J. Glob. Innov. Agric. Soc. Sci., 2018, 6(1):28-31
ISSN (Online): 2311-3839; ISSN (Print): 2312-5225
http://www.jgiass.com

TOXIC POTENTIAL OF THREE INDIGENOUS PLANTS AGAINST TWO STORED GRAINS INSECT PESTS

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The present investigations were planned to evaluate the toxic potential of three indigenous plant extracts (i.e., *Conocarpus erecta*, *Trachyspermum ammi* and *Datura alba*) against *Oryzaephilus surinamensis* and *Sitophilus zeamais*. Plant extracts were applied at concentrations of 5, 10 and 15% on filter papers, placed in sterilize petri-dishes. Twenty adults of each of the both insect species were released on treated filter papers. Data regarding contact toxicity was recorded after 24, 48 and 72 hrs. of the post treatments. The findings showed that the highest mortality in case of both insects viz; *O. surinamensis* (69.10%) followed by *S. zeamais* (60.98%) was observed at highest concentration (15%) of the with *D. alba* extract after exposure period of 72 hrs. Extract of *C. erecta* gave 63.75 and 55.20% against *O. surinamensis* and *S. zeamais*, respectively. While extract of *T. ammi* comparatively least (1.63%) was observed at 5% concentration and after 24 hrs. From results we conclude that extract of the three plant extracts proved effective against the two insect pests of stored commodities especially *D. alba* relatively better results than *C. erecta* and *T. ammi*. Hence plants extracts can be used in an integrated way to make the IPM more effect to overcome the insect pest management problem.

Keywords: Plant extracts, Mortality, Concentrations, Exposure periods, IPM.

INTRODUCTION

Stored grains and products are attacked by a number of insect pests which cause around 5-10% (in temperate zone) and 20-30% (in the tropical zone) and undermine the food security (Rajendran and Sriranjini, 2008). One of them is the saw-toothed grain beetle, *Oryzaephilus surinamensis* (L.) (Coleoptera: Silvanidae), a cosmopolitan and polyphagous stored product insect pest that most frequently found in stored grain and cereal products (Laszczak-Dawid*et al*., 2008; Trematerra and Sciarretta, 2004). Its detection is difficult due to habit of living in the bottom layers of infested food products (Madkur*et al.*, 2013). Timely detection and knowledge about the habits of pest species present in storages are the key steps to trigger the protection of grain products (Trematerra and Sciarretta, 2004; Wallbank and Collins, 2003). The maize weevil, *Sitophilus zeamais* (L.) (Coleoptera: Curculionidae) is one of the destructive primary insect pests of stored grains, especially maize, worldwide. Both larvae and adults damage the stored grains stuff (Tefera *et al*., 2011). The Maize weevil, *Sitophilus zeamais* (Motschulsky) (Coleoptera: Curculionidae) is a severe pest of stored grains, both in the field as well as in storages structures (Demissie *et al*., 2008). Both larvae and adults of this pest damage grains of a number of cereals belonging to Poaceae family such as *Triticum aestivum* L., *Zea mays* (L.) (Ukeh *et al*., 2010).

Normally synthetic chemical insecticides have been used worldwide to control the pests of stored grain (Pereira *et al*., 1997), particularly *S. zeamais* (Cherry *et al*., 2005). For stored grain insect pest, the current controlling strategy consist of use of insecticides from two groups i.e., residual chemical and fumigants. Use of chemicals is effective but it imposes several undesirable effects on environment and living organisms (Benhalima *et al*., 2004). Further, in several insects, insecticides resistance is increasing due to use of excessive chemical (Athie and Mills, 2005; Lorini *et al*., 2007). Therefore, alternative approaches are utmost need of current era to manage insect pest problems.

Bio-derived insecticides have engrossed an increasing attention these days due to the facts of eco- friendly and cast no residual effects to surroundings (Benelli *et al*., 2012; Copping and Menn 2000; Popoola *et al*., 2013; Souguir *et al*., 2013). Plant based insecticides have toxic and feeding deterrence effects against insect pests (Isman, 2006; Shah *et al*., 2008; Tripathi *et al*., 2002). At present, bio-insecticides (plant extracts and oils) are used to control insect pests. In the light of above scenario, present study was planned to check the toxicological effects of some plants against these two insect pests.

MATERIALS AND METHODS

***Collection and Rearing of Test Insects*:** Heterogeneous populations of *Oryzaephilus surinamensis* and *Sitophilus zeamais* were collected from the storages of rice mills and maize processing industries, Punjab, Pakistan, to establish the laboratory culture of insects. The insects were kept separately in small plastic jars provided with diet (rice for *O. surinamensis* and maize for *S. zeamais*), covered with a muslin cloth (tightened with rubber bands) to avoid the escape of insects. These jars were placed in growth chambers (T = 30±2 ºC; R.H = 70±5 %). After 72 hr, adults were sieved out and each diet with the insect eggs was shifted to separate sterile small plastic jars for hatching, provided with respective fresh diets. These plastic jars were placed in an incubator at optimum laboratory conditions (as described earlier) for 28–32 days to get the homogeneous populations of *O. surinamensis* and *S. zeamais.* 7-day-old adults of both insects were used for toxicity bioassays.

***Collection of plant materials*:** Plant materials (leaves) of *Conocarpus erecta*, *Trachyspermum ammi* and *Datura alba* from the different localities in Faisalabad.

***Extraction of Plants Extracts*:** The plant materials were cleaned with distilled water to avoid contamination and shade dried. Then were grinded to get powder. The extraction of plant materials was accomplished using Rotary shaker by dipping 50 grams of powder in 250 ml acetone, following the procedure which is being pronounced by Ahmed *et al*., 2006. The essential plant extracts which were obtained poured into clean bottles and stored in refrigerator for further use.

***Bioassay for Mortality*:** The experiment was carried in Petri-dishes by treating filter papers with different concentrations of plant extracts and allowed to get dry. Twenty adults of both test insects were released in each separate Petri-dish and covered with perforated lids. Mortality of the adults was recorded three times after 24, 48 and 72 hr. of the post treatment application.

***Statistical Analysis*:** After the completion of the experiment the recorded data was analyzed using statistical software and the corrected mortality measured using Abbott's formula. The data was analyzed using Completely Randomized Design and suitable statistic software.

RESULTS AND DISCUSSION

The findings of toxicity bioassays revealed that main effects (Concentrations, d.f= 2; f (cal.) = 8.291), plants (d.f = 3, f (cal.) = 6.169) and interaction effect were found significant at $p<0.002$.

Data in table 1 depicted that highest mortality (54.19 %) against *Oryzaephilus surinamensis* at highest concentration (15 %) of the *Datura alba* extract compared to *Sitophilus zeamais* (47.12 %) whilst comparatively least (1.63 %) was observed at 5 % concentration of*Trachyspermumammi*. From the result we conclude that extract of *D. alba* comparatively proved more effective than other two extracts, used.

Table 1. Efficacy of three plant extracts against the two insect pests at differentconcentrations afterexposure of 24 hr.

Conc. (%)	Plants	Mortality (%) ± SE	
		Sitophilus zeamais	***Oryzaephilus surinamensis***
5	*Trachyspermum ammi*	1.63 ± 1.92	5.51 ± 1.92
	Conocarpus erecta	4.88 ± 1.11	7.21 ± 1.92
	Datura alba	13.72 ± 1.34	12.27 ± 2.93
10	*Trachyspermum ammi*	14.51 ± 2.93	19.32 ± 2.54
	Conocarpus erecta	21.17± 2.13	24.42 ± 2.94
	Datura alba	26.08± 1.12	31.13 ± 2.41
15	*Trachyspermum ammi*	35.31 ± 5.09	39.18 ± 3.28
	Conocarpus erecta	39.20 ± 4.84	43.20 ± 2.11
	Datura alba	47.12 ± 3.82	54.19 ± 2.94

Data in Table 2 illustrated that highest mortality (60.76 %) was observed against *Oryzaephilus surinamensis* at highest concentration (15 %) of the *Datura alba* extract than *Sitophilus zeamais* (51.29 %). While extract of *Trachyspermum ammi* comparatively least (7.13 %) was observed at 5 % concentration of *Trachyspermum ammi*. The results indicated that extract of *D. alba* comparatively proved more effective than other two extracts.

Table 2. Efficacy of three plant extracts against the two insect pests at different concentrations after exposure of 48 hr.

Conc. (%)	Plants	Mortality (%) ± SE	
		Sitophilus zeamais	***Oryzaephilus surinamensis***
5	*Trachyspermum ammi*	7.13 ± 1.52	13.33±3.14
	Conocarpus erecta	12.34 ± 1.12	20.16±1.92
	Datura alba	25.55 ± 2.93	34.43±2.93 e
10	*Trachyspermum ammi*	20.71 ± 2.93	27.42 ±2.94 de
	Conocarpus erecta	29.66 ± 2.44	38.76±2.89 cde
	Datura alba	41.15 ± 3.54	46.68±3.09 cd
15	*Trachyspermum ammi*	42.11 ± 5.09	49.23±2.88 c
	Conocarpus erecta	47.20 ± 4.84	56.15±1.94 ab
	Datura alba	51.29 ± 8.82	60.76±2.78 a

Table 3 showed that highest mortality (69.10%) was observed against *Oryzaephilus surinamensis* at highest concentration (15%) of the *Datura alba* extract compared to *Sitophilus zeamais* (60.98%). While extract of *Trachyspermum ammi* comparatively least (7.13%) was observed at 5 % concentration. The results indicated that extract of *D. alba* comparatively proved more effective than other two extracts.

Table 3. Efficacy of three plant extracts against the two insect pests at different concentrations after exposure of 72 hr.

Conc. (%)	Plants	Mortality (%) ± SE	
		Sitophilus zeamais	***Oryzaephilus surinamensis***
5	*Trachyspermum ammi*	15.23 ± 2.52	23.32 ± 2.94 e
	Conocarpus erecta	20.54 ± 1.12	29.06 ± 3.14 e
	Datura alba	27.55 ± 2.93	37.43 ± 2.92 de
10	*Trachyspermum ammi*	34.71 ± 2.93	41.12 ± 1.84 d
	Conocarpus erecta	40.86 ± 2.44	53.76 ± 2.19 bc
	Datura alba	49.15 ± 2.54	59.38 ± 3.09 ab
15	*Trachyspermum ammi*	47.11 ± 5.09 a	52.23 ± 5.88 a
	Conocarpus erecta	55.20 ± 4.84 a	63.75 ± 2.94 a
	Datura alba	60.98 ± 8.82 a	69.10 ± 7.78 a

DISCUSSION

The toxic effects of three plants extract (*Trachyspermum* ammi, *Conocarpus erecta and Datura alba* were evaluated after 24, 48 and 72 hr. against the two insect pests of stored grains. The results elaborated that the highest mortality in case of both insects viz; *Oryzaephilus surinamensis* (69.10 %) and *Sitophilus zeamais* (60.98 %)was observed at highest concentration (15 %) of the with *Datura alba* extract after exposure of 72 hr. Extract of *Conocarpus erecta* gave 63.75and 55.20 % against *O. surinamensis* and *S. zeamais*, respectively. While extract of *Trachyspermum ammi* comparatively least (1.63 %, 7.13 and 15.23 %) was observed at 5 % concentration of *Trachyspermum ammi* at three exposure periods, respectively. Our mortality results of *S. zeamais* (55.20 %) are close to Tavares *et al*. (2013) who evaluated the 50 % of the same insect. Slight difference may be due to use of different concentration, used. Our findings are in line with Al-Qahtani *et al*. (2012) who used plant powders (i.e., *Zingiber afficinale*, *Foeniculum vulgare* etc.) and recorded mortality values of *O. surinamensis* up to 66.6 and 63.2 % and 68.4 % in cardamom-treated units. The findings of our study are also close to many Shaaya*et al*. (1991), in accordance with Moreira *et al*. (2007) similar to results of Ebadollahi *et al*. 2010. The outcomes of present study (my study) are close to Najafabadi *et al*. (2014) who used some plant extracts and found mortality values for *O. surinamensis*.

***Conclusion*:** Plant derived insecticides can be helpful for eco-friendly management of stored grain insect pests.

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