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Activity of some essential oils against *Uncinula necator* causing powdery mildew of grapevine

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Powdery mildew of grapevine, caused by *Uncinula necator* (Schw.) Burn, is an important disease in the Punjab state. It reduces fruit quality and the yield. Many fungicides like sulphur, dinocap and triazole compounds have been used to control this disease but these chemicals especially site-specific systemic fungicides have several adverse effects such as development of resistant strains, environmental pollution and contamination of food etc. Antifungal activity of extracts of several plant species has been reported (4). Essential oils are a rich source of terpenoids which impart them antifungal and antibacterial properties (5,6). Although these plant based products are being tested on numerous pathogens but much work has not been done to study the effect of essential oils against powdery mildew diseases. The present study was undertaken to evaluate essential oils for their activity against *U. necator*.

Ten essential oils from different plants viz. *Eucalyptus camaldulensis, Cymbopogon citratus, Mentha piperita, Parthenium hysterophorus, Cyperus scariousus, Allium sativum, Cuminum cyminum, Clerodendron inerme, Callistemon lanceolatus* and *Anethum graveolens* prepared by steam distillation were obtained from the Department of Chemistry, for evaluating against *U. necator* by spore germination technique.

Healthy young leaves of grapevine cv. Perlette were washed with running tap water, air dried and treated with different concentrations (100, 200, 500 and 1000 µg/ml) of essential oils. Bayleton 25 WP (triadimefon 25%) and Karathane 48 EC (dinocap 48%) were used as standard fungicides. After drying for 30 minutes, leaf discs of 15mm diameter were cut from the treated leaves, with the help of a cork borer and placed (with treated surface upside) in petriplates containing water agar. Leaf discs from untreated leaves served as control. Ten discs were used for each treatment. After 6 h, dusting of conidia form young colonies of *U. necator* on infected leaves was done using settling tower technique (7) followed by incubation at 20±1°C with 16 h light. After 72 h of incubation, germinating conidia were detached from the leaf discs using a transparent adhesive (cello) tape and mounted on the glass slide after staining with lactophenol cotton blue. Conidial germination and germ tube length were recorded under microscope by observing atleast 50 conidia/disc. Germination inhibition and inhibition of germ tube were calculated by using the standard formula. The experiment was repeated once. The oils found effective in this assay were further tested on potted plants in growth chamber.

Grapevine plants of variety Perlette were raised in earthen pots (9" diameter) under pot house conditions. One year old plants were sprayed with *Allium sativum, Cyperus scariousus, Cuminum cyminum, Cymbopogon citratus* and *Eucalyptus camaldulensis* oils at two concentrations i.e. 1000 and 2000 µg/ml each (prepared by using water and Tween 80) using a plastic baby sprayer. Bayleton 25 WP was used as the standard fungicide at 250 and 500 µg/ml. After 6 h of spray, the plants were shifted to the growth room (20±1°C, 16 h light with fluorescent tubes) and inoculated by dusting conidia of *U. necator* uniformly (25-30 conidia/10 x 10x field) from the already infected and heavily sporulating leaves. Untreated plants

served as control. Three plants were used for each treatment. After 14 days of inoculations, observations on the leaf area covered by powdery mildew colonies were recorded on the basis of 0-5 rating scale (0=healthy, 1=1-10 per cent, 2=11-25 per cent, 3=26-50 per cent, 4=51-75 per cent and 5=more than 75 per cent leaf area infected). Thirty leaves were examined for each treatment. Per cent disease index (PDI) was calculated for each treatment by the standard formula.

In general, the essential oils evaluated against *U. necator in vitro* were observed to provide high level of efficacy against the pathogen even at lower doses (Table 1). Among ten essential oils tested, *Allium sativum* exhibited maximum efficacy providing complete inhibition of conidial germination at 100 µg/ml and above followed by *Cyperus scariousus* and *Cuminum cyminum* which gave complete inhibition of conidial germination and germ tube elongation at 100 and 500 µg/ml concentrations, respectively. The oils of *Eucalyptus camaldulensis* and *Cymbopogon citratus* also showed considerable efficacy as complete inhibition of conidial germination and germ tube elongation was observed at 1000 µg/ml. The oil of *Callistemon lanceolatus* appeared next in order of efficacy where 98% and 92.74% inhibition of conidial germination and germ tube elongation, respectively, was recorded at 1000 µg/ml. It was followed closely by *Mentha piperita*. The oil of *Parthenium hysterophorus* exhibited 82.06% inhibition of germination and 70.96% inhibition of germ tube length at 1000 µg/ml. Rest of the oils viz. *Anethum graveolens* and *Clerodendron inerme* showed moderate efficacy. Lemon grass, clove and clocimum oils have been reported to provide cent per cent inhibition of conidial germination at the lowest concentration of 250 µg/ml tested against powdery mildew (*Erysiphe polygoni*) of opium poppy (2). The standard fungicide Karathane 48 EC was able to inhibit spore germination and germ tube elongation completely at 100 µg/ml whereas in case of Bayleton 25 WP, although not much influence on conidial germination was observed but no germ tube elongation was recorded at any of the concentration tested after initial germination.

Oils of *Allium sativum, Cyperus scariousus, Cuminum cyminum, Cymbopogon citratus* and *Eucalyptus camaldulensis* exhibiting highly

Table 1. Effect of essential oils on conidial germination and germ tube elongation in *Uncinula necator* following leaf disc inoculation method

Treatments	% Inhibition of conidial germination/Conc (µg/ml)				% Inhibition of conidial germ tube length/Conc. (µg/ml)			
	100	200	500	1000	100	200	500	1000
Eucalyptus camaldulensis	22.0	56.6	90.7	100.0	25.0	50.3	71.8	100.0
Anethum graveolens	38.1	43.1	44.3	69.9	18.4	31.2	39.5	53.6
Cymbopogon citratus	88.9	90.1	94.7	100.0	89.8	93.2	95.4	100.0
Mentha piperita	3.4	9.5	52.8	86.1	22.5	40.3	59.5	78.8
Parthenium hysterophorus	27.4	49.5	52.7	82.0	19.8	40.5	56.1	70.9
Cyperus scariousus	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Callistemon lanceolatus	32.7	61.1	86.1	98.0	51.9	61.0	67.3	92.7
Allium sativum	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cuminum cyminum	96.6	98.5	100.0	100.0	91.4	92.6	100.0	100.0
Clerodendron inerme	23.9	48.5	60.7	70.5	29.4	43.2	55.5	66.9
Bayleton 25 WP	49.7	49.7	50.8	54.1	95.3	95.3	95.3	95.3
Karathane 48 EC	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
CD (p=0.05)								
Essential oils			1.64				1.40	
Concentrations			0.94				0.81	
Interaction			3.29				2.80	

Data are based on mean of three replications

promising activity against *Uncinula necator* in the laboratory, were further tested against grapevine powdery mildew on potted plants. It is evident from the data that no powdery mildew symptoms appeared at any of the concentrations (1000, 2000 µg/ml) of the 5 essential oils tested indicating their high efficacy against grapevine powdery mildew. PDI of 56.5 was observed in the untreated plants. Unrefined cotton seed oil applied at rate of 0.5-2% has been reported to provide 81-93% efficiency against powdery mildew of ornamental roses in green house in Bulgaria(3). Likewise, Olive oil and rapeseed oil significantly reduced the incidence of powdery mildew (*Sphaerotheca fuligenea*) on squash in New Zealand (1). Bayleton 25 WP, the standard fungicide used in the present study, also provided complete control of this powdery mildew at concentration of 250 and 500 µg/ml. The oils provided highly promising control of powdery mildew of grapevine which could be due to the ectoparasitic nature of the pathogen.

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