World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 5.088

THE BIO-INSECTICIDAL POTENCY OF SOME BOTANICAL EXTRACTS AGAINST COWPEA BEETLE *CALLOSOBRUCHUS MACULATUS* F. (COLEOPTERA: CHRYSOMELIDAE) UNDER LABORATORY CONDITIONS

Hussein Ali Salim*[1], Majida Hadi Mahdi[2], Mohammed Nadeem Kasim Hantoosh[3], Donia Ali Zedan[1] and Balkees Othman Rosoki[1]

[1]Directorate of Diyala Agriculture, Ministry of Agriculture.
[2]College of Science, University of Baghdad.
[3]College of Agriculture, University of Diyala, Iraq.

***Corresponding Author: Hussein Ali Salim**
Directorate of Diyala Agriculture, Ministry of Agriculture.

Article Received on 09/09/2018 **Article Revised on 30/09/2018** **Article Accepted on 21/10/2018**

ABSTRACT

Two experiments were conducted at the laboratory of plant pathology, Directorate of Diyala Agriculture during 2017 to study the efficacy of aqueous botanical extracts viz. *Moringa oleifera, Origanum majorana, Artemisia vulgaris, Trigonella foenum and Syzygium aromaticum* with three concentrations 10, 20, and 30% against cowpea beetle *Callosobruchus maculatus* F. under laboratory conditions. *S. aromaticum* concentration 30% showed higher repellency percentage was reached 66. 6% and 86. 6% after 20 and 30 minute respectively, whereas the average of repellency for botanical extracts after 30 Minute was highest in *S. aromaticum* and *T. foenum* were reached 57. 7% and 46. 6 % respectively. Percentage mortality of *C. maculatus* was Highest in *S. aromaticum* conc. 30% reached 26. 6% and 60 % followed by *T. foenum* conc. 10% which recorded 20% and 33. 3% respectively with significantly different from other treatments after one and two days. after three days a mortality percentage of *C. maculatus* was increased in *S. aromaticum* conc. 30% and 20 % reached 73. 3% and 40% respectively followed by *T. foenum* conc. 10% and 20% which recorded 33. 3% and 26. 6 % respectively and *M. oleifera* conc. 20% and 30% reached 26. 6% with significantly different from control 0%.

KEYWORDS: *Callosobruchus maculatus; Moringa oleifera; Origanum majorana; Artemisia vulgaris; Trigonella foenum and Syzygium aromaticum.*

INTRODUCTION

The grain legumes are the most stored food commodities in the tropics **(Odeyemi and Daramola, 2000).** Cowpea (*Vigna unguiculata* L. *Walp*) is a food and animal feed crop grown in the regions covering Europe, Africa, Asia, Central and South America and United States. It is important economic crop due to containing high protein content with vitamins and minerals, It has the ability to improve soil fertility, the adaptability to different types of soil, prevent erosion and resistance to drought **(Mojisola *et al.* 2016).** Insect pests cause heavy losses in post-harvest stored grain globally and the losses problems are more in developing countries **(Boxall *et al.* 2002).** Cowpea weevils, *Callosobruchus maculatus* F., (Coleoptera: Bruchidae) is the major storage pest of legumes (**Beck, Bulmer, 2014**). It is infests cowpea in storage and lead to reducing the quality and quantity of the seeds (**Dike, 1994**). *C. maculatus* is very destructive due to its short life cycle **(Ojebode *et al.* 2016)**. The destructive activities of storage pests have been effectively suppressed with synthetic insecticides **(Adedire *et al.*, 2011)**. but the application of these chemicals as agents of pest control lead to many problems, such as non-availability of the chemicals and increasing costs of application, a high persistence of the compounds, direct toxicity to the users, genetic resistance of pests, poor knowledge of the application, negative effects on non-target organisms, **(Sharma *et al.*, 2006; Berger, 1994).** However, the replacement of synthetic insecticides with natural compounds are safe to protect stored grains from insect pests **(Suleiman, 2014; Vanmathi *et al.*, 2012).** The use of botanical insecticides against *C. maculatus* as effective protectants for stored cowpea from infestation and damage **(Asawalam and Anaeto, 2014; Suleiman and Suleiman, 2014).**

The objective of this research was to evaluate the efficacy of five plants extracts viz *Moringa oleifera*, *Origanum majorana*, *Artemisia vulgaris*, *Trigonella foenum* and *Syzygium aromaticum* in different

concentrations 10, 20 and 30 % as insecticidal agents against *Callosobruchus maculatus.*

MATERIALS AND METHODS

Collection of *Callosobruchus maculatus*

Adults of *C. maculatus* were obtained from infested chickpea seeds that stored for a long time in my house and sieved out from this infested seeds (figure 1and 2).

Collection and preparation of plant extracts

The plants materials of *Moringa oleifera, Origanum majorana, Artemisia vulgaris, Trigonella foenum* and *Syzygium aromaticum* powders were obtained from a local market in Baqubah, One hundred grams of plants powders were mixed separately with 500 ml water in an electric grinder then filtered through muslin cloth for three times and these extracts were diluted to make 10, 20 and 30 %.

Repellency Testing

Method of **Mc Donald *et al,* (1970)** was adopted with slight modification from **Talukder and Howse, (1993)** by using Petri dishes of 9 cm diameter and a height of 2 cm, the Petri dishes were divided into two equal halves and drawn a circle of 2 cm diameter in the center, one of the halves was treated by added 1 ml from each concentration by rubbing in a cotton piece and the other half treated with water only and left to dry in the air, Ten adults of *C. maculatus* were introduced into each Petri dish in the circle, each treatment was replicated three times, percentage of adults in untreated part was recorded for 10, 20 and 30 minutes. Percentage repellency (PR) values were computed using the formula:

PR= 2(C-50 %) **(Talukder and Howse, 1993).**

Where; PR = percentage repellency
C= percentage of adults in untreated part

Mortality Testing

Method of **Mohammed and Rukhosh, (2011)** was adopted by using Petri dishes of 9 cm diameter and a height of 2 cm, and treated by added 2 ml from each concentration by rubbing in a cotton piece and another 2ml of ethanol 99% was used as a control and air – dried, five adults of *C. maculatus* were introduced into each Petri dish, each treatment was replicated three times, Dead beetles in each replicate were recorded daily for 3 days and adult mortality was assessed as

$$\% \text{ Mortality} = \frac{\text{Number of Dead Weevils}}{\text{Total Number of Weevils}} \times 100$$

Statistical Analysis

The factorial experiment was conducted and the data was analyzed by one way Analysis of Variance (ANOVA) **(Fisher and Yates, 1968).**

RESULTS AND DISCUSSION

The result of Table 1 was shown no significant differences among the botanical extracts and their concentrations in repellency percentage of *C. maculatus* after 10 Minute while *S. aromaticum* concentration 30% showed higher repellency was reached 66. 6% with significant differences from *O. majorana* concentration 10% and *A. vulgaris* concentration 10% and 20 % after 20 Minute, whereas the average of repellency for botanical extracts after 30 Minute was highest in *S. aromaticum* and *T. foenum* were reached 57. 7% and 46. 6 % respectively with significant differences from *M. oleifera* and *O. majorana*, also *S. aromaticum* concentration 30% was recorded higher repellency reached 86. 6% with significant differences from *M. oleifera* in concentrations (10, 20, 30 %) and *O. majorana* and *A. vulgaris* in concentration 10%. Data showed that *S. aromaticum* had generally a more effective repellent against adults C. maculates from other treatments.

Table 1: Effect of different concentrations from aqueous botanical extracts on repellency percentage to adults of *C. maculatus* after 10, 20, 30 Minute.

Treatments (A)	(B) 10 Minute				20 Minute				30 Minute			
	10%	**20%**	**30%**	**Av.**	**10%**	**20%**	**30%**	**Av.**	**10%**	**20%**	**30%**	**Av.**
Moringa oleifera	0	26. 6	20	15. 5	46. 6	6. 6	6. 6	20	-33. 3	-20	-13. 3	-22. 2
Origanum majorana	6. 6	0	6. 6	4. 4	-53. 3	33. 3	33. 3	4. 4	-46. 6	33. 3	20	2. 2
Artemisia vulgaris	20	13. 3	46. 6	26. 6	-33. 3	0	20	- 4. 4	0	13. 3	20	11. 1
Trigonella foenum	0	40	40	26. 6	40	40	40	40	40	53. 3	46. 6	46. 6
Syzygium aromaticum	6. 6	26. 6	60	31. 1	13. 3	33. 3	66. 6	37. 7	46. 6	40	86. 6	57. 7
Average	6. 6	21. 3	34. 6		2. 6	22. 6	33. 3		1. 3	24	32	
CD 5% A	**40. 3**				**37. 1**				**43. 8**			
B	**31. 2**				**28. 7**				**33. 9**			
A×B	**69. 8**				**64. 3**				**75. 9**			

Percentage mortality varied according to botanical species and concentrations of the botanicals applied after one day. Highest 26. 6% adult mortality of *C. maculatus* was caused by *S. aromaticum* conc. 30% followed by *T. foenum* conc. 10% which recorded 20% with significantly different from other treatments, while *S. aromaticum* was recorded higher average of mortality reached 13. 3% with significant differences from other

treatments with no significant differences among the concentrations (Table 2).

After two day a mortality percentage of *C. maculatus* was Highest (60% and 26. 6%) in *S. aromaticum* conc. 30% and 20 % respectively followed by *T. foenum* conc. 10% which recorded 33. 3% with significantly different from other treatments, while *S. aromaticum* was recorded higher average of mortality reached 28. 8 % followed by *T. foenum* 20%, *O. majorana* 17. 7% and *A. vulgaris* 13. 3% with significant differences from control 0% with no significant differences among the concentrations.

A mortality percentage of *C. maculatus* was increased in *S. aromaticum* conc. 30% and 20 % reached 73. 3% and 40% respectively followed by *T. foenum* conc. 10% and 20% which recorded 33. 3% and 26. 6 % respectively and *M. oleifera* conc. 20% and 30% reached 26. 6% with significantly different from control 0% after three days, while all treatments were achieved a higher average of mortality of *C. maculatus* reached (40, 24. 4, 24. 4, 17. 7 and 15. 5%) in *S. aromaticum*, *T. foenum*, *M. oleifera*, *O. majorana* and *A. vulgaris* with significantly different from control 0% respectively with no significant differences among the concentrations.

General results indicate that, there are a positive relation between the mortality of adult insects and the time with using the botanical extracts especially *S. aromaticum*. These results agree with **Iqbal & Poswal (1995)**, who stated that cloves (*S. aromaticum*) gave good results for controlling *C. maculatus*. The essential oils of *Syzygium aromaticum* are more toxic in control of *Callosobruchus maculatus* in stored cowpea (*Vigna unguiculata*) **(Jose *et al*, 2017).** the essential oil of clove (*Syzygium aromaticum*) can play an important role in the protection of cowpea grains from *C. maculates* due to it has potential repellent activity against adults *C. maculates* **(Hany Ahmed Fouad, 2013). Albandari F. Al Yousef, (2015)** who reported that the effectiveness of clove oil against the cowpea seed beetle, *Callosobruchus maculates*.

Table 2: Effect of different concentrations from aqueous botanical extracts on mortality percentage to adult of *C. maculatus* after 1, 2, 3 days.

Treatment (A)	(B)1 day				2 day				3 day			
	10%	**20%**	**30%**	**Av.**	**10%**	**20%**	**30%**	**Av.**	**10%**	**20%**	**30%**	**Av.**
Moringa oleifera	6. 6	0	0	2. 2	13. 3	0	20	11. 1	20	26. 6	26. 6	24. 4
Origanum majorana	6. 6	0	0	2. 2	13. 3	20	20	17. 7	13. 3	20	20	17. 7
Artemisia vulgaris	0	0	6. 6	2. 2	20	6. 6	13. 3	13. 3	20	6. 6	20	15. 5
Trigonella foenum	20	0	0	6. 6	33. 3	20	6. 6	20	33. 3	26. 6	13. 3	24. 4
Syzygium aromaticum	0	13. 3	26. 6	13. 3	0	26. 6	60	28. 8	6. 6	40	73. 3	40
control	0	0	0	0	0	0	0	0	0	0	0	0
Average	5. 5	2. 2	5. 5		13. 3	12. 2	20		15. 5	20	25. 5	
CD 5% A	**10. 6**				**13. 2**				**15. 3**			
B	**7. 5**				**9. 3**				**10. 8**			
A×B	**18. 4**				**22. 8**				**26. 5**			

CONCLUSION

All the tested botanical extracts exhibited varied toxic action against the cowpea beetle (*C. maculatus*), *Syzygium aromaticum* was found to be highly effective, other botanical extracts were little effective. Therefore, *Syzygium aromaticum* can be used as the option for the control of *C. maculatus* in stored cowpea. However, these can serve as an alternative to synthetic chemicals used in insect pest control in storage which may accumulate to damage health and the environment.

Fig. 1: Adult of cowpea beetle (*C. maculatus*).

Fig 2: Eggs, larvae and Adults of cowpea beetle (*C. maculatus*) on chickpea.

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