

EFFECT OF COLCHICINE ON THE SEEDLING BLIGHT OF JUTE AND ITS CAUSATIVE AGENT *MACROPHOMINA* *PHASEOLI*

By

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While inducing polyploidy in jute seedlings, raised in jute field soil, a high rate of damping off was observed within 12-14 hours after colchicine treatment. The causative agent was isolated and identified as *Macrophomina phaseoli* (Maubl.) Ashby.

Isolated pycnidiospores and sclerotia were treated with different concentrations of aqueous colchicine solution, soil extract, soil extract+colchicine (1:1 v/v) and distilled water. Low concentration colchicine (0.02%) produced maximum stimulation of germination and subsequent growth of pycnidiospores and sclerotia. When jute seedlings were raised in sterile jute field soil, no damping off was observed even in the colchicine treated plants.

INTRODUCTION

While inducing polyploidy in selected strains of jute (*Corchorus olitorius* L. and *C. capsularis* L.) with colchicine, a high rate of mortality (damping off) was observed in the treated seedlings. The causative agent was isolated from the diseased seedlings and identified as *Microphomina phaseoli* (Maubl.) Ashby (Ashby, 1927).

The properties of colchicine in causing meiotic abnormalities, changes in growth and biochemical behaviour are well known in higher plants and fungi (Dustin *et al.*, 1937; Blakeslee, 1938; Eigsti and Dustin, 1947, 1949; Beneke and Wilson, 1950). Richards (1938) observed stimulated growth in yeast and Gordon and McKechnie (1945) attributed increase in penicillin-yield to chromosomal aberrations as a result of colchicine treatment. Rai and Sinha (1963) recorded increase in growth and sporulation of *Alternaria tenuis* Nees ex. pers. due to colchicine application. Singh (1966) observed increased growth and sporulation in *Colletotrichum falcatum* as also an increase in the number of chlamydospores produced.

The present paper deals with the effect of different concentrations of colchicine on germination of pycnidiospores and sclerotia of *M. phaseoli* and suggests measures for avoiding damping off of jute seedlings in seed trays.

MATERIALS AND METHODS

Fifty second generation seeds from selected lines (X and Gamma-rays irradiated) of different jute varieties, viz., JRO-632, D-154, JRC-212 and CG were germinated on seed trays with jute field soil and sterile soil respectively in duplicate. Just prior to emergence of the first leaf, 0.2% aqueous solution of colchicine was applied to the seedling tips using soaked cotton method (Dutta, 1963 ; Singh, 1968).

The effects of colchicine on the germination of pycnidiospores and sclerotia were studied in grooved slides with aqueous colchicine concentrations of 0.02, 0.2, 0.5, and 1.0% soil extract+0.2% colchicine and distilled water respectively. The pycnidiospores and sclerotia were separated and suspended in water so as to contain 50 spores and 6 sclerotia per ml respectively. The per cent germination of spores and sclerotia and the length of the germ tube was recorded at different intervals of time.

RESULTS AND DISCUSSION

The per cent germination of different lines of jute seeds and their mortality on treatment with colchicine in jute field and sterile soil respectively are presented in Table 1. Mortality was observed normally within 12 to 24 hrs. following treatment. A high rate of mortality in jute-field soil was observed. No damping off was observed in sterile soil. In general, it appeared that irradiated lines were slightly more susceptible to damping off than the non-irradiated controls but there is no apparent difference between the irradiated varieties.

The pathogen isolated from the dead plants and the jute field soil was identified as *Macrophomina phaseoli* on the basis of mycelial characters and size of sclerotia (60 to 110 μ , mostly 100 μ , densely knotted, brown to black in colour) in PDA media. It appeared that pycnidiospores and sclerotia present in jute-field were stimulated to germinate by colchicine application, to the tips of seedlings, part of which drips to the soil.

Effect of colchicine on the germination of pycnidiospores and sclerotia of *M. phaseoli* was then investigated to corroborate the conclusion that damping off of jute seedlings in seed trays is due to stimulation of germination. Pycnidiospores were collected from jute plants affected with stem-rot, known to be caused by *M. phaseoli*. The results are presented in Tables 2 and 3. During a three hour period, low concentration of colchicine (0.02%) stimulated more vigorous germination of pycnidiospores (Table 2) and growth of hyphae than higher con-

centrations (1.0%). Again, while in low concentrations the germination is monopolar, bipolar and sometimes lateral, with higher concentrations the germination is more and more of a monopolar type. Branching habit of the growing hyphae is also more vigorous in lower concentrations.

Table 1. Percentage mortality of jute seedlings treated with 0.2% colchicine in jute field and sterile soil.*

Var./Treatment	Selection Number	Field soil		Sterile soil	
		% germination	% mortality**	% germination	% mortality
CG	Control	81	87.2	80	0.0
CG 50 KR Gamma ray	323	71	96.2	73	0.0
CG 50 KR X-ray	352	76	100.0	73	0.0
-do-	354	66	90.0	73	0.0
CG 70 KR X-ray	386	52	96.6	51	0.0
JRO 632	Control	76	89.8	84	0.0
JRO 30 Kr Gamma ray	113	44	90.0	56	0.0
JRO 50 Kr Gamma ray	128	32	100.0	49	0.0
JRO 90 Kr Gamma ray	142	51	100.0	44	0.0
JRO 50 Kr X-ray		44	83.4	42	0.0
JRC-212	Control	67	85.8	78	0.0
JRC 50 Kr Gamma ray	224	54	83.4	60	0.0
-do-	267	50	100.0	45	0.0
JRC 30 Kr Gamma ray	268	47	92.4	57	0.0
JRC 70 Kr Gamma ray	472	63	85.3	66	0.0
D 154	Control	74	84.3	85	0.0
D 50 Kr Gamma ray	21	67	100.0	66	0.0
D 70 Kr Gamma ray	34	65	91.2	74	0.0
D 90 Kr Gamma ray	39	56	100.0	59	0.0
D 100 Kr Gamma ray	42	48	95.7	52	0.0

* The results are an average of two replicates of 50 seeds each.

** % Mortality of germinated seeds after colchicine treatment.

Table 2. *Effect of different concentrations of colchicine on the germination of pycnidiospores with time.*

Treatment (% colchicine)	Period of treatment						Remarks
	One hour		Three hour		Five hour		
	%ger- mina- tion	g.t. len- gth	%ger- mina- tion	g.t. len- gth	%ger- mina- tion	g.t. len- gth	
1.0	6	1	32	31.5	32	63.0	Polar germination ; g.t. not branched.
0.5	0	0	60	73.5	80	136.5	Mostly polar, few bipolar germination ; g.t. not branched.
0.2	0	0	80	126.0	82	178.5	Germination bipolar ; a few lateral ; branching scanty.
0.02	40	1	86	157.5	100	252.0	All types of germination ; vigorous branched growth of mycelium from g.t.
Soil Extract.	0	0	50	94.5	58	157.5	Mono — and bipolar germination ; g.t. show few branches.
Soil Extract *0.2% colchicine	0	0	80	105.0	80	241.5	Mostly polar germination ; profuse growth of mycelium from g.t.
Distilled water	0	0	0	0.0	20	42.0	Both mono — and bipolar germination ; a few g.t. show branching.

* Each observation on 50 spores and the data is an average of three such observations.

Abbreviations : I—initiation of germination ; g.t.—germ tube.

The effect of colchicine on the germination of sclerotia (Table 3), indicates a pattern similar to that observed on pycnidiospores. Low concentrations of colchicine stimulate vigorous germination of sclerotia in 24 hrs., while higher concentrations, in fact, have a depressing effect. Initiation of germination is also much earlier (3 hrs.) with lower concentrations of colchicine. Branching habit of the expanding sclerotia is also stimulated by lower concentrations of colchicine.

Table 3. *Effect of different concentrations of colchicine on the germination of sclerotia with time.**

Treatments	Period of Treatment				Remarks
	1 hr.	3 hrs.	5 hrs.	24 hrs.	
	No. of germinated sclerotia				
1% colchicine	—	—	—	—	
0.5% colchicine	—	—	—	—	
0.2% colchicine	—	—	3	6	Hyphæ slow in growth. Mycelium grows rapidly after five hours.
0.02% colchicine	—	6(1)	6		
Soil extract	—	—	1(1)	1	Hyphæ not branched.
Soil extract + 0.2% colchicine (1 : 1)	6(1)	6	6		Profuse branching and rapid growth after 3 hrs.
Distilled water	—	—	—	2(1)	

* Each observation on six sclerotia and data is an average of three such observations.

Abbreviations used: I—Initiation of germination.

In general, it is observed that low concentrations of colchicine, 0.02 to 0.1%, under the experimental conditions, stimulate early germination and rapid growth of germinated pycnidiospores and sclerotia. The vigorous damping off caused in seed trays to jute seedlings treated with 0.2% colchicine is because the colchicine was carried in the soil to the pycnidiospores and sclerotia in a much diluted form. Such damping off in seed trays may be prevented by sterilising the soil.

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* Originals not consulted.

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