.54**	**3.10**	**0.87**

The result indicates that among the treatments T_7 (Microalgae + Phosphate Rich Organic Manure) significantly increased the plant height of wheat as compared to T_5 (Microalgae + Mycorrhiza), T_6 (Microalgae + Mustard Seed Cake), T_1 (Microalgae), T_2 (Mycorrhiza), T_4 (Phosphate Rich Organic Manure), T_3 (Mustard Seed Cake) including from T_0 (Control).

The above results are in agreement with Ronga *et al.,*[16] and Kadam *et al.,*[17] as they have also found that application in combination of microalgae and bioresources increased the crops production. Righini and Roberti[18] stated that algae are used in agriculture as soil amendment for their beneficial effects on plant health and productivity. In fact, algae contain several molecules such as plant growth hormones (cytokinins, auxins, abscisic and gibberellic acid), polysaccharides, betaines and micronutrients. Among biotic stresses, algae showed antifungal activity against different pathogens especially of horticultural plants. Singh and Siddiqui[19] reported that foliar dusting of fly ash at 2.5 and 5.0 g/plant/day significantly improved growth, yield, and biochemical parameters in wheat cultivars under *Alternaria triticina* infection. However, 7.5 g had adverse effects. Cultivar HD-2009 showed the highest disease severity without treatment, which was reduced by fly ash application.

No. of spike per plant

The data presented in table 4 reveals the response of different amendments on number of spikes of wheat. Among all the treatments T_7 (14.6) significantly increased the length of spikes as compared to T_5 (13.8), T_6 (12.96), T_1 (12.1), T_2 (11.9), T_4 (11.2), T_3 (10.9) and T_0 (10.5).

The response of different amendments on number of grains per spikes of wheat indicates that among all the treatments T_7 (60) significantly increased the number of grains per spikes followed by T_5 (56). The response of different amendments on test weight of wheat seeds indicates that among all the treatments, T_7 (43.56) significantly increased the test weight of wheat as compared to other treatments.

Acknowledgements

We are grateful to all of the co-authors for their help in assisting with data analysis, manuscript preparation, and review editing. The authors would like to sincerely thank Department of Plant Pathology, SHUATS, Prayagraj for providing encouragement and necessary facilities.

Compliance with ethical standards

The article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of interest

The authors declare no conflict of interest.

Funding Declaration

No funding was received for this study.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

References

1. Nayik GA, Tufail T, Anjum FM and Ansari MJ (Eds.). 2023. *Cereal grains: composition, nutritional attributes, and potential applications*. CRC Press.
2. Pingali, P. L. 2012. Green revolution: impacts, limits, and the path ahead. *Proceedings of the national academy of sciences*, *109*(31), 12302-12308.
3. Aditya S, Aggarwal R, Bashyal BM, Gurjar MS, Saharan MS and Aggarwal S. 2024. Unraveling the dynamics of wheat leaf blight complex: isolation, characterization, and insights into pathogen population under Indian conditions. *Front Microbiol 15*, 1287721.
4. CABI International. 2022. *Alternaria triticina* (leaf blight of wheat). *PlantwisePlus Knowledge Bank*

5. Gayathri M, Kumar PS, Prabha AML and Muralitharan G. 2015. *In vitro* regeneration of *Arachis hypogaea* L. and *Moringa oleifera* L. using extra cellular phytohormones from *Aphanothece* sp. MBDU 515. *Algal Res* 7: 100-105.
6. Prasanna R, Kanchan A, Kaur S, Ramakrishnan B, Ranjan K, Singh MC, Hasan M, Saxena AK and Shivay YS. 2016. Chrysanthemum growth gains from beneficial microbial interactions and fertility improvements in soil under protected cultivation. *Hortic Plant J* 2(4): 229-239.
7. Mutum L, Solomon W, Janda T and Molnár Z. 2024. Time of application and cultivar influence on the effectiveness of microalgae biomass upon winter wheat (*Triticum aestivum* L.). *Cereal Res Commun 52*(3), 1153-1161
8. Mückschel F, Ollo E, Glaeser SP, Düring R, Yan F, Velten H and Frei M. 2023. Nitrogen use efficiency of microalgae application in wheat compared to mineral fertilizer. *J Plant Nutr Soil Sci 186*(5), 522-531.
9. Pu Z, Zhang C, Zhang R, Wang H and Wang XX. 2025. Analysis of the influence of phytate-P on shoot and root traits in mycorrhizal-enhanced wheat varieties. *Plant and soil*, *508*(1), 785-799.
10. Saari EE and Prescott LM. 1975. A scale for appraising the foliar intensity of wheat diseases. *Plant Dis* 59: 377-380.
11. Wahab AA. 2018. Increasing productivity and head quality of lettuce using bio-stimulnts. *Middle East J Agric Res* 7(3): 67-70.
12. Kumar D, Kumaravel R, Gopalsamy J, Sikder MN and Kumar P. 2017. Microalgae as bio fertilizers for rice growth and seed yield productivity. *Waste and Biomass Valorization*. 9(5): 793-800.
13. Edra J, Dorta, F, Medina C, Ramirez A, Ramirez I. and Pena-Cortes H. 2011. Anti- phytopathogenic activities of macro-algae extracts. *Mar Drugs* 9: 739-756.
14. Jiménez E, Dorta, F, Medina C, Ramírez A, Ramírez I and Peña-Cortés H. 2011. Anti-phytopathogenic activities of macro-algae extracts. *Mar Drugs 9*(5), 739-756.
15. Deka B, Upamanya GK and Baruah, RMB. 2024. Eco Friendly Management of Alternaria Blight Disease: A Review. *Asian J Agric Res 24*(10), 34-43.
16. Ronga D, Biazzi E, Parati K, Carminati D, Carminati E and Tava A. 2019. Microalgal biostimulants and biofertilisers in crop productions. *Agron* 9: 192-201.
17. Kadam SB, Pable AA and Barvkar VT. 2020. Mycorrhiza induced resistance (MIR): a defence developed through synergistic engagement of phytohormones, metabolites and rhizosphere. *Funct Plant Biol* 47(10): 880-890.
18. Righini H and Roberti R. 2019. Algae and cyanobacteria as biocontrol agents of fungal plant pathogens. *PMI* 8: 219-238.
19. Singh LP and Siddiqui ZA. 2003. Effects of Alternaria triticina and foliar fly ash deposition on growth, yield, photosynthetic pigments, protein and lysine contents of three cultivars of wheat. *Bioresour Technol 86*(2), 189-192.

How to cite this article:

Abhinav Thakur, Sweta Pathania, Sobita Simon, Shiv Kumar Saini and Priya Mehta. 2025. Ecofriendly Management of Foliar Blight (*Alternaria triticina*) of Wheat (*Triticum aestivum* L). *Int.J.Curr.Microbiol.App.Sci.* 14(12): 197-203
doi: https://doi.org/10.20546/ijcmas.2025.1412.020