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RESEARCH ARTICLE

Exploiting the extract of medicinal plants for the management of grapevine powdery mildew

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ABSTRACT

Extract of fifteen medicinal plants were screened for their antifungal activity against grapevine powdery mildew caused by *Uncinula necator*. The results of the *in vitro* study revealed that, the neem seed kernel extract (NSKE) 5 per cent recorded the highest germination inhibition of 72.02 per cent. This was followed by leaf extract of *Ocimum sanctum*(10%), rhizome extract of *Curcuma longa* (5 %) and leaf extract of *Catharanthus roseus* (10 %) which inhibited the conidial germination by 69.1, 65.9 and 64.2 per cent, respectively. The results of the field experiment showed that two rounds of spraying with NSKE (5 %), first spray immediately after the appearance of the disease and second at 15 days intervals effectively reduced the powdery mildew (62.24% disease reduction) disease incidence.

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INTRODUCTION

Medicinal plants are the excellent source of antimicrobial agents which posses antifungal, antibacterial and antiviral properties. Plant generally produces many secondary metabolites which constitute important sources of micro biocides. The search for antimicrobial activity of medicinal plants against plant pathogen is highly essential because green plants are safer than costly synthetic fungicides. The objective of present study was to investigate the antifungal activity of traditionally used medicinal plant extracts against grapevine powdery mildew disease caused by *Uncinula necator*. Grapevine powdery mildew causes up to 50 per cent losses in South India (Sohi, 1983). Powdery mildew affected berries are cracked there by providing entry sites for *Botrytis cinerea* and sour rot organism (Sall *et al*.,1981).Powdery mildew fungi infection resulted in reduced average bunch and berry size and weight(Thind *et al*., 1998). Most of the grapevine growers use fungicides for the management of powdery mildew which have many adverse side effects. To overcome all the ill effects caused by the synthetic fungicides and to evolve eco-friendly management strategy for grapevine powdery mildew, the present study was undertaken.

MATERIALS AND METHODS

***Preparation of plant extracts* :**

Extract of fifteen medicinal plants were screened for their antifungal activity against *U. necator in vitro*. Freshly collected plant material (leaf, seed rhizome and root) were separately washed with tap water and then with alcohol and finally with repeated changes of sterile distilled water. These were separately grounded in sterile distilled water (1 ml/ g of the tissue) using a pestle and mortar. The extract was strained through two layers of muslin cloth. Subsequently filtered through Whatman No.1 filter paper and finally passed through Seitz filter to eliminate bacterial contamination. This formed standard plant extract solution (100 %). This was further diluted to the required concentration with sterile distilled water. All the leaf extracts were used at 10 per cent concentration while seed and rhizome extracts were used at five per cent concentration.

***In vitro* efficacy of medicinal plant extracts against *U. necator*:**

The efficacy of plant extracts against conidial germination of *U. necator* was assessed by detached leaf technique (Varalakshmi *et al*., 1999). Grapevine leaves were washed in sterile distilled water and air dried. Plant extract of each of the medicinal plants was placed individually on the ad adaxial surface of the leaf, the droplets were evenly spread with a fine camel hair brush and allowed to air dry. The treated leaves were inoculated with the conidia of *U.necator* (3 x 10^4 conidia/ ml). The leaves sprayed with the conidial suspension alone served as the control. Three leaves from each treatment were transferred to a Petri dish with their petioles dipped in water and incubated at 20 °C. Each treatment replicated thrice. After 72 h, the leaves were observed with microscope equipped with fine light arrangement for conidial germination. The total and germinated conidia were counted in three microscopic fields and per cent inhibition of conidial germination was worked out.

Efficacy of plant extracts against grapevine powdery mildew in pot culture under artificial inoculation :

Six plant extracts (seer/kernel/rhizome) which were found effective against U.necator in vitro were tested for their efficiency against powdery mildew in pot culture under artificial inoculation. The treatments consisted of T_1- Catharanthus roseus (leaf extract - 10%), T_2-Curcuma longa (rhizome extract-5%) ,T_3- (Datura stramonium leaf extract-10%),T_4- Neem seed kernel extract (NSKE) (5%), T_5- Ocimum sanctum (leaf extract 10%), T_6- Vitex negundo (leaf extract,10%), T_7- Wettable sulphur (0.4%), T_8 - Control. The highly susceptible Thompson seedless, grapevine stem cuttings were raised in pots and maintained in glass house by regular, uniform and judicious watering. The 120 d old plants were inoculated with the conidial suspension (3x10 4 conidial/ ml) of *U. necator*. Necessary water congestion was given both 24 h prior to and after inoculation for maintaining saturated humid condition. After 24 h of inoculation, the above mentioned treatments were imposed by spraying. The wettable sulphur (0.4%) was used as the chemical control .The plant sprayed only with *U.necator* served as the control. The intensity of the disease was recorded 15 d later using score chart developed d by Singh *et al*. (1994). The results were expressed as perc ent disease reduction.

Efficacy plant extracts against grapevine powdery mildew in the field :

Based on the results obtained on the efficacy of plant extracts in pot culture, two promising medicinal plant extracts were selected and tested in the field. Field experiment was conducted with four treatments and five replications in Randomized Block Design to evaluate their efficacy against grapevine powdery mildew. The treatments comprised of T_1 – *C. roseus* (leaf extract, 10%) ,T_2-Neem seed kernel extract (5%), T_3- Wettable sulphur (0.4%) and T_4- Control. Spraying was given with all the above treatments on grapevine plants one month after pruning and immediately after the appearance of disease symptoms. Fifteen days after first spraying second spraying was given with all the treatments observation and disease incidence was recorded 15 d after second spraying by score chart already mentioned. Fruit yield was also recorded for all the treatments.

RESULTS AND DISCUSSION

Among the 15 plant extracts tested, NSKE (5%) recorded the minimum conidial germination of 24.75 per cent as against 88.4 per cent in the control, which accounted for the germination inhibition of 72.02 per cent (Table 1). The antifungal activity of neem products (azadiractchtin, nimbin , nimbidin) has been reported by several workers (Schmutterer, 1995) Govindachari *et al.,* 1998).The formulated product *viz.,* neemazal containing 62.5 PPM azadirachtin effectively reduced the conidial germination of *Sphaerotheca fuligena* on cucumber (Conventry and Allen 2001. Next to NSKE (5%) leaf extracts *O. sanctum* (10%), rhizome extract of *C.longa* (5%) and leaf extract of *C.roseus* (10%) were found to be effective which reduced the conidial germination by 69.10, 65.90 and 64.23 per cent, respectively. The leaf extract of *Aloe vera* (10%) gave highest conidial germination of 68.34 per cent and lowest germination inhibition of 22.72 per cent (Table 1).

Post inoculation (artificial) spraying of NSKE (5%) was significantly superior in reducing the disease incidence by recording only 36.86 per cent and with 60.21 per cent disease reduction as against 70.4 per cent in the control. Leaf extract of *C. roseus* and *O. sanctum* (10%) reduced the disease incidence by 40.50 and 42.2 per cent, respectively (Table 2). The neem products gave good control of powdery mildew infection on grapevine leaves, shoots and berries (Rey and Schlosser, 1994). Neem derivatives displayed several remarkable qualities because of the presence of array of highly sensitive chemicals *viz.*, azadiractin, meliantriol salanin, nimbidin and nimbicidin.

Two sprays of NSKE (5%) given on grapevine plants first spray, just at the appearance of disease and second at 15 d later effectively reduced (62.24%) the powdery mildew in the field. The same treatment recorded fruit yield of 11.81 t/ha as against 8.5 t/ha in control (Table 3). Neem seed kernel extract has low mammalian toxicity and relatively safe to non-target organisms. Consequently the use of neem based product is gaining acceptability as a novel environmentally sound product in both developing and industrial countries. Therefore, spraying NSKE (5%) is the effective eco-friendly method for the management of grapevine powdery mildew.

Table 1: *In vitro* assay of medicinal plant extract against conidial germination of grapevine powdery mildew pathogen *U.necator*

	Medicinal plant extract		*U.necator*	
Sr.No.	Common name	Botanical name	Conidial germination*	Germination inhibition (%)
1.	Vasambu(LE)	*Acorus calamus*	44.73(41.98)	49.44
2.	Adathodai (LE)	*Adhatoda vasica*	56.03(48.47)	36.67
3.	Vilvam(LE)	*Aegle marmelos*	60.63(51.15)	31.47
4.	Sothukathazhai (LE)	*Aloe vera*	68.34(55.79)	22.72
5.	Sitharathai (LE)	*Alpinia galanga*	36.33(37.07)	58.94
6.	Aduthinnapalai (LE)	*Arisolochia bracteolata*	53.27 (46.88)	39.79
7.	Neem(Seed kernel)	*Azadirachta indica*	24.75(29.80)	72.02
8.	Periwinkle (LE)	*Catharanthus roseus*	31.65(34.24)	64.23
7.	Vallarai (LE)	*Centella asiatica*	63.35(52.75)	28.39
8.	Omavalli (LE)	*Coleus aromaticus*	38.75(38.50)	56.20
9.	Turmeric(Rhizome)	*Curcuma longa*	30.17(33.30)	65.90
10.	Umathai (LE)	*Datura stramonium*	33.97(35.65)	61.60
11.	Thulasi (LE)	*Ocimum sanctum*	27.34(31.52)	69.10
12.	Keezhanelli (LE)	*Phyllanthus amarus*	35.73(36.71)	59.61
13.	Siriyanangai (LE)	*Polygala grinersis*	54.03(47.31)	38.92
14.	Notchi (LE)	*Vitex negundo*	33.55(35.40)	62.34
15.	Amukara (root)	*Withania somnifera*	40.07(39.27)	54.70
	C.D.(P = 0.05)		1.44	

LE- Leaf extract at 10 per cent Seed kernel, rhizome, root extract at 5 per cent
* Mean of three replications. Data in parentheses represent arc sine transformed values

Table 2 : Efficacy of medicinal plant extract against grapevine powdery mildew disease in pot culture under artificial inoculation

Sr. No.	Treatments	Per cent disease index (PDI)*	Disease reduction (%)
1.	*C. roseus* (LE 10%)	42.17(40.50)	53.17
2.	*C. longa* (rhizome extract 5%}	50.63(45.36)	44.01
3.	*D. stramonium* (LE 10%)	53.87(47.22)	40.43
4.	Neem seed kernel extract (5%)	35.98(36.86)	60.21
5.	*O. sanctum* (LE 10%)	45.07(42.2)	50.16
6.	*V. negundo* (LE 10%)	45.98(42.70)	49.15
7.	Wettable sulphur (0.4%)	21.67(27.74)	76.04
8.	Control	90.43(70.04)	
	C.D.(P= 0.05)	1.40	

LE- Leaf extract at 10 per cent * Mean of three replications Data in parentheses represent arc sine transformed values

Table 3 : Efficacy of medicinal plant extract against grapevine powdery mildew disease in the field

Sr. No.	Treatments	Per cent disease index (PDI)*	Disease reduction (%)	Yield t/ ha
1.	*C. roseus* (LE 10%)	41.37(40.03)	47.27	10.12
2.	Neem seed kernel extract (5%)	29.62(32.97)	62.24	11.81
3.	Wettable sulphur (0.4%)	21.46(27.29)	72.64	
4.	Control	78.45(62.34)	-	
	C.D.(P= 0.05)	2.55		0.57

* Mean of five replications LE- Leaf extract at 10 per cent Data in parentheses represent arc sine transformed values

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