International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

IJFBS
International Journal of Fauna And Biological Studies

ISSN 2347-2677
IJFBS 2016; 3(1): 18-20
Received: 20-10-2015
Accepted: 22-11-2015

Mudassar Javed
Department of Agricultural Entomology, University of College of Agriculture, University of Sargodha, Pakistan.

Muhammad Zeeshan Majeed
Department of Agricultural Entomology, University of College of Agriculture, University of Sargodha, Pakistan.

Muhammad Arshad
Department of Agricultural Entomology, University of College of Agriculture, University of Sargodha, Pakistan.

Muhammad Hannan Ahmad
Department of Agricultural Entomology, University of College of Agriculture, University of Sargodha, Pakistan.

Hafiz Abdul Ghafoor
Department of Agricultural Entomology, University of College of Agriculture, University of Sargodha, Pakistan.

Correspondence:
Mudassar Javed
Department of Agricultural Entomology, University of College of Agriculture, University of Sargodha, Pakistan.

Insecticidal potentiality of *Eruca sativa* (mill.), *Piper nigrum* (l.) and *Withania somnifera* (l.) extracts against *Trogoderma granarium* (everts) (Coleoptera: Dermestidae)

Mudassar Javed, Muhammad Zeeshan Majeed, Muhammad Arshad, Muhammad Hannan Ahmad, Hafiz Abdul Ghafoor

Abstract
The Khapra beetle, *Trogoderma granarium* is the most voracious and pervasive pest of stored grain products under tropical and subtropical environments. In this study insecticidal potential of plant extracts of *Eruca sativa*, *Piper nigrum* and *Withania somnifera* was tested against *Trogoderma* granarium under laboratory conditions 30±20 ºC and 65±5% R.H, with four extract concentrations (2, 4, 6 and 8%) and an untreated check for each plants extract. The insecticidal action was evaluated in terms of adults' mortality rate, growth inhibitory effect and their latent effects on population build up in F1 progeny. Experimental results indicated that per cent mortality of *Trogoderma granarium* was maximum due to the *Piper nigrum* (15.26%) followed by *Withania somnifera* (10.41%) and *Eruca sativa* (7.15%). Nonetheless, per cent population buildup was seen maximum due to the *Eruca sativa* (115.47%) followed by *Withania somnifera* (92.33%) and *Piper nigrum* (78.60%). Further, *Piper nigrum* treated *Trogoderma granarium* exhibited reduced growth rate as compared to other extracts. It is concluded that order of efficacy of all plant extracts was *Piper nigrum* > *Withania somnifera* > *Eruca sativa*, and thus indicated *piper nigrum* extract as potential natural insecticides against *Trogoderma granarium*.

Keywords: *Trogoderma* granarium, *Piper nigrum*, *Withania somnifera*, *Eruca sativa*.

1. Introduction
Khapra beetle *Trogoderma granarium* (Everts) is considered one of the most severe stored grain and cereal pest worldwide. It is considered a very serious pest of stored products under hot, dry condition. *T. granarium* have more than nine generation in a year, high humidity have adverse effects on population buildup of this pest [1]. The main infestation of the khapra beetle is the loss of stored grain. The khapra beetle larvae are one of the most serious stored seed pests but adult beetle does not damage. When attack of this pest is very serious in grain, it makes grains unable to germination or unmarketable because larvae consume specific nutrients during feeding on grain [2]. Losses occur due to *T. granarium* infestation range from 0.2 to 2.9% over a period of 1 to 10.5 months [3].

The efficient control of stored grains from insect pests is dependent on synthetic insecticide such as fumigation with phosphine or methyl bromide or dusting with compounds as pirimiphos methyl and permethrin. It has been substantiated that resistant occur against phosphine in different development stages of *T. granarium* [4]. Due to excessive use of such chemical insecticide have prominent effects on stored grain insect pest including resistance to insecticides [5], increased cost, handling hazards, residual effects on grains and harmful effects on human health as well as environmental hazards.

Therefore, there is an urgent need to develop environment friendly alternatives with the potentials to replace the highly toxic chemicals. Throughout the world the new trend is towards the use of botanical having insecticidal properties. Some plant extracts are highly effective and safe for human beings and the environment, convenient and inexpensive for protection of stored grains. The toxicity of plant extracts has been checked against a number of stored product insects. So keeping in view, the need of the time, the present research program was planned to determine the response of *Trogoderma granarium* (Everts) to different doses of plant extracts.

Materials and Methods

The experiment was conducted in the Grain Research, Training and Storage Management Cell, Department of Agricultural Entomology, University of Agriculture Faisalabad. The material was comprised of *Trogoderma granarium*, three plant parts (*Eruca sativa*, *Withania somnifera* and *Piper nigrum*), oven, grinder, soxhlet apparatus filter paper, Petri dishes and jars. Insects were collected from different warehouses of grains from different godowns of food departments in Faisalabad and placed separately for rearing of the strain to get a homogenous population. The insect culture was maintained in sterilized jars placed in the incubator at 30+2 ºC and 65+5% Relative Humidity to get the homogenous population. The culture medium was the whole wheat grain sterilized at 60 °C for 60-90 minutes. The jars were covered with muslin cloth, tied with rubber bands to avoid the escape of insects.

Seed extract of *Eruca sativa*, seed extracts of *Piper nigrum* and root extract of *Withania somnifera* were collected from the fields and markets of Faisalabad. Plant materials were dried under shade and grinded with the help of electric grinder. The powders were sieved with a 40-mesh sieve to obtain a fine powder. Extraction was done using ethanol as solvent by adding 50 gm. of powder and 100 ml. of solvent (ethanol). The samples were loaded on rotary shaker at 120 rpm for 24 hours. Filtration was done with the help of Whatman filter paper. Each experiment was carried out in glass jar. Four different concentrations 2, 4, 6 and 8% of plant extract of *Piper nigrum*, *Withania somnifera* and *Eruca sativa*; and an untreated control was applied. 20 gm. of wheat grains was put in each jar. 20 insects were introduced in each jar while covering it with muslin cloth. Morality rate of adult was observed after 2, 4 and 6 days. In another replicated experiment ethanolic extracts in each concentration were applied on 20 gm of wheat grain. The extracts were sprayed on grains surface. The treated grains were placed in glass jars of 50 ml capacity. 10 pairs of 3-5 days larvae were liberated in each glass jar. Observations on oviposition and egg hatching, larval and pupation duration and adult emergence were recorded at regular interval and duration of different life stages were compared with untreated check. The survived larvae from bioassay were transferred in to the new clean jars containing 200 gm sterilized wheat grains. The data were recorded after 30 and 60 days in F1 progeny. Data of larval mortality was corrected by Abbott's formula [6] and data of corrected larval mortality and all the other treatments were analyzed statistically by using software Statistix v 8.1. The significant results were compared using Turkey's HSD test.

Results and Discussions

The present study was conducted to check the mortality, growth inhibitory effects and population buildup of *Trogoderma granarium* (Everts) against different concentrations (2, 4, 6 and 8%) of plant extracts (*Piper nigrum*, *Withania somnifera* and *Eruca sativa*) and exposure periods i.e., 2, 4 and 6 days. The efficacy of three plant extracts in the control of *T. granarium* infesting wheat grains varied with the concentration of the plant extract and duration of exposure. The data regarding overall insect mortality and population buildup achieved with test insecticides, in three different concentrations and at various exposure time are given in the Tables.

The data in table 1.2 showed mean mortality by *Piper nigrum*, *Withania somnifera* and *Eruca sativa*. 8% concentration of *Piper nigrum* gave maximum mortality (26.308%) while 2% yielded minimum mortality (7.632%) which differs significantly from the per cent mortality at 6% and 4% concentration while in case of *Withania somnifera* maximum mortality was caused by 8% concentration (15.396%) and minimum mortality was observed against 2% concentration (5.931%), and same results were observed in *Eruca sativa* which gave maximum mortality 10.85% at 8% concentration and minimum 3.06% at 2%.

The data in table 2.2 shows mean population buildup by *Piper nigrum*, *Withania somnifera* and *Eruca sativa*. 2% concentration of *Eruca sativa* gave maximum population buildup (26.308%) while 8% yielded minimum population buildup (7.632%) which differs significantly from the per cent population buildup at 6% and 4% concentration while in case of *Withania somnifera* maximum population buildup was caused by 2% concentration (15.396%) and minimum population buildup was observed against 8% concentration (5.931%), and same results were observed in *Eruca sativa* which gave maximum population buildup 10.85% at 2% concentration and minimum population buildup 3.06% at 8%. Post treatment population build-up of surviving insect from various treatments revealed that population build up was reduced with the increase in dose exposure period against plant extracts used in this study. Similar studies were carried out on the extracts of *Acatia nilotica* indicated its insecticidal activity against *T. granarium and T. castaneum, C. maculates* and *S. zeamais* [7].

The insecticidal constituents of many plant extracts are mainly monoterpenoids [8]. Due to their high volatility, they have fumigant action and gaseous action might be of importance for stored-product insects. The monoterpene carvacrol has broad insecticidal and acaricidal activity against agricultural, stored-product, and medical pests, and acts as a fumigant [9]. Concentration of 05 mg/cm² for neem extract, 90% at 12.9mg/cm² for cypermethrin 96% at 0.64 mg/cm² for methyl parathion [10]. Rizvi SA [11] tested the efficacy of dumdum leaves (Clerodendrum inerme) extract and cypermethrin against adults beetles of *T. castaneum*. After plotting a graph between mortality and dose, LD Sub (50) was found to be 4 mµ g/cm² and 0.34 mµ g/cm², respectively.

Bouda H [12] studied the effect of essential oils from leaves of *Ageratum conyzoides, Lantana camara and Chromolaena odorata* on the mortality of *Sitophilus zeamais* and found that mortality of *S. zeamais* increased with the concentration of the essential oils of the three plants and the duration of exposure of the weevils on the treated substrates. The efficacy of neem extract, cypermethrin and methyl parathion was observed against *T. castaneum*. The present study relating with the work done in the past by [13] checked the botanical powders of some medicinal plants against the stored grain pest, *Trogoderma granarium* under controlled laboratory conditions. Botanical powders have resulted in high mortality, delay in development and subsequent significant population reduction.

The result of present study were also coincides with those [14], [15]. No past work was found in the literature where the same type of plant extract, which was use in the present study.

Table 1: Overall mean per cent mortality of *T. granarium* against *Piper nigrum*, *Withania somnifera* and *Eruca sativa* at various concentrations.

Table 1.1

Treatments	Mean Percent Morality
Eruca sativa	7.15 B
Withania somnifera	10.41 B
Piper nigrum	15.26 A

The data in table 1.1 shows mean of per cent mortality by *Piper nigrum* (15.26%), Withania somnifera (10.41%) and *Eruca sativa* (7.15%).

Table 1.2

Concentrations	Mortality Percent Mean		
	Piper nigrum	*Withania somnifera*	*Eruca sativa*
2 %	7.632 B	5.931 C	3.060 B
4 %	11.675 B	8.630 BC	6.892 AB
6 %	15.408 B	11.696 AB	7.778 AB
8 %	26.308 A	15.396 A	10.849 A

Table 2: Overall mean percent population buildup of *T. granarium* against *Piper nigrum*, *Withania somnifera* and *Eruca sativa* at various concentrations

Table 2.1

Treatments	Mean Percent Population buildup
Eruca sativa	115.47 A
Withania somnifera	92.33 B
Piper nigrum	78.60 C

The data in table 2.1 shows mean of percent population buildup by *Piper nigrum* (78.60%), *Withania somnifera* (92.33%) and *Eruca sativa* (115.47%).

Table 2.2

Concentrations	Population buildup Percent Mean		
	Piper nigrum	*Withania somnifera*	*Eruca sativa*
2 %	74.33 B	94.67 B	118.67 B
4 %	65.00 B	78.33 BC	94.67 BC
6 %	54.67 BC	73.00 C	99.33 BC
8 %	42.33 C	51.67 D	83.67 C

References

1. Ramzan M, Chahal BS. Effect of interspecific competition the population buildup of some storage insects. Ind. J Ecol. 1986; 13:313-317.
2. Jood S, Kapoor AS. Protein and uric acid contents of cereal grains as affected by insect infestation. J Agric Food Chem. 1993; 46(2):143-146.
3. Irshad M, Khan A, Baloch UK. Losses in wheat in public sector storage in Rawalpindi region during 1984-1985. Pak. J Agric Res. 1988; 9(2):136-140.
4. Sharma DR, Kalra RL. Phosphin resistance during different developmental stages of *T. granarium* (Everts). Ann. Pl. Protect. Sci, 1998; 6(2):198-200.
5. White NDG. Insects, mites and insecticides in stored grain ecosystems. In: Stored Grain Ecosystems. Jayas, D. S., N. D. G. White and W. E. Muir, (eds.), Marcel Dekker. New York, 1995, 123-168.
6. Abbott WS. A method of computing the effectiveness of an insecticide. Econ. Entomol, 1925; 18:265-267.
7. Dwivedi SC, Mamta B, Bajaj M. Efficacy of Acacia nilotica leaf extract as pesticide against Trogoderma granarium (Everts), Govt. Of Pakistan, 2011. Economic survey of Pakistan 2010-11. Min. Food, Agric., Livestock. Econ. Wing, Islamabad, pp. 15-33. J Exp Zool India. 2000; 3(2):153-155.
8. Konstantopoulou L. Insecticidal effects of essential oils. A study of the effects of essential oils extracted from eleven Greek aromatic plants on D. auraria. . Experimentia, 1992; 48:616-619.
9. AY J. Insecticidal and acaricidal activity of carvacrol and β-thujaplicine derived from Thujopsis dolabrata var. hondai sawdust. J Chem Ecol. 1998; 24(1):1-90.
10. Imtiaz A. Determination of toxicity of neem extract, cypermethrin and methyl parathion against stored grain pest, Tribolium castaneum, PARC strain. Proceed. Pak. Cong. Zool. 1999, 19.
11. Rizvi SA. Determination of toxicity of clarodenderum inerme and cypermethrin against Tribolium castaneum and their effects on acid phosphatase and cholinesterase enzymes. Proceed. Pak. Cong. Zool., 2001; 21:175-180.
12. Bouda H. Effect of essential oils from leaves of *Ageratum* conyzoides, Lantana camara and Chromolaena odorata on the mortality of Sitophilus zeamais (Coleoptera, Curculionidae). J Stored Prod Res. 2001; 37(2):103-109.
13. Al-Moajel NH. Testing some various botanical powders for protection of wheat grain against Trogoderma granarium Everts. J Biol Sci. 2004; 4(5):592-597.
14. Musa AK, Dike MC, Onu I. Evaluation of Nitta (Hyptis suaveolens Poit.) Seed and Leaf Extracts and Seed Powder for the Control of Trogoderma granarium Everts (Coleoptera: Dermestidae) in Stored Groundnut. Am-Euras J Agron. 2009; 2(3):176-179.
15. Bai X. Anti-hepatotix and antioxidant effects of extracts from Piper nigrum L. root. Afr. J Biotechnol. 2011; 10(2):267-272.