Uluslararası İleri Doğa Bilimleri ve Mühendislik Araştırmaları Dergisi
Sayı 8, S. 503-510, 4, 2024

Araştırma Makalesi

International Journal of Advanced Natural Sciences and Engineering Researches
Volume 8, pp. 503-510, 4, 2024

Research Article

https://as-proceeding.com/index.php/ijanser
ISSN: 2980-0811

Management of Angoumois Grain Moth, *Sıtotroga cerealella* Usıng Indıgınous Plant Extracts

Farid Asif Shaheen[1*], Muhammad Hamza Daud[1], Mustajab Ali Measum[1] and Shakeel Hussain[1]

[1]*Department of Entomology, PMAS Arid Agriculture University, Rawalpindi-46300, PAKISTAN*

[*]*(shaheen@uaar.edu.pk)*

(Received:18 May 2024, Accepted:26 May 2024)

(3rd International Conference on Engineering, Natural and Social Sciences ICENSOS 2024, May 16-17, 2024)

ATIF/REFERENCE: Shaheen, F. A., Daud, M. H., Measum, M. A. & Hussain, S. (2024). Management of Angoumois Grain Moth, Sıtotroga cerealella Usıng Indıgınous Plant Extracts. *International Journal of Advanced Natural Sciences and Engineering Researches*, 8(4), 503-510.

Abstract – Angoumois grain moth (*Sitotroga cerealella*) is a destructive pest of wheat in storage. It causes severe damage in wheat and other stored grains also. The world is looking forward towards the eco-friendly use of botanicals as insecticides including Neem (*A. indica*), Phulai (*A. modesta*), Piazi (*A. tenuifolius*), Pholi (*C. oxyacantha*), Bhangra (*E. prostrata*), Khatiboti (*O. corniculata*), Asgand (*W. somnifera*), Kandiyari (*S. marianum*), Bhakra (*T. terrestris*) and Sukh chain (*D. indica*), leaf extract of different indigenous plants were used against *S. Cerealella* in wheat grains. Results showed that the least insect count was recorded at 30% concentration of *A.indica* after 60 days as compared with control where maximum numbers of insects were counted 22.93. Similarly the results of *E. prostrata,S. marianum, T. terrestris*also showed significant results and inhibited the insect growth. The results depicted that 20% concentration of *S. marianum* showed statistically pairing repellent effect as showed by 30% concentration of *C. oxyacantha*. While *W. somnifera* plant extract at 10% concentration gave similar observations as observed by the application of *A. modesta* 20% concentrations. The outcome of this research will lead to an effective and environmental friendly control measures against *S. cerealella* and lead to development of different formulations of bio pesticides of these indigenous plant materials.

Keywords – Angoumois grain moth, Management, Plant extracts, Concentrations and Repellency

I. INTRODUCTION

Wheat (*Triticum aestivum*) is the most significant and broadly cultivated crop in the world accounting for 20% of all calories used up worldwide. These losses caused mainly by stored insects, including the angoumois grain moth *(Sitotroga cerealella)*. In stored commodities like stored pulses, seeds etc major losses have been reported due to insect pests. So to overcome qualitative and quantitative losses and deterioration, these stored commodities require hygienic protection. The quality and quantity of stored grains loss due the feeding of insects on grains and the production of their waste material or it may be due to the growth of microorganisms [1]. In Pakistan, the most damaging stored product insect pests include *Trogoderma granarium, Rhizopertha dominica, Sitophilus oryzae, S. cerealella* and *Tribolium castaneum*. The damage pattern of Angoumois grain moth in stored grains particularly in wheat is that the adults lay eggs in the grains and then after hatching the larvae enters the grains by making a

hole and start feeding inside the grains. The larvae change into pupa inside the grains and before going to pupa the larvae mark a small hole which is help full for the emergence of adults.This hole also point out the damage grains. A number of plant products have been reported as being in use against insect pest in stored grains including wheat to minimize storage losses due to insects. Neem *(Azardirachta indica*) products like leaves, seed, bark from which oil cake and extracts are prepared have been reported to possess fungicidal, nematicidal, insecticidal, insect repellent and antifeedent properties. Before the development in the chemical control strategies, fumigants has been widely used in the world to manage and suppress all stored product insect pests including *S. cerealella* that is well known as the most damaging pest of barley, wheat rice and maize. Still further research work is required for the development of environmentally favorable control strategies likewise varietal screening that is considered as the major constituent of IPM programme to overcome the environmental pollution hazards [2].

The objective of the study was to manage *Sitotroga cerealella* by using extracts of indigenous plants in stored wheat grains.

II. MATERIALS AND METHOD

The research study wascarried out to check the effectiveness of aqueous plant extract of ten different indigenous plants viz, Neem (*Azadirachta indica*), Phulai (*Acacia modesta*), Piazi (*Asphodelus tenuifolius*), Pholi (*Carthamus oxyacantha*), Bhangra (*Eclipta prostrata*), Khatiboti (*Oxalis corniculata*), Asgand *(Withania somnifera*), Kandiyari (*Silybum marianum*), Bhakra (*Tribulus terrestris*) and Sukh chain (*Derris indica*), were used against *S. cerealella* in wheat grains.

Rearing and collection of *Sitotroga cerealella*

Insects were reared in the selected variety of damaged grain of wheat in the controlled conditions at 25-30 ^{0}Ctemperature and humidity glass jars of 1 kilograms capacity were taken for rearing of insects. After the rearing process complete, the infested grains having adult, pupa, larva and eggs of *S. cerealella* were screened through mesh to separate the adults from the jars of the equal size and life. Then shifted to jars and botanicals application and data analysis started.

Preparation and application of extracts

Firstly, the fresh leaves were plucked from the *Neem* ,Phulai , Piazi , Pholi , Bhangra , Khatiboti, Asgand, Kandiyari, Bhakra and Sukh chain plants from the different areas of Pothowar region and then were brought to laboratory. Now the plant leaves were washed thoroughly with distilled water, and then it was kept for dry in shade properly. Next step was to make the very fine powders of these leaves by using grinder. These powders were taken in quantity of 100gm and were mixed with 200gm of distilled water (w/v) for 24 hours. This material was then undergo shaking process using electrical shaker for 24 hours and then was filter by filter paper.

Preparation of different concentrations

All concentrations of plants extracts were made from the pure extracts. Beaker flask method was used to prepare these concentrations. To prepare the concentration of 20% 10gm crude extract were add to flask and then remaining 20 ml water were added in it same like 30% and 10% concentration was prepare via this method. To check the repellency effect of the botanicals it was applied in the petri dishes and the data were count after 24, 48 and 72 hours intervals and then statistical analysis of data were done to check the difference in different concentrations effect.

Parameters of Research

a) Insect count

Insect count was done at every 10 days interval for 2 months. Each jar was treated with the different concentration of botanicals prepared and then insects were released in the jars. The total no. of insects alive before the application and the total no. of insects alive after the application were count. For counting of insects the wheat were removed from the jar on a paper and alive insects were divided with camel hair brush.

b)Repellency Effect

Repellency study of the *S. cerealella* was done by using the filter paper strip technique. The filter paper were cut in a strip length wise (8×10 cm) and half of the strip were treated with the concentration of botanicals and then place in the petri dish with the help of binding tape. After that 15 insects were released in the petri dish. Data were recorded after the time duration of 24, 48 and 72 hours application of plant extracts.

III. RESULTS

Insect Count

The total number of insects alive before the application and the total number of insects alive after the application were counted. For counting of insects the wheat were removed from the jar on a paper and the alive insectswereseparated with camel hair brush. Results showed that the least insect count was recorded at 30% concentration of *A. indici a*fter 60 days as compared with control where maximum numbers of insects were counted 22.93. Similarly the results of *E. prostrata, S. marianum, T. terrestris* also showed significant results and inhibited the insect growth Table 1.

Repellency Effect

Results showed that the most repellency effecton Angoumois Grain Moth, (*S. cerealella)* was exhibited in wheat grains with the application *A. indica* (10.24) 30% plant extract liquid after 24 hours followed by *E. prostrata, S. marianum, T. terrestris, C. oxyacantha, A. tenuifolius, O. corniculata, W. somnifera, A. modesta* and lowest in *D. indica,* (1.30) as compared with the control treatment where the observed repellent effect was the least i.e. 0.99 as shown in Table 2 and 3.The means followed by different letters shown statistically significant repellent effect on adult *S. cerealella* after 24 hours of application. *A. indica* extract showed most significant results as compared to other plant extracts. The results of 10% *A. indica* plant extract were statistically similar in repellency efficacy against adults of *S. cerealella* as compared to 20% *E. prostrata, 20% S. marianum.* The 30%, 20% and 10% extract concentrations of *E. prostrata and S. marianum* showed statistically identical results. The results showed that*A. Indica* and *E. prostrata* plant extracts at 10% and 20% concentrations showed the statistically similar repellency effect whereas 20% *E. prostrata* showed identical repellency as exhibited by plant extract of *T. terrestris* at 30% concentration after 24 hours.The results depicted that 20% concentration of *S. marianum* showed statistically pairing repellent effect as showed by 30% concentration of *C. oxyacantha*. While *W. somnifera* plant extract at 10% concentration gave similar observations as observed by the application of *A.modesta* 20% concentrations. Similarly the identical results of repellency were exhibited by *E. prostrata* and *S. marianum* by applying their 30% and 20% concentration respectively. However in control the results were non-significant and showed the least adult repellency after 24 hours as compared with treated wheat grains where results were highly significant and showed more repellent effect on *S. cerealella* after 24 hours. After 48 hours of application, the most repellency effect on *S. cerealella* was exhibited in wheat grains by extracts of *A. indica* (14.62) 30%, plant extract liquid followed by *E. prostrata, S. marianum, T. terrestris, C. oxyacantha, A. tenuifolius, O. corniculata, W. somnifera, A. modesta* and lowest in *Derris indica,* (2.63) as compared with the control treatment where the observed repellent effect wasthe least i.e. 0.2 as shown in tables. The means followed by different letters shown statistically significant repellent effect on adult *S.cerealella* after 48 hours of application. Table depicted that *A. indica* extract showed most significant results as compared to other plant extracts and control treatments.

Table 1 Mean Numbers of Angoumois Grain Moth, (*Sitotrogacerealella)*count after the application of 10%, 20% and 30% Various Indigenous Plant Extracts after 02 months

Sr. No	**Plant Extracts**	**10%**	**20%**	**30%**
1	*Azadirachtaindica*	13.78±0.10 f	12.15±0.08 d	10.37±0.08 a
2	*Ecliptaprostrata*	14.42±0.18 l	13.39±0.15 k	11.07±0.05 h
3	*Silybummarianum*	15.19±0.11 t	13.85±0.07 r	11.59±0.07 n
4	*Tribulus terrestris*	16.70±0.05 u	15.75±0.11 s	14.45±0.13 op
5	*Carthamusoxyacantha*	17.68±0.07 j	17.02±0.10 i	15.25±0.84 g
6	*Asphodelustenuifolius*	20.22±0.10 h	19.73±0.06 f	18.54±0.06 c
7	*Oxalis corniculata*	20.85±0.10 r	20.15±0.05 o	18.78±0.09 m
8	*Withaniasomnifera*	21.32±0.10 s	20.43±0.09 pq	19.31±0.13 m
9	*Acacia modesta*	21.68±0.06 g	20.97±0.10 e	19.94±0.09 b
10	*Derris indica*	23.05±0.04 x	22.75±0.04 w	22.36±0.10 v
11	Control	23.21±0.05 x	23.02±0.01 wx	22.93±0.03 wx

Means followed by the same letters within columns and rows are non significant (P ≤ 0.05); DMRT, Duncan, 1951.

Table 2 Mean Numbers of Angoumois Grain Moth, (*Sitotrogacerealella)*repelled with application of 10%, 20% and 30% Various Indigenous Plant Extracts after 24 Hours

Sr.No	Plant Extracts	10%	20%	30%
1	*Azadirachtaindica*	10.24 ± 0.12 r	11.73 ± 0.08 s	13.49 ± 0.09 u
2	*Ecliptaprostrate*	9.55 ± 0.12 q	10.50 ± 0.05 r	12.76 ± 0.06 t
3	*Silybummarianum*	8.94 ± 0.15 p	10.31 ± 0.09 r	12.56 ± 0.07 t
4	*Tribulus terrestris*	7.48 ± 0.06 n	8.38 ± 0.09 o	9.72 ± 0.14 q
5	*Carthamusoxyacantha*	6.47 ± 0.10 l	7.18 ± 0.10 m	8.91 ± 0.10 p
6	*Asphodelustenuifolius*	3.95 ± 0.10 gh	4.44 ± 0.05 i	5.61 ± 0.06 k
7	*Oxalis corniculate*	3.51 ± 0.08 f	4.17 ± 0.06 hi	5.54 ± 0.09 k
8	*Withaniasomnifera*	3.00 ± 0.11 e	3.90 ± 0.08 g	5.05 ± 0.13 j
9	*Acacia modesta*	2.64 ± 0.08 d	3.22 ± 0.09 e	4.22 ± 0.09 hi
10	*Derris indica*	1.30 ± 0.01 b	1.62 ± 0.01 c	1.83 ± 0.03 c
11	Control	0.99 ± 0.00 a	1.22 ± 0.02 ab	1.26 ± 0.05 ab

Means followed by the same letters within columns and rows are non significant (P ≤ 0.05); DMRT, Duncan, 1951.

Table 3 Mean Numbers of Angoumois Grain Moth, (*Sitotrogacerealella)*repelled with application of 10%, 20% and 30% Various Indigenous Plant Extracts after 48 Hours

Sr.No	Plant Extracts	10%	20%	30%
1	*Azadirachtaindica*	11.21 ± 0.10 r	12.84 ± 0.08 t	14.62 ± 0.08 w
2	*Ecliptaprostrate*	10.57 ± 0.18 q	11.60 ± 0.15 s	13.92 ± 0.05 v
3	*Silybummrianum*	9.80 ± 0.11 p	11.14 ± 0.07 r	13.40± 0.07 u
4	*Tribulus terrestris*	8.29 ± 0.05 n	9.24 ± 0.11 o	10.54±0.13 q
5	*Carthamusoxyacantha*	7.31 ± 0.07 l	7.97 ± 0.10 m	9.74± 0.08 p
6	*Asphodelustenuifolius*	4.77 ± 0.10 g	5.26 ± 0.06 i	6.45 ± 0.06 k
7	*Oxalis corniculata*	4.14 ± 0.10 f	4.84 ± 0.05 gh	6.21 ± 0.11 k
8	*Withaniasomnifera*	3.63 ± 0.10 e	4.56 ± 0.09 g	5.68 ± 0.13 j
9	*Acacia modesta*	3.32 ± 0.06 d	4.02± 0.10 f	5.05 ± 0.09 hi
10	*Derris indica*	1.94 ± 0.04 a	2.24± 0.09 b	2.63 ± 0.10 c
11	Control	1.78 ± 0.05 a	1.97 ± 0.01 ab	2.06 ± 00.03 ab

Means followed by the same letters within columns and rows are non significant (P ≤ 0.05); DMRT, Duncan, 1951.

IV. DISCUSSION

Our results indicated that *A. indica* was the most active in inhibiting *S. cerealella* emergence as compared statistically with other plant extracts. In wheat grains it was observed that number in insects were increased in control and decreased in treated ones. This may be due to some ovicidal action of the some active component in *Azadirachta indica* as studied by [3]. The results of 10% *A. indica* plant extract were statistically similar in efficacy against adult *S. cerealella as compared to 20% E. prostrata, 20% S. marianum.* The 30%, 20% and 10% extract concentrations of *E. prostrata and S. marianum* showed statistically identical results. However in control the results were non-significant and show the highest alive Sitotroga adult after 24 hours as compared with treated wheat grains where results were highly significant and showed more adult mortality of *S. Cerealella* [4]

The use of plant extracts to manage insect pests of stored products is one of the best alternatives to traditionally used chemicals and fumigants. Botanical extracts inhibit adult emergence of storage insect pests and that the active ingredient present in these extracts suppress the embryonic development of eggs. The result of this study are in conformity with [5] who used plant oils of *Capsicum frutescens, Anacardium occidentale, Monodora tenuifolia, Xylopia aethiopica,* and *Ricinus communis* to manage

Ephestia cautella in the laboratory at ambient temperature of 28 ± 2 °C and relative humidity of 78 ± 5%. Results showed that oil of *A. occidentale* was more effective than other extracts as it effects up to 76.65 and 90.00% adult mortality of the moth at 0.5 and 1.0 ml, respectively. Researchers [6] [7] conducted experiments to evaluate the efficiency of leaf powders of *Tridax procumbens, Withania somnifera, Pongamia pinnata* and *Gliricidia maculata* against pulse beetle. Dried leaf powders of *T. procumbens* and *W. somnifera* (5 mg/g seed) was found to be more effective, causing 100% mortality, than leaf powders of *P. pinnata* and *G. maculata* (20 mg/g seed), that showed 73.1 and 69.2% mortality, respectively. However, all plant leaf powders showed 100% ovicidal activity [8]. In a study executed by [9] who tested the effect of covering dates bunches on *Ephestia cautella* infestation during date fruit development season in the field. Results indicated that dates fruit bunches provided with covers showed less *E. cautella* infestation as compared to uncovered dates fruit bunches. Studies on *E. cautella* population dynamics revealed that this insect starts building up in the month of September and reach to its peak during November and then starts declining and remains low in the subsequent months. Our results showed that plant extracts reduce hatchability of eggs laid by moths and inhibit emergence of F1 adults and confirming results revealed by [10] in which *M. tenuifolia* was used to reduce egg hatching.

V. CONCLUSION

For the control of this pest the use of synthetic pesticides and fumigants is common, however chemical methods have severe problems like resistance by insects, residual toxicity, vertebrate toxicity, environmental hazards etc. The world is looking forward towards the eco-friendly use of botanicals as insecticides including Neem (*A. indica*), Phulai (*A. modesta*), Piazi (*A. tenuifolius*), Pholi (*C. oxyacantha*), Bhangra (*E. prostrata*), Khati boti (*O. corniculata*), Asgand (*W. somnifera*), Kandiyari (*S. marianum*), Bhakra (*T. terrestris*) and Sukh chain (*D. indica*), leaf extract of different indigenous plants were used against *S. cerealella* in wheat grains. The purpose of present research was to find out the most effective botanical extract against *S. cerealella* stored grain insect pest in Pakistan. Insect count was done at every 10 days interval for 2 months. Results showed that the least insect count was recorded at 30% concentration of *A. indica* after 60 days as compared with control where maximum numbers of insects were counted 22.93. Similarly the results of *E.prostrata, S. marianum, T. terrestris* also showed significant results and inhibited the insect growth.

The highest percent adult mortality (81.20) of Angoumois Grain Moth, (*S. cerealella)* was observed in wheat grains with the application *A. indica* 30%, plant extract liquid after 24 hours followed by *E. prostrata, S. marianum, T. terrestris, C. oxyacantha, D. indica, A. tenuifolius, O. corniculata, W. somnifera,* and lowest in *A. modesta,* (23.25) as compared with the control treatment where the percent mortality was 3.12. Results also showed that the most repellency effect on *S .cerealella* was exhibited in wheat grains with the application *A. indica* (10.24) 30% plant extract liquid after 24 hours followed by *E. prostrata, S. marianum, T. terrestris, C. oxyacantha, A.tenuifolius, O. corniculata, W. somnifera, A. modesta* and lowest in *D. indica,* (1.30) as compared with the control treatment where the observed repellent effect was the least i.e. 0.99.

The outcome of this research will lead to an effective and environmental friendly control measures against *S. cerealella* and lead to development of different formulations of bio pesticides of these indigenous plant materials.

REFERENCES

[1] Mohale, S., J. Allotey and B. Siame (2010). "Control of Tribolium confusum J. du val by diatomaceous earth (Protect It™) on stored groundnut (Arachis hypogaea) and aspergillus flavus link spore dispersal." African Journal of Food, Agriculture, Nutrition and Development 10(6).

[2] Irshad, M. and S. Talpur (1993). "Interaction among three coexisting species of stored grain insect pests." Pakistan Journal of Zoology 25(2): 131-133.

[3] Gupta, L. and M. Srivastava. 2008. Effect of *Withania somnifera* extracts on the mortality of *Callosobruchus chinensis* L. J. Biopesticides, 1: 190-192.

[4] Kamran, A., M. Adnan, M. A. Khan, Z. Hussain, K. Junaid, N. Saleem, M. Ali, A. Basir and A. Ali. 2015. Bioactive neem leaf powder enhances the shelf life of stored mung bean grains and extends protection from pulse beetle. Pak. J. Weed Sci. Res., 21: 71-81.

[5] Akinneye, J. O., O. C. Ogungbite. 2013. Effect of seeds of five indigenous plant extracts on *Ephestia cautella* moth (Lepidoptera: Pyralidae). J. Phytopathol and plant pro. 46: 1488-1496.

[6] Yankanchi, S. R. and G. S. lendi. 2009. Bioefficacyof certain plant leaf powder against pulse beetle (*callosobruchus chinensis* L). J. Biol., 1: 54-57.

[7] Ani, D. S. 2010. Screening of some bio-pesticides for the control of *Callosobruchus chinensis* in stored black beans (*Vigna mungo*) in Imo state. J. American Sci. 6: 186-188.

[8] Yadu, Y., R. Saxena, V. Dubey and D. Rana (2000). "Evaluation of certain plant productsagainst S. cereallea (Oliv.) in stored maize and paddy." Indian Journal of AgriculturalResearch 34(4): 261-263.

[9] Ogendo, J.O., Deng, A.L., Belmain, S.R., Walker, D.J. and Musandu, A.A.O. 2004. Effects ofinsecticidal plant materials, Lantana camara L. and Tephrosia vogelli Hook on thequality parameters of stored maize grains. Journal of Food Technology, 9(1): 29-35.

[10] Ashamo MO, Akinneye JO. 2004. Toxicity of powders of some tropical plants against the yam moth *Euzopherodes vapidella* Mann (Lepidoptera; Pyralidae). Niger J Exp Appl Biol. 5:63-68.