Annals of Plant and Soil Research 23 (4):448-451 (2021)
https://doi.org/10.47815/apsr.2021.10100

Influence of weather parameters on development of root rot in ajwain (*Trachyspermum ammi* L.)

BABU LAL FAGODIA*, B L MALI AND R.K. FAGODIYA

Department of Plant Pathology, Maharana Pratap University of Agriculture & Technology, Udaipur, Rajasthan, 313 001 (India)

Received: March, 2021; Revised accepted: June, 2021

ABSTRACT

The effect of various weather parameters along with different dates of sowing on the development of root rot was investigated during Rabi 2015-16 and 2016-17 at Rajasthan College of Agriculture Udaipur. The various weather factors viz., temperature, relative humidity and rainfall under inoculated conditions and with staggered dates of sowing were taken to observe the effect on disease progression.InRhizoctonia root rot, maximum plant mortality of26.5-39.3% in the plant sown on 5th October (inoculated on 30th October) and the lowest 19.4-37.0% in plants sown on 5th September (inoculated on 30th September) were observed during 49th to 51st standard meteorological week. It reached maximum39.0-42.8% in the plants sown on 5th October (inoculated on 30th October) and the lowest 35.1- 39.2%in plants sown on 5th September (inoculated on 30th September) were observed during 4th to7th standard meteorological week.It was also observed that the delayed sowing predisposes the ajwain plants for Rhizoctonia root rot disease so farmers should be advised to practice early sowing of ajwain crop.

Key words: Ajwain, plant mortality, *R. solani*, root rot, temperature, relative humidity

INTRODUCTION

Ajwain (*Trachyspermum ammi* L.) also known as bishop's weed and carom seed, is one of the most important seed spice crop belongs the family Apiaceae. The use of contaminated seeds by farmers for sowing purpose are loaded with several fungi, which are responsible for deterioration of ajwain seeds in storage causing reduction in the germination potential and chemical constituents of seeds (Sharma, 2006). Root rot (*Rhizoctonia solani* Kuhn) and Powdery mildew (*Erysiphepolygoni* D.C.) are two major diseases of ajwain (Meena *et al.* 2009). Among these, the root rot disease is most common and destructive disease of ajwain, caused by *R. solani*, caused losses in yield as well as quality of the crop. Yield losses vary between 10 to 100 per cent depending on varietal susceptibility and agro-climatic conditions. The typical symptoms of root rot are varying degrees of rotting of the root leading to foliage yellowing. Relatively, younger plants (at the age of 30 to 45 days) are found to be infused more by this disease. The affected plants later on wither and dry up. It is serious problem in ajwain growing areas and drastically reduces the yield (Lal *et al.* 2012). Management of *Rhizoctonia* root rot is difficult due to unavailability of commercial resistant varieties to the disease. The disease progress curve, referred to as the signature of an epidemic, represents the integration of all the host, pathogen and environmental effects during the epidemic (Madden *et al.,* 2007). The Area under Diseased Progress Curve (AUDPC) decreased significantly for all different weather parameters. The value of AUDPC was negatively correlated to different weather attributes proving that the pathogen had a damaging effect on the crop attributes of ajwain. The natural epidemics of root rot are strongly influenced by environmental conditions and severe disease appears every year in India. Hence, the present study was confined on the epidemiological aspects of root rot of ajwain was undertaken.

MATERIALS AND METHODS

The ajwain local cultivar based on staggered sowing was done from 05th September and dates were as 15thSeptember, 25th September and 5th October during *Rabi,* 2015-16 and 2016-17 on the instructional farm of Rajasthan College of Agriculture, Udaipur. The plants were inoculated with culture of *R. solani* developed on sand corn meal medium and per cent mortality was recorded at weekly intervals.

*Corresponding author E-mail: blfagodia25@gmail.com

Per cent plant mortality was calculated based on each reading till physiological maturity of crop. Weekly meteorological data on maximum and minimum temperature morning and evening relative humidity, rainfall and duration of sunshine hours were obtained from agro met observatory, Agronomy farm, RCA, Udaipur. Multiple regression equation, correlation coefficient and coefficient of multiple determination (R2) were calculated as per the standard statistical formula Y = a + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 where Y = Percent disease index, a is intercept/ constant value, b1… b5 are regression coefficient of corresponding independent weather variables, X1 …X5 are independent weathers variables. AUDPC was calculated as described by Madden *et al.* (2007). Lower AUDPC represented slower disease progression and the high AUDPC represents faster disease progression.

RESULTS AND DISCUSSION

In the first planting on 5th September and inoculated on 30th September, the plant mortality was 10.4%, in the next week it was 13.0% and in the third week (60-day old plants) it reached to 14.2%. The plant mortality during 45th to 52nd weeks ranged from19.2 to 25.5% and higher plant mortality (39.2%) was observed in 6thmeteorological week in the plots sown on 5th September followed by (36.4%) plant mortality 05th meteorological week. These results are in accordance with Oliveira *et al.* (2014).The plots sown on 15th September and inoculated on 10th October, the plant mortality in the first week after inoculation (29th Oct. to 4th Nov.) was 10.2%. It progressed slowly and up to next 7 weeks (45th to 52nd weeks), it ranged between 14.0 and 23.7%. In the following weeks (01st to 07th weeks) there was a sudden decrease in per cent plant mortality (26.0%) and it reached to 29.5, 29.7, 33.5, 31.4, 36.2 and 34.2% in the following weeks. In the plants sown on 25th September and inoculated on 20th Oct. plant mortality was 12.5% at 45th standard week. It increased to 16.0% on next week and remained in the range of 19.5-28.3.0% during next 47th to 52nd weeks, respectively. Higher plant mortality (39.0%) was recorded in the 07th standard weeks in the plots sown on 25th September followed by (38.3%) on 6th meteorological week. In the field plant sown on 5th Oct. and inoculated on 30th Oct. the plant mortality in the first week after inoculation (12nd Nov. to 18th Nov.) was 17.5%. It was higher than those first three dates sown. It increased to 19.5% in next week and remained in the range of 23.3-30.5% during next 48th to 52nd weeks, respectively. Higher plant mortality of 42.8% was recorded in the 07th standard week in the plot sown on 30th Oct. followed by (40.8%) plant mortality at 8th meteorological week. While, in later sown ajwain (25th Sept. & 5th Oct.), per cent plant mortality was much higher as compared to early sown (5th Sept.).Rini *et al.* (2017) reported that a heavy rain was conducive for initiation of the disease followed by low and medium rain of 13 to 38 mm, which found favorable for development of the disease. A maximum temperature range of 31^{0}C to 34^{0}C and minimum temperature range of 17-23^{0}C with 70-83 per cent evening relative humidity were found effective for disease development.Kumar *et al.* (2018) also reported the effect of different dates of sowing and weather parameters on development of *Rhizoctonia* root rot of french bean. Furthermore, Yadav *et al.* (2019) reported the effect of environmental factor for progression and development of root rot fenugreek.

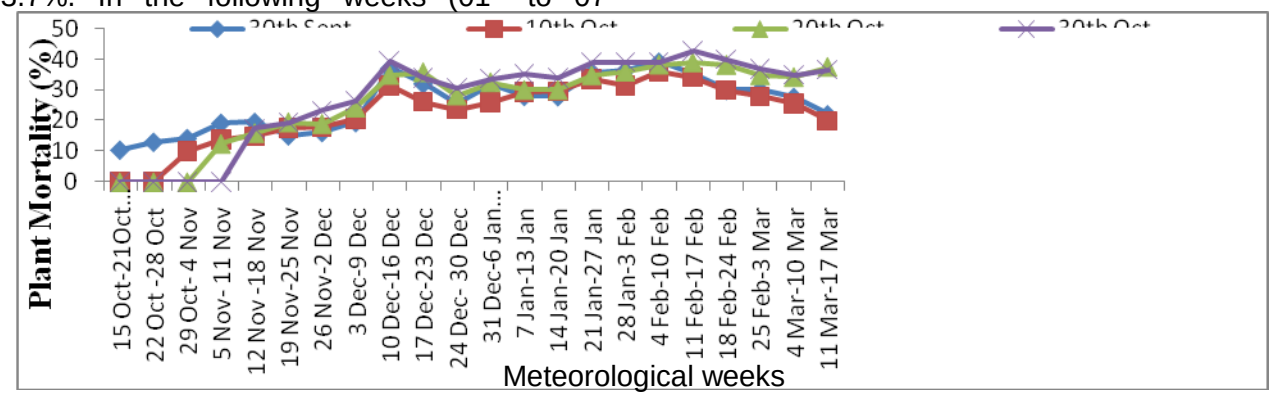

Fig. 1: Progression of root rot on ajwain in relation to weather parameters

It was observed that the disease progressed faster when maximum temperature ranged between 25.0 and 29.0°C and minimum between 06.5 and 12.0°C as compared to 25.0-29.5° C. The age of plants was also important as disease progress was higher on 10th to 30th Dec. 2015 (50th to 52nd meteorological week). Studies on the effect of weather factors on disease development revealed that 15th Oct. to 30th Dec. due to 66.7 to 83.3 per cent relative humidity and 25.7-34.1°C temperature, the plant mortality was between 10.4 and 37.0% on 5th Sept. sown plots, 10.2-31.5% on 15th Sept. sown plot, 12.5-35.8% on 25th Sept. sown plots and 17.5-39.3% on 5 Oct. sown plots, respectively. During 3rd to 23rd Dec. was moderate period for root rot development as during this period the minimum and maximum relative humidity ranged from 26.3-33.3 and 79.5-83.3 per cent coupled with minimum and maximum temperature 6.3-14.3°C and 25.7-28.5°C and plant mortality was 39.3.0% on 5th Oct. sown plants followed by 37.0% plant mortality sown on 15th Sept. in 50th week. The period from midDecember to Februarywas found to be highly favorable for disease development and more severity during this period was observed as compared to progressive phase. Dubey *et al.,* (2012) reported that the web root rot disease in pulses (*R. solani)* was favored by wide range of soil temperature (18-41°C) and soil moisture (28-68 %). Nitesh *et al.* (2015) also reported the role of environmental factor in the progression and development of the sheath blight of rice.

Table 1: Effect of environmental factors on root rot of ajwain caused by *Rhizoctonia solani*

Std. week	Meteorological weeks	Temperature (°C)		Relative humidity (%)		Sun shine hrs.	Total rainfall (mm)	AUDPC**			
								Plants inoculated on different dates			
		Max.	Min.	Max.	Min.			30th Sept.	10th .Oct.	20th Oct.	30th Oct.
								Per cent plant mortality*			
42	15 Oct-21Oct 2015	34.1	18.4	67.5	27.3	7.7	0.0	10.4	0	0	0
43	22 Oct -28 Oct	32.5	16.1	70.3	28.3	8.4	0.0	13.0	0	0	0
44	29 Oct- 4 Nov	29.8	14.3	75.6	32.9	8.2	0.0	14.2	10.2	0	0
45	5 Nov- 11 Nov	31.5	13.4	66.7	25.7	8.2	0.0	19.2	14.0	12.5	0
46	12 Nov -18 Nov	30.7	12.3	72.6	31.6	8.5	0.0	19.5	15.0	16.0	17.5
47	19 Nov-25 Nov	30.0	11.3	76.5	28.2	8.7	0.0	15.1	17.7	19.5	19.5
48	26 Nov-2 Dec	29.3	11.1	72.5	29.6	7/4	0.0	16.2	17.9	19.0	23.3
49	3 Dec-9 Dec	28.5	14.3	79.5	31.3	8.5	0.0	19.4	20.5	24.3	26.5
50	10 Dec-16 Dec	26.6	8.6	79.8	33.0	8.3	0.0	37.0	31.5	34.9	39.3
51	17 Dec-23 Dec	25.7	6.9	83.3	26.3	8.0	0.0	32.1	26.2	35.8	34.0
52	24 Dec- 30 Dec	27.7	8.1	82.1	21.6	8.0	0.0	25.5	23.7	28.3	30.5
01	31 Dec-6 Jan 2016	27.4	9.0	87.8	31.9	7.5	0.0	31.5	26.0	32.5	33.7
02	7 Jan-13 Jan	24.1	6.9	86.3	32.1	6.6	0.0	28.0	29.5	30.0	35.1
03	14 Jan-20 Jan	22.7	7.5	87.8	39.0	5.7	0.0	27.9	29.7	30.0	33.9
04	21 Jan-27 Jan	26.0	7.5	85.8	34.5	7.1	0.1	35.6	33.5	34.8	39.0
05	28 Jan-3 Feb	27.3	9.3	81.8	31.8	8.4	0.0	36.4	31.4	36.0	39.2
06	4 Feb-10 Feb	25.9	7.2	81.0	24.1	8.8	0.0	39.2	36.2	38.3	39.2
07	11 Feb-17 Feb	26.7	11.6	78.0	13.6	8.1	0.0	35.1	34.2	39.0	42.8
08	18 Feb-24 Feb	30.2	11.5	68.0	22.0	8.2	0.0	30.0	30.0	38.2	40.0
09	25 Feb-3 Mar	31.5	12.1	69.3	23.5	9.0	0.0	30.0	28.0	34.8	36.8
10	4 Mar-10 Mar	30.4	13.1	70.3	26.2	8.1	0.0	27.7	25.7	34.2	35.0
11	11 Mar-17 Mar	30.0	12.6	66.3	44.5	7.6	0.0	22.0	20.0	37.5	36.7

**Mean of three replications & Plants inoculated 25 DAS, **Observation started 15 days after inoculation and at weekly intervals & I sown-5th Sept., II -15th Sept., III -25th Sept. and IV -5th Oct*

From the results, it may be concluded that the role of different weather parameters *viz.,* temperature, relative humidity, sunshine hrs and rainfall was most important factors for infection and progression of root rot of ajwain with increase in temperature and relative humidityfor development of disease.

REFERENCES

Dubey, S.C., Tripathi, A., Upadhyay, B.K. and Singh, B. (2012) Influence of weather and soil parameters on development of wet root rot in pulse crops and virulence analysis of *Rhizoctonia solani* isolates. *Journal of Agricultural Sciences* **4**(11): 195-205.

Kumar, M and Kudada, N. (2018) Effect of sowing dates and weather conditions on *Rhizoctonia* root rot disease incidence and green pod yield of French bean. *Journal of Pharmacognosy and Phytochemistry* 7(3): 893-899.

Lal, G., Anwar, M.M., Mehta, R.S., Meena, S.S. and Mahria, S.P. (2012) *Major seed spices Istedition (Production technology).* Agrotech Publishing Academy, Udaipur. pp. 195-196.

Madden, L.V., Hughes, G., and van den Bosch, F. (2007) The Study of Plant Disease Epidemics. *American Phytopathological Society*, St. Paul, M.N.

Meena, S.S., Mehta, R.S., Anwar, M.M., Lal, G., Sharma, Y.K., Kakani, R.K. and Saxcena, S.N. (2009) Advance production technology of ajwain, ICAR-NRCSS, Ajmer *Technical Bulletin*, pp. 1-2.

Nitesh, B., Ram, S. and Naresh, M. (2015) Progression and development of sheath blight of rice in relation to weather variables.*Indian Journal of Mycology and Plant Pathology***45**: 13-19.

Oliveira, A.C.C., de Souza, P.E., de Pozza, E.A. Dornelas, G.A.andMonteiro, F.P. (2014)Influence of temperature on the *Rhizoctonia solani* (Kuhn) strains obtained from cotton fields on the Brazilian states. *Bioscience Journal* **30**: 119-130.

Rini, P., Ankar, M, Mohan, K.B. andBirendrana, T.H. (2017) Effect of weather parameters on the initiation and progression of sheath blight of rice. *Journal of Agro meteorology*19: 39-43.

Sharma, A.K. and Sharma, K.D. (2006) Studies on seed mycoflora of some umbelliferous species.*Agricultural Science Digest25*: 211-213.

Yadav, S.L.,Ghasolia, R.P. Yadav, R. andYadav, P. (2019) Studies on survey and epidemiology of *Rhizoctonia solani* causing root rot of fenugreek. *International Journal of Seed Spices* 9(2):91-95.