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ANTIFUNGAL PROPERTIES OF PLANT LEAF DECOCTIONS AGAINST LEAF RUST OF WHEAT

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Abstract

Leaf decoctions of 16 phanerogams were tested against leaf rust of wheat. Decoctions of *Acacia nilotica*, *Calatropis procera*, *Datura stramonium*, *Dodonaea viscosa* and *Rhazya stricta* effectively controlled the rust on detached leaves of wheat whereas *Cassia senna* enhanced germination of urediniospores.

Introduction

Many plants are poisonous and a great number of plants are used by herbal experts to cure human and animal diseases. Keeping in view these properties of plants research workers have been attracted to find safe and cheap control of plant diseases using extracts of different plant parts (Misra & Dixit, 1977; Charya *et al.*, 1979; Kumar *et al*, 1979; Awasthi & Mukerjee, 1980; Kapoor *et al.*, 1981; Rahber-Bhatti, 1986). Experiments were carried out to study the control of leaf rust of wheat (*Puccinia recondita* f.sp. *tritici*) with plant products for minimizing health hazards by the use of chemical fungicides.

Materials and Methods

Decoction: Leaves of the plants (Table 1) were collected in the morning, dried at 25-30°C and crushed. Powdered leaves at 0.5, 1.0 and 1.5 gl^{-1} were separately added to distilled water in conical flasks, autoclaved for 15 min and filtered through Whatman No. 1 filter paper followed by Millipore filter (pore size 0.22 µm) before use.

Host and parasite: Seeds of Mexi-Pak wheat were sown in clay pots at 20°C under continuous illumination of 2000 Lux. From seedlings in 3 leaf stage, fully expanded lower 2 leaves were detached, cut into 15 mm portions, placed in Petri dishes (5 pieces/dish) containing water-saturated cotton wool which were then inoculated with unrediniospore suspension (5×10^4 spores ml^{-1}) of *Puccinia recondita* f.sp. *tritici* following the techniques described by Rahber-Bhatti & Shattock (1980). Inoculated plates were sealed with adhesive tape and incubated at 20°C under constant illumination of 2000 Lux. The fungus was thus maintained by serial subcultures after every fortnight.

Urediniospore germination: In each concentration of leaf decoction, 1% agar was added which was dissolved by heating in water bath containing boiling water and poured

in Petri dishes. The dishes were inoculated with urediniospores and incubated at 20°C under 24 h darkness keeping 5 replicates of each treatment. Urediniospore germination was recorded after 24 h following the techniques described by Shattock & Rahber-Bhatti (1983) which was transformed into inhibition percentage by the following formula:

$$\text{Inhibition } \% = \left(1 - \frac{\text{Germination on decoction}}{\text{Germination on control}}\right) \times 100$$

If any decoction exhibited 100% inhibition at the dilution of 0.5 gl^{-1}, its further lower concentrations (0.25, 0.125 and 0.0625 gl^{-1}) were also tested. The ED50 and ED90 values were calculated by probit analysis.

Detached leaves: Plants with low ED50 and ED90 values were selected for rust control on detached leaves of wheat. One dilution (1 gl^{-1}) of each leaf decoction was separately prepared and used against the infection of *P. recondita* f.sp. *tritici*. To test protective effect of the decoctions the leaf segments were dipped for 5 min in decoction and placed 5 per Petri dish on water-saturated cotton wool. Control leaf portions were dipped in distilled water for the same time. Leaf segments were then inoculated with spore suspension of the rust. The plates were then sealed with adhesive tape and 5 Petri dishes of each treatment and control were incubated at 20°C under constant illumination of 2000 Lux.

To test curative effect of the same leaf decoctions, detached leaf portions of wheat were first set up in Petri dishes containing water-saturated cotton wool, inoculated similarly and incubated under the same conditions. Three days after inoculation 25 leaf portions were separately dipped in each leaf decoction for 5 min and returned to the same Petri dishes. Control leaf segments were dipped in distilled water. Five plates (5 leaf portions in each) of each treatment and control were sealed with adhesive tape and incubated under the same conditions.

Petri dishes of both experiments were observed under the microscope 15 days after inoculation. Following the techniques of Shattock & Rahber-Bhatti (1983) the mean number of uredinia per microscope field (x 10) in each treatment was calculated by observing 5 random fields on each leaf segment.

Results

Urediniospore germination: Cassia senna showed enhanced germination of urediniospores whereas all other leaf decoctions reduced urediniospore germination of *P. recondita* f.sp. *tritici*. ED50 and ED90 values of *Datura stramonium* were lowest among all the plants tested. ED50 and ED90 values of *Acacia nilotica, Calotropis procera, Dodonaea viscosa* and *Rhazya stricta* were very low as compared with other plants (Table 1).

Table 1. Inhibition of urediniospore germination of *Puccinia recondita* f.sp. *tritici* in 1% tap water agar containing leaf decoctions of different plants (ED50 and ED90 values calculated by probit analysis).

PLANTS			
English Name	Latin Name	ED50 (gl^{-1})	ED90 (gl^{-1})
Indian mallow	*Abutilan indicum* Linn.	0.50	0.90
Gum tree	*Acacia nilotica* (Linn.) Delile.	0.30	0.54
Neem	*Azadirachta indica* (L.) A. Juss.	0.53	0.96
Fever nut	*Caesalpinia bonduc* (L.) Roxb.	1.01	1.60
Indian laburnum	*Cassia fistula* Linn.	1.21	2.18
Senna	*Cassia senna* L.	*	*
Swallow-wart	*Calotropis procera* R. Br.	0.33	0.60
Jimson weed	*Datura stramonium* L.	0.29	0.52
Dodonaea	*Dodonaea viscosa* (L.) Jacq.	0.29	0.53
Henna	*Lawsonia inermis* L.	0.55	0.98
Drek or Persian lilac	*Melia azedarach* L.	0.78	1.41
Indian cork tree	*Millingtonia hortensis* Linn.	0.72	1.30
Indian oleander	*Nerium oleander* L.	0.54	0.88
Prickly clover	*Fagonia arabica* L.	0.90	1.63
(Not known)	*Rhazya stricta* Dcne.	0.41	0.73
Tamarind	*Tamarindus indica* L.	0.75	1.34

*Slightly enhanced urediniospore germination.

Detached leaves: Decoctions of $1gl^{-1}$ powder of leaves of *A. nilotica, C. procera, D. stramonium, D. viscosa* and *R. stricta* showed significant ($P < 0.001$) effect on reducing sporulation of *P. recondita* f.sp. *tritici* on detached leaf segments of wheat. *A. nilotica, C. procera* and *R. stricta* were highly effective as protectant and therapeutant against the rust. Protective application of *D. viscosa* completely checked the rust infection but decoction of the same plant failed to show similar effect when applied 3 days after inoculation. *D. stramonium* was least effective against rust infection on detached wheat leaf segments (Table 2).

Discussion

Decoctions of dry leaves have been used for the first time againt leaf rust of wheat. Leaves of 15 plants tested inhibited urediniospore germination, when *Cassia senna* showed enhanced spore germination of *P. recondita* f.sp. *tritici*. Sathe & Rahalkar (1975) used extracts of 7 plants against spore germination of leaf rust of wheat. There are reports of inhibition of spore germination of *Botryodiplodia theobromae* (Manoharachary &

Table 2. Effect of leaf decoctions (1 gl^{-1}) on the infection of leaf segments of wheat by *Puccinia recondita* f.sp. *tritici*.

Treatment	Mean number of uredinia per microscope field (x 10) on detached leaf segments	
	Protective[a]	Curative[b]
Acacia nilotica (Linn.) Delile.	0	0
Calotropis procera R. Br.	0	0
Datura stramonium L.	5	11.3
Dodonaea viscosa (L.) Jacq.	0	15
Rhazya stricta Dcne.	0	0
Control (water-treated)	60	68.4

[a]Decoction applied to leaf segments before inoculation with urediniospores.
[b]Decoction applied to leaf segments 3 days after inoculation with urediniospores.
All decoction treatments significantly different from control at $P < 0.001$.

Reddy, 1978), *Ustilago tritici*, *U. hordei* (Misra & Dixit, 1979) and *in vitro* growth of *Rhizoctonia solani* and *Sclerotium oryzae* (Naidu & John, 1981). The present and previous studies show that different parts of *Azadirachta indica* and *Lawsonia inermis* possess antifungal activity (Charya *et al.*, 1979; Singh & Singh, 1981). Use of leaf decoctions on inhibition of rust infection on wheat leaf segments (Table 2) supports the results of other workers when extracts of *Datura stramonium* and other plants completely controlled rice blast (Lapis & Dumancas, 1979), sugarcane mosaic (Shukla & Joshi, 1980) and bunt of wheat (Singh *et al.*, 1980) under field conditions.

These results and the findings of Rahber-Bhatti (1986) show that plant extracts, diffusates and decoctions could be used to control plant diseases as they reduce susceptibility or increase resistance of treated plants (Verma & Awasthi, 1979; Roychoudhury, 1980).

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