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INFLUENCE OF OILS ON OVIPOSITION PREFERENCE AND HATCHABILITY OF ACARID MITE, *TYROPHAGUS PUTRESCENTIAE* SCHRANK ON GROUNDNUT

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ABSTRACT

The effect of various oils on oviposition and hatching of acarid mite, *Tyrophagus putrescentiae* were studied during the year 2017-18 and 2018-19 at Acarology Laboratory, Department of Entomology, N.M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat. The present study revealed that on an average 117.17 eggs were laid by the acarid mite, *T. putrescentiae* in the control. Further, the minimum number of eggs were laid at 2.00 ml/kg concentration when groundnut seed was treated with the sesame oil were 54.17 eggs were observed which were followed by mustard oil, coconut oil, cotton oil and soybean oil (61.00, 77.83, 91.17 and 93.67 eggs), respectively. The maximum numbers of eggs (107.00 eggs) were laid on groundnut seeds treated with soybean oil at 0.50 ml/kg concentration. However, out of all the oils tested, the deterrence was maximum in sesame oil at all the three concentration of 0.50, 1.00 and 2.00 ml/kg indicated by DQ 0.22, 0.28 and 0.37, respectively. All the edible oils proved effective at 2.00 ml/kg concentration with only 89.50, 86.67, 92.33, 91.83 and 86.33 per cent hatchability, coconut oil, mustard oil, soybean oil, cotton oil and sesame oil treatment, respectively in comparison to 91.83, 89.00, 95.00, 94.33 and 87.33 per cent hatchability observed in case of coconut oil, mustard oil, soybean oil, cotton oil and sesame oil treatments respectively at 0.50 ml/kg concentration.

Keywords: Oils, oviposition preference, *Tyrophagus putrescentiae* Schrank, groundnut

INTRODUCTION

Mites act as secondary invaders among storage pests as they can not infest sound grain instead feed upon broken kernels, debris, high moisture seeds and damaged grain by primary insect pests. These invaders contribute directly to grain spoilage after establishment, just as primary pests do (Weaver and Petroff, 2009). Stored-grain mites damages usually go unnoticed until the grain is removed from the storage facility. Mites from family Acaridae are gaining importance as storage pests due to their increasing incidence and their association/ interaction with fungi and insects causing rapid qualitative and quantitative deterioration of grains (Weaver and Petroff, 2009). Studies on acarid mites infesting stored products have been conducted in several regions throughout the world (Weaver and Petroff, 2009). Among the stored grain mite, *Tyrophagus putrescentiae* Schrank (Schrank, 1781) is a ubiquitous, agriculturally, medically important mite species and is considered a severe pest of number of stored commodities with high fat and protein content throughout world. The mite, *T. putrescentiae* is a common and serious pest of stored grains due to its ability to tolerate low humidity and a wide range of temperatures (Hughes, 1976). It can cause problems for many foodstuffs ranging from weight reduction and degradation of stored foods to accumulation of harmful residues (fungi, dead mites, faeces, eggs and bits of food) through their activities (Hughes, 1976, Zdarkova, 1971). This makes the infested grain storage unhygienic. World over, there is an increasing trend among grain buyers towards zero-tolerance to these contaminants. For effective and economical management of the mite, *T. putrescentiae*, it is a felt need to manage this mite pest by using some plant products like oils. The present study therefore is an attempt to test the effect of different oils on oviposition preference and other life parameters of the mite, *T. putrescentiae*.

MATERIALS AND METHODS

Mite culture: Acarid mite, *T. putrescentiae* was reared in plastic Petri dishes (5cm diameter) with groundnut and

yeast flour as food (4:1). These were placed in a dessicator containing super saturated solution of Potassium chloride to provide desired humidity which in turn was placed in BOD. Thus, stock culture of *T. putrescentiae* was maintained in laboratory at 27±10ºC and 80-85% RH. Copulating pairs were picked from the culture and were released in observation arenas.

Five oils were used against acarid mite, *T. putrescentiae* infesting stored groundnut seeds, 15g of groundnut seeds were taken in a Petri dishes (11cm x 2cm) and 15 pairs of adult mite were released to it. Oils treated at three specified concentrations (0.50, 1.0 and 2.0 ml/kg) were mixed thoroughly by mechanical shaking with the groundnut seeds. Prior to application of the oils, the groundnut seeds were sterilized at 40˚C for 24 hours in order to make them free from any other infestation. Observations were recorded daily in the observation arenas. The observations on fecundity *i.e.* number of eggs laid by a single mite as well as the observations were also recorded on the effects of various oil treatments on the ovipositional behavior and number of eggs laid.

(1) The total number of eggs laid per mite was computed.

(2) Ovipositional preference was measured by

$$\text{Discrimination Quotient (DQ): } = \frac{\text{Number of eggs laid on control seeds} - \text{Number of eggs on treated seeds}}{\text{Total number of eggs}}$$

(3) Per cent hatching at each oil treatment was recorded.

RESULTS AND DISCUSSION

During the year 2017-18, the application of all oils *i.e.* coconut oil, mustard oil, soybean oil, cotton oil and sesame oil was found successful in reducing the number of eggs laid by acarid mite, *T. putrescentiae*. The oils were effective at all the three concentrations *viz.*, 0.5, 1.00 and 2.00 ml/kg as compared to control. The data presented in the Table 1 revealed that on an average 115.00 eggs were laid by the *T. putrescentiae* in the control. When the coconut oil was applied at 0.50, 1.0 and 2.00 ml/kg concentrations, 90.33, 82.67 and 77.67 eggs were recorded, respectively. In mustard oil treated seeds 80.33, 71.00 and 60.67 eggs were observed at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. Moreover, in soybean oil treated groundnut seeds 106.67, 100.33 and 93.33 eggs were observed at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. In case of cotton oil treated seeds 105.33, 99.67 and 90.67 eggs were observed at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. When sesame oil wa applied at 0.50, 1.00 and 2.00 ml/kg concentrations, 75.33, 65.67 and 54.00 eggs were observed, respectively. The minimum number of eggs were laid at 2.00 ml/kg concentration, groundnut seeds were treated with the sesame oil were 54.00, followed by mustard oil, coconut oil, cotton oil and soybean oil *i.e.*, 60.67, 77.67, 90.67 and 93.33 eggs, respectively. This shows that among various edible oils sesame oil was more effective in reducing egg laying and soybean oil was least effective in reducing egg laying. The maximum number of eggs *i.e.* 106.67 eggs were laid on groundnut seeds treated with soybean oil at 0.50 ml/kg concentration. It is important to mention that egg laying was inversely proportional to the increase in concentrations of different oils *i.e.,* coconut oil, mustard oil, soybean oil, cotton oil and sesame oil. The data of first year *i.e.* 2017-18, indicated that the maximum reduction in the egg laying of acarid mite, *T. putrescentiae* was at 2.00 ml/kg concentration of sesame oil (Av. 54.00). The Table 1 clearly indicated that as the concentrations of different oils increased the number of eggs laid by the mite decreased in case of all oils. During the year 2018-19, all the edible oils were found effective in reducing the number of eggs laid by acarid mite, *T. putrescentiae*. The oils were effective at all the three concentrations *viz.*, 0.50, 1.00 and 2.00 ml/kg. Coconut oil, mustard oil, soybean oil, cotton oil and sesame oil were found effective in decreasing egg laying of the acarid mite. The data presented in Table 1 revealed that when coconut oil applied at 0.50, 1.00 and 2.00 ml/kg concentrations, 91.33, 83.00 and 78.00 eggs were observed, respectively. In mustard oil 81.00, 72.00 and 61.33 eggs were noticed at 0.50, 1.00, and 2.00 ml/kg concentrations, respectively. In soybean oil treated groundnut seeds 107.33, 101.33 and 94.00 eggs were observed at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. Further, in case of cotton oil 105.00, 100.33 and 91.67 eggs were noticed on groundnut at 0.50, 1.00 and 2.00 ml/kg, respectively. While, in sesame oil treated seeds 75.67, 66.00 and 54.33 eggs were observed at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. The minimum number, of eggs were laid at 2.00 ml/kg concentration treated groundnut seeds with sesame oil were 54.33, followed by mustard oil, coconut oil, cotton oil and soybean oil, respectively. The maximum numbers of eggs (107.33 eggs) were laid on groundnut seeds which were treated with soybean oil at 0.50 ml/kg concentration.

The two years pooled over data on the influence of various oils on fecundity of acarid mite, *T. putrescentiae* on groundnut seeds were presented in the Table 1. The data revealed that the application of all edible oils *viz.*, coconut oil, mustard oil, soybean oil, cotton oil and sesame oil were found effective in reducing the numbers of egg laid by *T. putrescentiae* on groundnut seeds. All the oils were found effective at all the three concentrations *viz.*, 0.50, 1.00 and 2.00 ml/kg as compared to control. The data presented in the Table 1 revealed that on an average 117.17 eggs were laid by the

acarid mite, *T. putrescentiae* in the control. When coconut oil was applied at 0.50, 1.00 and 2.00 ml/kg concentrations, 90.83, 82.83 and 77.83 eggs were observed, respectively. In mustard oil treated groundnut seed 80.67, 71.50 and 61.00 eggs were observed at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. In case of soybean oil treated groundnut seeds 107.00, 100.83 and 93.67 eggs were noticed at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. However, in cotton oil treatment 105.17, 100.00 and 91.17 eggs were recorded at all the three concentrations. Further, number of eggs *i.e.* 75.50, 65.83 and 54.17 eggs were recorded at 0.50, 1.00 and 2.00 ml/kg concentrations were observed in sesame oil. However, it was less than the number of eggs laid in control. Further, the minimum number of eggs were laid at 2.00 ml/kg concentration when groundnut seed were treated with the sesame oil were 54.17 eggs were observed which were followed by mustard oil, coconut oil, cotton oil and soybean oil (61.00, 77.83, 91.17 and 93.67 eggs, respectively). This shows that sesame oil was more effective in reducing egg laying whereas soybean oil was least effective in reducing eggs lying (Table 1). The maximum numbers of eggs (107.00 eggs) were laid on groundnut seeds treated with soybean oil at 0.50 ml/kg concentration. It is very important to mention that egg laying was inversely proportional to the increase in level of concentrations of different oils. The present data clearly indicated that the maximum reduction in egg laying of *T. putrescentiae* was recorded at 2.00 ml/kg concentration in sesame oil (54.00 eggs). The Table 1 clearly indicated that as the concentrations of different oils increases, the number of eggs laid by the mite decreased in case of all oils. The statistical analyses showed that number of eggs laid on various oil treatments were significantly different from each other (Table 1). Statistical analysis showed that fecundity at all the five level of treatments differed significantly from each other. All the five oils evaluated have a significant effect on the fecundity of acarid mite, *T. putrescentiae*. Fecundity was markedly reduced when groundnut seeds infested with acarid mite were mixed with coconut, mustard, soybean, cotton and sesame oil at the different levels of concentration of oils *i.e.* 0.50, 1.00 and 2.00 ml/kg. The maximum effect was assessed in sesame oil treated seeds at 2.00 ml/kg concentration because the minimum eggs were laid on the groundnut seeds treated with this oil at this concentration, it was followed by mustard oil and coconut oil while the soybean oil was least effective in reducing egg laying of acarid mite. As the concentration of oil increased in stored groundnut seeds, a corresponding decrease in fecundity was observed. All the treatments were found markedly superior over untreated control. In general, oils *i.e.* sesame oil, mustard oil and coconut were found more effective in reducing by egg laying at all the level of treatments of rest of oils. Similar results were also recorded by Verma and Pandey (1978), Khaire *et al.* (1992) who observed fecundity by safflower, karandi and maize oils on pigeonpea at 0.50, 0.75 and 1.00 per cent oil treatment up to 100 days of storage. Raheja and Singh (1998) reported that neem, castor, mustard, groundnut and sesame oil at 0.25 ml/kg, 0.50 ml/kg and 0.75 ml/kg were effective to control stored mite, *Suidasia nesbitti* in stored pigeon pea. Eucalyptus, mint, turmeric and garlic products were reported to reduce the egg laying capacity of *T. putrescentiae* under laboratory conditions as reported by Gulati (1998) from Hisar in wheat. Further, Kim *et al.* (2003) tested acaricidal activity of 54 plant essential oils against acarid mite, *T. putrescentiae* and found neem oil, karanj oil and castor oil as very effective in reducing the egg laying activity of female mites.

Discrimination Quotient (DQ): During the year 2017-18, it is evident from the Table 1 that DQ ranged from 0.04 to 0.36 for all oil treatments. All the oil treatments deterred the oviposition in *T. putrescentiae* infesting groundnut seeds. However, out of all the oils tested, the deterrence was maximum in sesame oil at all three concentrations, 0.50, 1.00 and 2.00 ml/kg indicated by DQ 0.21, 0.27 and 0.36, respectively. However, in mustard oil DQ values at 0.50, 1.00 and 2.00 ml/kg concentrations was 0.18, 0.24 and 0.31. When coconut oil and cotton oil was applied at 0.50, 1.00 and 2.00 ml/kg concentrations 0.12, 0.17, 0.19 and 0.04, 0.10, 0.12 DQ was recorded, respectively. In soybean oil treated groundnut seeds 0.04, 0.07 and 0.11 DQ was noticed at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. Further, Table 1 showed that the effect was less intense in all other oils than that of sesame oil. All the five oils at 0.50, 1.00 and 2.00 ml/kg concentrations indicated that the effect was not so strong as was at 2.00 ml/kg concentration. The highest DQ values were shown by sesame oil at all concentrations and lowest DQ values were shown by soybean oil at all the concentrations. These values ranged from 0.21 to 0.36 in case of sesame oil and 0.04 to 0.11 in case of soybean oil at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. In the year 2018-19, it is evident from Table 1 that DQ ranged from 0.05 to 0.37 for all oil treatments. All the oil treatments deterred the oviposition in *T. putrescentiae* infesting groundnut seeds. However, out of all the oils tested, the deterrence was maximum in sesame oil at all three concentrations, 0.50, 1.00 and 2.00 ml/kg indicated by DQ 0.22, 0.29 and 0.37, respectively. However, in mustard oil the DQ values at 0.50, 1.00 and 2.00 ml/kg concentrations were 0.19, 0.25 and 0.32. When coconut oil and cotton oil were applied at 0.50, 1.00 and 2.00 ml/kg concentration, 0.13, 0.18, 0.21 and 0.06, 0.09, 0.13 DQ were observed, respectively. Moreover, in soybean oil treated groundnut seeds 0.05, 0.08 and 0.12 DQ was observed at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. The effect was less intense in all other oils than that of sesame oil at all the

Table 1. Influence of different oils on ovipositional preference and percentage hatchability of *T. putrescentiae* on groundnut

Treatment	Conc. ml/kg	Fecundity						Percentage hatchability		
		Number of eggs laid per female			Discrimination Quotient (DQ)					
		2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Coconut oil	0.5	9.50 (90.33)	9.56 (91.33)	9.53 (90.83)	0.12	0.13	0.13	73.58 (91.67)	73.92 (92.00)	73.75 (91.83)
	1.0	9.09 (82.67)	9.11 (83.00)	9.10 (82.83)	0.17	0.18	0.17	72.41 (90.67)	73.26 (91.67)	72.84 (91.17)
	2.0	8.81 (77.67)	8.83 (78.00)	8.82 (77.83)	0.19	0.21	0.20	71.80 (90.00)	70.64 (89.00)	71.22 (89.50)
Mustard oil	0.5	8.96 (80.33)	9.00 (81.00)	8.98 (80.67)	0.18	0.19	0.18	71.70 (90.00)	69.74 (88.00)	70.22 (89.00)
	1.0	8.42 (71.00)	8.48 (72.00)	8.45 (71.50)	0.24	0.25	0.25	70.17 (88.33)	69.19 (87.33)	69.68 (87.83)
	2.0	7.78 (60.67)	7.83 (61.33)	7.81 (61.00)	0.31	0.32	0.31	69.28 (87.33)	68.08 (86.00)	68.68 (86.67)
Soybean oil	0.5	10.33 (106.67)	10.36 (107.33)	10.34 (107.00)	0.04	0.05	0.05	77.51 (95.00)	77.22 (95.00)	77.36 (95.00)
	1.0	10.02 (100.33)	10.07 (101.33)	10.04 (100.83)	0.07	0.08	0.08	76.47 (94.33)	75.56 (93.67)	76.02 (94.00)
	2.0	9.66 (93.33)	9.69 (94.00)	9.67 (93.67)	0.11	0.12	0.11	74.43 (92.67)	74.00 (92.00)	74.21 (92.33)
Cotton oil	0.5	10.26 (105.33)	10.25 (105.00)	10.25 (105.17)	0.04	0.06	0.05	76.89 (94.67)	76.08 (94.00)	76.49 (94.33)
	1.0	9.98 (99.67)	10.02 (100.33)	10.00 (100.00)	0.10	0.09	0.10	76.74 (94.33)	75.42 (93.33)	76.08 (93.83)
	2.0	9.52 (90.67)	9.57 (91.67)	9.55 (91.17)	0.12	0.13	0.12	74.22 (92.33)	72.92 (91.33)	73.57 (91.83)

Continued...

Table 1. Continued...

Treatment	Conc. ml/kg	Fecundity						Percentage hatchability		
		Number of eggs laid per female			Discrimination Quotient (DQ)					
		2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Sesame oil	0.5	8.68 (75.33)	8.70 (75.67)	8.69 (75.50)	0.21	0.22	0.22	68.89 (87.00)	69.67 (87.67)	69.28 (87.33)
	1.0	8.10 (65.67)	8.12 (66.00)	8.11 (65.83)	0.27	0.29	0.28	70.10 (88.33)	68.88 (87.00)	69.49 (87.67)
	2.0	7.35 (54.00)	7.37 (54.33)	7.36 (54.17)	0.36	0.37	0.37	68.69 (86.67)	68.04 (86.00)	68.36 (86.33)
Control	-	10.72 (115.00)	10.92 (119.33)	10.82 (117.17)			-	79.14 (96.33)	80.12 (97.00)	79.63 (96.67)
S. Em. ±		0.142	0.127	-				1.946	1.592	-
Treatment (T)				0.095				-	-	1.257
(Y × T)				0.135				-	-	1.778
C. D at 5%		0.410	0.365	-				5.607	4.586	-
Treatment (T)				0.269						3.552
(Y × T)				NS						NS
C.V. (%)		2.68	2.37	2.53				4.60	3.79	4.22

*Figures in parentheses are original value while those outside are square root transformed values for fecundity while arc sine transformed value for percentage hatchability

concentrations. All the five oils at 0.50, 1.00 and 2.00 ml/kg concentrations indicated that the effect was not so strong as was at 2.00 ml/kg concentration. The highest DQ values were shown by sesame oil at all level of concentrations and lowest DQ values were shown by soybean oil at all concentrations. These values were ranging from 0.22 to 0.37 in case of sesame oil and 0.05 to 0.12 in case of soybean oil at 0.50, 1.00 and 2.00 ml/kg concentrations.

The two year pooled data on discrimination quotient (DQ) were presented in the Table 1 clearly showed that DQ values ranged from 0.05 to 0.37 for all oil treatments. All the oil treatments deterred the oviposition in *T. putrescentiae* infesting groundnut seeds. However, out of all the oils tested, the deterrence was maximum in sesame oil at all the three concentrations (0.50, 1.00 and 2.00 ml/kg) indicated by DQ 0.22, 0.28 and 0.37, respectively. However, in mustard oil DQ values at 0.50, 1.00 and 2.00 ml/kg concentrations were 0.18, 0.25 and 0.31. When coconut and cotton oil was applied at 0.50, 1.00 and 2.00 ml/kg concentration, 0.13, 0.17 and 0.20 ml/kg as well as 0.05, 0.10 and 0.12 DQ was noticed, respectively. In case of soybean oil treated groundnut seeds, 0.05, 0.08 and 0.11 DQ was observed at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. The effect was less intense in all other oils than that of sesame oil at all the concentrations. All the five oils at 0.50 and 1.00 ml/kg concentrations indicated that the effect was not as strong as was at 2.00 ml/kg concentration. However, the highest DQ values were noticed in case of sesame oil at all concentrations and lowest value was recorded in soybean oil at all concentrations. These values ranged from 0.22 to 0.37 in case of sesame oil and 0.05 to 0.11 in case of soybean oil at 0.50, 1.00 and 2.00 ml/kg concentrations.

All the five oils deterred the oviposition of *T. putrescentiae* infesting groundnut seeds at different concentrations. The discrimination quotient (DQ) was recorded highest 0.37 in sesame oil at 2.00 ml/kg concentration and was minimum *i.e.* 0.05 at 0.50 ml/kg in soybean oil and castor oil treatment. Agarwal *et al.* (1988) reviewed that coconut oil at 0.1 per cent, sesame oil at 0.2 per cent and castor oil at 0.3 per cent inhibited oviposition of *Callosobruchus chinensis* L. on greengram during storage. Oils have been reported to reduce fecundity due to the blockage of oogenesis and egg retention in the lateral oviducts. Further, Suman Rani (2000) from Hisar, Haryana also reported maximum DQ when pigeon pea grains were treated with anola oil against mite, *S. nesbitti*. All these earlier work more or less closely support the present findings.

Per cent hatchability:

In the year 2017-18, it is evident from the data presented in the Table 1indicated that all the oils used as protectants significantly reduced the per cent eggs hatchability with increase in concentrations of the oil. The per cent hatchability observed in the coconut oil treatments was 91.67, 90.67 and 90.00 at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. In mustard oil per cent hatchability observed was 90.00, 88.33 and 87.33 at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. The per cent hatchability observed in soybean oil at 0.50, 1.00 and 2.00 ml/kg concentrations was 95.00, 94.33 and 92.67 per cent, respectively. The per cent hatchability observed in case of cotton oil and sesame oil was 94.67, 94.33, 92.33 and 87.00, 88.33, 86.67 per cent at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. The per cent hatchability was highest in the untreated groundnut seed, it was 96.33. The present finding indicated that all the oils at all the concentrations showed lesser per cent hatchability as compared to untreated groundnut seeds. Further, all the oils proved to be most effective at 2.00 ml/kg concentration where only 90.00, 87.33, 92.67, 92.33 and 86.67 per cent hatchability was observed in case of coconut oil, mustard oil, soybean oil, cotton oil and sesame oil treatments, respectively at 2.00 ml/kg concentration in comparison to 91.67, 90.00, 95.00, 94.67 and 87.00 per cent hatchability observed in case of coconut oil, mustard oil, soybean oil, cotton oil and sesame oil treatment, respectively at 0.50 ml/kg concentration. Sesame oil proved most effective whereas soybean oil was found least effective. In sesame oil at 2.00 ml/kg concentration only 86.67 per cent of eggs were hatched, whereas in soybean oil at 2.00 ml/kg concentration, 92.67 per cent of eggs were hatched which is more than all other edible oils but less than that of control.

Further in the year 2018-19, the data revealed that all the oils used as protectants significantly reduced the percentage of eggs hatching with the increase in concentration of the oil. The per cent hatchability observed in the coconut oil treatments was 92.00, 91.67 and 89.00 at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. In mustard oil, the per cent hatchability observed was 88.00, 87.33 and 86.00 at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. The per cent hatchability observed in soybean oil at 0.50, 1.00 and 2.00 ml/kg concentration were 95.00, 93.67 and 92.00 per cent, respectively. The per cent hatchability observed in cotton oil and sesame oil were 94.00, 93.33, 91.33 and 87.67, 87.00 and 86.00 per cent at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. Moreover, the per cent hatchability was highest in the untreated groundnut seeds, which was 97.00 per cent in control. In the second year of experiment, it was found that all the edible oils at all the level of concentrations showed lesser per cent hatchability as compared to untreated groundnut seeds. In the present study all the oils proved to be most effective at 2.00 ml/kg concentration where 89.00, 86.00,

92.00, 91.33 and 86.00 per cent hatchability were noticed in case of coconut, mustard, soybean, cotton and sesame oils, respectively at 2.00 ml/kg concentration in comparison to 92.00, 88.00, 95.00, 94.00 and 86.67 per cent hatchability observed in case of coconut oil, mustard oil, soybean oil, cotton oil and sesame oil treatment, respectively at 0.50 ml/kg concentration. Sesame oil proved most effective as compared to other oils.

The two years pooled over data on per cent hatchability of the eggs of acarid mite, *T. putrescentiae* on groundnut seeds treated with different concentrations of oils were presented in the Table 1. It revealed that all the oils used as protectants significantly reduced the per cent egg hatchability with the increase in concentration of the oils. The per cent hatchability noticed in coconut oil treatments were 91.83, 91.17 and 89.50 at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. In case of mustard oil treated groundnut seeds the per cent hatchability observed at 0.50, 1.00 and 2.00 ml/kg concentration was 89.00, 87.83 and 86.67, respectively. The per cent hatchability observed in soybean oil and cotton oil was 95.00, 94.00, 92.33 and 94.33, 93.83 and 91.83 per cent at 0.50, 1.00 and 2.00 ml/kg concentrations, respectively. The per cent hatchability was 87.33, 87.67 and 86.33 per cent in case of sesame oil treated groundnut seeds. Moreover, maximum per cent hatchability was noticed in the untreated groundnut seeds (96.67 per cent). In the present investigation all the edible oils at all the level of concentrations show lesser per cent hatchability as compare to control. All the edible oils proved to be, most effective at 2.00 ml/kg concentration, where only 89.50, 86.67, 92.33, 91.83 and 86.33 per cent hatchability was observed in case of coconut oil, mustard oil, soybean oil, cotton oil and sesame oil treatments, respectively in comparison to 91.83, 89.00, 95.00, 94.33 and 87.33 per cent hatchability observed in case of coconut oil, mustard oil, soybean oil, cotton oil and sesame oil treatments, respectively at 0.50 ml/kg concentration. Sesame oil proved most effective followed by mustard oil, soybean oil, cotton oil and sesame oil. In sesame oil at 2.00 ml/kg concentration only 86.33 per cent of eggs were hatched. However, in case of soybean oil at 2.00 ml/kg concentration, 92.33 per cent of eggs were hatched which were more than all other oils but less than that of control.

The reduction in hatching of the eggs treated with oils may be due to the fact that oil entered in the eggs through its micropyle and stopped the protoplasmic movement of freshly laid eggs. Somewhat similar observations were recorded by Singh *et al*. (1994) in case of *C. chinensis*. Suman Rani (2000) also reported sesame oil, mustard oil and coconut oil as one of the most effective treatment in reducing hatchability of stored mite, *S. nesbitti* on stored pigeon pea. Rim and Jee (2006) from Korea in a study found that essential oils from various plants like pennyroyal, ylangylang, citronella, lemmon grass, tea tree, neem and food oils like coconut oil, rosemerry were very effective in reducing egg hatching against mite, *Dermatophagoides farina* and *D. pteronyssinus*. All these reports were more or less in accordance with the present findings.

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