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Prospects of Using Plant Extracts in Management of Pineapple Heart Rot

Pineapple is the third most important commercial tropical fruit crops in the world. The cultivated pineapple (*Ananas comosus* (L.) Merill, belongs to family Bromeliaceae. The production of pineapple in India accounts to 11,00,000 tonnes. It is currently grown commercially over a wide range of latitudes ftom approximately 30^0 N in the northern hemisphere (30° 45'N in India (Hayes,1960) and 28° 30' in the Canary Islands (Galan Sauco *et aI.,* 1988) to 33° 58'S in South Africa (Bartholomew and Kadzimin, 1977). Pineapple is cultivated predominantly for its fruit that is consumed fresh or as canned fruit and juice. The stems and leaves of pineapple plant are also source of fiber that is white, creamy and lustrous as silk. The most serious and widespread one is heart rot caused by *Phytophthora parasitica*. To minimize use of fungicides for the management of heart rot efforts were made in using the plant extracts.

The fresh samples of seeds, leaves, bark and corm from *Amorphophallous companulatus, Azadirachta indica, Gnidia glauca, Pongamia pinnata and Strychnus nuxvomica* were collected and washed in distilled water and dried in hot air oven for 48h at 50°C and then dried parts were powdered. From each species, 50g powdered sample was suspended in 250ml distilled water, boiled and filtered through Whatman No. 1 filter paper. From this extract, 5% and 10% dilutions were prepared. The pathogen was isolated on Oatmeal and by employing Poisoned Food Technique was used (Nene and Thapliyal, 1979) to test the efficacy of plant extracts. Suitable control checks were also maintained. The plates were incubated at 25°C, growth of colony was measured after 72h and 120h of inoculation. The radial growth of mycelium was measured at two points along the diameter of the plate and the mean of these two readings were taken as the diameter of the colony. The growth of the colony in control was compared with that in different treatments and the difference was converted in to per cent inhibition as given by Vincent (1947). An experiment was conducted at Kadagodu in Sirsi taluka which is major pineapple growing area in Uttara Kannada, Karnataka. Blitox @ 0.3% was drenched around the root zone as a recommended practice. The treatments which showed higher efficacy under *in vitro* were selected for field study. The observation on disease incidence before and after 90 days of drenching of extracts, initiation of leaves, death of leaves and yield were recorded and Cost: Benefit ratio was worked out using the yield (q/ha) obtained in each treatment over control (Price of fruits Rs 700/h). The results revealed that the inhibition of mycelial growth by plant extracts at 5 per cent concentration of plant extracts was significant for extract and extract x concentration. The average mycelial inhibition was 27.22 per cent and the maximum inhibition was noticed in *Amorphophallous companulalus* corm extract (42.32 % followed by *Strychnus nux-vomica* bark extract (41.31%) and *Azadirachta indica* kernel extract (35.23%). The minimum mycelial inhibition was found in *Strychnus nux-vomica* leaf extract (14.57%), *Amorphophallous companulatus* seed extract (14.65%) and *Pongamia pinnata* seed extract (18.46%). There were no significant differences between the treatments for concentration alone (TabIe 1). Where as for 10 per cent concentration, there was a significant difference among the treatments for extract, concentration and extract x concentration (1.15, 2.17 and 3.76, respectively). The maximum mycelial inhibition was found in *Amorphophallous companulatus* corm extract (48.63%) followed by *Azadirachta indica* kernel extract (43.81%), *Strychnus nux-vomica* bark extract (43.29%), *Azadirachta indica* leaf extract (34.96%) and *Gnidia glauca* leaf extract (34.59%). The minimum mycelial inhibition was found in *Amorphophallous companulatus* seed extract (23.65%), *Pongamia pinnata* seed extract (26.84%) and *Gnidia glauca* seed extract (28.47%) with a mean of 35.05 per cent. The higher inhibition of mycelium of *Phytophthora parasitica* by Amorphophallous companulatus corm may be attributed to *"Calcium oxalate*" chemical present in corm. The inhibition in *Strychnus nux-vomica* may be due to chemical "strichnin" in bark and "Azadirctin" in kernels of *Azadirachta indica*. These results are in line with work of Biswas *et al*. (1995) who reported that the effects of 10 per cent alcoholic water extract of fresh plant parts from 20 different species on the development of powdery mildew (Phyllactinia corylea) leaf spot (Pseudocercospora mori) and leaf rust (Cerotelium fici) of mulberry. Aqueous extracts of Allium cepa, *Calotropis procera, Chenopodium album*, *Azadirachta indica* were tested *in vitro* for antifungal properties against *Macrophomina phaseolina* and *Phytophthora palmivora* and *Azadirachta indica* showed higher antifungal activity (Tasleem *et al*., 1998). The treatments differed significantly in controlling the heart rot under field conditions (Table 2). After 90 days of soil drenching at 10 percent concentration, *Azadirachta indica*

Table 1. *In vitro* evaluation of plant extracts against Phytophthora parasitica

Treatment	Mycelial inhibition over control (%)	
	5% concentration	10% concentration
T_1 : *Strychnus nux vomica* Seeds	29.96	34.52
T_2 :*Strychnus nux vomica Leaves*	14.57	28.02
T_3 :*Strychnus nux vomica Bark*	41.31	4329
T_4 :*Azadirachata indica* Seeds	35.23	43.81
T_5 :*Azadirachata indica* Leaves	25.60	34.96
T_6 :*Azadirachata indica* Bark	37.32	32.35
T_7 :*Gnidia gluca* Seeds	19.16	28.47
T_8 :*Gnidia gluca* Leaves	15.90	34.59
T_9 :*Gnidia gluca* Bark	23.46	33.60
T_{10} : *Amorphophallous companulatus* Seeds	14.65	23.65
T_{11} : *Amorphophallous companulatus* Corm	42.32	48.63
T_{12}: *Pongamia pinnata* Seeds	18.46	26.48
Mean	27.22	35.05
SEm ±	1.05	1.33
CD at 1 % Extract	0.90	1.15
Conc	NS	2.17
Ext X Conc	2.97	3.76

Table 2. Field evaluation of plant extracts for pineapple heart rot *(Phytophthora parasitica)*

Treatment	Disease incidence before spray	Disease incidence after 90 days of spray	Initiation of leaves		Death of leaves	
			Before spray	After spray	Before spray	After spray
T_1: Control	21.00	24.70	10.00	12.00	11.00	31.00
T_2: Blitox 0.3 %	17.00	18.50	10.00	20.00	12.00	16.00
T_3: *Azadirachta indica* Kernel	15.00	16.20	7.00	25.00	12.00	12.00
T_4: *Strychnus nux vomica* Bark	17.30	18.70	5.00	19.00	6.00	17.00
T_5 :Amorphophallous companulatus Corm	16.70	20.00	7.00	18.00	10.00	19.00
T_6: Pongamia pinnata Seeds	20.00	21.00	10.0	18.00	13.00	22.00
T_7: *Lantana camara Leaves*	18.00	19.70	9.00	11.00	15.00	26.00
Mean	17.90	19.81	8.38	17.57	11.24	20.43
SEm±	2.45	1.48	2.62	2.09	1.83	3.40
CD at 5%	NS	4.56	NS	6.43	NS	10.46

Table 3. Cost: benefit ratio for various treatments of disease management in pineapple heart rot (Market value Rs 700/q)

Treatment	Average fresh yield (q/ha)	Income/ ha (Rs)	Yield increase over control	Income/ ha (Rs) Over control (q/ha)	Additional cost over control (Rs)	Net income/ha (Rs)	Cost Benefit ratio
Contro 1	9.44	6,608	-	-	-	6,608	-
Blitox 0.3 %	12.08	8,456	2.64	1848	1000	7,456	1:7
Azadirachta indica Kernel	15.66	10,962	6.22	4354	900	10,062	1 :11
Strychnusnux vomica Bark	24.55	17,185	15.11	10,577	900	16,285	1 :18
Amorphophallous companulatus corm	6.68	4,676	- 2.76	- 1932	900	3,776	1:4
Pongamia pinnata seeds	10.82	7,574	1.38	966	900	6,674	1:7
Lantana camara leaves	8.90	6,230	- 0.54	- 378	900	5,330	1:6

Kernel extract around seedlings helped for reducing disease development (16.20 %) as compared to control (24.70%). However, drenching with Blitox @ 0.3% and *Strychnus nux-vomica* bark extract were on par with each other in controlling the disease (18.50%) with mean of 19.81 per cent. Prakasam and Subbaraja (1994) reported that dipping planting material in Copper oxychloride (0.25%) helped in controlling heart rot disease. Among the plant extracts used *Azadirachta indica* kernels and *Strychnus nux vomica* bark extracts were most prominent in reducing the disease development in pineapple due to higher toxic chemical compounds like azadiractin and strychnin present in kernel and bark. The least incidence was recorded in *Pongamia pinnata* seed extract (21.00%) as compared to control (24.70%). There was significant difference with respect to yield, highest yield was recorded in treatment with *Strychnus nux-vomica* Bark (2455 kg/ha) followed by *Azadirachta indica* Kernel (1561.50 kg/ha) with mean of 1258.43 kg/ha. Effect of plant extracts indicated that initiation of new leaves was maximum upto 90 days in *Azadirachta indica* Kernel extract (25no) as compared to control (12no). Drenching of *Strychnus nux-vomica* Bark and Blitox @0.3% were on par with each other in initiating the new leaves (20 no) (Table 2). The average initiation was 17.57 with least in *Lantana camara* leaf extract (10 no). Similarly, death of leaves in each treatment was recorded and analysed to know the effect of plant extracts drenched. It was observed that, death of leaves in *Azadirachta indica* Kernel extract was minimum (12 no) as compared to control (31no). The treatments *Strychnus nux vomica* Bark and Blitox @ 0.3 % were on par with each other in causing the death of leaves (17.00). The cost benefit ratio was worked out for various treatments of disease management in pineapple heart rot (Table 3). The results suggested that the highest yield (qlha) was recorded in drenching bark extract of *Strychnus nuxvomica* (24.55 q/ha) followed by *Azadirachta indica* kernel (15.66 q/ha), Blitox @0.3% (12.08 q/ha), and *Pongamia pinnata* seed extract (10.82 q/ha) over the control (9.44 q/ha). The lowest was observed in treatment with *Amorphophallous companulatus* corm extract (6.68 q/ha) though it performed better in inhibiting the mycelium under *in vitro* conditions. The maximum yield increase over control was recorded in drenching bark extract of *Strychnus nux vomica* (15.11 qlha) and *Azadirachta indica*

kernel (6.22 q/ha). The highest net incomel ha and C:B ratio over control was obtained in drenching bark extract of *Strychnus nux vomica* (Rs 16,2851ha and 1: 18, respectively) and *Azadirachta indica* kernel (Rs 10,062 1ha and 1: 11, respectively).

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