EFFECT OF *ACORUS CALAMUS*, BIOSAL® AND DELTAMETHRIN ON FECUNDITY OF *CALLOSOBRUCHUS ANALIS*

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Abstract

Effect of two phytopesticides, *Acorus calamus* (AC) essential oil, Biosal® (Neem formulation = NF Neem pesticide registered by APTA) and Deltamethrin (synthetic) was observed after 15 days of treatment by direct application method (DAM). The LC_{50} dose was used for three compounds 0.15608 µl/cm^2 for *Acorus calamus*, 1.338504 µl/cm^2 for Biosal® and 0.03352 µl/cm^2 for Deltamethrin. Emergence was observed by (DAM) in control and treated the fecundity of three compounds 62.5% and 58.33% by *Acorus calamus*, 72% and 67.74% by Biosal and 78.94% and 50.79% by Deltamethrin.

Introduction

In different parts of world Scientists are working for the development and establishment of plants pesticides usually called phytopesticides, natural pesticides, botanical pesticides or bio pesticides (Saxena *et.al* 1974; Chauhan *et. al* 1987; Ravikant *et. al* 2007; EL-Nahal *et al* 1994; Ermel *et. al* 1991). Deltamethrin is a synthetic pyretheriod, broad spectrum, non-cumulative insecticide, a fast acting neurotoxic agent with good contact and stomach action and no fumigation action. Tabassum *et al* (1998) reported the effect of Neem and Dimilin on eggs production and adult emergence against *C. analis*. Boateng and Kusi (2008) worked on the suspectibility of *C. maculates*. Jayakumar (2010) studied the oviposition determence on cowpea *vigna ungulate* (L.) against *C.maculates* using phytopesticide. The present work on fecundity effect of phytopesticides *Acorus calamus*, Biosal as compared to synthetic pesticide Deltamethrin. The phytopesticides are easily available in Pakistan and others parts of the world, and these pesticides may be stored for a long time at normal room temperature. Synthetic and commercial pesticides are hazardous not only beneficial insects but also for environment and specially for human. Therefore present study is a search of phytopesticide.

Materials and Methods

The fecundity of *Callosobruchus analis* was studied at 30 ± 1.0°C on mung grains (*vigna radiata*). Fifty gram of seeds were taken in six dishes were set. Then variable volume of pesticides was applied on the dishes by direct application method at LC_{50} dose. The LC_{50} dose were used for three compounds 0.15608 µl/cm^2 for *A.calamus*,1.338504 µl/cm^2 for biosal and 0.03352 µl/cm^2 for Deltamethrin. Then ten pairs of freshly emerged *C. analis* were released for egg laying and hatching. The ten pairs of adults were noticed that they died after 15 days. The total number of eggs laid was counted and the insects were left grow. Emergence from egg was observed, readings were recorded daily and the calculation of mean developmental period of *C. analis* was calculated. The formula used for fecundity was as follows.

$$\text{Fecundity \%} = \frac{\text{No. of adults}}{\text{No. of egg}} \times 100$$

For inhibition of eggs and emergence of the adults from the eggs was calculated by the following formula.

$$\text{Inhibation of egg / emergence} = \frac{\text{Control} - \text{treated}}{\text{Control}} \times 100$$

Results and Discussions

Table 1. shows the results of fecundity effect of *A. calmus,* Biosal and Deltamethrin against *Callosorbruchus analis* (test species) after 15 days of treatment at LC_{50} dose by direct application methods. It is shown that capacity of egg laying and average number of adults were reduced to 160 to 98 and 100 to 56 respectively when this species was treated with *A. calamus.* Similarly test species (*C. analis*) on mung seed was treated with Biosal, average number (100) of eggs and average number (72) of adults were reduced to 62 eggs and 42 adults. This table also indicated that when 95 eggs and 75 adults were treated with Deltamethrin, eggs and adults were reduced to 63 and 32 respectively. The average number of emergence on mung seeds, when

treated with *A. calamus* was 62 (control) to 58% (treated). Almost similar results were obtained applying Biosal (Table 1). Considerable reduction (79 to 51%) in emergence was recorded when test species was treated with Deltamethrin. Percentage of inhibition in egg laying and emergence are also shown in Table 1. Similar results (about 38%) were obtained when test species was treated with *A. calamus* and Biosal, while highest (57.33%) inhibition in emergence was recorded when Deltamethrin was applied to the test species (*C. analis*).

Fig. 2. Histogram shows the emergence of *C. analis* after 15 days of treatment using *A.calamus* Biosal and Deltamethrin. Rajapaksi and van Emden (1997) worked on ten plants and four vegetable oils in managing the Bruchid beetle of legumes *i.e Callosobruchus chinensis*, *C.maculates* and *C.rhodesianus*. Oils used were Corn Ground nut, Sun flower and sesame.These oils significantly reduced the oviposition all *Callosobruchus genes*

Table 1. Fecundity effect of *A. calamus*, Biosal and Deltamethrin against *C. analis* after 15 days of treatment at LC_{50} dose by direct application method.

S.No.	Pesticides	Treatment	Average no. of eggs	Average no. of adults	Average no. of emergence	Inhibition in egg laying	Inhibition in emergence
1.	*A. calamus*	Control	160	100	62.5%	00	00
		Treated	98	56	58.33%	38.75%	44.00%
2.	Biosal	Control	100	72	72%	00	00
		Treated	62	42	67.74%	38%	41.66%
3.	Deltamethrin	Control	95	75	78.94%	00	00
		Treated	63	32	50.79%	33.68%	57.33%

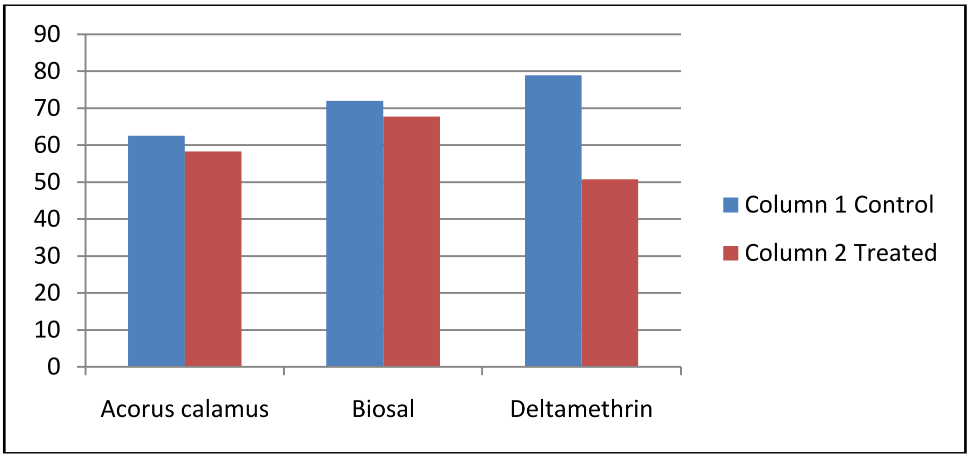

Fig. 1. Histogram showing the emergence of *C. analis* after 15 days of treatment using *A. calamus*, Biosal and Deltamethrin.

at 10 ml/kg and also significantly reduced the longenity of adults of *C. maculates* and *C. chinensis* at this dose. They observed that only corn and sun flower oil caused significantly reduction of longenity of *C. rhodesianus* at 10 ml/kg. The number of eggs laid by all three Bruchid species was significantly reduced in treatment. The present study used the phytopesticides against *C. analis*, the treatment shows inhibition in both eggs and adults, both studies shows the effectiveness of phytopesticides. Tabssum *et al* (1998) reported on effect of neem compound (NfC and NC) and dimilin of *Callosobruchus analis* as fecundity by two method filter paper impregnation and Glass film method. They observed the effect of compounds on eggs production and adult emergence. The difference in the results may be due to the different methods and phytopesticide used in both studies. Aslam *et al* (2002) investigated the insecticidal potential of some species against *Callosobruchus chinensis* on stored chickpea with six treatments. They reported mortality, adult emerged number, number of adults and chickpea weight loss. Present study was in agreement with his results through the phytopesticides and test species were different. This gives the additional support to the opinion that phytopesticides are as effective as chemical pesticides.

Mania (2004) reported the influence of initial infestation with bruchid eggs (2,3,4,5% of seeds with 2 eggs) on progeny development of *C. subinnotatus* and damage to three cultivars (Bakingangala, Ole and Bulmono) of Bambra ground nut. Mania observed significantly increased seed infestation with varying proportion of Bruchid eggs. The result was different due to the different environmental factor, species and pesticide. The phytopesticides used in present study gave better results reducing egg laying and emergence.

Shukla *et al* (2009) carried out the laboratory and field experiments to investigate the bioefficacy of sweet flag (*A. calamus*) against *Callosobruchus chinensis*, which infests stored chickpea. They observed the percentage of egg laying reduced from 12.8% to 100% with increasing doses of powders and extracts. He used different species while our result 38% may be due to the difference in the test species since each species has its own characteristics.Sanon *et al* (2010) worked on the stored grain pest *Callosobruchus maculates* (F.) (Coleoptera:Bruchidae). The biopesticied spinosad controlled many insects pests of stored food product. Laboratory and field trials were carried out to determine the efficacy of this pesticide against the cowpea weevil, (*C.maculates*) the main storage pest of cowpea, *vigna ungulate*. In laboratory spinosad caused high mortality of adult *C. maculates* and decreased the number of eggs laid by females. However spinosad was less toxic in the 24 hour treatment to *C. maculates* than Deltamethrin. In farm experiments spinosad was effective in controlling *C. maculates* after 6 months storage. The number of insects emerging from cowpea seeds was reduced > 80% by coating seeds with spinosad but only 43% by coating with Deltamethrin less than 20% of seeds were perforated in the spinosad treatment compared with 29% for Deltamethrin. They observed spinosasd controlled *C. maculates* in 6 months cowpea storage whereas Deltamethrin failed to control *C. maculates* after 3 months of storage. Spinosad has the potential to be more effective in controlling *C. maculates* than Deltamethrin. Sanon *et al* (2010) used the same pyrethroid, showing considerably higher number (80%) inhibition in egg laying compare to the present study. This may be due to higher dose, methodology or environment of the trial. Present study was based on 15 days trial only which may be considered preliminary investigation on phytopesticides / test species, therefore detailed investigation is recommended for future studies.

References

Aslam, M., Khan, K.A and Baiwa, M.Z.H. (2002). Potency of some species against *Callosobruchus chinensis* Linnaeus. Online journal of biological sciences (Pakistan) 3 ills, 1 table 17 ref, summary (EN) (7): 449-452.

Boateng, B.A. and Kusi, F. (2008). Toxicity of Intropha seed oil to *Callosobruchus maculates* (Coleoptera:Bruchidae) and its parasitoid, *Dinarmus basalis* (Hymenoptera:Pleromalidae). *Journal of Applied Sciences Research* 4(8): 945-951.

Chauhan, S.P.S., Kumar, A., Singh, C.L. and Pandey, U.K. (1987). Toxicity of some plants extracts against rice moth *Corcyra cephalanica* (Stainton) (Lepidooptera). *Indian J. Entomol.* 49(5): 532-534.

EL-Nahal, A.K.M., Schmidt, G.H. and Risha, E.M. (1994). Influence of vapours of *Acoruc calamus* L. oil on the reporoductivity of some stored produt Coleoptera. *Pak. J. Entomol. Karachi* 9(1): 21-27.

Ermel, K., Kalinowski, H.O. and Schmuiterer, H. (1991). Isolation and characterization of marrangin, a new insect growth regulating (IGR) substance from seed Kernels of the marrayngo tree, *Azadirachta excestsaI* (jack). *J. Appl. Entomol.* 112(5): 512-519.

Jayakumar, M. (2010). Ovipostion deterrent and adult emergence activities of some plants aqueous extract against *Callosobruchus maculates* F. (Coleoptera:Bruchidae). *Journal of Biopesticieds* 3(1): 325-329.

Mania, Y.T. (2004). Effect of initial infestation and interspecific competition on the development of *Callosobruchus subinnotatus* (Pic) in bambra ground nut *Vigra subterranean* (L.) (*University of Maiduguri Nigeria Dept. Crop Protection. Lale N.E.S*) *Verd Court; 4 table 9 ref. summary* (*En*) 6(6): 1059-1061.

Rajapakse, R. and Van Emden, H.F. (1997). Potential of four vegetable oils and ten botanical powders for reducing infestation of cowpeas by *Callosobruchus maculates, C. chinensis* and *C. rhodesianus*. *Journal of Stored Product Research* 33(1): 59-68.

Ravikant, U., Jaiswal, G. and Xadav, N. (2007). Toxicity repellency and oviposition inhibating activity of some essential oils against *Callosobruchus chinensis. Journal of Applied Bioscience* 33(1): 23-28.

Sanon, A., Ba, N.M., Binso-Dabire, C.L. and Dirgh, P.B.R. (2010). Effectiveness of spinosad naturalytes in controlling the cowpea storage pest, *Callosobruchus maculates* (Coleoptera:Bruchidae). *Journal of Economic Entomology* 103(1): 203-210.

Sexena, B.P.E., Rohden, B.D. and Verig, B. (1974). Morphological changes in the *Thermobia domestica* under the influence of *Acorus calamus* oil vapours. *Separatum Experimentia* 30: 1298.

Shukla, R., Kumar, A., Prasad, C.S., Srivastava, B. and Deubey, N.K. (2009). Efficacy of *Acorus calamus* L. leaves and rhizome on mortality and reproduction of *Callosobruchus chinensis* L. (Coleoptera:Bruchidae). *Applied Entomology and Zoology* 44(2): 241-247.

Tabassum, R., Naqvi, S.N.H., Ahmed, I. and Khan, M.F. (1998). Effect of Neem compounds (Nfc and Nc) and Dimilin of *callosobruchus analis* fecundity by filter impregnation and glass film method. *Bulletin of Pure and Applied Science* 17(1): 9-12.