

## RESEARCH ARTICLE

# Effect of edible and non-edible oils on the growth and development of *Callosobruchus maculatus* infesting green gram (*Vigna radiata*)

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## ABSTRACT

Effect of edible and non-edible oils of sesame, coconut, groundnut, soybean, mustard, mahua, castor, karanj, neem and linseed on *Callosobruchus maculatus* infesting green gram was investigated. The green gram seeds were treated with @ 2.5ml, 3.5ml, 4.5ml and 5.5ml per kg. seeds. All the oil treatments recorded significant effect in reducing the egg deposition (2.19 to 28.41 eggs) over control (70.69 eggs). There was no egg deposition on 120 and 150 days old treated seed of neem oil treatments. Similarly castor oil was most effective in which no adult emergence was recorded and found significantly superior to rest of the oil treatments except neem oil treatment.

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## INTRODUCTION

The pulse beetle, *Callosobruchus maculatus* (Fab.) is a major insect pest of green gram and other storage pulses causing substantial damage in the storage. The bruchids (*Callosobruchus* spp.) though attack these crops in field and are carried to store where they continue to damage the grain (Singh and Ahlawat, 2005). Fumigation is the most effective chemical control measure. In the recent years, it has been realized that the major emphasis should be given to vegetable oils used as grain protectants. Earlier it was proved that great losses caused by pulse beetle can be avoided if vegetable oils are smeared on the pulse (Mummigatti and Raghunathan, 1977; Sujatha and Punnaiah, 1985 and Parsai *et al.*, 1994; Rajpakse *et al.*, 1998). Doharey *et al.* (1987) proved that higher concentration of coconut, groundnut, mustard, sesame, and taramira oils were more effective against bruchid attack under longer period of storage. The present paper is also an attempt in this regard.

## MATERIALS AND METHODS

Present investigation was conducted under laboratory conditions in the Department of Zoology, Holkar Science College, Indore (M.P.) in the year 2008 to 2009.

The homogenous culture of pulse beetle, *Callosobruchus maculatus* was maintained on green gram at 27.5°C ± 1°C in incubator on variety K-851 (as per procedure described by Strong *et al.* (1968) and key given by Raina, 1970). The seeds of green gram were treated with the different vegetable oils *viz.*, sesame, coconut, groundnut, soybean, mustard, mahua, castor, karanj, neem and linseed oils @ 2.5, 3.5, 4.5 and 5.5 ml/kg. seed in bulk and kept in polythene bags for further experiment. One hundred seeds treated with each oil and untreated seeds were kept in petridishes at 60, 90, 120 and 150 days after treatment. Three pairs of pulse beetle were released in each petridish for 72 hours and then all the adults were removed after counting the dead and alive adults. The experiments were replicated three times. Number of eggs laid

**Table 1: Ovipositional (number of egg laid) preference of pulse beetle on different oil treatments**

Treatments	Dose (ml./kg)	Number of eggs laid								Mean	
		Seed exposed (days after treatments)									
		60 DAT		90 DAT		120 DAT		150 DAT			
1	2	3	4	5	6	7	8	9	10	11	12
Control	0.00	72.02	1.86*	67.16	1.83*	71.77	1.86*	71.81	1.86*	70.69	1.85*
Sesame oil	2.50	27.24	1.45	4.02	0.70	23.30	1.38	30.22	1.49	21.20	1.25
	3.50	26.46	1.44	3.77	0.68	22.32	1.36	29.20	1.48	20.44	1.24
	4.50	26.14	1.42	3.66	0.67	21.70	1.35	28.65	1.47	20.04	1.23
	5.50	25.67	1.42	3.59	0.66	21.00	1.34	27.67	1.45	19.48	1.22
Mahua oil	2.50	19.00	1.30	6.30	0.86	8.70	0.99	13.73	1.17	11.93	1.08
	3.50	18.66	1.29	5.90	0.84	8.28	0.97	13.41	1.15	11.56	1.06
	4.50	18.00	1.28	5.40	0.80	8.06	0.95	13.00	1.14	11.12	1.04
	5.50	16.90	1.25	5.11	0.78	7.77	0.94	12.59	1.13	10.59	1.03
Coconut oil	2.50	17.66	1.27	4.88	0.77	31.69	1.51	43.31	1.65	24.39	1.30
	3.50	17.00	1.25	4.40	0.73	30.58	1.50	42.00	1.63	23.49	1.28
	4.50	16.55	1.24	4.00	0.69	29.70	1.48	41.00	1.62	22.81	1.26
	5.50	16.00	1.23	3.60	0.65	28.67	1.47	39.97	1.61	22.06	1.24
Mustard oil	2.50	48.92	1.70	33.22	1.53	11.71	1.10	19.80	1.32	28.41	1.41
	3.50	47.66	1.69	31.80	1.52	11.38	1.09	18.70	1.29	27.38	1.40
	4.50	46.00	1.67	31.00	1.50	11.09	1.08	18.40	1.29	26.62	1.39
	5.50	45.67	1.67	30.55	1.50	10.80	1.07	17.92	1.28	26.23	1.38
Groundnut oil	2.50	27.42	1.45	1.10	0.32	11.60	1.10	17.90	1.27	14.51	1.04
	3.50	26.90	1.44	0.90	0.28	11.00	1.08	16.60	1.24	13.85	1.01
	4.50	26.70	1.44	0.73	0.24	10.22	1.05	16.10	1.23	13.44	0.99
	5.50	25.40	1.42	0.66	0.22	9.92	1.03	15.66	1.22	12.91	0.97
Soybean oil	2.50	16.90	1.25	6.88	0.89	13.77	1.17	23.30	1.38	15.21	1.17
	3.50	16.00	1.23	6.44	0.87	13.30	1.15	22.60	1.37	14.59	1.15
	4.50	15.61	1.22	6.22	0.85	13.10	1.15	21.00	1.34	13.98	1.14
	5.50	15.33	1.21	5.92	0.84	12.65	1.13	20.67	1.33	13.64	1.13
Castor oil	2.50	33.10	1.53	0.88	0.27	11.80	1.11	19.66	1.31	16.36	1.06
	3.50	31.90	1.52	0.66	0.22	11.50	1.10	18.88	1.30	15.74	1.03
	4.50	31.87	1.52	0.50	0.18	11.00	1.08	18.00	1.28	15.34	1.01
	5.50	31.40	1.51	0.33	0.12	10.76	1.07	16.90	1.25	14.85	0.99
Karanj oil	2.50	8.90	1.00	0.78	0.25	16.30	1.24	22.55	1.37	12.13	0.96
	3.50	8.60	0.98	0.67	0.22	15.70	1.22	21.75	1.36	11.68	0.94
	4.50	8.30	0.97	0.43	0.15	15.20	1.21	21.34	1.35	11.32	0.92
	5.50	7.00	0.90	0.33	0.12	14.67	1.19	20.33	1.33	10.58	0.89
Neem oil	2.50	9.10	1.00	1.00	0.30	0.00	0.00	0.00	0.00	2.53	0.33
	3.50	8.60	0.98	0.90	0.28	0.00	0.00	0.00	0.00	2.38	0.32
	4.50	8.20	0.96	0.80	0.25	0.00	0.00	0.00	0.00	2.25	0.30
	5.50	8.00	0.95	0.77	0.25	0.00	0.00	0.00	0.00	2.19	0.30
Linseed oil	2.50	16.73	1.23	4.80	0.76	28.20	1.46	38.10	1.59	21.96	1.26
	3.50	15.86	1.22	4.30	0.72	27.66	1.45	37.10	1.58	21.23	1.24
	4.50	15.50	1.21	4.00	0.69	26.00	1.43	36.40	1.57	20.48	1.23
	5.50	15.30	1.21	3.81	0.68	25.00	1.41	35.33	1.56	19.86	1.22
C.D. at 5 %			0.026		0.027		0.023		0.022		
S.E. <sub>±</sub>			0.013		.014		0.012		0.011		

\* Transformed value log (X+1)

Table 2 : Number of adults emerged from different treatments											
Treatments	Dose (ml./kg)	Number of adult emerged								Mean	
		Seed exposed days after treatments									
		60 DAT		90 DAT		120 DAT		150 DAT			
1	2	3	4	5	6	7	8	9	10	11	12
Control	0.00	36.58	1.57*	36.40	1.57*	38.33	1.59*	45.63	1.64*	39.24	1.60*
Sesame oil	2.50	4.27	0.72	3.05	0.61	3.55	0.66	6.13	0.87	4.25	0.71
	3.50	4.16	0.71	2.89	0.59	3.24	0.63	6.00	0.82	4.07	0.69
	4.50	3.89	0.69	2.71	0.57	3.14	0.62	5.66	0.83	3.85	0.67
	5.50	3.67	0.67	2.66	0.56	3.00	0.60	5.00	0.83	3.58	0.66
Mahua oil	2.50	0.00	0.00	0.00	0.00	3.96	0.69	6.66	0.90	2.66	0.40
	3.50	0.00	0.00	0.00	0.00	3.76	0.68	6.00	0.83	2.44	0.38
	4.50	0.00	0.00	0.00	0.00	3.57	0.66	5.00	0.82	2.14	0.37
	5.50	0.00	0.00	0.00	0.00	3.33	0.64	5.00	0.75	2.08	0.35
Coconut oil	2.50	2.29	0.52	2.51	0.54	14.89	1.20	19.93	1.32	9.91	0.90
	3.50	2.22	0.51	2.33	0.52	13.98	1.18	19.25	1.29	9.45	0.87
	4.50	2.12	0.49	2.00	0.47	13.67	1.17	19.00	1.28	9.20	0.85
	5.50	2.11	0.49	2.00	0.47	13.51	1.16	18.66	1.27	9.07	0.85
Mustard oil	2.50	0.00	0.00	2.30	0.52	3.13	0.62	5.07	0.82	2.63	0.49
	3.50	0.00	0.00	2.11	0.49	2.87	0.59	4.81	0.75	2.45	0.46
	4.50	0.00	0.00	1.71	0.43	2.76	0.57	4.73	0.75	2.30	0.44
	5.50	0.00	0.00	1.67	0.43	2.67	0.56	4.67	0.75	2.25	0.44
Groundnut oil	2.50	2.29	0.52	0.00	0.00	2.27	0.51	2.31	0.52	1.72	0.39
	3.50	2.19	0.50	0.00	0.00	2.10	0.49	2.11	0.50	1.60	0.37
	4.50	2.08	0.48	0.00	0.00	1.87	0.46	1.85	0.44	1.45	0.35
	5.50	2.00	0.47	0.00	0.00	1.67	0.43	1.67	0.44	1.34	0.33
Soybean oil	2.50	2.61	0.55	0.00	0.00	8.13	0.96	12.04	1.13	5.69	0.66
	3.50	2.43	0.53	0.00	0.00	7.78	0.94	11.90	1.12	5.53	0.65
	4.50	2.29	0.51	0.00	0.00	7.35	0.92	11.20	1.08	5.21	0.63
	5.50	2.22	0.51	0.00	0.00	7.00	0.90	11.00	1.07	5.06	0.62
Castor oil	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Karanj oil	2.50	0.00	0.00	0.00	0.00	2.66	0.56	3.90	0.69	1.64	0.31
	3.50	0.00	0.00	0.00	0.00	2.33	0.52	3.60	0.66	1.48	0.29
	4.50	0.00	0.00	0.00	0.00	2.00	0.48	3.30	0.64	1.33	0.28
	5.50	0.00	0.00	0.00	0.00	2.00	0.48	3.00	0.59	1.25	0.27
Neem oil	2.50	2.02	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.12
	3.50	1.89	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.12
	4.50	1.77	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.11
	5.50	1.67	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.11
Linseed oil	2.50	2.28	0.51	1.20	0.34	12.19	1.12	14.33	1.27	7.50	0.79
	3.50	2.21	0.51	1.15	0.33	11.77	1.11	13.88	1.21	7.25	0.79
	4.50	2.00	0.48	1.10	0.32	11.00	1.08	12.70	1.11	6.70	0.75
	5.50	2.00	0.48	0.98	0.29	10.33	1.05	12.00	1.12	6.33	0.73
C.D. at 5 %			0.017		0.013		0.014		0.019		
S.E.±			0.009		0.006		0.007		0.010		

\* Transformed value log (X+1)

on seeds in each treatment was counted at 10 days after release. The Petridishes were observed daily to record the adult emergence in each treatment.

## MATERIALS AND METHODS

Under the treatment of "control", highest number of eggs deposited was recorded, 70.69 as mean while 72.02 number of eggs deposited was recorded at the expiry of 60 days after the treatment (Table 1). Neem oil at all the doses tested was recorded as best which gave the range of 2.19 to 2.53 eggs followed by karanj oil (10.58 to 12.13 eggs), mahua oil (10.59 to 11.93 eggs), groundnut oil (12.91 to 14.51 eggs), soybean oil (13.64 to 15.21 eggs), sesame oil (19.48 to 21.20 eggs) and linseed oil (19.86 to 21.96 eggs). Thus, minimum number of eggs deposited was recorded under the treatment of neem oil followed by karanj oil, castor oil, soybean oil, groundnut oil, coconut oil, mahua oil and sesame oil treatments. Similar result were also obtained by Parsai (1994) on pigeonpea seed treated with edible oils which reduced oviposition. Singhal *et al.* (1998) also observed that treatment with neem, coconut, mahua and sesame oils, the oviposition was prevented and Biswas and Biswas (2005), in respect to karanj and neem oil. All the treatments were recorded to be highly significant superior to control from the statistical point of view. Thus, neem oil and karanj oil were found as best treatments all over the different oils tested in this study.

All the oil treatments recorded significantly reduced adult emergence (0.00 to 9.91 adults) over control (39.24 adults) at 60, 90, 120 and 150 days after treatment (Table 2). Castor oil was most effective in which no adult emergence was recorded and found significantly superior to rest of the oil treatments except neem oil treatments. The maximum adults (9.91) emerged in coconut oil with the treatment 2.5 ml./kg. Results indicated that castor oil followed by neem oil and karanj oil were the best treatments as compared to coconut oil, soybean oil and mustard oil treatments. Tripathi *et al.* (2007) reported that in respect of mahua oil, karanj oil, mustard oil and castor oil at 5 or 10 ml/kg seed, no. adult progeny emerged.

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