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(RESEARCH ARTICLE)



Effectiveness of plant extracts (lemon grass and tobacco) and insecticide Spinosad against *Tribolium castaneum* and *Rhyzopertha dominica*

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Abstract

Stored grain products are damaged by various types of insects during preservation of *T. castaneum* and lesser grain borer are most dangerous insect of preserved food. *Rhyzopertha dominica* is inner feeder and influences the wide variety as good as high quality of grains. Spinosad insecticide are very potent to manipulate the stored grain pest. Current research work was performed in the Department of Entomology, University of Agriculture, Faisalabad. Five concentrations 0.01%, 0.02%, 0.03%, 0.04%, 0.05% along with one control treatment of Spinosad was formed in hundred ml of purified water from standard dilutions and 2, 4, 6, 8, 10% concentrations of each plants were prepared. Treatments were applied to check their possible toxic effects against *T. castaneum* and *R. dominica*. The data were recorded after 24, 48 and 72 hours, treatment means were compared with the help of (THSD) test. Spinosad gave maximum mortality 89.77% as compared to plant extracts lemon grass and tobacco 38.55% and 40.00% against lesser grain borer. Spinosad gives maximum mortality 87.27% as compared to plant extract lemon grass and tobacco 34.55% and 29.09% against red flour beetle.

Keywords: Mortality; Spinosad; Red flour beetle; Lesser gain borer

1. Introduction

Rhyzopertha dominica and *Tribolium castaneum* (Herbst) cause great financial losses of stored wheat grains. The conservative way to manage these insect pests had been with the use of insecticides, either in a straight line apply to grains or by gas fumigation. However, concerns have arisen about the persistence of insecticide residues in grains which can be harmful to mammals [1]. Herbst is extremely frequent and mainly critical insect of preserved goods in all over the world and it is mostly present in warehouses, mills, stored grains and granaries. Together larvae as well as adults not simply nourish on new cereals however, they can as well nourish on grains previously attacked by another insect [2].

Tribolium castaneum (Herbst) (Coleoptera: Tenebrionidae), red flour beetle, is one of the major preserved cereals pests reported to cause damage to broad choice of items such as spices, nuts, dried fruits, cacao, flour, peas, beans and grains, but crushed cereal food stuffs like coat are their favorite food [3]. Spinosad decreased viable pesticides found on the fermentation goods of an actinomycete bacterium, has been tag which is used against two-hundred and fifty crops in more than fifty countries. Spinosad a commercial bacterial insecticide, from the actinomycete microbes Saccharin polypore Spinosad [4]. They were reported to be efficient against *R. dominica* on 11-13% moisture wheat

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stored at temperatures [5]. *Nicotiana tabacum* L. is a financial set spread generally during the region, having different chemical material, it is biologically active against natural enemies such as herbivorous bacteria, insects and fungi. Nicotine and nicotinic acid are organic compounds naturally produced by tobacco plants used as insecticides [6].

Rhyzopertha dominica, the lesser grain borer, belonging to family Bostrichidae is a chief pest present both in temperate as well as in tropical regions of the world. It causes severe damage to stored grains which include maize, wheat, barley, sorghum and rice [7]. *Rhyzopertha dominica* is the crucial pest of stored grain which is normally controlled by using phosphine fumigant [8]. To control this pest, generally chemical maneuvers are applied but highly adaptive characteristics of *R. dominica* develop resistance to a range of contact insecticide [9].

Examination of insecticidal potential of Tobacco and Lemon grass as plant extract against Red flour beetle and Lesser grain borer. To study the relative toxicity of new chemistry insecticide Spinosad.

2. Material and methods

The material includes *Tribolium castaneum*, Spinosad, tobacco extracts, *Cymbopogon* plastic cans, sterilized wheat flour, rubber bands, fine cloth, sieves, incubator, fine brushes and electric grinder.

2.1. Rearing of insects

Collected insects of red flour beetle and lesser grain borer was transferred to sterile crystal jars covered with cotton. Each strain was individually labeled and housed separately in a growth chamber at $30 \pm 20^\circ\text{C}$ and $70 \pm 5\%$ relative humidity. Sterilized wheat and flour were used for lesser grain borer and red flour beetle feeding media. After 5 days, the adult worms were removed and placed in another tank to provide optimal conditions for hatching eggs and uniform F populations for infested grains and flour.

2.2. Plant extracts bioassay

Nicotiana tabacum and *Cymbopogon* plant materials was washed with distilled water, dried in a cool place and grinded with assistance of electrical grinder to make it into powdered form. Extraction of plant materials was done using acetone as a flush by addition 50 grams of powder of each plant powder in 150 ml of acetone in Erlenmeyer flasks. The flask was placed on a rotary shaker and rotated at 220 rpm for 24 hours. Whatman filter paper was used for filtration. First, a 100% stock solution of four dilutions of each extract was prepared in acetone. Solution was applied on filter paper and after dry place them in petri dishes. Control treatments 20 immature adults of red flour beetle and lesser grain borer were placed in the petri dishes. Insect mortality data is available at 24, 48 and 72 hours.

2.3. Insecticide bioassay

Five concentrations 0.01%, 0.02%, 0.03%, 0.04%, 0.05% along with one control treatment of Spinosad was prepared. 100ml of distilled water used from stock solution. With the help of syringe each medication was pragmatic at the rate of 0.3ml/ filter paper. This was applied regularly on filter paper and allowed to dry. In each dish twenty insects of lesser grain borer and red flour beetle are released. Their mortality data were collected after 24, 48 and 72 hours.

3. Results

Table 1 shows that the effect of *Nicotiana tabacum* against *T. castaneum* and *R. dominica* after 24, 48 and 72 hours. In which mortality of *Tribolium castaneum* was maximum after 72hrs at 10% dose and maximum mortality recorded was 34.55% after 72hrs, while effects of *Nicotiana tabacum* against *R. dominica* was recorded were maximum mortality was 40% at 10% dose.

Table 1 Mortality effect of *Nicotiana tabacum* against *T. castaneum* and *R. dominica* after different exposure time periods.

Insect	Dose (%)	Time periods		
		24hrs Mortality	48hrs	72hrs
<i>T. Castaneum</i>	2	8.62±1.72c	7.15±1.38c	10.91±1.40c
	4	10.35±1.87c	14.29±1.50b	16.37±1.56c
	6	13.80±2.00bc	17.86±1.65b	23.64±1.66b
	8	18.96±2.29ab	25.01±1.80a	27.28±1.78b
	10	25.87±2.43a	28.58±1.96a	34.55±1.99a
<i>R. dominica</i>	2	10.35±1.72d	12.51±1.38c	16.37±1.40c
	4	15.52±1.90cd	19.65±1.55b	21.82±1.49c
	6	20.69±2.12bc	23.22±1.71b	29.09±1.59b
	8	24.14±2.32ab	30.36±1.80a	32.73±1.78b
	10	31.04±2.44a	33.93±1.95a	40.00±1.99a

Table 2 shows that the mortality effect of *Cymbopogon* against *T. castaneum* and *R. dominica* after 24, 48 and 72 hours. In which mortality of *Tribolium castaneum* was maximum after 72hrs at 10% dose. Maximum mortality recorded was 29.09% after 72hrs, while mortality effects of *Cymbopogon* against *R. dominica* was recorded were maximum mortality was 34.55% at 10% dose after 72hrs of exposure time period.

Table 2 Mortality effect of *Cymbopogon* against *T. castaneum* and *R. dominica* after different exposure time periods.

Insect	Dose (%)	Time periods		
		24hrs Mortality	48hrs	72hrs
<i>T. Castaneum</i>	2	3.45±1.54c	1.79±1.38d	5.46±1.14d
	4	8.62±1.81bc	8.94±1.49c	12.73±1.26c
	6	12.07±1.99b	14.29±1.65bc	16.37±1.33c
	8	15.52±2.10ab	17.86±1.80ab	23.64±1.51b
	10	20.69±2.18a	23.22±1.95a	29.09±1.62a
<i>R. dominica</i>	2	6.90±1.33c	7.14±1.59d	10.91±1.14d
	4	10.35±1.49c	12.51±1.66cd	18.19±2.49c
	6	17.24±1.55b	19.65±1.81bc	21.82±2.89c
	8	20.69±1.76ab	23.22±1.99ab	29.09±2.99b
	10	25.87±1.88a	28.58±2.26a	37.85±1.62a

Table 3 shows that the mortality effect of Spinosad against *T. castaneum* and *R. dominica* after 24, 48 and 72 hours. In which mortality of *Tribolium castaneum* was maximum after 72hrs at 0.05% dose. Maximum mortality recorded was 87.27% after 72hrs, while mortality effects of Spinosad against *R. dominica* was recorded were maximum mortality was 89.77% at 0.05% dose after 72hrs of exposure time period.

Table 3 Mortality effect of Spinosad against *T. castaneum* and *R. dominica* after different exposure time periods.

	(%)	Mortality		
<i>T. Castaneum</i>	0.01	29.83±1.57c	53.58±1.79b	65.46±1.82d
	0.02	35.09±1.72c	55.36±1.90b	70.91±1.99dc
	0.03	43.86±1.99b	60.72±1.98b	74.55±2.32bc
	0.04	50.88±2.00ab	71.43±2.12a	80.00±2.41ab
	0.05	52.63±2.22a	76.79±2.53a	87.27±2.57a
<i>R. dominica</i>	0.01	29.83±1.57d	53.58±1.96c	65.46±2.15c
	0.02	36.84±1.70cd	55.36±2.12c	70.91±2.49c
	0.03	43.86±2.00bc	62.50±2.43bc	74.55±2.89bc
	0.04	50.88±2.11ab	71.42±2.51ab	83.64±2.99ab
	0.05	54.39 ±2.22a	78.57±2.77a	89.77±3.04a

4. Discussion

The present research was conducted to assess the resistance in *Rhyzopertha dominica* (F) and *Tribolium castaneum* against insecticide Spinosad and plant extract tobacco and lemon grass. Populations of these insects were collected from various parts of district Jhang. These insects were exposed to five concentrations (0.01, 0.02, 0.03, 0.04 and 0.05%) of Spinosad and five concentrations (2%, 4%, 6%, 8% and 10%) of plant extract tobacco and lemon grass. Five concentrations 0.01%, 0.02%, 0.03%, 0.04%, 0.05% along with one control treatment of Spinosad was prepared. 100ml of distilled water used from stock solution. With the help of syringe each medication was pragmatic at the rate of 0.3ml/ filter paper. This was applied regularly on filter paper and allowed to dry overnight. In each dish, 20 insects of lesser grain borer and red flour beetle, and for 20 insects, wheat flour was supplied at a rate of 3 g / dish. Each concentration was repeated three times by using a completely randomized design. Their mortality data were collected after 24, 48 and 72 hours. Data regarding mortality was recorded after 24, 48 and 72 hours. Abbott formula was used to calculate mean mortality value was calculated by performing CRD. In this experiment first of all we checked the mortality rate in both insects. The chief objective of this study was to determine resistance level in *T. castaneum* and *R. dominica*. The results are similar to the [10] which revealed that the effectiveness of Spinosad depend on dose level and time exposure. With the increase in concentration and duration of time the mortality rate also increased. Herbst is extremely frequent and mainly critical insect of preserved goods in all over the world and it is mostly present in warehouses, mills, stored grains and granaries. Together larvae as well as adults not simply nourish on new cereals however, they can as well nourish on grains previously attacked by another insect [2]. *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae), red flour beetle, is one of the major preserved cereals pests reported to cause damage to broad choice of items such as spices, nuts, dried fruits, cacao, flour, peas, beans and grains, but crushed cereal foodstuffs like coat are their favorite food [3]. Table 1 shows that the effect of *Nicotiana tabacum* against *T. castaneum* and *R. dominica* after 24, 48 and 72 hours. In which mortality of *Tribolium castaneum* was maximum after 72hrs at 10% dose and maximum mortality recorded was 34.55% after 72hrs, while effects of *Nicotiana tabacum* against *R. dominica* was recorded were maximum mortality was 40% at 10% dose. Table. 2 shows that the mortality effect of *Cymbopogon* against *T. castaneum* and *R. dominica* after 24, 48 and 72 hours. In which mortality of *Tribolium castaneum* was maximum after 72hrs at 10% dose. Maximum mortality recorded was 29.09% after 72hrs, while mortality effects of *Cymbopogon* against *R. dominica* was recorded were maximum mortality was 34.55% at 10% dose after 72hrs of exposure time period. Table. 3 shows that the mortality effect of Spinosad against *T. castaneum* and *R. dominica* after 24, 48 and 72 hours. In which mortality of *Tribolium castaneum* was maximum after 72hrs at 0.05% dose. Maximum mortality recorded was 87.27% after 72hrs, while mortality effects of Spinosad against *R. dominica* was recorded were maximum mortality was 89.77% at 0.05% dose after 72hrs of exposure time period.

5. Conclusion

This study reveals that Spinosad gives excellent mortality the plant extracts against both insects as the same time plant extracts also give considerable effects against red four beetle and laser grain borer. We concluded that Spinosad can be used against these both insects which is more helpful to control these insects than plant extracts.

Compliance with ethical standards

Acknowledgments

The authors declare that they have no conflict of interest.

Disclosure of conflict of interest

There is no conflict of interest among all the authors.

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