EFFECT OF OILS ON STORED COWPEA AND THE INCIDENCE OF PULSE BEETLE *(Callosobruchus chinensis)*

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DISSERTATION
submitted in partial fulfilment of
the requirement for the
Post Graduate Diploma in Agriculture
(Plant Protection)

Faculty of Agriculture
Kerala Agricultural University

COLLEGE OF AGRICULTURE
Vellayani, Trivandrum

1982

DECLARATION

I hereby declare that this dissertation entitled "effect of oils on stored cowpea and the incidence of pulse beetle (*Callosobruchus chinensis*)" is a bonafide record of research work carried out by me during the course of research and that this dissertation has not previously formed the basis for the award to me any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

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College of Agriculture,
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March, 1982.

CERTIFICATE

Certified that this dissertation entitled "Effect of oils in stored cowpea and the incidence of pulse beetle (*Callosobruchus chinensis*)" is a record of research work done by Sri. Thomas Mathew under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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ACKNOWLEDGEMENT

The author wishes to place on record his deep sense of gratitude to:

Dr. N. Mohan Das, Chairman of the Advisory Committee, Professor and Head of the Department of Entomology for suggesting the problem and for his sustained and inspiring guidance rendered during the entire course of investigation and preparation of the dissertation,

Dr. (Mrs.) A. Visalakshi, Associate Professor of Entomology for various timely suggestions, guidance and encouragement as well as her generous help,

Dr. James Mathew, Associate Professor of Plant Pathology, Dr. S. Balakrishnan, Associate Professor Plant Pathology for serving as members of the Advisory Committee and for their suggestions and encouragements during the investigation.

Shri. Vageen Thomas, Assistant Professor, Statistics, Shri. P. Gangadharan, Assistant Professor, Statistics for their kind assistance rendered in the Statistical work.

The staff and students of the Department of Entomology, and Department of Plant Pathology for their kind and whole hearted co-operation and to my friends and colleagues who have lent me their helping hands for the successful completion of this endeavour.

Grateful acknowledgement are also made to the Director of Agriculture, Department of Agriculture, Kerala State and the Kerala Agricultural University for having selected me for the course and awarding this project.

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INTRODUCTION

The pulse beetle Callosobruchus chinensis is a very destructive pest of stored pulses. Considerable work has been done on its biology and ecology. In cowpea seed this beetle can grow very fast and the numerical increase is enormous (Saxena, 1978). The ovi position of C. chinensis is higher on cowpea than on any other pulse seed (Rajmohan et al., 1975). The beetle destroys completely the endosperm portion of seed, leaving only the seed coat. The seed thus looses its viability and is also rendered unfit for consumption. Insecticides are not legally permitted to be mixed with pulses stored for edible purpose. Use of vegetable oil is in vogue among the cultivators for the control of this bruchid. Naturally occurring oils are esters or organic salts of the trihydric alcohol, glycerine and fatty acids. They are less stable, being hydrolised without difficulty in the presence of acids and forming soaps in the presence of alkalies. The presence of unsaturated fatty acids permits combination with oxygen to a limited extent (Sree Ramulu, 1979). Two compounds alpha chlorolauric acid and alpha bromolauric acid were synthesised from coconut oil which were found to kill insect such as cowpea beetle, rice weevil, flour beetle and the common house fly (Anon, 1976). Generally the oils used for cooking are being used for treating the grain irrespective of

the extent of protection it provides. Protective properties of certain edible oils for protecting the pulses against the infestation of pulse beetle were evaluated by various workers. (Kavadia, 1974; Pennugattil, 1977; Sbhoonhoven, 1978 and Varma et al., 1973; 1974; 1975; 1976). But the effect of oil on different growth stages of the beetle and the curative effect of oils on the infested stock have not been extensively studied. Keeping this in view detailed studies were taken up to assess (1) the protective efficiency of coconut oil and groundnut oil mixed with cowpea seed and stored in gunny bags when exposed to artificial infestation by the pest; (2) the curative effect of coconut oil and groundnut oil on an infested stock; (3) the effect of above oils on different growth stages of the pest (ie. egg, larva, pupa and adult); and (4) effect on the viability of the seeds treated and stored.

REVIEW OF LITERATURE

A review of literature available on the effect of mixing of oils, antifeedants etc. with stored materials on the pests affecting the commodity has been made briefly.

Powdered neem seed kernel one to two parts when mixed with 100 parts of wheat seed gave protection against Sitophilus oryzae, Rhizopertha dominica and Trogoderma granarium for about 269, 321 and 371 days respectively. The germination of treated seeds was not impaired (Jotwani and Sircar, 1965).

Jotwani and Sircar (1967) reported that cowpea could be effectively protected from the attack of Callosobruchus maculatus for about nine months by mixing the seed with crushed neem seed at the rate of 1 to 2 per cent (W/W). Germination of the treated seeds was la also not impaired. Organoleptic tests, carried out after washing and cooking showed that the taste or smell was not adversely affected by the treatment.

While studying the efficacy of neem seed kernel powder as an antifeedant against some stored grain pests it was found that neem seed powder had an important role as an antifeedant in case of external feeders like Trogoderma granarium, while in case of internal feeders it did not have significant effect (Girish and Jain, 1974).

Nair (1976) observed that mixing of pulse seeds with neem powder gave effective control of pest infestion. Qudri and Rao (1977) studied the toxicities of crustard apple (Anona squamosa) in combination with neem (Azadirachta indica) against Callosobruchus chinensis, Rhizopertha dominica and Musca domesticia Nebulo. It was found that neem extract had a synergistic action on custard apple for the control of all the three insects.

Paul et al. (1965) observed that petroleum ether extract of Acorus calamus Linn or the sweet flag was found to be toxic to Sitophilus oryzae.

Powdered drupes and leaves of dharek (Melia azedarach) mixed with wheat at the rate of one to two parts/100 parts of seed (W/W) and four to eight parts (W/W) respectively protected the seed against damage by Sitotroga cerealella and completely prevented the build up of adult population for 135 days. The germination of seeds in either case was not impaired (Teotia and Tiwari, 1971).

Deshpande et al. (1974) found that extracts of two Indian medicinal plants Nigella sativa and Pogostamon heyneanus were found toxic to Callosobruchus chinensis and to some other stored grain pests. The bio-assay results indicated that contact insecticidal activity of

Nigella sativa was associated with lipid fraction. The unsaturated fatty acids viz. oleic acid and linoleic acid exhibited different degrees of insecticidal activity. These fatty acids could be effectively and economically used against Bruchus chinensis. Eugenol in Pogostemon heyneaus being resistant to oxidation retained its activity for a longer time.

Use of plant powders, oils and extracts as protectants against Callosobruchus chinensis showed that gram was protected upto 135 days by the addition of one to two parts of powdered drupes of Thevitia nerifolia, eight parts of leaf powder of Ipomea carnea or one to three parts of petroleum ether extracts of garlic or neem oil. There was no adverse effect on germination of gram (Pandey et al.,1976).

Saxena et al. (1976) reported that Acorus calamus oil vapour acted as antigonadial agent for insect control. In Callosobruchus chinensis the oil vapour had initiated infecundity and the regression in the terminal follicle of vitellarium.

Schnoenhoven (1978) found that application of vegetable oils to stored dry beans Phaseolus vulgaris at the

rate of one ml/kg of beans provided good protection from the attack of Zabertes subfasciatus which affixed their eggs to the seed coat within a protective covering. At five or ten ml/kg complete protection was obtained, the effect lasting for more than 75 days. Treated and untreated beans germinated equally well. The oils increased adult mortality and reduced oviposition, egg hatching and number of adult progeny. Oil applications were recommended since they were cheap, safe and easy to do.

Groundnut oil at five ml/kg completely protected cowpea seeds in storage from Callosobruchus maculatus upto 180 days. The treatment had not adverse effect on cooking time or taste of the cooked beans or on the germination even after six months storage. The oil treatment prevented emergence of progeny rather than affecting oviposition or mortality of adult weevils (Singh et al., 1978).

Verma and Pandey (1978), found that when stored seeds of green gram were treated with coconut, mustard, sesamum and sunflower oil at 0.3 parts/100 parts (W/W), fecundity of Callosobruchus maculatus was inhibited. Oviposition was completely inhibited when coconut and mustard oils were used and very few eggs were found in green gram treated with groundnut, sesamum and sunflower oils. Though the oils as such had no insecticidal effect on the pulse

beetles they showed repellent action. This action lasted for three months from the time of treatment. The eggs laid during the period did not hatch indicating ovicidal properties of the oil. The development of adult population of the beetle was prevented at least for five months and the germination or viability of the treated seed was not affected. Coconut oil was the best followed by mustard, groundnut and sesamum oils.

Pandey, Srivastava and Varma (1979) found that mustard and coconut oils could be mixed with pulses for protecting them against pulse beetles without affecting the organoleptic qualities such as smell, taste and palatability and without fear of rancidity. Time required for cooking was is less in oil treated pulses than untreated.

The National Science Development Board (Philippines) was able to identify and synthesize two compounds from coconut oil, which were found to kill insects such as corn borer, rice weevil, flour beetle and common housefly. The compounds are alpha chlorolauric acid (liquid) and alpha bromolauric acid (solid) (Anon. 1978).

MATERIALS AND METHODS

The efficiency of coconut oil and groundnut oil in protecting cowpea seeds from infestation of the pulse beetle C. chinensis and curative effect of the oils on the infested stock were assessed. Effect of oils on different growth stages (ie. egg, larval, pupa and adult) of the beetle, and on the germination of the cowpea seeds also were studied.

Conditioning of seeds for treatment

Cowpea seeds required for the experiments were procured locally. The seeds were thoroughly cleaned to remove small grains and foreign particles. The cleaned material was stored in insect proof containers to avoid future infestation.

Rearing of Callosobruchus chinensis

Glass jars of size 20 x 20 x 12 cm were filled to quarter capacity with conditioned cowpea seeds. Hundred beetles were introduced in each jar and closed with muslin cloth held in position with rubber bands. The jars were kept in the laboratory. New adults emerged in the fourth week after initial release. Such settings were made at fortnightly intervals so as to obtain sufficient number of adults for release at various intervals.

Oil used

Coconut oil and groundnut oil procured from local market were used for the experiment. The dosages were 0.5 and 1.0 per cent on weight/weight basis.

Treating the seeds

Five hundredgof conditioned cowpea seeds were mixed with each dose uniformly in glass jars. The oil treated seeds were filled in gunny bags of size 30 x 20 cm and the openings were stitched properly. Each treatment and control were replicated four times.

Infesting the treated seeds with C. chinensis.

Deal wood boxes (90 x 90 x 75 cm) having the capacity to hold 20 Nos. of 30 x 20 cm bags were used for artificial infestation. The treated bags along with the control were arranged randomly in the box.

About 1500 freshly emerged adult beetles, obtained from the culture maintained in the laboratory, were released into the box at 15 day intervals, so as to maintain a high intensity of pest inoculum in the box.

Assessment of results

A grain extractor, 22 cm long having a pointed tip suited to draw sufficient seed was used for taking

samples. One sample from each bag was drawn at 15 day intervals. Seeds drawn from each treatment were mixed thoroughly and thousand grains were randomly sorted. The number of infested grain was counted and percentage of infestation was assessed.

Ovipositional behaviour

Ovipositional behaviour on different treatments was assessed by counting eggs present on a lot of 100 seeds taken from the samples drawn at 15 day intervals upto 90 days.

Curative test

One hundred grams of cowpea seeds infested with C. chinensis after assessing the percentage of infestation were treated with oils as in the previous experiment. The seeds were filled in cylindrical jars of size 14 x 7.5 cm and was closed with muslin cloth held in position with rubber bands. Another jar with infested material served as control. Each treatment was replicated four times. Emergence of adult beetles was observed daily for fifty three days and adult beetles were removed on the date of emergence.

Effect of oils on egg stage

Preconditioned cowpea seeds were taken in a glass trough and 700 adult beetles collected from the culture, maintained in the laboratory were released into the trough. The beetles were removed on the next day. Cow pea seeds with 100 eggs were collected and mixed with conditioned seeds to make the total weight to 10 g Oils at the levels mentioned earlier were mixed with the seed by turning them gently in a large bottle so as to give a uniform spread. Treated seeds were transferred to the petri dishes and labelled and incubated. Each treatment was replicated four times with one control in each replication. Observations were made on the emergence of adult beetles.

Effect of oil on larval stage

To test the influence of oils on the developing larvae, seeds were exposed for two days to large number of adults were used. Ten gram of cowpea seeds with 100 eggs were placed in petri dish as done in the previous experiment. Eggs were allowed to hatch. After making sure that the newly hatched larvae entered the seeds (ie. 11th day after egg laying) the infested seeds was treated with oils and stored as done before. Emergence of adult was observed.

Effect of oil on pupal stage

Cowpea seeds with 100 eggs were mixed with pre-conditioned seeds to get 10 g of seeds. After 20 days when the insects were in pupal stage the seeds were treated with oils at different dosages and kept for adult emergence. Each treatment was replicated four times with one control for each replication. Adult beetle emergence was recorded.

Effect of oil on adult stage

Ten g each of preconditioned, cowpea seeds were treated with oil as in previous experiments and were transferred to a glass jar. Each treatment was replicated four times and controls were also maintained. Five pairs of adult beetles were introduced in each treatment. The longevity of the adult beetles also was recorded.

Effect of oil treatments on the viability of the seeds

For assessing effect of different treatments on the germination of seeds 100 seeds were taken at random from the treated lots at 30 day intervals upto 90 days of storage. Seeds were kept in petridishes over a wet filter paper. The germination of the seeds was noted upto one week and percentage of seeds germinated was calculated.

Statistical analysis of data

The data collected from the above experiments were subjected to the analysis of variance.

RESULTS & DISCUSSION

Effect of treating cowpea seeds with oils stored in gunny bags on the incidence of Callosobruchus chinensis when artificially inoculated.

The extent of damages observed at different intervals after treatment are presented in Table 1 and Fig. 1. There was no infestion in the treatments including control on 15th day. The mean percentage of infestation at the end of 30 days in control was 8.25, while the treatments were free from any damage. The third observation showed that coconut oil 1.0% and groundnut oil 1.0%, were superior to all other treatments and it was followed by groundnut oil 0.5% and coconut oil 0.5% there being no significant difference among themselves. The mean percentage infestation ranged up to 0.5 in different treatments while in control it was as high as 39. The fourth observation showed that groundnut oil 1.0% gave best protection and it was followed by coconut oil 1.0%, coconut oil 0.5% and groundnut oil 0.5%. The mean infestation percentage ranged from 0.0 to 6.01 in effective treatments and 69.13 in control. The fifth observation showed that groundnut oil 1.0% gave best protection. This was followed by groundnut oil 0.5%, coconut oil 1.0% and coconut oil 0.5% with no significant difference among themselves. The mean percentage infestation ranged from 1.25 to 18.5 in different

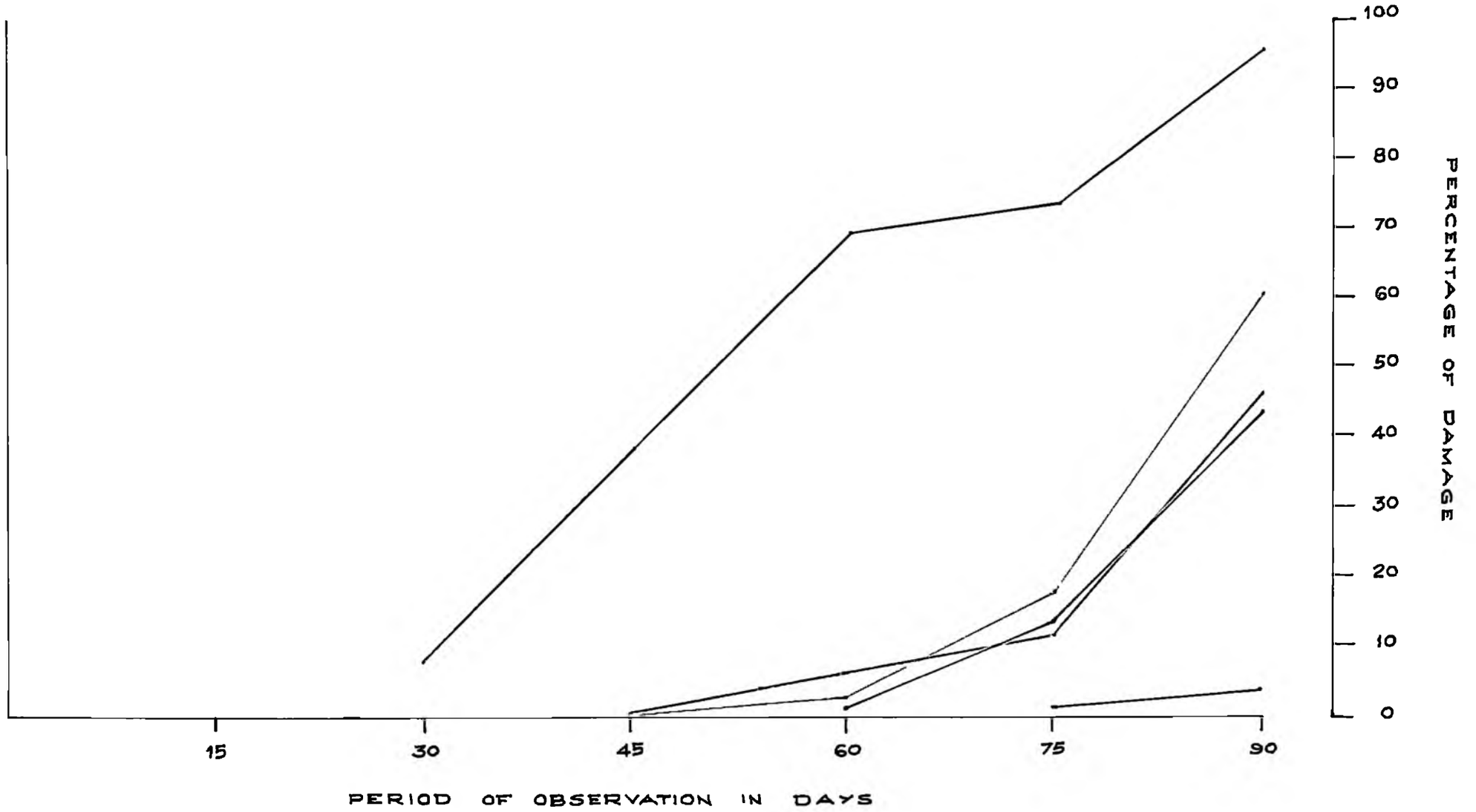
Table 1. Mean percentage of damaged pulse seeds, treated with oils and stored in gunnies when exposed to C. bruchus.

Treatments	Concentration W/W	Percent of seed damaged at the end of (days)					
		15	30	45	60	75	90
Control	0.0	0	8.25(16.587)	3.90(38.640)	69.13(56-391)	74(62.279)	96.75(81.573)
Coconut oil	1.0%	0	0.0	0.0	1.13(5.976)	14.5(22.164)	44.75(41.940)
Coconut oil	0.5%	0	0.0	0.5(2.869	2.95(9.753)	18.5(25.205)	61.25(51-642)
Groundnut oil	1.0%	0	0.0	0.0	0.0(0.0)	1.25(6.337)	4.75(12.296)
Groundnut oil	0.5%	0	0.0	0.45(2.032)	6.01(12.904)	13.25(21.189)	46.75(43.137)

Results of statistical analysis	df	Mean squares				
Treatments	4	220.101**	1126.235**	2031.462**	1731.032**	2457.817**
Error	15	1.057	5.869	17.042	16.526	39.519
C.D. for Comparison between different levels or between levels and control		1.54	3.650	6.220	6.126	9.473

Figures within parentheses are transformed values.
** Data significant at 1% level

FIG 1 AVERAGE PERCENTAGE OF DAMAGE CAUSED TO PULSES SEEDS TREATED WITH OILS



treatments while in control it was 74. Groundnut oil 1.0% was found to be superior among the treatments at the end of third month and it was followed by coconut oil 1.0% and ground nut oil 0.5% there being no significant difference among themselves. Coconut oil 0.5% gave least protection. The mean percentage of infestation ranged from 4.75 to 61.25 in different treatments while in control it was 96.75.

Groundnut oil 1.0% gave high protection to cowpea seeds during 90 days of storage. The mean percentage of infested seeds in the lots treated with groundnut oil 1.0% were 1.25 and 4.75 at the end of 75th day and 90th day while in control it was as high as 75 and 96.75. Hence this treatment can be considered effective for protecting cowpea seeds stored in gunny bags from infestation by the pest in godown. This finding is in line with the earlier reports of Schoonhoven (1978), Singh, Luse, Lee Schnor and Mangju (1978), Varma and Pandey (1978), Pandey et al. (1979).

Coconut oil 1.0% gave protection for 60 days but in the subsequent observations they came low in ranking. The two oils at 0.5% were found to be ineffective in protecting the seeds beyond 45th day. Mean percentage of infestation was found to be 2.95, 18.5 and 61.25 in case

of coconut oil 0.5% and 6.01, 13.25 and 46.75 in case of groundnut oil 0.5% on 60th, 75th and 90th days respectively.

Ovipositional behaviour of the beetle on cowpea seeds treated with different oils are presented in Table 2. Groundnut oil 1.0% limited the egg laying through out the period of storage. The mean number of eggs laid in the treatments with groundnut oil 1.0% at the end of 90th day was 123.25 while in control it was 410.25. No significant difference was observed in the treatments with coconut oil 0.5% and 1.0% through out the period of storage. Mean number of eggs laid was 0.5 and 2.75, 6.5 and 21, 36.5 and 63.25, 81.75 and 100.50, 140.5 and 157 and 190.5 and 249.50 respectively on 15th, 30th, 45th, 60th, 75th and 90th day of observations in the coconut oil treatments with 1.0% and 0.5%. Though groundnut oil 1.0% ranked first throughout there was no significant difference between the seeds treated with 0.1 and 0.5% groundnut oil on 90th day of observation. Mean number of eggs laid in the above two treatments were 123.25 and 168.25 respectively.

Mean number of eggs laid in control was high as compared to all other treatments on all the days of observations. Oil treated seeds were not much preferred for oviposition. The relative efficacy of vegetable oil in

Table 2. Mean number of eggs found on 100 cowpea seeds treated with oils during the period storage when exposed to C. Chinensis.

Treatments	Concentration W/W	No. of eggs laid at the end of (days) 15th	30th	45th	60th	75th	90th
Control	0.0	49.25(7.066)	189.75 (13.678)	200.75 14.062)	194.25 (13.924	397.50 (19.914)	410.25 (20.200)
Coconut oil	1.0%	0.5 (1.183)	6.5 (2.366)	36.50 (6.037)	81.75 (9.062)	140.50 (11.857)	190.50 (13.774)
Coconut oil	0.5%	2.75(1.925)	21.0 (4.659)	63.25 (7.877)	100.50 (10.035)	157.00 (12.527)	248.50 (15.632)
Groundnut oil	1.0%	2.75(1.925)	3.25 (1.970)	41.0 (2.112)	14.25 (3.649)	52.75 (6.864)	123.25 (11.010)
Groundnut oil	0.5%	5.0(2.438)	25.50 (5.106)	41.0 (6.440)	78.25 (8.885)	115.50 (10.748)	168.25 (12.945)
Results of statistical analysis	df	Mean squares					
Treatments	4	22.579**	90.007**	75.299**	53.904**	90.161**	48.670**
Error	15	0.234	1.772	2.221	1.066	3.068	3.949
C.D. for Comparison between different levels or between levels and control		0.729	2.006	2.245	1.556	2.639	2.990

Figures within parenthesis are transformed values $\sqrt{x+1}$

** Data significant at 1% level.

inhibiting oviposition had been reported by earlier workers (Girish et al., 1974; Schoonhoven, 1978; and Varma and Pandey, 1978).

Curative effect of mixing coconut oil and groundnut oil on cowpea seed infected with Callosobruchus chinensis.

The data relating to this studies are given in Table 3. Emergence of adult beetle was noticed on 23rd day after treatment and the emergence lasted upto 32nd day in the first generation. In the second generation emergence of adult beetle was observed from 44th day and lasted up to 53rd day after treatment.

Groundnut oil 1.0% was found to be superior among the treatments at the end of first generation ie. 32 days after treatment and it was followed by coconut oil 1.0% and 0.5% and groundnut oil 0.5% with no significant differences among themselves. All the treatments were significantly superior over the control. The mean number of adult emergence varied from 3.0 to 0.33 in different treatments while in control it was 30.3. Groundnut oil 1.0% was found to be superior over other treatments, also in second generation starting from 44th day and ending

Table 3. Adults emerged from cowpea seeds infested with the C. chinensis and treated with oils.

Treatments.	Concentration (V/W)	Adult beetle emerged at the end of (days)										Total	Mean
		23	24	25	26	27	28	29	30	31	32		
Control	0.0	77.0 (8.83)	58.0 (7.68)	45.0 (6.78)	22.5 (4.85)	27.5 (5.34)	45.0 (6.78)	14.0 (3.87)	9.0 (3.16)	4.0 (2.23)	5.0 (2.)	305 (51.53)	30.5 (5.15)
Coconut oil.	1.0%	12.5 (3.67)	5.0 (2.45)	2.5 (1.87)	7.5 (2.91)	5.0 (2.44)	5.0 (2.44)	0.5 (1.22)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	38 (20.0)	3.8 (2.0)
Coconut oil	0.5%	22.5 (4.85)	15.0 (4.0)	15.0 (4.0)	12.5 (3.67)	7.5 (2.91)	0.0 (0.0)	1.0 (1.41)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	73.5 (24.85)	7.35 (2.48)
Groundnut oil	1.0%	10.0 (3.32)	2.5 (1.87	5.0 (2.45)	5.0 (2.45)	7.5 (2.91)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	30.0 (18.0)	3.0 (1.8)
Groundnut oil	0.5%	35.0 (6.0)	15.0 (4.0)	12.5 (3.67)	7.5 (2.91)	22.5 (4.84)	2.5 (1.87)	1.5 (1.58)	1.0 (1.41)	1.0 (1.41)	0.0 (0.0)	98.5 (28.71)	9.85 (2.87)

Result of statistical analysis	df	Mean square
Treatments	4	18.144**
Error	45	2.503
C.D. for comparison between different levels or between levels and control.		1.422

Figures within parenthesis are transformed values
** Data Significant at 1% level.

(Contd.)

Table 3 (Contd). Adults emerged from Cowpea seeds infested with the C. Chinensis treated with oils.

Treatments	Concentration (V/W)	Adult beetle emerged at the end of (days)											
		44	45	46	47	48	49	50	51	52	53	Total	Mean
Control	0.0	12.5 (3.67)	10.0 (3.32)	2.0 (1.73)	4.0 (2.23)	7.0 (2.62)	15.0 (4.00)	17.0 (4.24)	11.0 (3.46)	16.0 (4.12)	9.0 (3.16)	103.5 (32.78)	10.35 (3.27)
Coconut oil	1.0%	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.0 (1.41)	5.0 (2.45)	0.0 (0.0)	2.0 (1.73)	0.0 (0.0)	8.0 (12.60)	0.80 (1.26)
Coconut oil	0.5%	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.0 (1.41)	9.0 (3.16)	11.0, (3.46)	3.0 (2.0)	1.0 (1.41)	0.0 (0.0)	25.0 (16.45)	2.5 (1.64)
Groundnut oil	1.0%	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	2.0 (1.73)	0.0 (0.0)	0.0 (0.0)	2.0 (10.73)	0.20 (1.07)
Groundnut oil	0.5%	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	3.0 (2.0)	9.0 (3.16)	13.0 (3.74)	6.0 (2.64)	31.0 (17.55)	3.1 (1.75)

Results of statistical anglysis	df	Mean square
Treatments	4	7.576 *
Error	45	0.595
C.D. for comparison between different levels or between levels and control		0.694

Figures within paranthesis are transformed values

*Data significant at 1% level.

on 53rd day after treatment. This was followed by coconut oil 1.0% coconut oil 0.5% and groundnut oil 0.5% there being no significant difference among treatments. All the above treatments were significantly superior over control. Mean adult emergence varied from 0.20 to 3.1 in different treatments while in control it was 10.35.

The oil treatments reduced the number of progeny adults. The emergence of adult beetle was significantly reduced compared with control in first and second generations.

Effect of oils on different growth stages of C. chinensis

The data relating to the three experiments are presented in Table 4 and Fig.2.

Effects of oils on eggs: The treatments were effective in reducing adult emergence. Number of adult emerged was low, ranging from 3 to 9.5. Groundnut oil 1.0% was superior to all other treatments followed by coconut oil 1.0%, 0.5% and groundnut oil 0.5% and number of progeny adults emerged was 3.75, 7.50 and 9.50 respectively. Control recorded a high adult emergence of 52.75 numbers. No significant difference was observed between 1.0% level of groundnut oil and coconut oil. Significant difference was

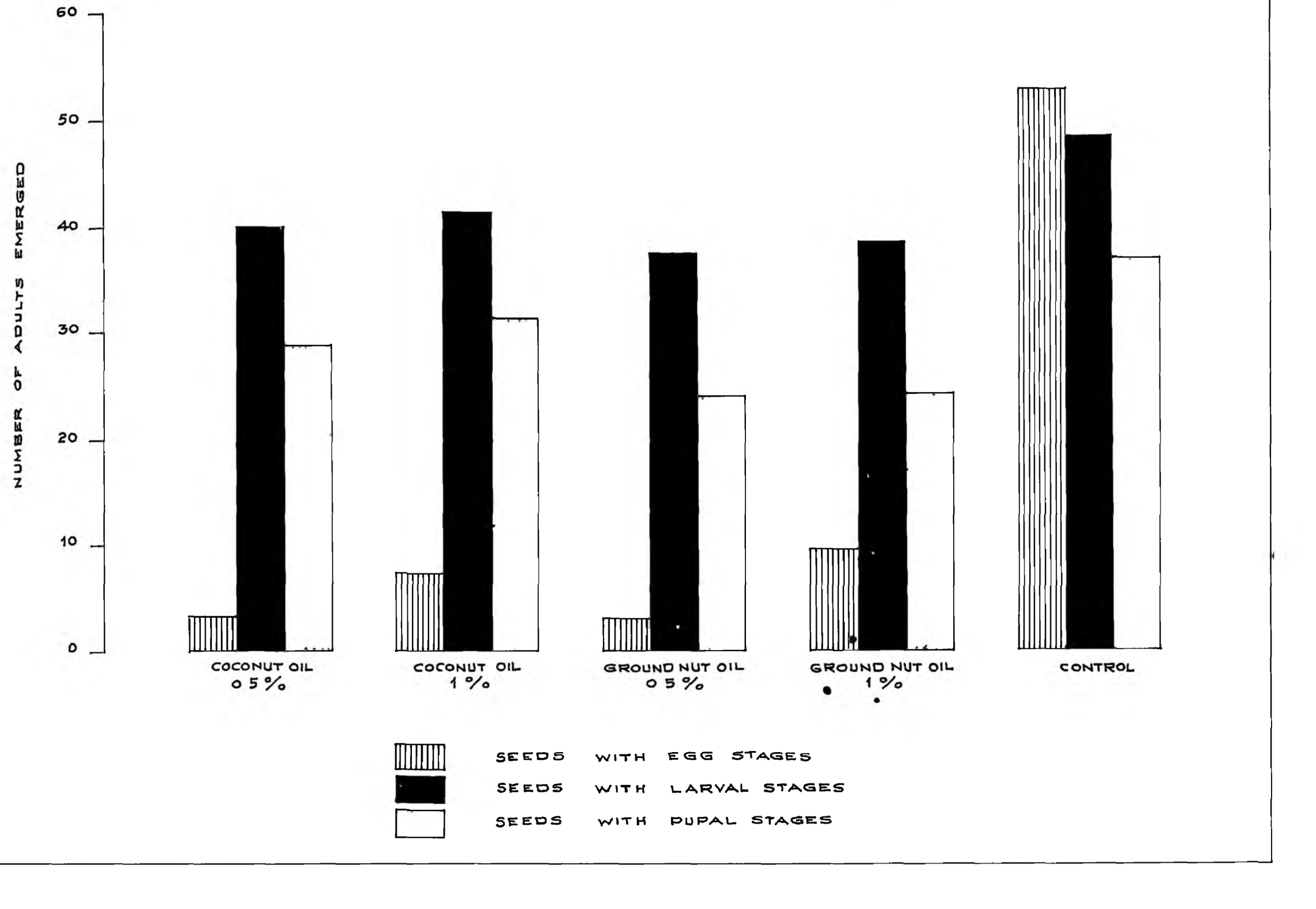
Table 4. Effect of oils on different growth stages of pulse beetle.

Treatments	Concentration (v/v)	Mean number of adults emerged from pulse seeds infested by *C.chinensis* and treated with oils at three life stage.		
		Egg	Larva	Pupa
Control	0.0	52.75 (7.329)	48.50 (7.034)	37.0 (6.123)
Coconut oil	1.0%	3.75 (2.140)	40.25 (6.419)	28.5 (5.325)
Coconut oil	0.5%	7.50 (2.886)	41.50 (6.517)	31.5 (5.644)
Groundnut oil	1.0%	3.00 (1.992)	37.25 (6.185)	24.0 (4.923)
Groundnut oil	0.5%	9.50 (3.229)	38.75 (6.264)	24.0 (4.923)
Results of statistical analysis.	df	Mean squares		
Treatments	4	19.236**	0.447**	1.004
Error	15	0.126	0.026	7.741
C.D. for comparison between different levels or between levels and control.		0.536	0.245	

Figures within parentheses are transformed values $\sqrt{x + 1}$

Data significant at 1% level.

FIG 2 EFFECT OF OILS ON DIFFERENT GROWTH STAGES OF *C Chinensis* INFESTING PULSES



observed between treatments of 1.0% and 0.5% level of both oils. All the above treatments were significantly superior over control. Applying 1.0% groundnut oil or coconut oil could be considered effective in reducing adult emergence in the earlier stage of infestion by the pest in the godown. The efficacy of vegetable oils in reducing egg hatching of stored grain pest had been reported by Schoonhoven (1978). The ovicidal properties of vegetable oils were reported by Varma and Pandey (1978), Singh et al. (1979) and Nandakumar (1981).

Effect of oils on larval stage: Different concentrations of coconut oil and groundnut oil had significant difference in the emergence of adults over the control. The mean adult emergence varied from 37.25 to 41.50 in different treatments while in control it was 48.50. Adult emergence was significantly less in treatments compared the control but the curative effect offered by the treatments was not seen adequate.

Effect of oils on pupal stage: Adult emergence in lots treated with groundnut oil 1.0% and 0.5% was 24 each. In coconut oil 1.0% and 0.5% the number of adults were 28.5 and 31.5 respectively while in control it was 37. Both groundnut oil and coconut oil 1.0% and 0.5% when applied

Table 5. Effect of oils on adult longevity of C. chinensis infesting cowpea seeds.

Treatment	Concentration (W/W)	Percentage mortality on 4th day after exposure.	Percentage mortality on 11th day after exposure.	Mean longevity (days)
Control	0.0	0	72.5 (59.197)	10.05
Coconut oil	1.0%	0	95 (80.782)	8.30
Coconut oil	0.5%	0	80 (63.803)	8.90
Groundnut oil	1.0%	32.5 (34.340)	100 (90.00)	5.78
Groundnut oil	0.5%	7.5 (11.250)	75 (63.586)	8.53
Results of statistical analysis.	df	Mean squares		
Treatments	4	890.129**	701.587**	
Error	15	53. 184	118.815	
C.D.		10.989	16.424	

Figures within paranthesis are transformed values

** Data significant at 1% level.

after pupation of the beetle had no inhibitory effect on the adult emergence.

Effect of oil on adult longevity: Data on the mean percentage of mortality of adult beetle showed wide differences. Therefore the observations on 4th and 11th day were statistically analysed after subjecting the values to angular transformation. The data are presented in Table 5. In seeds treated with groundnut oil 1.0%, twenty five per cent mortality of adult beetle was observed from the second day of exposure and a total of 32.5% mortality was observed on the fourth day of exposure. In all the other treatments including control there was no mortality. Complete mortality was observed in groundnut oil 1.0% on 11th day of exposure where as the kill observed in control during the period was 72.5% and that of groundnut oil 0.5% was 75%. Coconut oil 1.0% and 0.5% recorded 95% and 80% kill respectively on the 11th day. Singh, et al. (1978) reported that the oil treatment prevented emergence of progeny rather than causing mortality of adult beetle. But Schoonhoven (1978) reported that application of vegetable oils increased adult mortality of Bruchid.

Effect of oil treatments on viability of seeds with reference to duration of storage.

Effect of seed treatments with oils on viability of cowpea seeds are presented in Table 6. No significant

Table 6. Mean germination percentage of cowpea seeds treated with oils observed at different intervals after storage.

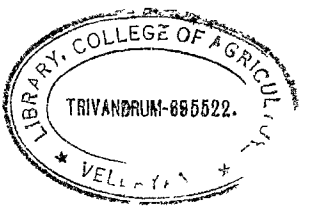
Treatments	Concentration (W/W)	Germination percentage at the end of (days)		
		30	60	90
Control	0.0	82.25	80.50	81.25
Coconut oil	1.0%	83.25	81.75	80.75
Coconut oil	0.5%	84.00	82.25	79.50
Groundnut oil	1.0%	85.75	83.00	81.25
Groundnut oil	0.5%	83.25	81.75	78.75

Results of statical analysis.	df		Mean Squares	
Treatments	4	8.5	3.325	5.08
Error	15	30.2	46.083	24.933

effect was observed, through the entire storage period. During first, second and third months groundnut oil 1.0% was found superior to all other treatments, there being no significant difference between themselves. Mean germination percentage was ranging from 82.25 to 85.75 in different treatments and 82.25 in control during the first month. During second and third months mean germination percentage was ranging from 81.75 to 83 and 78.75 to 80.75 in different treatments and 80.5 and 81.25 in control respectively. Earlier reports (Pandey, et al. (1976) Schoonhoven (1978); Singh et al. (1978) also agree with this finding.

The viability of treated seed stored in gunnies was not seen affected. This simple and non-toxic method of treating pulse seed with oil and keeping in gunny bag is within the means of an ordinary farmer. Groundnut oil 1 per cent can be considered best for pre-storage treatment against pulse beetles.

SUMMARY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VELLAYANI

The efficacy of coconut oil and groundnut oil in protecting cowpea seeds from infestation of the pulse beetle when stored in gunny bags and curative effect of the oils on different growth stages (ie. egg, larval, pupal and adult) of the beetle and on the germination of the cowpea seeds were also studied.

The results indicated that treating cowpea seeds with 1.0% groundnut oil could be considered effective in protecting the seeds stored in gunny bags from infestation by the pulse beetle in the godown.

Oil treated seed grains were not much preferred for oviposition.

The oil treatment reduced the number of progeny adult emergence. Application of 1.0% groundnut oil or coconut oil could be considered effective in reducing progeny adult emergence in the earlier stages of infestation by the Bruchid in the godown.

Oil treatment at the larval stage of the insect showed that the curative effect offerred by the treatment was not adequate.

Both coconut oil and groundnut oil when applied after pupation of the beetle had no inhibitory effect on the adult emergence.

Release of adult beetle in the oil treated cowpea seeds resulted only in preventing emergence of progony rather than causing mortality of adult beetle.

The germination or viability of the treated seed was not affected by the treatments.

Groundnut oil 1.0% could be considered as a simple and non-toxic method of treatment for pre-storage treatment against pulse beetle incidence.

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