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European Journal of Experimental Biology, 2015, 5(5):98-101

ISSN: 2248 –9215
CODEN (USA): EJEBAU

Plant extracts controls *Oryzaephilus surinamensis* by showing repellency behavior

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ABSTRACT

Saw-toothed grain beetle, flat grain beetle and red flour beetle are major among stored grain insect population. These insect destroy at least 15% of the food produced in only India as they feed almost entirely on the germ of the grain reducing its quality. For selection of control measure advantages, disadvantages and safety towards grain quality must be the first consideration. Plants are composed of many constituents some of them are insecticidal, attractants, repellent, anti-feedants, hormone mimics and hormone antagonist. Repellent behavior is one of the important measures as it does not kill the insect but protect the grain from infestation. Here some plant extract Punica gronatum, Chenopodium album, Vitex negundo and Maytenus emarginata and their combinations were applied to test insect Oryzaephilus surinamensis at the dose of 1, 2.5 and 5ml /100 gms of cashew nuts to control them through repellent behavior.

Key words: plant extract, repellency**,** *Oryzaephilus surinamensis*

INTRODUCTION

Oryzaephilus surinamensis is one of the serious pests of many kinds of food like dry fruits, spices, nuts, cereal and other cereal products. *Oryzaephilus surinamensis* is a Coleopteran of family Silvanidae commonly called as saw toothed grain beetle/ flat grain beetle as it is dorso-ventrally flattened body consisting of saw like projections on the thorax region. It is worldwide in distribution found in USA, China, Australia, Philippines, Yugoslavia and India in tropical and subtropical areas. Stored grain infestation usually occurs from top to bottom or vice versa through migration of pest *Sitophilus oryzae*, *Oryzaephilus surinamensis* and *Tribolium castaneum* known as vertical infestation. In this regard [1], [2] and [3] reported that damaged kernels are more susceptible than whole kernels to insect attack by *Oryzaephilus surinamensis*, *Tribolium castaneum* and *Sitophilus oryzae* and these insects are thus called as secondary pest. Synthetic insecticides like organochlorides, organophosphorous, carbamates and synthetic pyrethroids commonly used to control stored grain pests but this reduces quality of the grain, creates smelly odor, hazardous to human health causing bio-magnification. So, to use plant products have several advantages over synthetic insecticides and suggested as one of the important approaches of Insect Pest Management Programmes [4].

MATERIALS AND METHODS

Instruments and chemicals - Instruments like Soxhlet Apparatus, B.O.D Incubator, oven, binocular, mixer grinder, sieves of different types, balance, glass wares like rearing jars, troughs, culture tubes, petridishes, flasks, beaker and among chemicals petroleum ether, benzene are needed for conducting experiments.

Test insect- *Oryzaephilus surinamensis* is reared in incubator at 80±90 percentage Relative Humidity, 30±1°C temperature in the laboratory. The larva moults three times before pupation and converted into mature fourth instar larva. Pupa survives for 8 to 20 days inside the pupal cell after which an adult emerges. Adult to adult life cycle was completed within 4 to 6 weeks.

Plant extracts- For the preparation of plant extracts, leaves of various plants *Lantana camara*, *Punica gronatum*, *Chenopodium album*, *Vitex negundo* and *Maytenus emarginata* collected from field dried, grinded and passed through 30" mesh sieve. Fifty grams of the fine powdered leaves soxhleted in 150 ml of petroleum ether (B.P- 60-80°C) for about 5-6 hours over a water bath. Five grams of collected plant extract material (dry weight of leaf powder) was dissolved in 95ml of benzene. This was considered to be as stock solution.

Experimental design- The required amount of extract was mixed with the cashew nuts at the rate of 1, 2.5 and 5 ml/100 g cashew nuts. The least effective *Lantana camara* extract was mixed with other effective plant extracts (*Punica gronatum*, *Chenopodium album*, *Vitex negundo* and *Maytenus emarginata*) in the ratio of 1:1 at the same doses i.e 1, 2.5 and 5ml /100 gms of cashew nuts. Three samples of 50 g the treated cashew nuts were kept in small gunny bags, which were placed in a periphery making a small circle. Now 50 newly emerged insects were released in the centre of trough. After about seven days, the numbers of adults entered into the bags were counted and it was subtracted from the initial number to get the number of insects repelled. Average percentage of insects repelled at different concentrations is tabulated in Table-1. The mean repellency percentage was assigned repellency class by using the following scale:

Class percent repellency: 0:0.1; I 1.01-20; II: 20.1-40; III: 40.1-60; IV: 60.1-80; V 80.1-100 [5].

RESULTS AND DISCUSSION

Table-1 shows the repellency behavior of various plant extracts against test insect. The maximum repellent behaviour of *O. surinamensis* in treatment @ 1 ml/100 g of cashew nuts was recorded, when the seeds were treated with *Azadirachta indica* (80%) which was followed by *Lantana camara* + *Vitex negundo* (76%), *Punica gronatum* (75.33%), *Vitex negundo* (72%), *Lantana camara* + *Maytenus emarginata* and *Chenopodium album* (69.33%), *Lantana camara* + *Chenopodium album* (62%), *Maytenus emarginata* (58%), *Lantana camara* (52.67%), *Lantana camara* +*Punica gronatum* (49.33%).

In case of extract treatment @ 2.5 ml/100g, the maximum repellent behaviour was recorded on the seeds treated with *Azadirachta indica* (90%), which was followed by *Lantana camara* + *Vitex negundo* (84%), *Punica gronatum* (83.33%), *Chenopodium album* (76%) , *Lantana camara* + *Maytenus emarginata* (74%),*Vitex negundo* (72.67%), *Lantana camara* + *Chenopodium album* (68.67%), *Maytenus emarginata* (62.67%), *Lantana camara* + *Punica gronatum* (55.34%), *Lantana camara* (54.67%).

In the cashew nuts treated @ 5ml/100g, the maximum repellent behaviour was again recorded in *Azadirachta indica* (98.66%), which was followed by *Lantana camara* + *Vitex negundo* (91.34%), *Punica gronatum* (85.33%), *Chenopodium album* and *Lantana camara* + *Maytenus emarginata* (84.67%), *Vitex negundo* (76%), *Lantana camara* + *Chenopodium album* (70.67%) *Maytenus emarginata* (67.33%), *Lantana camara* (60.67%), *Lantana camara* + *Punica gronatum* (60%).

According to the repellency class, which is used as standard for a promising repellent given by [6] results show that cashew nuts treated @ 1m/100g of cashew nuts showed repellency class III and IV with the values ranging from 49.33% to 80%. In case of Cashew nuts treated @ 2.5ml/100g, showed repellency class IV and V where the maximum repellent behavior was recorded on the cashew nuts treated with *Azadirachta indica* (90%) belonged to class V. The repellency behavior ranges from 54.67% to 90%. In case of cashew nuts treated @ 5 ml/100g, showed

repellency class III, IV and V with the values ranging from 60% to 98.66%. All the repellency behavior treatments were significantly better than control.

Statistical analysis- The CD at 5% is 1.34582, Analysis of Variance (ANOVA) revealed that all doses were significant when compared to control.

Effect of various plant extracts as repellent against test insect are presented in Table- 1. It was observed that the repellent behavior of plant extracts ranged from 49.33% to 98.66% against *Oryzaephilus surinamensis*. *Azadirachta indica* has maximum repellency power against the test insect. The methanol extracts of coriander was only the polar extract that exhibited high repellency (85%) against these species. [7] had evaluated the repellency and toxicity of azadirachtin and 3 neem extracts (48, 23, and 7% AZA) to three stored product insects. [8] evaluated the repellency effect of different plant extracts against stored grain insects. Extracts of murraya, turmeric, nimbicidin showed good repellency against the test insect even after three months of ageing under laboratory conditions. [9] studied the repellency effect of urmoi, neem and turmeric extracts on rice weevil and granary weevil.

In the present study the repellency (used as the standard for a promising repellent) ranged form III and V (49.33% to 98.66%) for different plant extracts against *Oryzaephilus surinamensis* where as [6] stated that most of the plant extracts tested by them showed a lower value than repellency class III (40.1-60%) but they did not show repellency class V. Repellency of rapeseed extracts to adults of *Tribolium castaneum* and *Tribolium confusum* was shown by [10]. Repellency of some plant extracts to the stored product beetles, *Tribolium castaneum* and *Sitophilus zeamais* reported by [11].

Table: 1 Repellency Power of Plant Extracts against *Oryzaephilus surinamensis*

S.No	Plant extracts Used	1.0 ml/100 g					2.5 ml/100 g					5 ml/100 g				
		R1	R2	R3	M	%	R1	R2	R3	M	%	R1	R2	R3	M	%
1.	*A. indica*	38	40	42	40	**80.00**	44	46	45	45.00	**90.00**	49	50	49	49.33	**98.66**
2.	*P. gronatum*	35	38	40	37.67	75.33	40	43	42	41.67	83.33	43	40	45	42.67	85.33
3.	*L. camara*	28	18	33	26.33	52.67	25	23	34	27.33	**54.67**	35	28	28	30.33	60.67
4.	*C. album*	36	40	28	34.67	69.33	38	42	34	38.00	76.00	35	44	48	42.33	84.67
5.	*V. negundo*	35	38	35	36.00	72.00	38	36	35	36.33	72.67	39	37	38	38.00	76.00
6.	*M. emarginata*	25	30	32	29.00	58.00	28	32	34	31.33	62.67	30	34	37	33.67	67.33
7.	*L. camara + P. gronatum*	28	26	20	24.67	**49.33**	30	28	25	27.67	55.34	32	30	28	30.00	**60.00**
8.	*L. camara+ C. album*	28	30	35	31.00	62	30	35	38	34.33	68.67	34	32	40	35.33	70.67
9.	*L. camara+ V. negundo*	32	40	42	38.00	76	40	42	44	42.00	84.00	42	48	47	45.67	91.34
10.	*L. camara+ M. emarginata*	38	36	30	34.67	69.33	38	40	33	37.00	74.00	43	45	39	42.33	84.67
11.	Control	6	8	8	7.33	14.67										

Table: 2 Analysis of Variance (ANOVA)

Total						
Count	30	30	30			
Sum	996	1082	1169			
Average	33.2	36.06667	38.96667			
Variance	38.85517	40.68506	48.3092			
ANOVA						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Sample	2776.011	9	308.4457	21.80684	8.08E-16	2.040096
Columns	498.8222	2	249.4111	17.63315	9.47E-07	3.150411
Interaction	82.95556	18	4.608642	0.325827	0.99473	1.778446
Within	848.6667	60	14.14444			
Total	4206.456	89				

SEM=0.68664, CD at 5% = 1.34582

CONCLUSION

The result shows that different plant extracts possess repellent property. It is useful for the human health being non toxic, biodegradable and do not harm non target species. As the dose increased from 1, 2.5 to 5 ml/100gm the

number of insects repelled has also increased. Result gives repellency class fall in categories III, IV and V which is used as standard for this test. [12] shown that repellency of powdered plant material of the Indian neem tree, the labrador tree and the sweet flag against some stored product pests.

Acknowledgement
The authors show their gratitude towards Head, Jai Narain Vyas University, Jodhpur for providing laboratory facilities to carry out the work. The author is also thankful to guide and guardian Dr. P.M. Singhvi for giving correct path to conduct this experiment successfully.

REFERENCES

[1] B.P. Khare, R.P. Skukla and B. Singh, *Indian J. Agri. Sci*., **1979**, 49, 609-612.
[2] G.C White, *J. Stored Prod. Res*., **1982**, 18, 155-119.
[3] D.A. Flemming, *J. Stored Prod. Res*., **1988**, 24, 233-236.
[4] A. Prakash, I.C. Pasalu and K.C. Mathur, *Bull. Grain Tech*., **1981**, 19(1), 59-61.
[5] L.L. Mc Donald, R.H. Guy and R.D. Speirs, Preliminary evaluation of new candidate materials as toxicants, repellents and attractants against stored product insects. *Marketing Res. Report Agri. Res. Service Washington*, **1970**, 2, 86-89.
[6] G. Jillani and H.C.F. Su, *J. Econ. Ento*., **1983**, 76, 154-157.
[7] Y.S. Xie, P.G. Fields and M.B. Isman, *J. Econ. Entomol*, **1995**, 88(4), 1024-1031.
[8] C. Chander, D.K. Ahuja, A. Nagender, S.K. Berry, H. Chander, *J. Food Sci. Tech. Mysore*, **2000**, 37 (6), 582-585.
[9] M.S. Rahman, M. Hosain and M. Ahmad, *Bangladesh J. Entomol*, **1999**, 9(1-2), 9-16.
[10] S.M. Ediz and G.R.F. Davis, *Can. Ento*., **1980**, 112, 971-974.
[11] S.H. Ho, Ma-Y and H.T.W. Tan, M. Sidik, B.M. Rejesus, R.P. Garcia, B.R. Champ, M. Bengston, O.S. Dharmaputa and H. Halid, *Proc. Sym. Pest Manag. Stored Food*, **1997**, 59, 209-215.
[12] S. Ignatowicz and B. Wesolowska, *Polskie-pismo-Entomologicnze*, **1996**, 65 (1-2), 61-67.