



EFFICACY OF PLANT EXTRACTS WITH DIFFERENT SOLVENTS AGAINST *TAPHRINA* LEAF SPOT OF TURMERIC

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Abstract

Taphrina leaf spot is widely distributed in the genetic plains of Uttar Pradesh and Bihar. 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. Plant extract with cow urine was resulted lowest disease intensity in neem (47.5%), garlic (48.4%) and onion (50.7%) followed by water based extract of neem (48.1%), onion (44.9%) and garlic (54.1%) where as highest in acetone based extract of neem (49.3%), onion (50.0%) and garlic (53.4%). The plant growth and yield of turmeric were found highest in cow urine based plant extract as compared with acetone and distilled water based plant extract.

Key words: Turmeric, *Taphrina*, leaf spot disease, cow urine, plant extracts and yield

Introduction

Turmeric (*Curcuma longa*) is a tropical crop grown in India, occupies the third position in its importance among spice crops and native to tropical South East Asia. The economic importance of turmeric is dried rhizome. India has a 232.6 thousands ha area under turmeric cultivation with total production of 1189.90 thousand tons and productivity is 51.15q/ha (Anonymous, 2014). Turmeric crop is highly prone to several fungal diseases (Purthi, 2000). The serious foliar diseases reported in Uttar Pradesh are leaf spot caused by *Colletotrichum capsici* (Syd.) Butler & Bisby, and leaf spot caused by *Taphrina maculans*, Butler. *Taphrina* leaf spot was known to report from Gujarat, Saharanpur (UP) and Rangapur in 1911. It is widely distributed in the gangetic plains of Uttar Pradesh and Bihar. The foliar destruction due to leaf spot reduces the yield considerably when the disease starts in its early stages of crop growth. The farmers are growing local clones for their desirable aroma, colour and palatability. These clones are susceptible to the disease leaf spot diseases.

The application of chemical fungicides are producing hazardous consequences in term of soil pollution, reducing the quality of arable land and ground water (Bezbaruah,

2000) and bio-pesticides are usually inherently less toxic than conventional pesticides (Singh, 1999). They generally affect only the target pathogenic organism, in contrast to broad spectrum fungicides. Fresh plant extracts from different plant parts are becoming valuable for management of the pathogens, which can be easily prepared by farmers. Cow's urine is an important constituent of Panchgavya and is used in several Panchgavya formulations (Okigbo and Nameka, 2005). Cow's urine based Nigerian herbal formulation was prepared with the use of several herbs like tobacco, garlic, lemon juice and bulbs of onion. These herbal formulations have been described for the use in medicinal and agricultural applications. (Fulzele *et al.*, 2001). Keeping in view, field studies were carried out to select suitable management practices for reducing the leaf spot disease of turmeric.

Materials and Methods

Plant species viz. Neem (*Azadirachta indica*), Onion (*Allium cepa*) and Garlic (*Allium sativum*) 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*

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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 ; T₁ - cow urine +Neem (*Azadirachta indica*) leaf extract, T₂ - acetone +Neem (*Azadirachta indica*) leaf extract, T₃ - distilled water +Neem (*Azadirachta indica*) leaf extract, T₄ - cow urine +Garlic (*Allium sativum*), bulb extract, T₅ - acetone +Garlic (*Allium sativum*), bulb extract, T₆ - distilled water +Garlic (*Allium sativum*), bulb extract, T₇ - cow urine +Onion (*Allium cepa*), bulb extract, T₈ - acetone +Onion (*Allium cepa*), bulb extract, T₉ - distilled water +Onion (*Allium cepa*), bulb extract, T₁₀ - Control. The rhizomes were planted on raised bed 3 × 1 meter size at spacing 30 × 25 cm in the first fortnight 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-

$$PDI = \frac{\sum \text{of rating of infected leaves of plant}}{\text{No. of leaves observed} \times \text{maximum disease score}} \times 100$$

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 Discussions

Plant extract with cow urine was resulted lowest disease intensity in neem (47.5%), garlic (48.4%) and onion (50.7%) followed by water based extract of neem (48.1%), onion (44.9%) and garlic (54.1%) and acetone based extract of neem (49.3%), onion (50.0%) and garlic (53.4%). In control, it was found 62.6% PDI. At 120 days after planting, the effect was significantly variable with control (75.33 PDI). Single plant extract with cow urine, acetone and distilled water were also found significant with control, whereas PDI was recorded at par in between cow urine, acetone and distilled water based plant extracts. Results from table-1 revealed that all the plant extract treatments were significantly effective for reducing disease incidence as compared to the control. Disease control at the 90 days was seen maximum in cow urine based neem (24.06%), followed by Garlic (22.62%), acetone based neem (23.08%) and onion (20.22%). The percent disease control at 120 days was highest in Distilled water based botanical formulation (38.55%) followed by cow urine based neem (36.95%) and acetone based neem (35.19%). 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). Nduagu *et al.* (2008) observed strong fungi toxicity in extracts of *Azadirachta indica*, *Vernonia amygdalina* and *Cochlospermum planchonsi* against *C. capsici*. Masoko *et al.* (2005) found that the acetone extracts were superior to other extraction solvent such as hexane, methanol and water. The water based extract gave poor result *in vitro*, but performed well *in vivo*, due to solubility of compound in water was better as speculated by Masoko *et al.* (2005). Fungicidal effect of aqueous extract of garlic has been reported best by several researchers.

A result (table-2) indicates that all treatments significantly increased the plant height of turmeric over control. The increase was found highest in cow urine based plant extract as compared with acetone and distilled water based plant extract. The maximum height was recorded in cow urine + onion extract (102.72cm), Distilled water + onion extract (102.33cm) and cow urine + garlic extract (100.61cm), where as in control plant height was observed 89.17cm. The highest fresh rhizome yield was recorded in cow urine based onion extract (196.67gm/

Table1 : 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 disease of turmeric

Treatments	Neem extract				Onion extract				Garlic extract			
	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	47.57 (38.67)	24.06 (29.20)	47.49 (44.45)	36.95 (37.34)	50.76 (40.64)	18.96 (26.68)	56.51 (47.21)	32.61 (35.04)	48.47 (43.23)	22.62 (28.39)	50.32 (45.04)	33.20 (35.13)
Acetone	49.38 (40.08)	21.17 (27.25)	48.82 (44.61)	35.19 (36.15)	50.00 (40.43)	20.17 (26.45)	51.05 (43.68)	32.33 (34.53)	53.45 (45.88)	14.67 (22.45)	53.64 (45.72)	28.79 (32.45)
Distilled water	48.18 (38.16)	23.08 (28.49)	49.56 (44.38)	34.20 (35.73)	49.97 (41.48)	20.22 (25.61)	50.36 (44.77)	33.14 (29.97)	54.12 (45.73)	13.60 (21.46)	57.97 (47.94)	23.04 (28.64)
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±	1.071	2.188	1.406	1.820	0.896	1.948	0.931	1.265	0.584	1.268	0.635	0.847
CD (p=0.05)	3.707	7.572	4.865	6.299	3.099	6.740	3.222	4.377	2.021	4.387	2.196	2.931

Figures in parenthesis are sine transformed value

Table 2: Effect of plant extracts under different solvent on growth and yield of *Taphrina* leaf spot infected turmeric field

Symbols	Treatments	Plant Height (cm.)	Fresh rhizome yield (gm/plant)	Dry rhizome yield (gm/plant)
T ₁	Cow urine + neem	93.78	173.33	34.65
T ₂	Acetone+neem	92.11	168.06	33.66
T ₃	Distilled water+neem	91.89	163.17	32.46
T ₄	Cow urine + onion	102.72	196.67	39.33
T ₅	Acetone+onion	99.56	186.11	37.93
T ₆	Distilled water+onion	102.33	182.22	36.26
T ₇	Cow urine + garlic	100.61	169.64	31.06
T ₈	Acetone+garlic	98.83	168.56	32.58
T ₉	Distilled water+garlic	95.83	158.33	32.14
T ₁₀	Control	89.17	143.06	28.02
SEm±		3.42	6.99	1.37
CV		5.49	5.98	5.89
CD (p=0.05)		9.80	18.65	3.94

plant), acetone based onion extract (186.11gm/plant), distilled water based onion extract (182.22gm/plant), and cow urine based neem extract (173.33 gm/plant) as compared to control (143.00gm/plant). Result obtained in respect of efficacy of treatments on dry rhizome recovery of turmeric plants, indicated that all treatments significantly increased dry rhizome over the control, the highest dry rhizome recovery was in onion (39.33 to 36.26gm/plant) and neem (34.65 to 32.46 gm/plant). The lowest dry rhizome was recovered in garlic (34.06 to 32.14 gm/plant) and control 28.02gm/plant. The cow urine has it contains 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) followed by acetone based plant extract and distilled water based extract. This finding was supported by Ekbote (2005) and Singh *et al.* (2003). Bhaudaria (2002) 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 followed by distilled water based formulation. 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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