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ORIGINAL ARTICLE

Influence of Weather Parameters on *Alternaria* Leaf Spot of Niger in Konkan Region

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ABSTRACT

Introduction: Niger (*Guizotia abyssinica* L.) is a traditional minor oilseed crop predominantly cultivated in tribal regions of India. Under conducive environmental conditions, niger is susceptible to various diseases, among which leaf spot caused by *Alternaria* spp. is one of the most predominant, leading to significant yield losses. In recent years, the area under niger cultivation has increased in the Konkan region of Maharashtra. Therefore, the present study was conducted to assess the influence of weather parameters on the development of *Alternaria* leaf spot of niger (*Guizotia abyssinica* L.) under Konkan agro-climatic conditions during the Kharif season of 2024.

Methodology: Field experiments were carried out at the Department of Plant Pathology, College of Agriculture, Dapoli, and disease severity was recorded using a 0–9 disease rating scale. The calculated disease severity was correlated with prevailing weather factors.

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Results: During the experiment, disease initiation was observed from the 39th standard meteorological week, with PDI ranging from 2.19% to 44.44%. Correlation analysis revealed that maximum temperature (r = 0.923) was significantly and positively associated with disease intensity at the 5% level. In contrast, minimum temperature, morning and evening relative humidity, rainfall, and wind speed showed negative but non-significant correlations with PDI, while bright sunshine hours showed a non-significant positive association.

Conclusions: The results highlight that maximum temperature one week prior to disease observation played a critical role in influencing disease severity. The study underscores the importance of weather-based disease monitoring, which can facilitate the development of forecasting models and timely management strategies to reduce yield losses in niger cultivation.

KEYWORDS

• Niger (*Guizotia abyssinica*) • *Alternaria* leaf spot • Epidemiology • Weather parameters • Per cent disease intensity • Konkan agro-climatic conditions

INTRODUCTION

Niger (*Guizotia abyssinica* L.) is a traditional minor oilseed crop cultivated in India, belonging to the family Compositae. It is known by different vernacular names across the country, such as ramtil, jagni, jatangi, karale, khurasani, and uhechellu, reflecting its long history and cultural significance.[1] The crop is believed to have been introduced to India by Ethiopian immigrants around the third millennium BC, along with other crops like finger millet.[2]

In India, niger is mostly grown in the tribal regions of Madhya Pradesh, Odisha, Bihar, Karnataka, Maharashtra, Gujarat and Andhra Pradesh. Additionally, it is cultivated on a sizable area in several parts of Tamil Nadu, Rajasthan, Arunachal Pradesh, and Uttar Pradesh. The area under niger cultivation in India is 90 thousand hectares, with a production of 27 thousand tonnes.[3] It is grown during both the *Kharif* and *Rabi* seasons. In Maharashtra, the area, production, and productivity of niger are 5.5 thousand hectares, 2.1 thousand tonnes, and 386.7 kg/ha, respectively.[4] In the Konkan region, it is mainly cultivated in the Palghar and Thane districts.

Among the nine major oilseed crops grown in India, niger holds a unique position as it is primarily cultivated in tribal regions and contributes significantly to livelihood security in rainfed and marginal areas. India is one of the leading producers of niger globally, where it is valued for its edible oil content and adaptability to diverse agro-climatic conditions. The niger oil contains essential amino acids among these are leucine, lysine, isoleucine, threonine, and tryptophan are used in cooking, painting, anointing, and lubricating equipment.[5]

Leaf spot of niger, caused by *Alternaria alternata*, is a major disease in India, significantly reducing oil quality and yield.[6] The disease thrives in warm, humid conditions. Accidental rain during flowering increases *Alternaria* leaf spot incidence, reducing seed set and yield.[7] Niger crop losses due to diseases can reach 35–40%, with seed yield reductions of 20–30%. Epidemiological studies are therefore essential to understand the influence of weather parameters on disease initiation and progression, as environmental factors play a pivotal role in disease dynamics.

Weather conditions play a significant role in the development, spread and severity of plant diseases. Understanding how these weather parameters interact with plant diseases is essential for developing effective disease management strategies in agriculture. By monitoring weather conditions and predicting disease outbreaks, farmers can implement timely interventions such as fungicide applications, cultural practices and crop rotation to minimize disease damage and maintain crop productivity. With this background, the present investigation was undertaken to study the relationship between weather parameters and the development of *Alternaria* leaf spot of niger under Konkan agro-climatic conditions, with the aim of generating useful epidemiological information for disease forecasting and management.

MATERIALS AND METHODS

Location

The field experiment was conducted at the experimental farm of the Department of Plant Pathology, College of Agriculture, Dapoli, Dist. Ratnagiri during *Kharif* 2024 on the local variety of niger under natural epiphytotic conditions. The seeds of the niger variety Cv. Local susceptible to *Alternaria* leaf spot disease were sown on 16th August, .2024 in the field with a spacing of 30 × 10 cm. The recommended package of practices and protective irrigation was given as and when required, except for plant protection measures against leaf spot disease.

Weather data

The data regarding weather parameters *viz*., maximum temperature (Max. T.), minimum temperature (Min. T.), morning relative humidity (RH_1), evening relative humidity (RH_2), sunshine hours, wind speed (km/hr), rainfall were obtained from Gramin Krishi Mausam Sewa, Department of Agronomy, College of Agriculture, Dapoli, Dr. B. S. K. K. V., Dapoli.

Observations

Disease progression was recorded after initiation of the disease, as per standard meteorological weeks. Twenty five plants were randomly selected for recording observations and data was recorded by using 0-9 disease rating scale.[8]

Table 1: Scoring system used to assess *Alternaria* leaf spot severity on niger in the field

Rating/ Scale	Leaf covered with the spots
0	Healthy (Without spots)
1	< 1% leaf area covered with spots
3	1-10% leaf area covered with spots
5	11-25% leaf area covered with spots
7	26-50% leaf area covered with spots
9	> 50% leaf area covered with spots

Based on recorded data the Per cent disease Intensity (PDI) was calculated by using the formula.[9]

Statistical analysis

The correlation between disease intensity and weather parameters was worked out using correlation coefficient analysis. Significance of correlation was tested at 5% probability level.

RESULT AND DISCUSSION

Table 2: Correlation coefficient of weather parameters with the leaf spot disease development during *Kharif* 2024 (one week before)

Particulars	PDI (%)	Tmax (^{0}C)	Tmin (^{0}C)	RH I (%)	RH II (%)	Rainfall (mm)	WS (km/hr)	BSS (hr)
Range	2.19-44.44	28.87-33.97	17.06–21.76	89.14-95.14	58.43-86.86	0-26.86	2.21-5.41	1.76-7.61
Mean	19.97	31.70	20.74	92.66	75.05	6.40	3.31	6.40
Standard Deviation	14.60	1.67	1.54	2.04	8.10	9.05	0.93	2.36
Correlation	-	0.923*	-0.773^{NS}	-0.358^{NS}	-0.820^{NS}	-0.355^{NS}	-0.603^{NS}	0.451^{NS}

*Significant at P=0.05 Table value r at 5 %= 0.625 NS = Non- significant

Where, PDI - Per cent disease intensity, **Tmax** - Maximum temperature, **Tmin** - Minimum temperature, **RH I** - Relative humidity (Morning), **RH II** - Relative humidity (Evening), **WS** - Wind speed, **BSS** - Bright sunshine hours

The data presented in Table 2 revealed that, the weather parameters *viz*., maximum and minimum temperature, morning and evening relative humidity, wind velocity, and bright sunshine hours significantly influenced the intensity of leaf spot disease in niger (Cv. Local) during the *Kharif* season of 2024. Disease initiation was observed from the 39th standard meteorological week (MW) of 2024, with disease intensity ranging from 2.19 per cent to 44.44 per cent. In the one week before of disease initiation, the prevailing weather conditions included maximum temperatures ranging from 28.87°C to 33.97°C, minimum temperatures between 17.06°C and 21.76°C, morning relative humidity from 89.14% to 95.14%, evening relative humidity between 58.43% and 86.86%, rainfall ranging from 0 to 26.86 mm, wind velocity between 2.21 and 5.41 km hr^{-1} and bright sunshine hours ranging from 1.76 to 8.54 hours.

The correlation coefficient analysis revealed that the maximum temperature (r = 0.923) was found significant and positively correlated with PDI at 5 per cent significance level.

Whereas, bright sunshine hours (0.451) was non-significant and positively correlated with disease severity. However, the minimum temperature (r = -0.773), morning relative humidity (r = -0.358), evening relative humidity (r = -0.820), rainfall (r = -0.355) and wind speed (r = -0.603) found non-significant and negatively correlated with disease severity. This indicated that the maximum temperature during one week before were more responsible for influencing per cent disease intensity of leaf spot disease of niger. These findings are in agreement with the earlier reports of Hosalli.[10] Who reported that high relative humidity, low temperature, and limited sunshine hours as the primary factors contributing to increased pest and disease incidence in niger during the *kharif* season, which hindered economic production. Kivadasannavar *et al*.[11] reported that, the disease became more severe when the crop was exposed to rain during both vegetative and reproductive phases, especially in early sown crops. This rainfall exposure, particularly during flowering and seed development stages, led to increased incidence of *Alternaria* leaf spot, resulting in poor seed set and reduced seed yields. Similarly, Sharma *et al*.[12] found significant and positive correlations between PDI of leaf spot of niger and maximum relative humidity (r = 0.527), wind velocity (r = 0.582), and sunshine (r = 0.045). Additionally, positive correlations were observed between PDI and maximum temperature (r = 0.463), minimum temperature (r = 0.336), minimum relative humidity (r = 0.209), and rain (r = 0.106).

CONCLUSION

The study revealed that maximum temperature one week prior to disease observation was the most critical factor influencing the severity of *Alternaria* leaf spot of niger under Konkan conditions. Other weather parameters showed non-significant associations.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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