Efficacy Of Selected Plant Extracts On The Oviposition Deterrent And Adult Emergence Activity Of *Callosobruchus Maculatus* .F (Bruchidae; Coeleoptera)

GJSFR-G (FOR)
Classification: 060799

J.Shifa vanmathi[1] , C.Padmalatha[2], A.J.A.Ranjit Singh[3] and S.Suthakar isaac[4]

Abstract- **A study was undertaken to find out the effect of aqueous extracts of *Phyllanthus amarus, Ocimum tenuiflorum, Cynodon dactylon, Catharanthus roseus, Azadirachta indica, Tephrosia Purpurae, Morinda pubescens, Calotropis gigantea, Vitex negundo* and *Sesbania grandiflora* on oviposition deterrent and F_1 adult emergence were carried out at three different concentrations (1%, 3%, 5%) using black gram *Vigna munga* (L.) against *C. maculatus.* Maximum oviposition deterrent activity was observed in *C. dactylon* treatment *(*84.32%) which was par with *O. tenuiflorum* followed by *P.amarus* (83.83%) at higher concentration. All these plant extracts showed above 50% oviposition deterrent activity even at lower concentration. Reduction in F_1 adult emergence was also high after using these plant extracts.**

Keywords: *Callosobruchus maculatus*, aqueous extracts, oviposition deterrent activity, adult emergence.

I. INTRODUCTION

The cowpea beetle, *Callosobruchus maculatus* is a cosmopolitan insect pest of cowpea. It is a field -to-store pest as its infestation of cowpea often begins in the field as the mature pods dry (Huignard *et al.,* 1985; Sathyaseelan *et al.,* 2008) and when such seeds are harvested and stored, the pest population increases rapidly and results in total destruction within a short duration of 3-4 months (Rahman and Talukder, 2006). It multiplies very rapidly in storage (Ouedraogo *et al*, 1996) and reported 8.5% loss in pulses during post harvest handling and storage in India. Synthetic chemical insecticides have proved to be effective in the control of the beetle.Earlier, Petrolium ether extrat of neem (Ranjana Saxena and Beenam Saxena 2000), dichloromethane and methanol extract of *Acorus calamus* and *Cassia siamia* (Jayakumar *et al.,* 2005a), *Jatropha curcas* seed oil (Adebowale and Adedire, 2006), powdered leaves and extracts of *Vitex negundo* (Rahman and Talukder, 2006), plant lectins derived from *Cicer arietinum* (Sadeghi *et al*, 2006) and powder of *Terminalia chebula* and *Cassia auriculata* (Govindan and Jeyarajan Nelson, 2008) were reported to have significant oviposition deterrent and other biological activity against *C. maculatus.* In this context, based on the earlier literatures and easy availability of the plants, ten plants were screened viz *Phyllanthus amarus, Ocimum tenuiflorum, Cynodon dactylon, Catharanthus roseus, Azadirachta indica, Tephrosia purpurae, Morinda pubescens, Calotropis gigantea, Vitex negundo* and *Sesbania grandiflora* for their oviposition deterrent and adult emergence activity against *C.maculatus*

About[1]-PG Department of Zoology, Sarah Tucker College (Autonomous), Perumalpuram, Tirunelveli – 627 007.
About[2]-Dept of Advanced Zoology and Biotechnology, Rani Anna Govt. College for Women Gandhi Nagar, Tirunelveli – 627 008.
About[3]-Dept of Advanced Zoology and Biotechnology, Sri Paramakalyani College, Alwarkurichi, Tirunelveli – 627 412.
About[4]-PG & Research Department of Zoology, St.John's College, Palayamkottai.
Correspondingauthor:latharac@gmail.com

II. MATERIALS AND METHODS

1. *Insect culture*

Black gram seeds infested by the *C. maculatus* were collected from the grocery shop and brought to the laboratory. The infested seeds were set aside in a plastic container and covered with muslin cloth till the emergence of adult. Healthy adults emerged from the container were shifted to another plastic container and provided cleaned blackgram seed for oviposition and maintained at 28 ± 2°C and 70 ± 5% R.H. The container was undisturbed until the emergence of adults. Freshly emerged subsequent generations were used for further experiments.

2. *Preparation of plant extracts*

Fresh leaves of selected plants *Phyllanthus amarus, Ocimum tenuiflorum, Cynodon dactylon, Catharanthus roseus, Azadirachta indica, Tephrosia Purpurae, Morinda pubescens, Calotropis gigantea, Vitex negundo* and *Sesbania grandiflora* were collected at their respective places and brought to the laboratory. Each plant material was dried under shade and powdered by using electric grinder and pass through a 20 mesh sieve and kept in a 1 kg capacity polypropylene bag. 300 g of each powdered plant material were taken into 1 litre capacity conical flask and 1000 ml of distilled water was added to it and shaken for 8 h in a mechanical shaker and then kept it for 24 h. The extract was separated using fine muslin cloth and then filtered. The filtrate was collected in a 2 litre capacity conical flask and volume was made up to 1000.ml. This was considered as stock solution. Required concentrations (1%, 3%, 5%) were prepared from the stock solution.

3. Oviposition deterrent activity

Black gram seeds were cleaned and sterilized at 45° C for 6 h in order to kill the eggs and developing larvae. For each concentration, 25g blackgram seeds were taken in a conical flask and mixed with each concentration of aqueous extracts and seeds treated with water alone used as control. After thorough mixing the seeds were air dried and they were stored in plastic containers and 5 pairs of newly emerged adult *C maculatus* were introduced in each container. Three replicates were maintained for each concentration and control. After 15 days, number of eggs laid on treated seeds (Ts) and control seeds (Cs) were recorded and the percentage of oviposition deterrence (POD) was calculated as POD |(Ts-Cs)/Cs|X 100.

4. Adult Emergence activity

After the eggs were counted the experimental set up was kept undisturbed till the emergence of F_1 adults from the treated and untreated seeds. The number of F_1 adults emerged from the control seeds (Ac) and treated seeds (At) were recorded. The percentage reduction in F_1 adult (PRA) emergence (Fl) was calculated as PRA |(Ac-At)/ Ac|X 100.

5. Data analysis

Mean number of eggs laid on treated and control seeds and F_1 adult emergence were calculated using the above said formula. The data obtained from the experiments were subjected to two-way analysis of variance (ANOVA).

III. RESULT AND DISCUSSION

Earlier literature indicate the importance of plant extract in protecting seeds by way of direct mixing of the dried leaves, plant powders, solvent extracts, vegetable/ essential oils on seeds during post harvest storage (Rajapakse, 1996; Ngamo *et al.,* 2007; Meera Srivastava and Lalitha Gupta, 2007; Zahra Sahaf and Moharramipour, 2008; Othira *etal.,* 2009)
The reduction in oviposition was increased with the increase in dosage of each treatment. Earlier, Olaifa and Erhun (1998) found that higher concentration of the powder of *Piper guineense* significantly reduced the oviposition. These earlier findings are in conformation with the present study. Higher concentrations of plant extracts (5%) were found to be effective as compound to lower ones (1% and 3%) in bringing down the egg laying by the pest insect. Present study revealed that, maximum oviposition deterrent activity was observed in *O. tenuiflorum and C. dactylon* followed *by P. amarus* (Table 1). It is noteworthy that all these plant extracts showed more than 50% of deterrent activity even at lower concentration. It appears that these plant extracts might possess repellent and/or oviposition deterrent principles. Oviposition detergency may be due to the changes induced in physiology and behaviour in the adult of *C. maculatus* as reflected by their egg laying capacity.The data shown in Table 2 revealed the effect of leaf extracts on adult emergence of pulse beetle. A significant reduction in adult emergence was among the treatments. It is added that efficacy of these selected plant extracts was much stronger against F_1 than egg laying. Jayakumar *et al.* (2003) reported that plant extracts have obvious effects on postembryonic survival of the insect and resulting reduction in adult emergence in all the concentrations of different plants. In the present study, maximum reduction in the adult emergence was observed in the seeds treated with *Azadirachta indica.* Adult emergence was reduced to 5.66±0.66 at 1% 2.66±0.33 at 3% and 1.66± 0.33 at 5% concentration of *Azadirachta indica* . It was followed by T.purpurae (82.11%) at 1% (88.62%) at 3% and (94.31%)at 5% concentrations. However *O.tenuiflorum* was found to be effective in reducing the adult emergence at a higher concentration. Annie Bright (2001) and Raja *et al.* (2001) reported that botanicals inhibited adult emergence in C. *maculatus.* in cowpea. They further stated that, when the eggs were laid on treated seeds, the toxic substance present in the extract may enter in to the egg through chorion and suppressed their embryonic development. It is in agreement with the present study that adult emergence was greatly reduced in treated seeds than control seeds.Raja *et al.* (2001), Keita *et al.* (2001) and Sathyaseelan et al. (2008) reported that various plant products were effective in reducing oviposition and adult emergence of *C. maculatus* only, *but the* seed quality .and germination were not affected. These results are in accordance with our findings. The present investigation has brought out the efficacy of *Phyllanthus amarus, Ocimum tenuiflorum, Cynodon dactylon, Catharanthus roseus, Azadirachta indica, Tephrosia Purpurae, Morinda pubescens, Calotropis gigantea, Vitex negundo* and *Sesbania grandiflora.* Preparation of these aqueous extracts and application on the seeds are so easy and cheaper. Hence, effectual plant extract can be used as one of the component in Integrated Pest Management especially small godowns or shop retailer for short term storage.

***Heading** 1 Table: 1 Effect of plant extracts on Oviposition of pulse beetle, C. maculatus*

Treatment	Total no. of Eggs laid		
	Conc % v/w		
	1%	3%	5%
Control	134.00±2.88		
Phyllanthus amarus	39.66±0.66 (70.4)	31.66±1.45 (76.37)	21.66±0.33 (83.83)
Ocimum tenuiflorum	38.66±5.23 (71.14)	27.33±3.38 (79.6)	21.00±0.00 (84.32)
Cynodon dactylon	41.33±3.28 (69.15)	28.33±2.33 (78.85)	21.00±1.15 (84.32)
Catharanthus roseus	49.66±1.85 (62.94)	39.66±4.25 (70.4)	30.33±1.76 (77.36)
Azadirachta indica	55.33±4.33 (58.7)	43.66±5.45 (67.41)	26.00±0.57 (80.59)
Tephrosia Purpurae	69.00±2.30 (48.5)	55.00±2.00 (58.95)	40.66±1.20 (69.65)
Morinda pubescens	65.33±2.33 (51.24)	49.66±1.66 (62.94)	44.00±1.00 (67.16)
Calotropis gigantea	63.33±1.20 (52.73)	52.33±0.88 (60.94)	41.66±1.45 (68.91)
Vitex negundo	70.33±5.60 (51)	53.33±1.76. (60.2)	44.00±2.51 (67.16)
Sesbania grandiflora	73.66±3.52 (45.02)	52.00±4.50 (61.19)	35.00±0.57 (73.88)

Within the column values was statistically significant ($P<0.05$)

Heading 2 *Table: 2 Effect of plant extracts on adult emergence of pulse beetle, C. maculatus*

Treatment	Total no. of Eggs laid		
	Conc % v/w		
	1%	3%	5%
Control	41.00±0.57		
Phyllanthus amarus	27.00±3.00 (34.15)	15.66±0.33 (34.15)	14.33±0.33 (65.04)
Ocimum tenuifloum	20.33±0.33 (50.41)	20.33±0.33 (50.41)	4.00±0.57 (90.24)
Cynodon dactylon	27.66±2.66 (32.52)	19.00±4.93 (53.66)	10.00±0.00 (75.61)
Catharanthus roseus	36.33±0.33 (11.38)	26.00±0.00 (36.59)	16.33±0.33 (60.16)
Azadirachta indica	5.66±0.66 (86.18)	2.66±0.33 (93.50)	1.66±0.33 (95.93)
Tephrosia Purpurae	7.33±0.33 (82.11)	4.66±0.33 (88.62)	2.33±0.33 (94.31)
Morinda pubescens	26.33±0.33 (35.77)	21.66±0.33 (47.15)	19.00±0.57 (53.66)
Calotropis gigantea	24.66±0.33 (39.84)	21.33±0.33 (47.97)	18.00±0.57 (56.10)
Vitex negundo	27.33±0.66 (33.33)	23.00±0.57 (43.90)	19.00±0.57 (53.66)
Sesbania grandiflora	27.33±0.66 (33.33)	23.00±0.57 (43.90)	19.00±0.57 (53.66)

Within the column values was statistically significant ($P<0.05$)

IV. REFERENCES

1) Adebowale, K. O. and Adedire. £. O. 2006. Chemical composition and lnsecticdal properties of the underutilized *Jatropha curcas* seed oil. *African Journal of Agricultural Research,* 5(10): 901-906.

2) Ajayi, F. A. and Wintola, H. U. 2006. Suppression of the cowpea bruchid *(Callosobruchus maculatus* (F.) infesting stored cowpea *(Vigna unguiculata* (L.)) seeds with some edible plant product powders. *Pakistan Journal of Biological Sciences,* 9(8): 1454-1459.

3) Annie Bright, A., Babu, A., Ignacimuthu, S. and Dorn, S. / 2001. Efficacy of *Andrographis peniculataNzes.* On *Callosobruchus chinensis* L. during post harvest storage of cowpea. *Indian Journal of Experimental Biology,* 39: 715-718.

4) Govindan, K. and Jeyarajan Nelson, S. 2008. Effect often plant powders on mortality, oviposition, adult emergence and seed weight loss on pulse beetle, *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae). *Hexapoda,* 15(1): 64-66.

5) Huignard, J., Leroi, B., Alzouma, I. And Germain, J. F., 1985. Oviposition and development of *Bruchidius atrolineatus* and *Callosobruchus maculatus* in Vigna unguiculata in cultures in Nigeria, *Insect Science Application,* **6 :** 691-699.

6) Jayakumar, M., 2010. Oviposition deterrent and adult emergence activities of some plant aqueous extracts against *Callosobruchus maculates* F. (Bruchidae: Coleoptera). *Journal.of biopesticides* 325-329 PP.

7) Jayakumar, M., Raja, N. and Ignacimuthu, S. 2003. Efficacy of crude extracts of *Hyptis suaveolens* and *Melochia corchorifolia* on pulse beetle *Callosobruchus maculates.* In: *Biological control of Insect Pests.* (Ignacimuthu, S. and Jeyaraj, S. eds.). Phoenix Publishing House, New Delhi, 218-221 PP.

8) Jayakumar, M., John William, S. and Ignacimuthu, S. 2005a. Evaluation of some plant extracts on the oviposition deterrent and adult emergence activity of *Callosobruchus maculates* F. (Bruchidae: Coleoptera). *Pestology,* 29(1): 37-41.

9) Keita, S. ML, Vincent, C, Schmit, J. P., Arnason, J. T., Belanger, A. 2001. Efficacy of essential oil of *Ocimum basilicum* L. and *O. gratissimum* L. applied as an insecticidal fumigant and powder to control *Callosobruchus maculatus* (Fab.) (Coleoptera: Bruchidae). *Journal of Stored Products Research,* 37(4): 339-349.

10) Meera Srivastava and Lalita Gupta, 2007. Effect of formulations of *Solanum surratense* (Family: Solnaceae) an Indian desert plant on oviposition by the pulse beetle *Callosobruchus chinensis* Linn. *African Journal of Agricultural Research,* 2(10): 552-554.

11) Ngamo, T. S. L., Ngatanko, I., Ngassoum, M. B., Mapongmestsem, P. M. and Hance, T. 2007. Persistence of insecticidal activities of crude essential oils of three aromatic plants towards four major stored product insect pests. *African Journal of Agricultural Research,* 2(4): 173-177.

12) Olaifa, J. I. and Erhun, W. 0.1998. Laboratory evaluation of *Piper guineense* for the protection of cowpea against *Callosobruchus maculatus. Insect Science and Its Application,* 9: 55-59.

13) Othira, J. O., Onek, L. A., Deng, L. A. and Omolo, E. O. 2009. Insecticidal potency of *Hyptis spicigera* preparation against *Sitophilus zeamais* (I.) and *Tribolium castaneum* (Herbst) on stored maize grains. *African Journal of Agricultural Research,* 4(3): 187-192.

14) Ouedraogo, A. P., Sou, S., Sanon, A., Monge, J. P., Huignard, J., Tran, B. and Credland, P. F. 1996. (Coleoptera: Bruchidae) and Influence of its parasitoid *Dinarmus basalis* (Pteromalidae) in two climatic zones of Burkina Faso. *Bulletin Entomological Research,* 86: 695-702.

15) Rahman, A. and Talukder, F. A. 2006. Bio efficacy of some plant derivatives that protect grain against the pulse beetle, *Callosobruchus maculat-us. Journal of Insect Science,* 6(3): 19-25.

16) Raja,N., Babu, A., Dorn, S. and Ignacimuthu, S. 2001. Potential of plants for protecting stored pulses from *Callosobruchus maculatus* (Coleoptera: Bruchidae) infestation. *Biological Agriculture and Horticulture,* 19:19-27.

17) Rajapakse, R. H. S. 1996. The effect of four botanicals on the oviposition and adult emergence of *Callosobruchus maculatus* (F.). (Coleoptera: Bruchidae). *Entomon,* ***21 : 211***

18) Ranjana Saxena and Beenam Saxena, 2000. Bioactivity of certain plant extracts against *Callosobruchus maculatus* (Fab.). *Journal of Applied Zoological Research,* 11(1): 29-32.

19) Sadeghi, A., Van Damme, E. J.M., Peumans, W. J., Smagghe, G. 2006. Deterrent activity of plant lectins on cowpea weevil *Callosobruchus maculatus* (F.) oviposition. *Phytochemistry,* 67: 2078-2084.

20) Sathyaseelan, V., Baskaran, V. and Mohan, S. 2008. Efficacy of some indigenous pesticidal plants against pulse beetle, *Callosobruchus chinensis* (L.) on green gram. *Journal of Entomology,* 5(2): 128-132.

21) Talukder, F. A. and Howse, P. E. 2000. Isolation of secondary plant compounds from *Aphanamixis polystachya* as feeding deterrents against adults *Tribolium castaneum* (Coleoptera: Tenebrionidae). *Journal of Stored Product Research,* 107(5): 395-402.

22) Zahra Sahaf, B. and Moharramipour, S. 2008. Fumigant toxicity of *Carum copticum* and *Vitex pseudo-negundo* essential oils against eggs, larvae and adults of *Callosobruchus maculatus. Journal Pest Science,* 81(4): 213-220.