

## **Efficacy of Harmal *Pegnum harmala* on Rice weevil *Sitophilus oryzae* L in the stored Rice grains**

ALI DHUMAD KADHIM

Ministry of Science and Technology

HUSSEIN ALI SALIM

Ministry of Agriculture

MOHAMMED SAHIB ABED

Ministry of Higher Education

### **Abstract:**

*Aqueous and ethanol extracts of Harmal Pegnum harmal L. were tested at the concentrations 1%, 2% and 3% to evaluate their effects on mortality of rice weevil Sitophilus oryzae L. The results indicated that the seed powders had toxic effects. They had significant effect on adult mortality and there were significant differences between concentrations, the highest mortality was (98,100,100%) after 24, 48, 72 hour respectively recorded in ethanol extracts at concentration of 3 % followed by 2% and 3% while the aqueous extract at concentration of 3 % was recorded (64, 66, 74%) after 24, 48, 72 hour respectively followed by 2% and 3% as compared with the untreated check 0 % ,the mortality percentages were increased with increased of concentration and it were increased in concentrations of ethanol extract more than concentrations of aqueous extract.*

**Key words:** *Sitophilus oryzae* L, *Pegnum harmala*

## **INTRODUCTION**

Cereals are the staple and nutritive food but their storage is not safe due to the attack of certain stored grain insect pests. So, there is an urge to protect them safely from qualitative and

quantitative loss (Nyambo, 1993; Hagstrum *et al.*, 1999). *Sitophilus oryzae* L. (Coleoptera: Curculionidae) commonly called rice weevil has become primary pest of stored grains of warm climatic areas. They cause damage to grains which are stored at 25-30°C and at low RH as these conditions favored the development of this pest (Batta, 2004). It is the most destructive and widespread cereal pest in the world and got economic importance (Champ & Dyte, 1976). It causes 18.30% losses to stored grains (Adams, 1976). Female laid eggs in the seeds and also remains inside the seeds during their larval development. After completion, emerges as an adult from the seeds. They normally produce their large population in short times because of their short developmental period (Aitken, 1975). Using synthetic chemicals as insect pest control has given rise to a number of problems, including adverse effects on the environment and human health (Anonymous, 2004). Recently, there has been considerable pressure from consumers opposed the use of synthetic insecticides in foods (Dal Bello *et al.*, 2001). Plants are favorably exploited as for the biological control of insect pests and stored grain product pests, including the management of rice weevil (*Sitophilus oryzae*) in rice grain infestation (Huang *et al.*, 2002; Lee *et al.*, 2003). They produce different kinds of secondary metabolites which constitute important sources of pesticides include terpenoides, phenolics, flavonoides, tannins, essential oils and alkaloids. These phytochemical compounds have different behavioral and physiological effects on insects (Isman, 2006). Saljoqi *et al.*, (2006) reported that there are toxic and repellent properties of extracts from Harmal shoots and seeds (*Pegnum harmala*) against *S. oryzae*.

The aim of our study is to evaluate the insecticidal activity of the ethanol and water extracts from *Pegnum harmala* against adults of *Sitophilus oryzae*.

## **MATERIALS AND METHODS**

### **Preparation of Harmal seed powder**

Seeds of plants; Harmal *Peganum harmala* L. was obtained from the local market of Allahabad, India. The seeds were washed under tap water and then shed to dry out. The seeds were grounded by electric grinder into very fine powder. The seed powder of plant were kept in a separate small plastic vials covered air tightly which then kept into a refrigerator at a freezing point degree.

### **Preparation of Aqueous extract**

250 gram of the dry powdered seeds was macerated in 1L capacity glass bottles using 500 ml of hot water for 3 days. To ensure complete extraction, the samples were periodically shaken. The extract was then filtered through Muslin cloth and concentrated in 45 cm diameter plates under running warm air for 72 hours give a dried residue. Extracted substance was stored in refrigerator at 4 °C.

### **Preparation of ethanol extract**

250 gram of the dry powdered seeds was macerated in 1L capacity glass bottles using 500 ml of 99% ethanol for 3 days. To ensure complete extraction, the samples were periodically shaken. The extract was then filtered through Muslin cloth and concentrated in 45 cm diameter plates under running warm air for 48 hours to give a dried substance. Extracted substance was stored in refrigerator at 4 °C.

### **Preparation of concentrations**

Prepare concentrations of aqueous and ethanol extracts 1, 2, 3 % by adding 1, 2, 3 gm from each extract to 99, 98, 97 ml respectively in water and ethanol, each concentration has been placed in a separate container, well shaken to homogenize, mixed of each concentration with Rice grains and left to dry.

Ten g of Rice grains with each concentration were placed in plastic containers (4 cm diameter x 6 cm depth) lined with whatmann no.1 filter paper. Ten adult beetles were introduced to each container. For the control treatment, only 10 g of Rice grains and 10 adult beetles were placed in the container in the same way as previously mentioned.

### **Mortality tests**

The percent mortality of adults was calculated the Abbott's formula (**Abbott, 1925**) after 24, 48 and 72 hours. Each test was replicated five times

$$\text{Corrected \%} = \left(1 - \frac{\text{n in T after treatment}}{\text{n in Co after treatment}}\right) \times 100$$

Where: n = Insect population, T = treated, Co = control

### **Statistic analysis**

In the experiment Complete Randomized Design (CRD) was adopted. The analysis of variance (ANOVA) technique was applied for drawing conclusion from data. The calculated values were compared the tabulated values at 5% level of probability (**Fisher and Yates, 1968**).

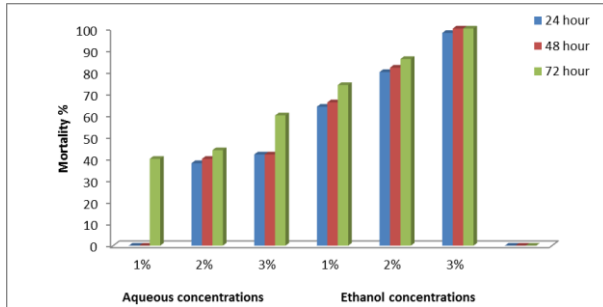
## **RESULTS AND DISCUSSION**

The result of Table 1 and fig 1 revealed that maximum significantly increased in mortality percentages the adults of *Sitophilus oryzae* in concentration of ethanol extract 3% at 24, 48 and 72 hour after treatment followed by 2% and 1% then concentrations of aqueous extract 3%, 2% and 1% as compared with control 0%.The Statistical analysis indicated that there were significant differences among the all concentrations after 24 and 48 hour but after 72 hour all concentrations of ethanol and aqueous extracts found non-significant among each other

with significantly increased in mortality percentages from control. The mortality percentages were increased with increased of concentration and it were increased in concentrations of ethanol extract more than concentrations of aqueous extract. However the results of some previous work of harmal on other insects such as the work on *Tribolium castaneum*, is supported our present findings (**Khalaf and Aelan, 2002**). **Kanvil et al. (2006)** reported that all concentrations of harmal were more effective initially, but with passage of time. Majority of previous workers also reported in the same trend (**Jacobson, 1983; Jilani et al. 1988; Harish et.al. 2000**). **Rao et al. (2005)** mentioned that harmal extract was effective on *Sitophilus. oryzae* .Our results have shown that *P. harmala* possess high insecticidal activity on *Sitophilus. oryzae*. **Abbassi et al. (2003)** have found the same effect on desert locust *Schistocerca gregaria* (Forsk.) . *P. harmala* is a rich source of carboline, alkaloids as harmol, harmine and harmaline (**Li, 1996; Kartal et al., 2003**). These alkaloids as well as other secondary metabolites of this investigated plant may explain the toxic effect in the studied insects.

**Table1. Effect of concentrations of aqueous and ethanol extracts of Harmal *Peganum harmala* against adults of *Sitophilus oryzae***

Treatments	Concentrations	24 hour	48 hour	72 hour
Aqueous extract	1 %	0	0	40
	2 %	38	40	44
	3 %	42	42	60
Ethanol extract	1 %	64	66	74
	2 %	80	82	86
	3 %	98	100	100
control		0	0	0
F- test		s	s	s
S. Ed. (±)		15.381	15.344	18.883
C. D. (P =0.05)		32.67	32.68	40.22



**Fig 1. Effect of concentrations of aqueous and ethanol extracts of Harmal *Peganum harmala* against adults of *Sitophilus oryzae***



**Fig 2. Adults of Rice weevil *Sitophilus oryzae* L**

## REFERENCES

- Abbassi K, Atay-Kadiri Z, Ghaout S (2003).** Biological effects of alkaloids extracted from three plants of Moroccan arid areas on the desert locust. *Physiol. Entomol.* 26: 232-236.
- Abbott W.** A method of computing the effectiveness of an insecticide. *J Econ Entomol* 1925; 18:265-267.
- Adams, J. M. (1976).** Weight loss caused by development of *S. oryzae*. *J. Stor. Prod. Res.*, 12: 269-272.
- Ahmed J. Mhemed, (2011).** The efficacy of four seed powders on some biological aspects and mortality of khapra

- beetle, the Iraqi Journal of Agricultural Sciences 42 (6):112 – 123
- Aitken, A.D. (1975).** Insect travelers I: Coleopteran Technological Bulletin, 31.
- Anonymous (2004).** Green pesticides in insect pest management. A report on the National Symposium on Green Pesticides for Insect Pest Management, Entomological Research Institute, Chennai. Current Science. 86(8): 1059- 1060.
- Batta, Y.A. (2004).** Control of rice weevil (*Sitophilus oryzae* L.) (Coleoptera: Curculionidae) with various formulations of *Metarhizium anisopliae*. Crop Prot., 23: 103-108.
- Champ, B.R. and C.E. Dyte. (1976).** Global survey of pesticide susceptibility of stored grain pests. FAO Plant Protection Science, No. 5, FAO, Rome.
- Dal Bello, G., Padin, S., Lastra, C. L., and Fabrizio, M. (2001).** Laboratory evaluation of chemical biological control of the rice weevil (*Sitophilus oryzae* L.) in stored grains. Journal of Stored Products Research. 37: 77-84.
- Fisher, R. A. and Yates, (1968).** Statistical method for research workers. Oliver and boyd ltd. *Edinburgh and London*, 10.
- Hagstrum, D.W., C. Reed and P. Kenkel. (1999).** Management of stored wheat insect pests in the USA. Int. Pest Manag. Rev., 4: 127-142.
- Harish, C., D.K. Abuja, A. Nagender, and S. K. Berry. (2000).** Repellency of different plant extracts and commercial formulations used as prophylactic spray to protect bagged grain against *Tribolium castaneum* J. Food Tech. Mysore. 6 (37): 582-585.
- Huang, Y., Ho, S. H., Lee, H. C., and Yap, Y. L. (2002).** Insecticidal properties of eugenol, isoeugenol and methyeugenol and their effects on nutrition of *Sitophilus zeamais* Motsch. (Coleoptera: Curculionidae) and *Tribolium castaneum* (Herbst) (Coleoptera:

- Tenebrionidae). *Journal of Stored Products Research*. 38: 403-412.
- Isman, M. B. (2006)**. Botanical insecticides, deterrents and repellents in modern agriculture and an increasingly regulated world. *Annual Review Entomology*. 51: 45-66.
- Jacobson, M.,(1983)**. Phytochemicals for the control of store product insects. In *Proceedings of The third International Conference on Stored Product Entomology*, Kansas State University, Manhattan, Kansas; 182-195.
- Jilani, G.N., R.C. Saxena, and B.P. Rueda. (1988)**. Repellent and growth inhibiting effects Turmeric oil, Sweet flag oil, Neem oil and “Margosan-O” on the red flour of *Tribolium castaneum* (Coleoptera: Tenebrionidae). *J. Econ. Entomol.* 81 (4): 1226-1230.
- Kanvil, S., G. Jilani, A. U. R. Saljoqi , and N. Hussain, (2006)**. Repellency of some indigenous plants against *Tribolium castanum* Herbst. *J. Agric.* 22( 2): 321-326.
- Kartal M, Altun ML, Kurucu S (2003)**. HPLC method for the analysis of harmol, harmalol, harmine and harmaline in the seeds of *Peganum harmala* L. *J. Pharm. Biomed. Anal* 31: 263-269.
- Khalaf, J.M., and A. A. Y. Aelan, (2002)**. The effect of powders and extracts of some plants seeds on *Tribolium castaneum* *Herbst*. *J. Basrah Research.*,28(1):150-162 (In Arabic).
- Lee, S., Peterson, C. J., and Coasts, J. R. (2003)**. Fumigant toxicity of monoterpenoids to several stored product insects. *Journal of Stored Products Research*. 39: 77-85.
- Li WK (1996)**. Extraction of alkaloids from *Peganum harmala* L. and study of their antihydatid chemical composition. *J. Lanz. Med. Coll.* 22: 16-18.
- Nyambo, B. T. (1993)**. Post-harvest maize and sorghum grain losses in traditional and improved stores in south Nyanza district, Kenya. *Int. J. Pest Manag.*, 39: 181-187.



**Rao, N. S, K. Sharma, and R. K. Sharma, (2005).** Anti-feedant and growth inhibitory effect of seed extracts of custard apple, *Annona squamosa* against Khapra beetle. *J. Agrice. Technol.* 1(1) : (43-54).

**Saljoqi, A. U. R., Afridi, M. K., Khan, S. A., and Rahman, S. (2006).** Effects of six plant extracts on rice weevil *Sitophilus oryzae* (L.) in stored wheat grains. *Journal of Agricultural Biological Science.* 1(4): 1-5.