e-ISSN: 2455-667X

Annals of Natural Sciences
(Peer Reviewed and UGC Approved International Journal)
Vol. 4(1), March 2018: 6-11
Journal's URL: http://www.crsdindia.com/ans.html
Email: crsdindia@gmail.com

Annals of Natural Sciences

ORIGINAL ARTICLE

Studying the Effect of Different Vegetable Oils on the Growth and Development of *Callosobruchus maculatus* Infesting 10 Varieties of *Cajanus cajan*

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ABSTRACT

Effect of different vegetable oils as grain protectants was tested to check the growth and damage C. maculatusin pigeon pea grains. The oils used in the study are- Sunflower– Helianthus annus, Castor- Ricinuscommunis, Neem- Azadiracitaindica, Eucalyptus– Eucalyptus citriodora Different vegetable oils were thoroughly mixed with grains of pigeon pea varieties in separate cylindrical jars by manual shaking in required quantity of 1ml and 3ml. The sample infested with 5 pairs of 24 hr old adult of C. maculatus were kept in 3 replication for taking observations on fecundity, incubation period, larval period, pupal period and adult emergence, F1 progeny and longevity Minimum number of eggs (6.35%) was observed on eucalyptus treated seeds which was at par with neem (7.56%) and sunflower oil (8.38%) but these were significantly superior to the castor bean treatment (10.61%). The emergence of the adult beetle was less in case of seeds treated with eucalyptus oil (1.01%) which was at par with neem oil (1.15%), castor oil (1.37%) and sunflower (4.36 %), respectively. The longer developmental period was observed on the seeds treated with eucalyptus (42.50 days). Minimum developmental period of 37.35 days was observed in sunflower oil treated seeds.

Key words: *Vegetable Oils, Callosobruchus maculatus, Cajanus cajan*

Received: 15th Jan. 2018, Revised: 5th Feb. 2018, Accepted: 10th Feb. 2018

How to cite this article:
Raj D.V. and Lal D. (2018): Studying the Effect of Different Vegetable Oils on the Growth and Development of *Callosobruchus maculatus* Infesting 10 Varieties of *Cajanus cajan*. Annals of Natural Sciences, Vol. 4[1]: March, 2018: 6-11.

INTRODUCTION

The use of synthetic insecticides is one of the methods used to control bruchids (Khalequzzaman and Chowdhary 2003). Ghoswal, *et al*., (2004) found that the losses can be managed by using insecticides but the chemical means of managing the pulse beetle *C. chinensis* (a stored product pest) is not advisable. Even though chemical control of stored product pest is predominant in the organized sector, traditional pest control practices are still continued especially in remote areas. Safe and efficient stored product pest management is essential to protect grains from infestation by insects and other agencies (Kiruba, *et al*., 2006 a, b; Kiruba, *et al*., 2007). Tripathi, *et al*. (2002) and Singh and Yadav (2003) have evaluated the toxicity of a large number of essential oils and their constituents against a number of bruchid pests and reported that essential oil and their constituents are potent source of botanical pesticide. Plant oils affect insect development due to the physical properties of coating and blocking of respiration rather than any specific chemical effect (Abulude, *et al*., 2007). Iloba and Ekrakene (2006) evaluated the powders of the leaves of *Hyptis suaveolens*, *Azadirachta indica* and *Ocimum gratissimum* for comparative effectiveness in controlling *Sitophilus zeamais* infesting stored maize and *C maculatus* infesting stored cowpea seeds. Swella and Mushobozy (2007) and Boateng and Kusi (2008) found that attention has been focused on the use of indigenous plants as

sources of cheap and locally available pesticides and the use of plant oils against *C. maculatus* have been reported. Diwan and Saxena (2010) observed that the plant extract of *Euphorbia hirta* (Doodhi) in water and alcohol showed insecticidal activity against *C. chinensis* infesting *Cajanus cajan* seeds. Different concentrations of the solution protected the seed weight loss caused by the larvae of *C. chinensis*. Jacob and Sheila (1990) tested the effectiveness of neem oil against *C. chinensis* on green gram which resulted in >60% mortality of the bruchid after 3 days. Choudhary (1990) applied 1% *Sesamum* oil (w/w) to stored chick pea and studied significant reduction in egg laying and seed damage by *C. chinensis* L. The studies also showed the residual effect of neem against *C. chinensis* which reduced the damage by this beetle on chickpea. Singh, *et al*. (2003) reported some plant products viz soyabean, ground nut, mustard, neem, citrus peels, *Saussurea lappa*, coconut and dharek is being effective against storage pests. Neem oil and powder obtainable from neem (*Azadirachta indica*) seed have been reported to provide sustained protection of stored grains (Ketoh, *et al*., 2002). Baral (2002) found 17% grain damage in grains treated with *A. indica* leaf dust but 0% in bojho treated grains in 70 days against *C. maculatus*. It was also observed that more number of populations caused more weight loss even more than control in *A. indica* leaf powder treated grains. Konar, *et al.* (2005) applied malathion as surface treatment on *Cajanus cajan* L. to control C. *chinensis* and achieved 100% mortality. The application was followed by *Ipomoea* leaf powder and *Azadirachtin* respectively at 1, 3 and 6 hours which reduced egg laying and emergence of pulse beetle. According to the findings of Tripathi, *et al.* (2006) seeds of pigeon pea can be effectively protected from the pulse beetle by mixing dried neem leaf powder. Mishra, *et al*. (2007) applied solvent- extracted seed oils from bitter gourd, small bitter gourd, bottle gourd and ridge gourd against *C. chinensis* on stored legume- pulse grains. All the vegetable seed oils were effective as legume grain protectants, resulting in negligible weight loss. Srinivasan (2008) studied the efficacy of certain plant oils, *viz.*- castor, eucalyptus, sunflower and neem oil at 5 and 10 ml/kg of seed against pulse beetle on pigeon pea. The observations revealed that plant oils were highly effective against pulse beetle. Naveen, *et al.* (2010) evaluated the efficacy of pesticides and neem products to control the field infestation of bruchid. The study revealed that spraying of Neem seed kernel extract (NSKE) resulted in good control of pulse beetle under field conditions. Shivanna, *et. al.,* (1994) used *A. calamus* as pre storage treatments against *C. chinensis* on red gram (*Cajanus cajan*) and on measuring fecundity; adult emergence and percent grain weight loss it was found that *A. calamus* powder gave maximum protection against a. Lolestani and Shayesteh (2009) observed the insecticidal and ovicidal effects of essential oil extracted from *Ziziphora clinopodioides* (Boiss.) (Lamiaceae) on adults and eggs of *C. maculatus*. Ravinder Singh (2011) evaluated the insecticide activity of powdered vegetables on *C. maculatus* in *Cajanus cajan.* Vegetable powders reduced oviposition and adult emergence to up to 100%. Pandey, *et al*. (2011) investigated the insecticidal and deterrent behaviour of volatile constituents derived from leaves and twigs of aromatic plants towards pulse bruchids *C. chinensis* and *C. maculatus*. All tested oils showed significant lethality and ovipositional deterrence of test insects as compared to control. The pesticidal potential of these aromatic plants can be used against insect infestation of pigeon pea seeds during storage. To reduce the losses and protect from pesticide residue, some of the vegetable oils @8ml/Kg on maize grains were tested as grain protectant against Sitotroga cerealella under laboratory condition by Verma, *et. al.,* (2016).

MATERIALS AND METHODS

The seeds of susceptible pigeon pea variety T-21 were tested with different vegetable oils as grain protectants viz- Neem oil, Eucalyptus oil, Sunflower oil, Castor oil @ 1ml / kg and 3ml/ kg seed to determine their effect on fecundity, adult emergence, developmental period and grain damage. Mass culture of *Callosobruchus maculatus* was maintained. The oils were thoroughly mixed with required quantity of seed and kept in 3 kg capacity of

glass jar by manual operation. For above each experiment was replicated thrice having 25 g seed in separate glass vials measuring 10×3 cm. In individual treatment of each replication, 5 pairs of matured adults were released into each vial obtained from the pure culture. All vials were kept under the room temperature of 27±2˚ and 75±5 percent relative humidity. The mouth of each vial was covered with muslin cloth and tied with rubber bands. For taking the observations on fecundity, emergence, developmental period and grain damage, three sets of experiments were managed separately for each study. Later on progeny adults were recorded daily when their emergence started. Damaged seeds were obtained after 90 days, while the germination of the treated grains was recorded after 120 days treatment.

RESULTS AND DISCUSSION

The vegetable oils namely: Neem oil, Eucalyptus oil, Sunflower oil, Castor oil were tested on the Growth and development of *C. maculatus.*

EFFECT ON FECUNDITY:

It is apparent from Table 1 and Figure 1 that least number of eggs was laid on seeds treated with eucalyptus oil (10.63%) which did not differ from seeds treated with neem (14.52%), sunflower (14.67%) and castor (15.37%). In case of oil treatment at 3 mL/kg seeds almost similar trends were observed. Minimum number of eggs (6.35%) was observed on eucalyptus treated seeds which was at par with neem (7.56%) and sunflower oil (8.38%) but these were significantly superior to the castor bean treatment (10.61%). Thus, the eggs laid by female on the grains treated with different grain protectants were significantly less in comparison to untreated control. Sangwani, *et al.* (2005) and Raghvani and Kapadia (2003) also observed retarded oviposition over the seeds treated with different oils. Pandey, *et al.,* (2011) reported the effects of 4 essential oils on *C. maculatus* infestation of pigeon pea. The oils were effective in inhibiting the longevity of adults, and adult emergence of C. maculatus. Lolestani and Shayesteh (2009) observed the insecticidal and ovicidal effects of essential oil extracted from *Ziziphora clinopodioides* (Boiss.) (Lamiaceae) on adults and eggs of *C. maculatus.*

Table1: Effect of different vegetable oils on fecundity of *C. maculatus*

Treatment	Effect on Fecundity	
	1 ml/kg seed (%)	3 ml/kg seed (%)
Neem	14.52	7.56
Castor	15.37	10.61
Eucalyptus	10.63	6.35
Sunflower	14.67	8.38
Control	42.12	40.45

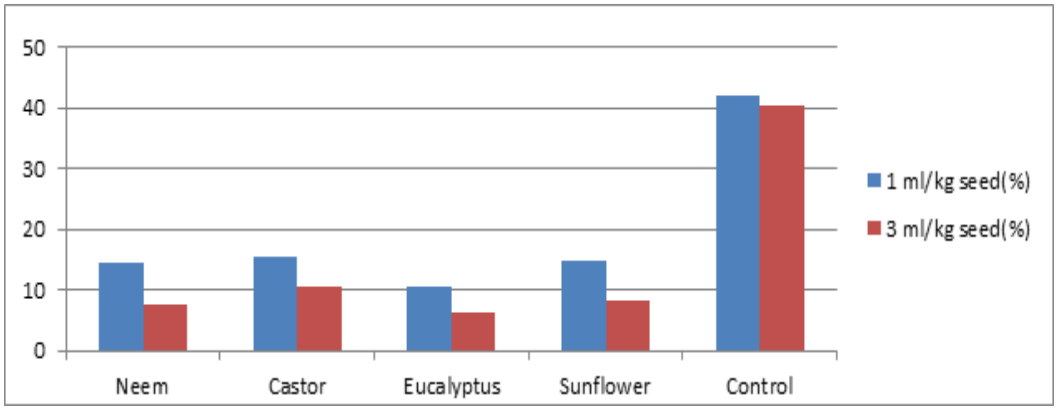

Fig.1: Effect of different vegetable oils on fecundity of *C. maculatus*

Table 2: Effect of different vegetable oils on adult emergence of *C. maculatus*

Treatment	Effect on Adult Emergence	
	1 ml/kg seed (%)	3ml/kg seed (%)
Neem	1.15	0.00
Castor	1.37	0.00
Eucalyptus	1.01	0.00
Sunflower	4.36	3.54
Control	61.11	61.30

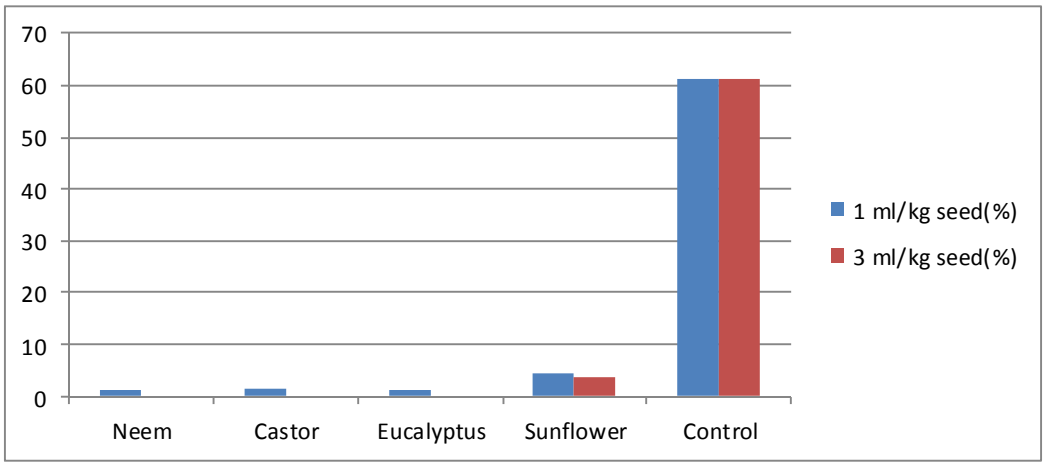

Fig. 2: Effect of different vegetable oils on adult emergence of *C. maculatus*

Table 3: Effect of different vegetable oils on growth and development of *C. maculatus*

Treatment	Effect on Development	
	1ml/kg seed (%)	3ml/kg seed (%)
Neem	41.33	0.00
Castor	41.66	0.00
Eucalyptus	42.50	0.00
Sunflower	37.35	38.00
Control	29.66	29.33

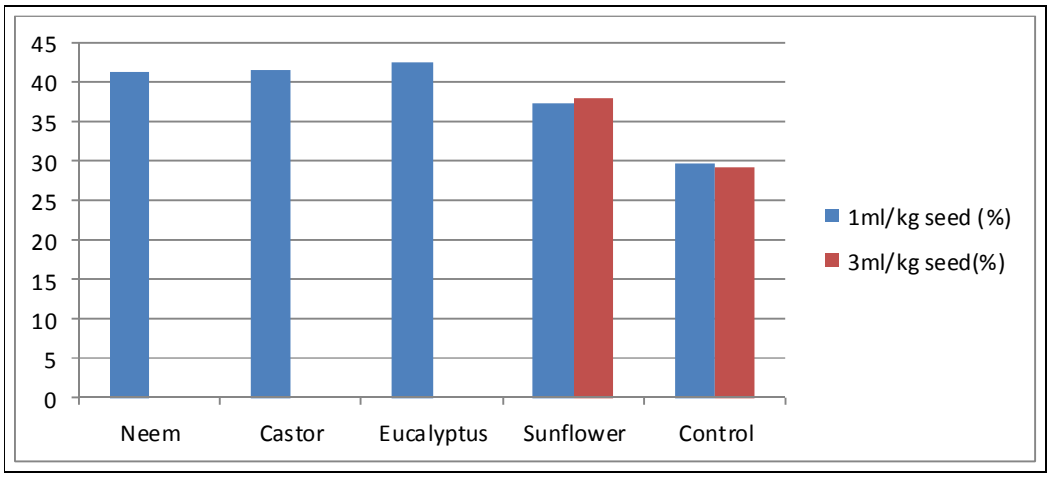

Fig. 3: Effect of different vegetable oils on growth and development of *C. maculatus*

EFFECT ON EMERGENCE:

The emergence of adult *C. maculatus* recorded on pigeon pea seeds treated with different vegetable oils @ 1 mL/kg seeds have been given in Table 2 and Figure 2. It is evident from the data that the emergence of the adult beetle was less in case of seeds treated with eucalyptus oil (1.01%) which was at par with neem oil (1.15%), castor oil (1.37%) and sunflower (4.36 %), respectively. Seeds treated with different vegetable oils @ 3 mL/kg seeds gave significantly better response over untreated control in reduction of beetle emergence. No adult was observed in seeds treated with neem, eucalyptus and castor oil. In sunflower oil 3.54% adult emergence was noted. Swella and Mushobozy (2007) and Ravinder Singh (2011) observed that the use of different oils prevented the emergence of adult beetles to upto 100%. Haghtalab, *et al.* (2009) and Tripathi, *et al*. (2001) observed complete suppression in progeny production was achieved on cowpea treated with castor oil at 9 mL kg-1. Chiranjeevi and Sudhakar (1996) found significant reduction in adult emergence of *C.maculatus* with the increase in dosage of leaf extracts of *Hyptis suaveolens*, *Azadirachta indica* and *Ocimum gratissimum*.

EFFECT ON DEVELOPMENTAL PERIOD:

Observations recorded on the efficiency of different oils @ 1mL/kg and 3mL/kg seed on the developmental period of *C. maculatus* are presented in Table 3 and Figure 3. It is evident from the data that longer developmental period was observed on the seeds treated with eucalyptus (42.50 days) which did not differ from neem and castor being (41.33 and 41.66 days, respectively). Minimum developmental period of 37.35 days was observed in sunflower oil treated seeds. Much better results were observed in 3mL/kg treated seeds. No development took place in seeds treated with neem, eucalyptus and castor oil. Maximum developmental period of 38 days was observed in sunflower treated seeds. The seed treated with different oils @ 3ml/kg gave significantly better results and completely inhibited development of pest (except sunflower oil). Tripathi, et al. (2006) and Singh and Yadav (2003) observed that oils appeared to hold promise in delaying the developmental period of Callosobruchus spp. Epidi and Udo (2009) used ethanolic extract of dried leaves of *Dracaena arborea* (Wild.) (Dragon tree; Dracaenaceae) dissolved in distilled water and observed that progeny production and development of eggs within grains were inhibited.

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