

Effect of Some Fungicides on *Rhizoctonia solani* causing Damping-off of Groundnut

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Fourteen systemic fungicides were fungistatic to *Rhizoctonia solani* growth in culture to a variable extent. Bavistin, Plantvax, Brassicol, Busan and Calixin completely controlled pre-emergence damping-off when the groundnut seeds were soaked in fungicidal solutions (250 µg/ml) and sown in *R. solani*-infested soil. Bavistin and Brassicol protected the transplanted seedlings from hypocotyl infection by *R. solani*.

Key Words: Fungicides, *Rhizoctonia solani*, Damping-off, Groundnut

Introduction

Damping-off (pre- and post-emergence) caused by *Rhizoctonia solani* Kühn is one of the important diseases of groundnut in almost all groundnut growing areas of the world. In view of regular occurrence of the disease and non-availability of resistant varieties, treatment with chemicals appears to be the method of choice for controlling this disease. The efficacy of certain fungicides on the growth of the pathogen in culture and on the control of damping-off, is reported here.

Materials and Methods

A highly virulent strain of the fungus (isolate FR) causing pre- and post-emergence

damping-off was isolated from groundnut (*Arachis hypogaea* L.). The growth of this isolate in Czapek-Dox agar medium incorporated with Bavistin WP, Vitavax 75% WP, Plantvax, Benlate, Difolatan 80 WP, Brassicol 75% WP, Kitazin 48% E. C., Busan 30A, Cuman-L, Captan, Agrosan GN, Cercobin M (Methyl thiphanate), Calixin (Tridemorph) or Sapro (Triforine) individually was determined in terms of colony diameter.

The systemic fungicides, Bavistin, Busan, Vitavax, Plantvax, Benlate and Difolatan were used in concentrations of 1,2,3,4 and 5 µg/ml and the remaining fungicides at 5,10,25,50,75 and 100 µg/ml. These concentrations were selected on the basis of results

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obtained in a preliminary trial. The fungicides were added to the sterilised medium just prior to its transfer to petridishes. Each plate was inoculated with a 2 mm mycelial disc cut from the periphery of a 2-day old culture of the isolate. Five replicate plates were inoculated for each treatment and five plates for control, which consisted of the basal medium without any fungicide. The mean colony diameter was recorded after 72 hr incubation at room temperature (25–30°C).

The effectiveness of different fungicides for the control of pre-emergence damping-off was evaluated by soaking seeds for 24 hr in 250 µg/ml concentration suspension of the respective chemical and then sowing them in pots containing *R. solani*-infested soil (10% of oatmeal-sand culture mixed in the soil). Twenty seeds were used for each

treatment and percentage of germination was recorded. For post-emergence damping-off control, the roots of one week old seedlings were immersed in respective fungicide solutions for 24 hr and then transplanted into pots containing *R. solani*-infested soil. Twenty five seedlings were used for each treatment. Suitable controls were set up using uninfested soil.

Results

The linear growth of the pathogen was considerably reduced by the fungicide and the degree of inhibition was directly related to increased chemical concentration in the medium (table 1). Total inhibition was noticed at concentrations as low as 5 µg/ml in Bavistin and Busan, at 25 µg/ml in Benlate, at 50 µg/ml in Calixin and Sapro

Table 1 *Linear growth of R. solani (colony diameter in mm ±) in the presence of fungicides (Control with no fungicidal treatment being 112 mm)*

Fungicide	Concentration (µg/ml) of fungicide									
	1	2	3	4	5	10	25	50	75	100
Bavistin	26	17	0	0	0					
Busan	5	5	3	2	0					
Vitavax					9	7	6	5	3	0
Plantvax					13	9	8	7	5	0
Benlate					10	1	0	0	0	0
Difolatan					14	9	7	5	3	0
Brassicol					55	48	46	43	31	17
Kitazin					82	69	58	36	18	2
Cuman-L					68	66	55	46	37	24
Captan					65	48	35	18	11	0
Agrosan					87	63	57	42	30	0
Cercobin M					87	71	58	30	26	21
Calixin					22	14	4	0	0	0
Sapro					91	87	69	0	0	0

*Each figure is an average of 5 replicates

0=No growth

and at 100 µg/ml for several others. Brassicol, Kitazin, Cuman-L and Cercobin M did not cause total inhibition even at this concentration.

Bavistin, Plantvax, Brassicol, Busan and Calixin completely controlled pre-emergence damping-off and all the seeds germinated and emerged and no hypocotyl lesions were observed even in post-emergence stage. The remaining chemicals also controlled the pre-emergence damping-off to a great extent but some of the seedlings in post-emergence phase showed lesions on the hypocotyls (table 2). In the untreated pots there was no

germination at all and all the seeds were found to have rotted.

Experiments on the control of post-emergence damping-off revealed that Brassicol completely protected the transplanted seedlings from hypocotyl infection by *R. solani*. Eighty percent of seedlings escaped lesion development in treatments with Vitavax, Cuman-L and Cercobin M (table 3). Some of the fungicide treated seedlings showed lesion development at later stages. All the untreated seedlings showed typical *R. solani* lesion.

Discussion

The results show that almost all the systemic fungicides have *in vitro* toxicity to the pathogen but the effectiveness varied. Bavistin and Busan were most effective in their *in vitro* action on the pathogen and in controlling pre-emergence damping-off.

The ability to enter and be translocated in plant tissue from the point of application is a desirable property of systemic fungicides and their use is definitely advantageous where soil borne pathogens are to be controlled. Seed treatment with such chemicals is well documented (Sinclair 1974). Uptake and translocation of systemic fungicides by seeds (Allam et al. 1969; Ellis et al., 1976) and by seedlings (Gray & Sinclair, 1970; Kirkpatrick & Sinclair, 1976) and control of several diseases have been well established.

The *in vitro* fungitoxic activity of the fungicides and their ability to protect seeds and seedlings from infection indicates that the systemic fungicides employed are taken up by the plant material. Control of pre-emergence and post-emergence damping-off indicated that the germinating seedlings were protected from attack by the pathogen and the chemicals acted as systemic ones. The inconsistency of some of the fungicides,

Table 2 Effect of soaking seeds (for 24 hr in 250 µg/ml solution) on germination and damping-off in *R. solani*-infested soil (10% oatmeal culture)

Chemical used for seed soaking	No. of seeds germinated* (out of 20)	No. of seedlings showing post-emergence damping-off
Inoculated		
Control (no fungicidal treatment)	0	0
Bavistin	20	0
Vitavax	20	8
Plantvax	20	0
Benlate	20	5
Difolatan	15	5
Brassiccol	20	0
Kitazin	15	10
Busan	20	0
Cuman-L	10	5
Agrosan	15	5
Cercobin M	20	5
Calixin	20	0
Saprol	20	15
Captan	15	12

*Each figure is an average of two separate experiments

Table 3 Seedlings (drenched for 24 hr with fungicide) transplanted into *R. soilni*-infested soil showing post-emergence damping-off*

Chemical used for root drench	Time of lesion appearance (in days)					
	2	3	4	6	8	10
Control (no fungicidal treatment)	25	0	0	0	0	0
Bavistin	0	0	0	0	0	0
Vitavax	0	0	0	0	5	5
Plantvax	0	0	0	0	15	15
Benlate	0	0	0	10	15	15
Difolatan	0	10	15	15	20	20
Brassicol	0	0	0	0	0	0
Kitazin	0	0	10	10	15	15
Busan	0	15	25	0	0	0
Cuman-L	0	0	0	0	5	5
Captan	0	10	15	15	15	15
Agrosan	0	0	20	22	22	22
Cercobin M	0	0	5	5	5	5
Calixin	0	0	15	20	20	20
Saprol	0	5	10	15	15	15

*Each figure is an average of two separate experiments employing 25 seedlings for each treatment
0=no disease

viz., Plantvax, Busan and Calixin in total control of pre-emergence damping-off but failure in post-emergence phase is not properly understood.

Some of the fungicides which were effective at early stages but allowing the disease to occur at a later stage may be due to several reasons like the breakdown of toxic compounds to non-toxic compounds, due to dilution of the fungitoxicants below the level needed for control as the plants grow the accumulation of fungitoxicants in tissues away from the point of inoculation or any combination of these factors, as suggested by Kirkpatrick and Sinclair (1976). The effect of Bavistin and Brassicol on total

disease remission may be due to the persistence of the toxicants in the plant.

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