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Short Communication

Effect of weather parameters on the progression and development of purple blotch of onion

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Onion (*Allium cepa* L.) is one of the most important spice crops as well as vegetable crops grown throughout India. In India, the prominent onion growing states are Maharastra, Gujarat, Uttar Pradesh, Odisha, Karnataka, Tamil Nadu and Andhra Pradesh (Kareem *et al.,* 2018). During 2017-18, area, production and productivity of onion were 33.47 thousand hectares, 379.34 thousand MT and 11.33 MT ha^{-1} respectively in the state of Odisha (Anonymous, 2018). Onion crop is attacked by many diseases and among the fungal diseases purple blotch caused by *Alternaria porri* is a major constraint. It causes severe yield loss ranging from 30 to 100 per cent both in seed and bulb crop from year to year (Brar *et al.*, 1990; Chethana *et al*., 2012). Typical symptoms of the disease appear on foliage and on foliage sheath. Small white sunken spots develop on the leaves which enlarge, become zonate and under moist conditions, turn purple and are also prominent on the inflorescence and stalks. The disease affects both bulb and seed production by breaking of floral stalks (Munoz *et al.*, 1984). In moist weather the surface of the spot is covered with brown or almost black sporulation of the fungus. At harvest time or later, the bulbs of the affected plants may show decay. Several workers have investigated the potential of new fungicides for the management of purple blotch of onion (Mandal *et al*., 2020) but as environmental factors play an important role for development and progression of the disease, therefore information on appropriate weather parameters is a must to manage the disease effectively. Various epidemiological models based on the temperature, relative humidity and rainfall have been developed for the prediction of foliar diseases for enhancing the efficacy of the management practices (Pal *et al*., 2017; Gupta *et al*., 2017). As infection of the disease is dependent upon weather factors, a suitable disease-weather relationship can be developed to assess the risk of the disease (McDonald and Boland, 2004). The weather based modelling for early warning of disease infestation may provide appropriate tool for predicting disease status (Agrawal *et al*., 2004). However, the environmental condition varies region to region of the country due to their geographical variations. Hence the knowledge about the progression of disease in relation to weather parameters needs to be investigated for appropriate management of the disease at this region. So, the present experiment was undertaken to find out the influence of weather parameters on development of purple blotch disease in west central table land zone of Odisha.

A field experiment was conducted during two consecutive rabi season (2017-18 and 2018-19) at the research farm of Regional Research and Technology Transfer Station, Chiplima (20^0 21'N latitude and 80^0 55'E longitude with an elevation of 178.8 m above mean sea level), Sambalpur, Odisha. Onion crop (variety Nasik red) was sown in a plot size of 15 m^2 with a spacing of 15cm X 20cm and replicated thrice. The recommended dose of fertilizers @ 110: 40: 60 (N: P_2O_5: K_2O) kg ha^{-1} and FYM @ 10 q ha^{-1} were applied. N, P and K were supplied through urea, di-ammonium phosphate and murate of potash, respectively. All the recommended agronomic practices were followed for raising the crop. Natural development of the disease was permitted in the field. Three sampling units of 1m^2 was selected in each plot and disease severity was recorded at weekly interval for ten randomly selected plants from each sampling units following SES scale starting from the initial infection of the disease till terminal disease severity.

The purple blotch disease intensity was recorded applying 0-5 point disease rating scale (Mayee and Datar, 1986). The description of scale is given in Table 1.

Based on numerical ratings/scale observed, per cent disease intensity (PDI) was worked out applying the formula:

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Table 1 : Decription of scale of disease in Healthy

Score/grade	Description
0	Healthy (no disease)
1	Traces (<5% leaf area affected)
2	Light (6-10% leaf area affected)
3	Moderate (11-25% leaf area affected)
4	High (26-50% leaf area affected)
5	Very high (> 50% leaf area affected)

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{No.of observations X Maxmimum rating}} \text{ X } 100$$

After scoring the percent disease severity of onion purple blotch disease, cumulative increase in percent disease index (CIPDI) was calculated following the standard formula

$$CIPDI = \frac{\text{Sum of all numerical ratings}}{\text{No.of observations X Maxmimum rating}} \text{ X } 100$$

The periodical increment in percent disease index (PIPDI) was also worked out from CIPDI and the weather parameters like maximum and minimum temperature, morning and evening relative humidity percentage and total rainfall in mm were recorded from the meteorological station of RRTTS, Chiplima for the entire period of experimentation. Data were arranged according to standard meteorological weeks and simple correlation coefficients among any pair of the weather variables were worked out. All data were statistically analyzed using SPSS software version 21.

The pooled data presented in Table 2 revealed that, disease development and spread was observed from 5th to 16th standard meteorological week (SMW) and during the period of disease development, the average maximum temperature ranged between 29^{0}C-40^{0}C and morning relative humidity reached 81% which predisposed the plants to be attacked by purple blotch pathogen and for further progress of the disease.

The first symptom of the disease was noticed during 5th SMW. PDI values exhibited gradual increasing trend with the advancement of dates of observation and maximum PDI was recorded on 16thSMW. The pooled value indicated that the disease reached its peak i.e., 53.33 CIPDI at 16th SMW (Table 2).

Correlation studies

It is evident from Table 3 that maximum temperature had a significant positive correlation (r= 0.875**) with CIPDI which implies that increase in maximum temperature had a positive influence on cumulative increase or progress of the disease and vice versa. During the period of disease development, the maximum temperature gradually increased from 29^{0}C to 40^{0}C with the progress of the disease and a maximum CIPDI of 53.33% was recorded on 16th SMW with a maximum temperature of 40^{0}C (Table 2). On the other hand, a non significant positive correlation (r=0.183) was observed between maximum temperature and Periodical Increment in Percent Disease Index (PIPDI). A significant positive correlation (r= 0.967**) was observed between minimum temperature and CIPDI (Table 3). During the period of disease development and spread i.e, from 5th to 16th SMW, the average minimum temperature gradually increased from 13^{0}C to 24^{0}C and with the increasing pattern of minimum temperature, an increase in CIPDI was noticed. On the other hand, a non significant positive correlation (r= 0.235) was observed between minimum temperature and PIPDI. The highest increment of 12.0% in PIPDI was observed on 13th SMW with an average minimum temperature of 19.0^{0}C (Table 2).

The relationship of morning relative humidity with CIPDI (r= 0.428) and PIPDI (r= 0.059) was found positive and non significant. A range of 60% to 81% morning relative humidity was found suitable for disease development and spread (Table 2). Evening relative humidity was found to have a significant positive correlation (r= 0.766**) with CIPDI (Table 3). A non significant negative correlation was observed between evening relative humidity and PIPDI (r= -0.296). The maximum PIPDI of 12.0% was recorded with an evening relative humidity of 33% where as a minimum PIPDI of 0.33% was recorded after reduction of

Table 2: Development of onion purple blotch disease (cumulative and periodical increment in PDI) in relation to weather parameter (Pooled of 2017-18 and 2018-19).

Standard metrological week (SMW)	Cumulative increase in disease (%)	Periodical increment in disease (%)	Temperature (^{0}C)		Relative Humidity %		Total Rainfall (mm)
			Max.	Min.	Morning	Evening	
4	0.0	0.0	28.6	12.1	78.6	36.1	0.0
5	7.67	7.67	29.4	13.2	75.8	32.4	0.0
6	12.0	4.33	30.4	13.7	72.8	31.4	0.0
7	14.33	2.33	31.0	14.2	74.6	33.9	2.6
8	17.67	3.34	32.4	14.9	73.3	29.6	0.0
9	19.33	1.66	33.9	15.3	69.9	31.3	0.0
10	20.33	1.0	34.6	16.8	67.3	32.9	2.0
11	24.0	3.67	33.6	16.2	70.7	31.7	0.9
12	32.0	8.0	34.6	17.6	75.1	30.1	0.5
13	44.0	12.0	35.6	18.9	80.4	32.9	0.0
14	51.67	7.67	36.8	20.9	81.0	37.7	0.0
15	52.0	0.33	38.7	21.9	59.6	23.0	0.0
16	53.33	1.33	40.1	24.0	72.4	29.8	0.0

Table 3: Correlation between weather parameters and increment in PDI (cumulative and periodical) onion purple blotch disease.

Sr. No.	Weather parameters	Cumulative increase in disease (CIPDI)	Periodical increment in disease (PIPDI)
1.	Maximum temperature	0.875**	0.183
2.	Minimum temperature	0.967**	0.235
3.	Rainfall	-0.044	-0.185
4.	Maximum (morning) relative humidity	0.428	0.059
5.	Minimum (evening) relative humidity	0.766**	-0.296

evening relative humidity to 23.0% (Table 2). A non-significant negative correlation (r=-0.044) was observed between total rainfall and CIPDI and also a non significant negative influence of rainfall was found on PIPDI (r= -0.185) which implies that the cumulative and periodical increment in disease was not increased with the proportion of rainfall (Table 3).

So after considering the result it was clear that, temperature had played an important role towards disease development. A maximum temperature range of 29 to 40^{0}C and minimum temperature range of 13 to 24^{0}C prevailed during the period of disease development and spread favoured the disease. An average range of 60-81% evening relative humidity was found favourable for disease development and spread.

Mohammad and Dabbas (2012) studied the influence of environmental factors on the development of purple blotch of onion under field conditions and found that temperature and RH play an important role in the disease development. Chadwa and Rajasab (1994) revealed that increased conidial catches of *A. porri* in onion crop have been associated with more than 60% relative humidity. Suheri and Price (2000) reported that the disease is more prevalent in warm and humid environment. The results of the present investigation are also in line with the above findings.

The results indicated that maximum temperature range of 29 to 40^{0}C and minimum temperature range of 13 to 24^{0}C and an average range of 60-81% evening relative humidity prevailed during the period of disease development and spread favoured the disease in western Odisha. However, still more epidemiological studies are required to strengthen the forecasting and prediction mechanism of the disease which will ultimately minimize the yield losses caused by the disease.

Conflict of Interest Statement: The author (s) declares (s) that there is no conflict of interest.

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REFERENCES

Agrawal, Ranjana, Mehta, S.C., Kumar, Amrender and Bhar, L. M. (2004). Development of weather based forewarning system for crop pests and diseases. Project Report, IASRI, New Delhi Mission mode project under NATP, PI, Dr. Y.S. Ramakrishna, CRIDA, Hyderabad.

Anonymous (2018). Horticulture Statics at a glance 2018. National Horticulture Board, Ministry of Agriculture, Government of India. p. 458.

Brar, S. S., Rewal, H. S. and Singh, H. (1990). Development of purple blotch of onion in relation to thrip injury. *Plant Dis. Res.,* 5: 133-135.

Chadwa, H. T. and Rajasab, A. H. (1994). Aerobiology of *Alternaria porri* and its relation to purple leaf blotch disease in onion. *Indian J. Mycol. Pl. Pathol.*, 24: 41–45.

Chethana, B. S., Rao, Ganeshan Girija., Archana, S. and Bellishree, K. (2012). In vitro evaluation of plant extracts, bioagents and fungicides against *Alternaria porri* (Ellis) Cif., causing purple blotch disease of onion. *Pest Manage. Hortic. Ecsyst.*, 18(2): 194-198.

Gupta, V., Khajuria, A., Razdan, V.K., Sharma, Kher, D. and Kumar, A. (2017). Effect of epidemiological factors on the severity of stripe rust of wheat caused by *Puccinia striiformis*. *J. Agrometeorol*., 19(1): 62-66 DOI: https://doi.org/10.54386/jam.v19i1.757

Kareem, M. Abdul, Bhat, Amruta S., Kurubetta, Krishna D., Mesta, R.K., Allolli, T. B., Ajjappalavar, P. S., Shweta, K., Masuthi, Dileepkumar and Waseem. M.A. (2018). Evaluation of silicon and bio-formulations for the management of purple blotch disease of onion. *Res J. Chem. Environ. Sci.,* 6(1):46-50.

Mandal, D., Pal, R. and Mohanty, A. K. (2020). Management of purple blotch of onion caused by *Alternaria porri* by using some novel fungicides under field condition in western Odisha. *Internat. J. Plant Protec.,* 13(2): 187-191.

Mayee, C. D. and Datar, V. V. (1986). Phytopathometry. Tech. Bull-1 Marathwada Agriculture University, Parbhani (M.S.), India.

McDonald, M. R. and Boland, G. J. (2004). Forecasting diseases caused by *Sclerotinia spp.* in eastern Canada: fact or fiction? *Can. J. Plant Pathol*., 26: 480 – 488.

Mohammad, A. and Dabbas, M. R. (2012). Influence of abiotic environmental factors on purple blotch disease (*Alternaria porri* Ellis Cif.) of onion. *Int. J. Agric. Sci.*, 8(1): 171-173.

Munoz, D. C. L., Martinez, J. J. P. and Perez, A. P. (1984). Onion seed production under tropical conditions. Humbalst Inst. Fund. *Res. Trop. Agric. Acad. Sci.,* 10(2): 42-45.

Pal, R., Mandal, D., Biswas, M. K. and Panja, B. N. (2017). Effect of weather parameters on the initiation and progression of sheath blight disease of rice. *J. Agrometeorol.,* 19(1): 39-43. DOI https://doi.org/10.54386/jam.v19i1.753

Suheri, H. and Price, T. V. (2000). Infection by *Alternaria porri* and *Stemphylium vesicarium* on onion leaves and disease development under controlled environments. *Plant Pathol*., 49: 377-384.