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Exploring the potential of *Elaeagnus angustifolia* as grain protectants

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Abstract
Methanol extracts from medicinal plant *Elaeagnus angustifolia* were used against rice weevil (*Sitophilus oryzae*) Survival was significantly inhibited when adults of *S. oryzae* were exposed to the extracts incorporated with no diet. The doses were 1ml, 1.5ml, 2.0ml, 2.5ml and 3ml while the mortality rates were 24, 33.5, 47, 54 and 62 respectively. The highest mortality rates were observed with the dose of 3ml. Thus, significant mortality rate was achieved with extract of these plants. These naturally occurring plant extracts could be useful for managing populations of *S. oryzae*. The leaves were dried powdered and extracted by methanol. The plant extract were used to investigate toxicological effect. The applied concentration were 1%, 1.5%, 2%, 2.5% and 3% and their mortality rate was 24, 62, 47, 54 and 33.5 respectively. Experimental extracts were applied on adult rice weevil and average mortality rate were observed after 12 h. In adults bioassay the highest toxicity was recorded for extract (LC_{50} =50%).The mortality revealed that *Elaeagnus angustifolia* has Significant toxic properties on *Sitophilus oryzae*. As this plant is widely distributed and can be used for further investigation also.

Keywords: *Elaeagnus angustifolia*, methanolic extract, toxicity, *Sitophilus oryzae*

1. Introduction
Rice is the most important food crop for more than half of the world's population. Losses of rice due to rice weevils are considerably high. Grains spoilage after harvest is due to lack of enough storage and processing facilities [1]. The rice weevil, *S. oryzae* L. (Coleoptera: Curculionidae) is a major pest of stored grains and it has been spread worldwide [2].
Rice weevil (*S. oryzae*) is a serious insect pest of different food grains of storage products [3]. It also affect the other commodities like grain, flour, peas, beans, cocoanuts, dried fruits, and spices, but milled grain products such as flour appear to be their preferred food [4]. Grain suffers heavy losses during storage due to insect pests. According to FAO, the loss done annually by insects and rodent pests is 10 - 25% of world-harvested food [5]. The adults and grubs both feed voraciously on a variety of stored cereals [6].
In Pakistan, about 2 - 6% food grain production is lost every year during storage by stored grain insect pests. Similarly, the total post-harvest loss of wheat is about 7.37% out of which 3.24% is due to stored grain insect pests. Weight loss of wheat during storage due to insect pests in Multan and Bhawalpur food grain storages on an average ranges between 0.45 and 0.75 % [7]. The rapid distribution of *S. oryzae* with their high reproduction rate and good ecological adaptability raising a large store grains problems all over the globe [8].
Control of these insects relies heavily on the use of synthetic insecticides including organochlorines (lindane), organophosphates (Malathion), carbamates (carbaryl), pyrethroids (deltamethrin) and fumigants including methyl bromide, phosphine, and sulfuryl fluoride. However, the indiscriminate application of synthetic products has led to various problems including toxic residual effects, environmental pollution, and development of resistance in insects. Therefore, it is an urgent need to develop safe, convenient and low-cost alternatives. Considerable efforts have been focused on the use of plant-derived materials including essential oils [12].
E. angustifolia has been traditionally used as a medicine includes fever, amoebic dysentery, gastrointestinal problems (nausea, vomiting and jaundice), jaundice, tetanus and asthma [8]. Noteworthy, pharmacological investigations have revealed that EA extract has potent anti-inflammatory, analgesic and muscle relaxant effects [10] & [11].
Additionally, *E. angustifolia* (EA) is one of the herbs with anti-inflammatory and analgesic effects. It also contributes to healing of the wounds and scar formations [13].

The herbal drugs have been widely used for the treatment of diseases. The ripe fruits of *E. angustifolia* have been used to treat amoebic dysentery [14]. Because of their negligible adverse effects [15] The Elaeagnaceae is a small family with three genera: *Elaeagnus* L., *Hippophae* L. and *Shepherdia* Nutt and has 77 species worldwide [16].

The objective of this study was to identify the effect of *E. angustifolia* against S. *oryzae*. Species were chosen because of their world-wide pest status and easy availability

2. Materials and Methods

S. oryzae was collected from a local market and reared in glass jars maintaining the laboratory conditions of 30 °C ± 1 °C constant to some extent and relative humidity (RH) of 75 ± 5% in continuous interval of darkness. The RH was kept by means of highly saturated solution of sodium chloride (NaCl). When the pupal stage completed, the adults were emerged. Mature *S. oryzae* were used for the experimental purposes and were treated with different amount of *E. angustifolia* extracted solution. In this way the different doses were applied against the rice weevils.

3. Materials

Fresh leaves of *E. angustifolia* were collected from the nearby village of district Bannu and the plant was taxonomically classified from Botany Department, KUST Kohat. The plant leaves were kept in Zoological Research laboratory KUST Kohat for further experimental procedures and for various biological activates.

3.1 Preparation of plant extracts

The leaves was finely cut into small parts and the aqueous extract was prepared by mixing 10 g of dehydrated leaves grinded powders of the *E. angustifolia* plant with 500 mL of water (heated and frozen purified water) with regular mixing through a stirrer rod. The suspension of dehydrated leaves crushed in water was left for 3 h, filtered throughout filter paper, and the filtrate was accumulated in amber colored air tight bottle at 10 °C and used within a week [17].

4. Results

The preliminary assortment is a good means of evaluation of the potential activity of plants popularly used for this purpose. Insecticidal activities of methanol extracts of *E. angustifolia* plants showed (Table 1).The crude extracts applied, the present results show that the maximum insect mortality rate was found in the (2%,2.5% and 3% in which 60% was observed. The extracts of *E. angustifolia* showed fruitful results from 2% - 3%, the mortality rate of the insects were highest with increasing concentration of plant extract against the *S. oryzae*. When the concentration was increased, the insects mortality rate was also increased (Figure 2). The plant extract were tested and evaluated by the association of LC_{50} values (Figure 1). The present study indicate that the mortality rates at a 3% concentration were highest of the methanol extracts tested for mortality and it was significantly high mortality rate then the 1%,2%,2.5% and 3%concentraion of extracts at 24, 48, 72 and 96 hours (Table 1). Generally, Increase in mortality was observed with increase in concentration of the plant extracts. Their mean result revealed that the plant extraction with methanol have direct effect on the *S. oryzae*. Various plants have the highest toxicological effect against insect which destroy our economic level. *E. angustifolia* plants are cosmopolitan in nature and have a variety of pharmacological importance. The *E. angustifolia* plants were easily accessible, so these plant extract was applied for their toxicological assessment against *S. oryzae*. Different

Table 1: Effect of different doses of *Elaeagnus angustifolia* extract against rice weevil (*S. oryzae*)

S. No.	Doses(ml)	Mortality rate at various interval				
		24 HAT	48 HAT	72 HAT	96 HAT	Average Mortality
1.	Control	0.00	0.00	0.00	0.00	0.00
2.	1	20	24	22	30	24
3.	1.5	34	30	38	32	33.5
4.	2.0	46	48	44	50	47
5	2.5	52	56	50	58	54
6	3	60	66	62	60	62

Hat, (Hour after treatment)

Table 2: Treatments of Different Plants Extract against rice weevil (*Sitophilus oryzae*) [18].

S No.	Common Names	Biological Names	Mortality rate of *S. oryzae* with different days(D)							
			D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8
1.	Lemon grass	*Cymbopogon citratus*	0.00	6.00	20.00	34.00	40.00	46.00	50.00	52.00
2.	Bakain drupes	*Melia azedarach*	2.00	16.00	42.00	62.00	80.00	82.00	82.00	82.00
3.	Bakain leaves	*Melia azedarach*	0.00	4.00	18.00	34.00	56.00	56.00	66.00	78.00
4.	Mint	*Mentha longifolia*	2.00	2.00	18.00	36.00	60.00	70.00	70.00	72.00
5.	Habulas	*Myrtus communis*	0.00	0.00	12.00	48.00	56.00	68.00	70.00	76.00
6.	Harmal	*Peganum harmala*	0.00	2.00	10.00	12.00	18.00	22.00	26.00	26.00
7.	Untreated check		0.00	0.00	0.00	0.00	0.00	0.00	6.00	10.00

Table 3: Previously reported Pharmacological consequence of *Elaeagnus angustifolia*

S. No.	Regions	Parts used	Treatment	References
1.	China	Flower, Fruit, Leaf and bark	Spleen, stomach, dyspepsia, diarrhea & cough	[19]
2.	Iran	Fruit	Hepatoprotective & gastric pain	[20]
		Oil	Myalgia, rheumatoid arthritis and knee ache	[21]
		Arborous parts	Osteoporosis, joints & jaundice	[22]
3.	Jordan	Fruits	Dysentery and diarrhea	[23]
4.	Lebanon	Arial parts	Digestive & genitourinary system	[24]
5.	Pakistan	Fruit, flower	Cough & cold remedies	[25]

		Fruit	Dyspepsia, blood purification, sore throat & high fever	[26]
		Whole plant	Headache, heart burning & skin infections	[27]
		Gum	Asthma, bronchial &lung disease	[28]
		Tree gum	Hair tonic for healthy and shiny	[29]
6.	Turkey	Fruit	Tonic, kidney disorder &diarrhea	[30]

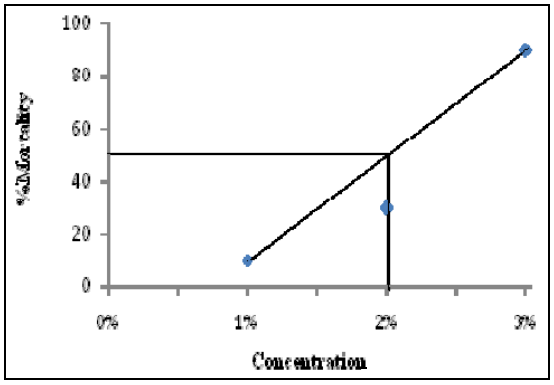

Fig 1: LC_{50} diagram showing % mortality of *S. oryzae* by *Elaeagnus angustifolia* plant.

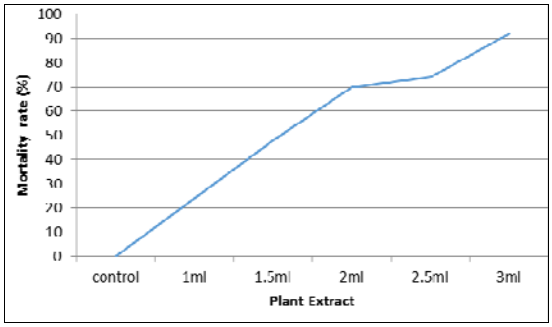

Fig 2: Applied plat extract against *S. oryzae and* mortality rate (%)

5. Discussion

The insecticidal activity of different plants extracted on *S. oryzae* have been observed by various researchers, where different plant extracts have different effects in preventing the store products from damage by *S. oryzae*. The plant extract was applied to rice weevil and observed the various mortality rates. The current study was subjected to check the toxicological effects of *E. angustifolia* on *S. oryzae* which damage the store products. Five different concentrations were applied on adult *S. oryzae*, and different percentage of deaths was observed. The highest percent mortality was observed while using 3 % methanol extract solution so the present study revealed the effect of *E. angustifolia* plant extract on *S. oryzae.* Significant insecticidal activity against *S. oryzae* adults was observed with crude methanol extract followed by extracts of *E. Angustifolia*. Plant extract was used for toxicological effect against rice weevil (Table 2). The adult *S. oryzae* were susceptible to the methanolic extracts. Methanol extracts from the studied species reduced significantly. The mortality was 47, 54 and 62 average rate of S. *oryzae* at 2 ml, 2.5ml and 3ml respectively. The whole plant used for the treatment of various types of human diseases (Table 3).

The ethanolic extracts of diverse medicinal plants were applied against *S. oryzae* in which the efficient rate were different. There was 80% effective rate for *Ageratum conyzoides* Similarly the mortality rates were 100%, 66% and 100% for *A. nodiflora, A. maraitima* and *C. halicacabum* respectively this treatment were carried out during 72 hours. A study conducted in which cumin seed extract of 1% was used against *S. oryzae* and *R. dominica*. The mortality was observed 57.8% and 11.3% respectively for the treatment of two days two weeks. It shows that cumin seed extract is more effective for *S. oryzae* and *R. dominica*. By comparing the result with current study it is analyzed that *E. Angustifolia* extract is more effective then cumin seed extract to the *S. oryzae* [31]. Different botanical extract were used for the treatment of *Sitophilus zeamais* in which the result were 56%, 25%, 25%, 20%, 10% and 10% for *D. pinnata, S. trifasciata, A. angustifolia, R. communis, E. pulcherrima* and *M. jalapa* respectively. *Ocimum viride* is more effective than *A. indica* and *C. Limon* [28] the hexane isopropyl alcohol solution of *O. viride* extract was used for *S. oryzae* in which the effective rate was 75% and 60% [32].

The time of pupation of *Spodoptera littoralis* (Boisduval) of larvae increased by the extract of *Adhatoda vasica.* Adults were observed dead with crude methanol extract from *P. harmala* followed by extracts of *A. Iva, Ari. Baetica, S. oryzae* and *R. raphanistrum*. The larvae were more susceptible than adults to extracts of *Ari. Baetica* and *R. raphanistrum*. In contrast adults were more susceptible than larvae to extract of *P. harmala* and *A. Iva*. V b young production significantly [33].

The repellent effect of the extracts of root bark of *C. gigantea* was also investigated. Methanol extract and its chloroform and petroleum ether fractions showed mild to moderate repellent effect on *S. oryzae*. Similar observations on other plant extracts have also been made [34, 36]. The crude seed extracts of pithraj *Aphanamixis polystachya* Wall and Parker, strongly repelled *S. oryzae* [35].

6. Conclusion

E. angustifolia plant extract was found to be strong contact toxins against *S. oryzae*. In a grain-treated bioassay against *S. oryzae* was the most active. *Abies grandis* was the least toxic in grain-treated bioassays against *S. oryzae*. These extract exhibit more than one mode of action and may constitute a "multichemical defense" against a variety of potential herbivores. Since the oils are composed of mixtures of compounds, they will be more effective than individual compounds in terms of forestalling and diluting resistance and habituation [37, 38, 39] for long-term use. These oils have been tested for the first time against woolly beech aphids to the best of our knowledge. Some of these oils have never been tested against rice weevils. This study has explored the potential for development of essential oils especially from conifers to be effective, economically and environmentally friendly commercial insecticides.

7. References

1. Singh RKP, Satapathy KK. Zero Energy Cool Chamber: a low cost storage structure. Journal North Eastern Council. 2003; 23:27-30.
2. Park IK, Lee SG, Choi DH, Park JD, Ahn YJ. Insecticidal activities of constituents identified in the essential oil from leaves of *Chamaecyparis obtuse* against *Callosobruchus chinensis* (L.) and *Sitophilus oryzae* (L.). Journal of Stored Product Research. 2003; 39:375-384.
3. Baloch UK. Integrated Pest Management in Food Grains. Food and Agriculture Organization of the United Nations and Pakistan Agricultural Research Council, Islamabad,

Pakistan. 1992, 117.
4. Klich MG. Leaf variations in *Elaeagnus angustifolia* related to environmental heterogeneity. *Environ Exp* Bot. 2000; 44:171-183.
5. Sahaf BZ, Moharramipour S, Meshkatalsadat MH. Chemical constituents and fumigant toxicity of essential oil from *Carum copticum* against two stored product beetle. Insect Science, 2007; 14:213-218.
6. Lee B, Choi W, Lee S, Park B. Fumigant toxicity of essential oils and their constituent compounds towards the rice weevil, *Sitophilus oryzae*. Crop Prot. 2001; 20:317-320.
7. Hasan M, Siddique MA, Sagheer M, Aleem M. Comparative efficacy of ethanol leaf extracts of *Amaranthus viridis* and *Salsola baryosma* (schultes) and cypermethrin against *Trogoderma granarium* (Everts). Pak. J Agri Sci. 2005; 42:3
8. Obon C. Beverage and culture. Zhou rat, a multivariate analysis of the globalization of a herbal tea from the Middle East. Appetite. 2014; 79:1-10.
9. Bonnefoy X, Kampen H, Sweeney K. Public Health Significance of Urban Pests, pp. 565. World Health Organization Regional Office for Europe, Copenhagen, 2008, 209-238.
10. Isman MB. Botanical insecticides, deterrents, and repellents in modern agriculture and an increasingly regulated world. Annu Rev Entomol, 2006; 51:45-66.
11. Ahmadiani A, Hosseiny J, Semnanian S, Javan M, Saeedi F, Kamalinejad M. Anti-nociceptive and anti-inflammatory effects of *Elaeagnus angustifolia* fruit extract. J Ethnopharmacol. 2000; 72:287-92.
12. Ayaz FA, Bertoft E. Sugar and phenolic acid composition of stored commercial oleaster fruits. J Food Compost Anal. 2001; 14:505-511.
13. Ramezani M, Hosseinzadeh H, Daneshmand N. Anti-nociceptive effect of *Elaeagnus angustifolia* fruit seeds in mice. Fitoterapia 2001; 72:255-62.
14. Rajendran S, Sriranjini V. Plant products as fumigants for stored-product insect control. J Stored Prod Res. 2008; 44:126-135.
15. Wang Q. Intera-specific genetic relationship analyses of *Elaeagnus angustifolia* based on RP-HPLC biochemical markers. Journal of Zhejiang University Science. 2006; 7(4):272-278.
16. Aguirre JM, Bagan JV, Rodriguez C, Jimenez Y, Martinez-Conde R, Diaz de Rojas F. Efficacy of mometasone fu-roate micro emulsion in the treatment of erosive-ulcerative oral lichen planus: pilot study. J Oral Pathol Med. 2004; 33:5-8.
17. Govindarajan M, Benelli G. One-pot green synthesis of silver nanocrystals using *Hymenodictyon orixense*: a cheap and effective tool against malaria, chikungunya and Japanese encephalitis mosquito vectors. RSC Advances. 2016; 6(64):59021-9.
18. Sun M, Lin Q. A revision of *Elaeagnus L*. (Elaeagnaceae) in mainland China. Journal of Systematic and Evolution. 2010; 48(5):356-390.
19. Saljoqi AUR, Afridi MK, Khan SA. Effects of six plant extracts on rice weevil *Sitophilus oryzae* L. in the stored wheat grains. 2006.
20. Wang Y. Four flavonoid glycosides from the pulps of *Elaeagnus angustifolia* and their antioxidant activities. Adv Mater Res. 2012; 756:16-20.
21. Ghasemi Pirbalouti A. Ethno botanical study of medicinal plants used by Kurd tribe in Dehloran and Abdanan districts, Ilam province, Iran. Afr J Tradit Complement Altern Med. 2013; 10:368-385.
22. Mikaili P. Pharmacological properties of herbal oil extracts used in Iranian traditional medicine. Adv Environ Biol. 2012; 6:153-158.
23. Mardaninejad S. Collection and identification of medicinal plants used by the indigenous people of Mobarakeh (Isfahan), southwestern Iran. J Herb Drugs. 2013; 4:23-32.
24. Lev E, Amar Z. Ethno pharmacological survey of traditional drugs sold in the Kingdom of Jordan. J Ethnopharmacol. 2002; 82:131-145.
25. Obon C. Beverage and culture. Zhou rat, a multivariate analysis of the globalization of an herbal tea from the Middle East. Appetite. 2014; 79:1-10.
26. Afzal S. Ethno-botanical studies from northern Pakistan. J Ayub Med College Abbottabad. 2009; 21:52-57.
27. Ali H, Qaiser M. The ethno botany of Chitral valley, Pakistan with particular reference to medicinal plants. Pakistan J Bot. 2009; 41:209-241.
28. Ahmed M. An ethno botanical study of medicinal plants in high mountainous region of Chail valley (District Swat- Pakistan). J Ethnobiol Ethno med. 2014; 10:1-18.
29. Qureshi RA. Ethno botanical studies of medicinal plants of Gilgit District and surrounding areas. Ethno botany Res Appl. 2006; 5:115-122.
30. Khan N. Important medicinal plants of Chitral Gol National Park (CGNP) Pakistan. Pakistan J Bot. 2011; 43:797-809.
31. Tuzlaci E, Bulu GE. Turkish folk medicinal plants, part IIV: Ezine (Çanakkale). J Fac Pharm Istanbul. 2007; 39:39-51.
32. Kamali SI, Roh JY, Kim DH, Lee HS, Ahn YJ. Insecticidal activities of aromatic plant extracts and essential oils against *Sitophilus oryzae* and Callosobruchus chinensis. J Stored Prod Res. 2009; 39:293-303.
33. Potenza MR, Juniour JJ, Alues JN. Evalution of contact activities of plant extracts against *Sitophilus zeamais* motschulsky (Coleoptera: Curculionidae), Instituto Biological APTA. Av conselheiro Rodriguez Alues, Sao Paulo SP Brazil. 2005, 7-19.
34. Owusu EO. Effect of some Ghanaian plant components on control of two stored product insect pest of cereals, Journal of stored products Research. 2000; 37:85-91.
35. Sabri MA, Khan MR, Ahmad M. Post-harvest field losses to wheat in Faisalabad Tehsil Pak. Entomol. 1984; 69:69-76.
36. Lie ZL, Ho SH. Bioactivity of the essential oil extracted from *Evodia rutaecarpa* Hook Thomas against the grain storage insects, *Sitophilus zeamais* motsch and *Tribolium castaneum* (Harbst). J. Stored Product Research. 1999; 35:317-328.
37. Isman MB. Botanical insecticides, deterrents, and repellents in modern agriculture and an increasingly regulated world. Annu Rev Entomol. 2006; 51:45-66.
38. Karimi G. Anti-nociceptive effect of *Elaeagnus angustifolia* fruits on sciatic nerve ligated mice. Iran J Basic Med Sci. 2010; 13:97-101.
39. Ramezani M. Anti-nociceptive effect of *Elaeagnus angustifolia* fruit seeds in mice. Fitoterapia. 2001; 72:255-262.
40. Hosseinzadeh H. Muscle relaxant activity of *Elaeagnus angustifolia* L. fruit seeds in mice. J Ethnopharmacol. 2003; 84:275-278.