Plant Archives Vol. 19 No. 1, 2019 pp. 1175-1178 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

ECO-FRIENDLY MANAGEMENT OF TAPHRINA LEAF SPOT DISEASE OF TURMERIC

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Abstract

Turmeric (*Curcuma longa*) is a tropical crop grown in India, occupies the third position in its importance among spice crops. The economic importance of turmeric is the dried rhizome. Turmeric crop is highly prone to several fungal diseases. The serious foliar diseases reported in Uttar Pradesh are leaf spot caused by *Taphrina maculans*, Butler. The foliar destruction due to leaf spot reduces the yield considerably when the disease starts in its early stages of crop growth. The herbal formulations have been described for the use in medicinal and agricultural applications. Hence, field studies were carried out to select plant extracts with suitable solvent for reducing the leaf spot disease of turmeric. The present study showed that all treatments were significantly superior over control for management of *Taphrina* leaf spot of turmeric in field condition. Among the treatment cow urine based botanical formulation was most effective at 90 days (44.04%) in comparison to acetone based botanical formulation (37.22%) and distilled water based botanical formulation (45.61%).

Key words : *Taphrina maculans*, leaf spot, turmeric, plant extracts, cow urine, growth, yield.

Introduction

Turmeric is very important spice in India, which produces nearly entire whole world crop and consumed 80% of it. India is by far the largest producer and exporter of turmeric in world. It has versatile uses in flavoring, dye making, drug preparation, cosmetics and medicine. Around 100 active constituents have been recorded from turmeric. This herbal plant is highly prone to several fungal diseases; one of them is Taphrina Leaf spot disease, caused by *Taphrina maculans*. The disease manifests whole leaves and reduces heavy yield loss. Managing the disease solely through the use of chemical pesticides being undesirable because of the associated risks of environmental pollution and human health, there is an all-round compulsion to go in for bio-rational alternatives. Eco-friendly disease management holds substantial importance in spice crop as most of them consumed as for direct spice purposes. Considering all these points and importance of crop, the present investigation was taken up to generate information regarding the cause of disease and tested various plant extract and mixture of these plant extract with cow urine, acetone and distilled water to find out management sources against the disease.

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Materials and Methods

Plant species Madar (*Calotropis procera*) and Dhatura (*Datura stramnium*) free from any disease were selected on the basis of their antifungal properties reported elsewhere and easy availability round the year in the field. The effectiveness of cow urine, acetone and distilled water based plant extracts were tested against naturally occurring year to year *Taphrina* leaf spot of turmeric in field experiment. Concentration of plant extract was selected on the basis of *in vitro* experiment on *Colletotrichum*. The field experiment was conducted at vegetable farm, Narendra Deva University of Agriculture and Technology Kumarganj Faizabad during 2014 to 2016 in sandy alluvial soil with having low organic matter and high ph 8.5. NDH-1 is susceptible variety to Taphrina leaf Spot and showed disease incidence ranging from 42.8 to 79.3% under natural condition (previous year)

was selected for trials in Randomized Blocked Design with 10 treatments and three replications *viz*; $\mathbf{T_1}$ - cow urine + Madar (*Calotropis procera*) extract, $\mathbf{T_2}$- acetone + Madar (*Calotropis procera*) extract, $\mathbf{T_3}$- distilled water + Madar (*Calotropis procera*) extract, $\mathbf{T_4}$- cow urine + Dhatura (*Datura stramnium*) extract, $\mathbf{T_5}$- acetone + Dhatura (*Datura stramnium*) extract, $\mathbf{T_6}$- distilled water Dhatura (*Datura stramnium*) extract, $\mathbf{T_7}$- cow urine + Madar + Dhatura extract, $\mathbf{T_8}$- acetone + Madar + Dhatura extract, $\mathbf{T_9}$- distilled water + Madar+ Dhatura extract, $\mathbf{T_{10}}$- Control. The rhizomes were planted on raised based 3x1 meter size at spacing 30x25 cm in the first fort night of July. Other standard agronomical practices were applied as per recommendation of N.D.U.A&T Kumarganj, Faizabad. Plant extracts (20%) were applied as foliar sprayed at 60 and 90 days after planting and foliar spray of water alone were applied in control for comparison. A sticker, ASPA 80 @ 0.1% was mixed with the spray fluid. Randomly six plants of each plot were recorded at 90 and 120 after planting. All the leaves of selected plants were individually scored based on 0-6 scale.Where 0 = No infection, 1 = 0.1 to 10 percent area infected, 2 = 10.1 to 20 percent area infected, 3 = 20.1 to 30 percent area infected, 4 = 30.1 to 40 percent area infected, 5 = 40.1 to 50 percent area infected, 6 = more than 50 percent area infected. The Plant Disease Intensity (PDI) was calculated according to the formula suggested by Dator and Mayee (1981) given as below:

$$PDI = \frac{\text{S of rating of infected leaves of plant}}{\text{No. of leaves observed} \times \text{maximum disease score}}$$

Percent Disease Control was calculated using the following formula :

$$PDC = \frac{\text{Disease in control} - \text{Disease in treatment}}{\text{Disease in control}} \times 100$$

Growth and yield of turmeric was recorded at the time of maturity in each treatment. Data recorded from the experiments were analyzed statistically to draw the conclusion. The significance differences of treatments were tested by variance ratio test of 5% level of probability.

Results and Discussion

The increasing reports about the negative effects of synthetic pesticides have intended the interest in natural pesticides as an eco chemical approach in pest control (Dubey *et al*., 2010). Natural pesticides are active substances derived from plants and are often used for pest management. The plant extracts of madar, datura and botanical formulation were showed broad spectrum

Table 1 : Effect of plant extracts with cow urine, Acetone and Distilled water against Percent Disease Intensity (PDI) and Percent Disease Control (PDC) of Taphrina leaf spot of turmeric at 90 and 120 Days after Planting.

Treatments	Madar extract				Datura extract				Botanical-formulation			
	90 DAS		120 DAS		90 DAS		120 DAS		90 DAS		120 DAS	
	PDI	PDC	PDI	PDC	PDI	PDC	PDI	PDC	PDI	PDC	PDI	PDC
Cow urine	52.68 (44.58)	15.90 (23.48)	58.55 (51.41)	22.27 (28.70)	51.57 (44.97)	17.67 (24.82)	55.34 (48.99)	26.53 (33.35)	35.05 (35.36)	44.04 (42.44)	47.73 (40.24)	36.63 (38.25)
Acetone	48.49 (46.97)	22.58 (27.75)	52.65 (45.42)	30.10 (33.28)	53.27 (47.71)	14.95 (22.36)	60.75 (53.08)	19.35 (25.71)	39.32 (34.50)	37.22 (41.54)	47.79 (41.18)	36.55 (37.19)
Distilled water	52.21 (45.62)	16.65 (24.05)	57.63 (51.73)	23.49 (27.94)	52.19 (43.79)	16.68 (24.01)	52.42 (47.19)	30.41 (30.91)	34.07 (34.50)	45.61 (37.63)	46.44 (42.55)	38.35 (37.16)
Control	62.64 (50.84)	0.00 (0.00)	75.33 (58.55)	0.00 (0.00)	62.64 (50.84)	0.00 (0.00)	75.33 (58.55)	0.00 (0.00)	62.64 (50.84)	0.00 (0.00)	75.33 (58.55)	0.00 (0.00)
SEm±	1.277	2.531	1.166	1.760	0.762	1.703	1.283	1.873	1.512	2.384	1.220	1.735
CD(p=0.05)	4.421	8.760	4.034	6.092	2.636	5.895	4.440	6.480	5.232	8.250	4.220	6.005

Table 2 : Effect of cow, acetone and distilled water based plant extract and its botanical formulation on growth and yield of Taphrina Leaf Spot infected turmeric under field condition.

Symbols	Treatments	Plant height (cm.)	Fresh rhizome yield (gm/plant)	Dry rhizome yield (gm/plant)
T-1	Cow urine + madar	107.94	184.11	36.73
T-2	Acetone+madar	97.83	168.33	33.50
T-3	Distilled water+madar	96.33	153.33	32.82
T-4	Cow urine +datura	98.00	256.67	54.16
T-5	Acetone+datura	95.67	217.50	44.37
T-6	Distilled water+datura	96.22	213.89	43.47
T-7	Botanical formulartion (cow urine+ M+D)	138.94	335.89	67.17
T-8	Botanical formulartion (Acetone+ M+D)	105.67	289.72	59.94
T-9	Botanical formulartion (Distilled water+ M+D)	104.17	294.17	58.83
SEm±		**3.42**	**6.99**	**1.37**
CV		**5.49**	**5.98**	**5.89**
CD (p=0.05)		**9.80**	**18.65**	**3.94**

M=Madar, D=Datuta

of activity against several diseases. Cow urine based botanical formulation and individual each plant extracts at 20% concentration were significantly minimized *Taphrina maculans* over the control.

It has been shown that cow urine posses antimicrobial activity against plant pathogenic microbes especially *Taphrina maculans* (Kanbar *et al*., 2013). In present study showed that all treatments were significantly superior over control for management of *Taphrina* leaf spot of turmeric in field condition (table 1). Among the treatment cow urine based botanical formulation was most effective at 90 days (44.04%) in comparison to acetone based botanical formulation (37.22%) and distilled water based botanical formulation (45.61%). Mohanty *et al*. (2014) have been observed that cow urine enhance the phagocytic activity of macrophages and thus helpful against bacterial and fungal infection. The recent study of Wate *et al*. (2011) related to cow urine and its role as a bio-enhancer. Distillate cow urine has an activity of enhancer and availability fascinator for bio active molecules (antibiotic and antifungal). Individual plant extract with cow urine was also found effective at 90 days. Second best plant extract was found with acetone, that gave maximum disease control in datura, whereas madar (22.58%) was least effective. Masoko *et al*. (2005) found that the acetone extracts were superior to other extraction solvent such as hexane, methanol and water. The result showed that distilled water based botanical formulation and individual plant extract performed better after 120 days of planting under field condition. The finding is highest in water based botanical formulation (38.55%) followed by cow urine based botanical formulation (36.63%) and acetone based botanical formulation (36.55%). The water based extract performed well *in vivo*, due to solubility of compound in water was better as speculated by Masoko *et al*. (2005).

Growth and yield

Finding of experiment showed that all treatments significantly increased the plant height and fresh rhizome yield of turmeric over the control (table 2). The maximum plant height was recorded in cow urine based botanical formulation (138.94cm) and individual plant extract because cow urine has rich contents of sodium, nitrogen, sulphur, vitamins A, B, C, D and E, minerals, manganese, iron, magnesium *etc,* which help to curing plant disease and increased the plant growth (Mahanty *et al*., 2014). Second best was acetone based plant extract and distilled water based extract. This finding was supported by Ekbote (2005) and Singh *et al*. (2003). The highest fresh rhizome yield was recorded in cow urine based botanical formulation (335.89 gm/plant). The spray of cow urine based botanicals increased the nutrient uptake by the plant because cow urine have 95% of water content, 2.5% urea and 2.5% mixture of minerals, salts, hormones and enzymes. Bhaudaria (2002) and Saunders (1982) reported that the cow urine boosted the annual rye grass yield by causing an increase in nitrogen component to the soil and marked depression in N fixation by 10% annually in clovers particularly in winter. The acetone based botanical formulation was second best (299.72gm/plant) followed by distilled water based formulation (294.17 gm/plant). Subhashini (2013) have been reported the performance of water and acetone based *Allium sativum*, *A.*

caudescens, *C. papaya* and *S. cordatum* extracts *in vivo* as both seed treatments and foliar fungicides treatments to control anthracnose disease of cowpea and common bean in same way, which decreases the disease incidence and increased the yield. In respect to dry rhizome recovery of turmeric data (table 2) indicated that all treatments increased dry rhizome recovery over the control. The maximum dry rhizome recovery was found in cow urine based botanical formulation (67.17gm/plant)), whereas it was found 28.02 gm/plant in control. Cow urine based formulation would definitely prove to be a potential medicine which in turn would reduce the pressure on the existing use of chemical and antibiotics; it could be a major step in disease management. Let's hope this urine could open doors for curing wide range of plant diseases because as we know, it is eco-friendly, economically viable and easily available at abundance.

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