

Original Research Article

Capability of Leaf Blotch Sickness of Turmeric (*Taphrina maculans*) at the Phenology of Crop and Its Yield Attributing Characters

Mukul Kumar^{1*}, A. K. Mishra¹, Paritosh Kumar¹, Bipul Kumar² and Shivam Maurya³

¹Department of Plant Pathology, ²Department of Extension education, Dr. Rajendra Prasad Central Agricultural University, Pusa Samastipur (Bihar) India

³Department of Plant Pathology, SKN Agriculture University, Jobner, (Rajasthan), India

*Corresponding author

ABSTRACT

Turmeric is very important spice in India, which produces nearly entire whole world's crop and consumes 80% of it. India is by far the largest producer and exporter of turmeric in the world. Turmeric occupies about 6% of the total area under spices and condiments in India. The spice turmeric, derived from the rhizome of *Curcuma longa* L, has been used for centuries in food preparation and in traditional medicines to treat numerous diseases. Rhizomes of turmeric are used in several culinary preparations. They have been used as household remedies since time immemorial. The turmeric crop suffers severely due to leaf blotch disease which is caused by *Taphrina maculans* (Syd.) Buttler and Bisby. The losses by leaf blotch are always considered to be a limiting factor for yield and quality of rhizomes. Losses occurred in green rhizome due to the leaf blotch were estimated at Tirhut College of Agriculture Dholi, Muzaffarpur during 2018-19. Losses were found in all the growth parameters viz., Number of leaves per plant, Number of tillers per plant, Leaf area, Number of fingers, Weight of fresh rhizomes Due to leaf blotch of turmeric, maximum losses were noticed in leaf area (26.27%) and in weight of fresh rhizomes (25.18%).

Keywords

Crop phenology,
Yield, Turmeric,
Leaf blotch and
*Taphrina
maculans*

Introduction

Turmeric (*Curcuma longa* L.) is known as the “golden spice” as well as the “spice of life”. It is also called nature’s precious gift and commonly known as ‘National Heritage’ (Maurya *et al.*, 2011). Turmeric (*Curcuma longa* L.) is spice crop native to Asia and India. According to data base of Horticulture statistic at a glance, 2018, the turmeric production of India was 1052 thousand MT from acreage of 193 thousand ha area. The main turmeric producing states in India are Andhra Pradesh, Tamilnadu, Orissa, West

Bengal, Maharashtra, Karnataka, and Kerala. Maximum area under turmeric cultivation is in Andhra Pradesh (71.61 thousand ha), where production is very high *i.e.*, 371.64 thousand tones. India, the “Home of spices” has been the largest turmeric producer (80%) and exporter (50%) in the world ranking third (Thiripurasundari and Salvarani, 2014). In Bihar, the turmeric production was 2.60 thousand MT from 2.40 thousand ha area (Horticulture statistic at a glance, 2017). Turmeric (*Curcuma longa* L.) is severely affected by several diseases, mostly fungal, have been recorded on turmeric. Bacterial

and viral diseases are of minor importance. The crop is prone to many fungal diseases viz., *Colletotrichum* leaf spot (*Colletotrichum capsici* [(Syd.), Butler and Bisby], leaf blotch (*Taphrina maculans* Butler) and Rhizome rot (*Pythium spp.*) are the most serious diseases resulting in yield losses in different parts of the country (Rathaiah, 1987; Annon, 1996). The poor productivity of the crop in the state has been attributed to leaf blotch disease caused by *Taphrina maculans* among other factors that hinder its production. Turmeric yield losses due to disease have been recorded up to 37.6-52.9 per cent and becoming so colossal in some areas that turmeric cultivation has become uneconomical, especially where susceptible varieties were grown (Panja *et al.*, 2000; Annon., 2011).

Materials and Methods

Histopathology

The hand cross sections of infected leaf spots were taken by using sterilized razor blade. They were incubated in acidified (pH 4.5) water in different material like cavity slide, watch glass at 20°C temperature for 48 hours in BOD incubator and observed under the binocular microscope. A series of groups of naked asci with ascospores were observed between the cuticle and epidermis (Fig3.). Mycelium also observed which were embedded in cuticle and intercellular spaces of epidermis.

Effect of leaf blotch disease on crop phenology

To know the effect of leaf blotch on different growth parameters and yield, 20 each of healthy and infected plants of susceptible variety (Morangia) were selected from the College Farm, Tirhut College of Agriculture, Dholi, Muzaffarpur, Bihar (Dr. Rajendra

Prasad Central Agricultural University, Pusa, Samastipur, Bihar) during the cropping season Kharif 2018-19. Observations on plant height, number of leaves/plant, numbers of tillers/plant and leaf area were taken after 5 months of planting from infected as well as healthy plants. Remaining observations viz., numbers of fingers and weight of fresh rhizomes per plant were also taken at the time of harvesting from infected and healthy plants.

Per cent loss of all the parameters were calculated on the basis of observed values of healthy and infected plant, using the following formula.

$$\text{Per cent avoidable loss} = \frac{\text{VH} - \text{VI}}{\text{VH}} \times 100$$

Where,

VH = Value of healthy plant

VI = Value of infected plant

Results and Discussion

Effect of leaf blotch disease on crop phenology

Leaf blotch of turmeric has an adverse effect on various growth parameters of infected turmeric plants as compared to healthy plants. To know the effect of leaf blotch on crop phenology, healthy and infected plants were observed and following observations were collected.

Plant height

In case of leaf blotch infected plants, height was ranged from 84.40 to 115.64cm (Av. 104.29 cm) while, it was ranged from 98.80 to 131.14 cm (Av. 116.28 cm) in healthy plants. Per cent reduction in plant height due to the leaf blotch was 11.99%.

Weight of fresh rhizomes

In case of infected plants, weight of fresh rhizomes was ranged from 230 to 468 g/plant (Av. 326.00 g/plant), while it was from 298 to 535 g/plant (Av. 435.75 g/plant) in healthy plants. Per cent reduction in weight of fresh rhizome yield due to leaf blotch was 25.18%. Due to the leaf blotch of turmeric, losses were found in all the growth parameters.

Leaf area

Leaf area measured in infected plants was ranged from 413 to 665.3 cm² (Av. 512.16 cm²) while it was from 598.6 to 777.3 cm² (694.58 cm²) in healthy plants. Per cent reduction in leaf area due to the leaf blotch was 26.27%.

Number of leaves per plant

In case of infected plants, number of leaves per plant was ranged from 6 to 10 (Av. 7.45), while in healthy plants, it was ranged from 8 to 11 (Av. 9.30) leaves per plant. Per cent reduction in number of leaves per plant due to the disease was 19.89%.

Number of tillers per plant

In case of infected plants number of tillers per plant were ranged from 1 to 3 (Av. 2.05) while in healthy plants, it was ranged from 2 to 4 (Av. 2.85). Per cent reduction in number of tillers per plant due to leaf blotch was 28.07%.

Number of fingers

Number of fingers of infected plants were ranged from 5 to 10 (Av. 7.20), while it were from 7 to 11 (Av. 8.70) in case of healthy plant. Per cent reduction in number of fingers per plant due to leaf blotch was 17.24%.

The Present findings are well supported by finding of Prasadji (2001) who also reported earlier loss in fresh rhizome yield caused by *T. maculans* was about 35%.

Prasadji *et al.*, (2005) observed also a significant reduction in the number of mother rhizomes, plant height and leaf length between different group of genotypes susceptible or resistant to foliar disease caused by *C. capsici* and *T. maculans*.

Table.1 Per cent reduction in different growth parameters due to leaf blotch of turmeric

Sr. No.	Growth Parameters/plant	Infected	Healthy	Reduction (%)
1.	Plant height (cm)	104.29	116.28	11.99
2.	Wt. of fresh rhizome(g)	326.00	435.75	25.18
3.	Leaf area (cm ²)	512.18	694.58	26.26
4.	No. of leaves	7.45	9.30	19.89
5.	No. of tillers	2.05	2.85	28.07
6.	No. of fingers	7.20	8.70	17.24

Table.2 Effect of leaf blotch disease on crop phenology

No. of plants	Plant height (cm)		No. of leaves/plant		No. of tillers/plant		Leaf area (cm ²)		No. of fingers/plant		Wt. of Fresh rhizome (g)/plant	
	Infected	Healthy	Infected	Healthy	Infected	Healthy	Infected	Healthy	Infected	Healthy	Infected	Healthy
1	110.25	125.40	7	9	1	4	645.30	769.4	5	11	408	392
2	104.70	125.50	9	8	2	3	520.90	598.6	7	9	370	523
3	95.20	115.30	8	10	1	2	504.20	725.4	8	8	290	430
4	110.20	120.55	7	8	2	3	507.70	603.7	6	7	280	495
5	115.20	122.50	7	9	1	2	481.40	696.6	7	7	320	365
6	115.00	125.75	6	9	3	3	501.50	633.8	7	8	468	380
7	105.60	105.95	8	11	2	4	493.80	763.3	7	7	250	408
8	100.00	98.80	8	9	3	2	526.50	732.4	9	8	270	302
9	84.40	108.20	10	9	2	3	505.20	662.4	5	9	335	422
10	105.40	110.90	9	10	3	2	458.20	754.2	8	7	489	530
11	105.50	105.80	8	9	2	2	500.70	777.3	5	9	296	380
12	100.10	101.25	9	10	1	3	490.30	646.8	9	10	386	406
13	101.30	103.60	9	8	2	3	665.30	694.1	7	9	352	324
14	92.45	120.75	10	10	2	4	497.60	756.1	8	7	230	298
15	96.85	131.14	7	10	2	2	498.20	638.3	7	8	315	480
16	115.64	125.54	8	9	2	3	413.00	664.4	6	8	301	535
17	110.30	115.25	6	9	3	4	620.80	749.2	8	9	270	505
18	100.20	123.30	8	10	2	2	495.30	666.7	6	10	390	487
19	112.20	110.8	7	9	3	3	497.70	728.2	6	11	268	515
20	105.50	130.25	8	9	2	3	419.50	632.6	10	11	230	534
Mean	104.29	116.28	7.45	9.30	2.05	2.85	512.18	694.58	7.20	8.70	326.00	435.75

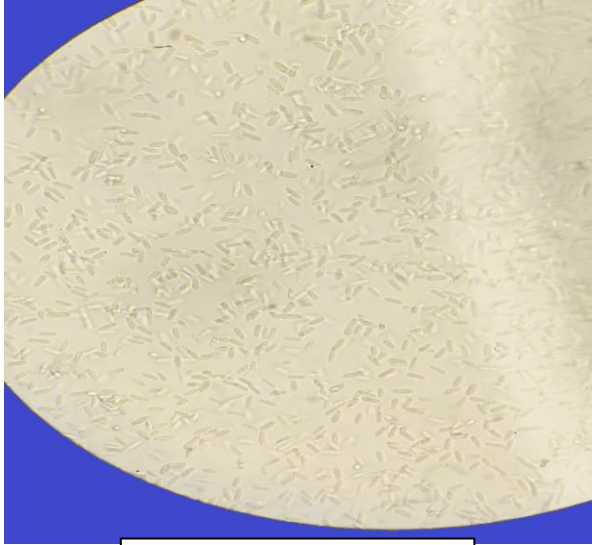
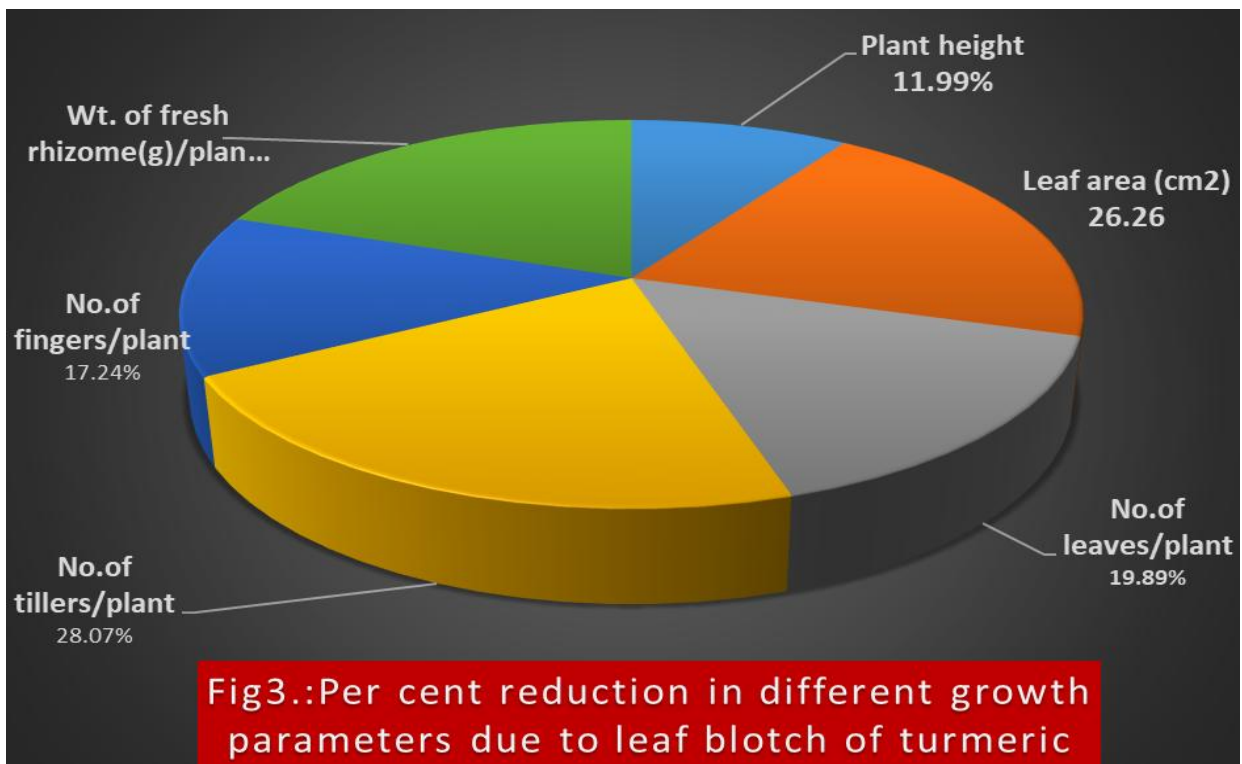


Fig1. Blastospore



Fig2. Naked Ascospore



Maurya *et al.*, (2011) noted that leaf blotch of turmeric caused by *T. maculans* is one of the destructive foliar diseases of the crop. It causes enormous loss in rhizome production. Loss caused by leaf blotch and leaf spot diseases in turmeric is ranging from 20 to more than 60% in some cases (Nair and Ramakrishnan, 1973).

Butler (1918) stated that though precise crop loss figure are not available in case of leaf blotch of turmeric, the foliar destruction due to *T. maculans* in turmeric would reduce the yields considerably especially when the disease occurs in early stages of crop growth.

References

- Anonymous. 1996. Quinquennial Report (1992-1996). AICRP on spices, Rajendra Agricultural University, Pusa, Samastipur, Bihar. Pp. 53.
- Anonymous. 2011. *Annual Report* on All India Coordinated Research Project on spices, Indian Institute of Spices Research Calicut, Kerala. Pp. 36-41.
- Butler EJ. 1918. Fungi and disease in plants. Thacker, Spink and Co., Calcutta, 6: 346 – 348.
- Maurya S, Singh A, Mishra A and Singh UP. 2011. *Taphrina maculans* reduces the therapeutic value of Turmeric (*Curcuma longa*). *Achieves of Phytopathology and Plant Protection*, 44: 1142-1146.
- Panja BN, De DK and Mazumder D. 2000. Assessment of yield losses in turmeric genotypes due to leaf blotch disease (*Taphrina maculans* Bult.) from Tarai region of West Bengal. *Plant Protection Bulletin Faridabad*. 52(3/4): 13-15.
- Prasadji JK. 2001. Epidemiology and management of leaf blotch of turmeric caused by *Taphrina maculans* Butler. Ph.D. thesis submitted to Acharya N.G. Ranga Agricultural University, Hyderabad, Telangana, India.
- Prasadji JK, Bhagvan BVK, Ramapandu S and Muralidharan, K. 2005. Diversity in turmeric genotype with differential reaction to leaf blotch and leaf spot disease. *J. Mycol. Pl. Pathol.*, 35(3): 451 - 459.
- Rathaiah Y. 1987. Disease of turmeric in Assam. *Pesticide*. 21(8): 15-17.
- Thiripurasundari K and Selvarani K. 2014. Production of turmeric in India: an analysis. *Int J Bus. Manag.* 2(9): 229.