

Black Pepper as a Grain Protectant

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Ground black pepper and its crude extract were found to be good surface protectants of rice and greengram against the attack by rice moth and cowpea weevil for 4 months. Crude extract was highly toxic to the rice moth, rice weevil, lesser grain borer, red flower beetle and cowpea weevil at higher concentrations when applied topically.

Black pepper (the dried unripe fruit of *Piper nigrum*), a widely used spice in the tropical countries, is known to be a toxicant to house fly (Harwill et al., 1943; Synerholm et al., 1945), a repellent to corn earworm (Freeborn and Wymore, 1929), a protectant of yellow eyebeans (Lathrop and Keirstead, 1946) and a synergist of pyrethrins (Nakayama, 1955). Su (1977) reported the toxic nature of black pepper to rice weevil, *Sitophilus oryzae* (L.) and cowpea weevil, *Callosobruchus maculatus* (F.). In this paper, the results of laboratory studies on the toxicity of black pepper to some pests of stored products are presented.

MATERIAL AND METHODS

Black pepper powder and its crude extracts were prepared as per the method described by Su (1977). Grains of maize, cholam, green gram and unhusked paddy were used to test the toxicity of black pepper to the adults of rice weevil, *Sitophilus oryzae* (L.),

red flour beetle, *Tribolium castaneum* (Herbst), cowpea weevil, *Callosobruchus chinensis* (L.) and lesser grain borer, *Rhizopertha dominica* (F.) and larvae of rice moth, *Corcyra cephalonica* Staint. Black pepper powder and crude pepper extract in acetone were applied separately to the above grains in glass jars at 5000, 2500, 1250, 625 and 500 ppm. Ten pairs of adults of rice weevil, lesser grain borer, cowpea weevil and red flour beetle and 100 larvae of rice moth were introduced at monthly intervals and the mortality counted after 72 hr. The insects alive at the end of 72 hr. were removed and the jars examined daily for F1 emergence. The experiment was replicated thrice with untreated and acetone treated hosts serving as controls.

The necessary amount of crude pepper extract was dissolved in acetone to get the desired concentrations for treating the insects. Insects anaesthetised with CO_2 were treated with 0.5 ml of

TABLE I Effect of surface treatment of seeds with ground black pepper powder and crude black pepper extract on different stored product pests.

Host	Dosage (ppm)	% Mortality after treatment												Period before 1st emergence F1 progeny (days)
		GROUND BLACK PEPPER				CRUDE BLACK PEPPER EXTRACT				CRUDE BLACK PEPPER EXTRACT				
		Post treatment period (Months)				Post treatment period months				Post treatment period months				
		1	2	3	4	1	2	3	4	1	2	3	4	
		Rice Moth												
SORGHUM	5000	100.0	92.0	71.0	41.5	147	100.0	93.5	81.5	59.5	148			
	2500	100.0	90.0	59.5	38.0	140	100.0	88.5	69.5	52.5	145			
	1250	100.0	70.5	42.5	11.0	95	100.0	72.5	57.5	19.0	95			
	625	72.5	55.0	17.0	7.5	82	82.5	67.5	22.0	11.5	79			
500	67.5	29.5	15.0	0.0	48	61.5	38.5	21.5	7.5	50				
		Lesser Grain Borer												
PADDY	5000	100.0	90.0	72.0	47.5	97	100.0	89.5	65.0	47.5	92			
	2500	100.0	87.5	52.5	38.5	95	100.0	84.5	57.5	44.0	94			
	1250	100.0	80.5	42.0	31.5	92	100.0	89.0	50.0	42.5	92			
	625	95.5	72.5	37.5	22.0	68	96.0	79.5	48.5	31.5	72			
500	67.5	51.0	28.5	12.0	62	63.5	57.0	41.0	30.0	68				
		Red Flour Beetle												
SORGHUM	5000	100.0	91.0	72.0	57.0	125	100.0	92.0	77.0	51.0	132			
	2500	100.0	82.0	67.0	32.5	120	100.0	91.5	71.5	47.5	120			
	1250	88.0	52.5	31.0	17.5	75	98.0	59.5	37.0	22.5	68			
	625	67.5	41.0	22.0	11.5	75	56.0	43.0	19.0	12.5	74			
500	48.5	38.5	9.0	0.0	62	51.5	42.5	17.5	8.5	65				
		Rice Weevil												
MAIZE	5000	100.0	72.0	27.0	6.5	67	100.0	68.5	31.0	14.0	68			
	2500	52.0	32.0	23.0	5.0	55	55.0	41.0	28.0	11.5	62			
	1250	27.0	11.0	0.0	—	42	31.0	22.5	17.5	10.5	55			
	625	11.5	0.0	—	—	37	12.5	6.5	0.0	—	42			
500	5.0	0.0	—	—	32	7.0	0.0	—	—	35				
		Cowpea Weevil												
GREENGRAM	5000	98.0	100.0	67.0	52.0	162	100.0	91.5	72.5	64.0	155			
	2500	100.0	87.0	67.5	50.0	160	100.0	90.5	58.5	52.5	161			
	1250	97.0	92.0	54.5	42.5	142	93.5	82.5	52.5	50.5	145			
	625	88.0	64.5	41.5	27.5	130	78.5	64.5	41.5	36.5	140			
500	62.0	57.5	17.5	11.0	82	67.5	51.5	21.5	12.0	87				
Control Untreated		—	—	—	—	32	acetona treated	—	—	38				

TABLE II Influence of topical application of crude black pepper extract on some stored product pests.

Dosage (μ g/insect)	Average % Mortality (Days)																				
	Corcyra			Rhizopertha			Tribolium			Sitophilus			Callosobruchus								
	3	5	7	3	5	7	3	5	7	3	5	7	3	5	7						
50	100	—	—	100	—	—	92	94	100	100	—	—	100	—	—						
25	100	—	—	100	—	—	80	95	100	98	100	—	100	—	—						
12.5	90	92	92	100	—	—	85	83	90	100	—	—	97	100	—						
6.25	90	90	90	90	92	92	72	75	75	95	97	100	97	97	100						
5.0	70	72	75	84	83	88	42	45	52	88	90	100	90	92	95						
2.5	62	65	65	62	62	62	32	35	35	72	75	78	60	60	62						
1.0	48	50	55	57	53	60	15	15	19	52	55	55	42	42	45						
Control (Acetone treated)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—						

the solution with a microsyringe applicator (C.S.I.R. Laboratory, Jammu-Tawi). Insects treated with solvent alone served as control. Each treatment consisted of 100 insects and the treated insects were confined to 200 mm petridishes with host grains. The dishes were examined for dead insects every 24 hr for 7 days.

RESULTS AND DISCUSSION

The surface protectant property of the black pepper is set out in Table I. Even at the lowest concentration (500 ppm) both the ground black pepper the crude pepper extract were toxic to the insects tested. However, at concentrations less than 2500 ppm rice weevil was not affected. Overall, the ground black pepper and the pepper extract at 5000 and 2500 ppm afforded absolute protection to the seeds for the first 2 months and thereafter, their effectiveness decreased to varying degrees. However, at 5000 ppm concentration the residue effectiveness was observed nearly upto 4 months in sorghum and greengram affording protection to grains for about 145 days against the rice moth and cowpea weevils. It is possible that the high mortality of insects exposed to higher concentrations of ground black pepper and crude extract might be due to their enhanced activity as stomach or contact poison.

The toxicity of crude extract of black pepper when applied topically to

different stored product pests is presented in Table II. It caused a very high mortality of insects tested. A direct relationship was observed between the concentration of crude pepper extract and the mortality of different insects tested. Thus, the studies indicate that the black pepper is a potential, safer insecticide to many of the stored product pests but for the prohibitive cost. (Further critical studies are in progress to test whether any feller material could be used to reduce the cost without any loss in the insecticidal value)

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