2013 International Nuclear Atlantic Conference - INAC 2013
Recife, PE, Brazil, November 24-29, 2013
ASSOCIAÇÃO BRASILEIRA DE ENERGIA NUCLEAR – ABEN
ISBN: 978-85-99141-05-2

RESISTANCE OF THE PACKING TO ATTACK OF INSECTS PEST IN IRRADIATED RATION

Paula B. Arthur[1], Valter Arthur[1,2], Lúcia C. A. S. Silva,[1] Suely S. H. Franco[1,2], José G. Franco,[2] Anna L. H. C. Villavicencio[2]

[1]Centro de Energia Nuclear na Agricultura, CENA/USP, Laboratório de Radiobiologia e Ambiente, Av. Centenário, 303, Bairro São Dimas, CEP: 13400-970 – Piracicaba – SP – Brasil. paula.arthur@hotmail.com

[2]Instituto de Pesquisas Energéticas e Nucleares, IPEN/CNEN – SP - Av. Professor Lineu Prestes 224205508-000 São Paulo, SP, Brasil
gilmita@uol.com.br, villavic@ipen.br

ABSTRACT

The pests as beetles, acarids, moths and mushrooms among other, usually infest products stored as: grains, crumbs, flours, coffee, tobacco, dried fruits, animal rations, spices, dehydrated plants, causing the visual depreciation and promoting the deterioration of the products. The objective of the research was use the gamma radiation of Cobalt-60 in the disinfestation of some types of rations used for feeding of animals of small size. In the experiment packing measuring 10 cm x 20 cm with capacity of 70 grams of substrate (ration) with 4 types of existent marks in the trade: (1), (2), (3) and (4) of free samples were used. Each treatment had 10 repetitions, that were irradiated with doses of: 0 (control) 0,5; 1,0 and 2,0 kGy, to do the disinfestation of the ration samples. After the irradiation all the packing and the control were conditioned in plastic boxes of 80 cm x 50 cm with cover, where the insects: *Lasioderma serricorne*, *Plodia interpuctella*, *Sitophilus zeamais* and *S. oryzae* were liberated, in a total of 400 for each box. The boxes were maintained at room acclimatized with 27 ± 2ºC and relative humidity of 70 ± 5%. The counting of the number of insects and holes in the packing were made after 60 days. The results showed that only the package of the ration type number 4, was susceptive to the attack of the species of insects.

Keywords: Animal ration, irradiation, package, disinfestation, insects

1. INTRODUCTION

The curses as beetles, acarids, moths and mushrooms among other, usually infest products stored as: grains, crumbs, flours, coffee, tobacco, dried fruits, animal rations, spices, dehydrated plants, causing the visual depreciation and promoting and deterioration of the products.

The insects that more they damage those products are the: woodworms, beetles and weevils, belonging order Coleopteran. Those pests can cause damages to the such products as: weight loss, commercial depreciation, nutritional value loss and contamination for the penetration of other organisms as mushrooms for the holes left by them.

Seeking to solve the damages and losses caused by the pests some measured of control they should be adopted such as: good storage practice, rising of the pests and chemical treatment, this last is one more used in the moment, and causing some damages to the environment, besides the acquired resistance for the insects to the chemical products, and due to that, alternative methods should be used for a more efficient control and of low cost. Therefore the irradiation of foods comes if turning the best solution in the control of pests of grains and stored products [1]..

The first work using radiations ionizing in insects was accomplished by [2] in 1912 when irradiated *Sitophilus oryzae* with rays X, but he didn't obtain satisfactory results due to certain resistance of the insect.

The first result proving the efficiency of the radiations ionizing was obtained by [3] in 1916 that used rays X to control *Lasioderma serricorne*, pest of the stored tobacco. Starting from 1950 there was a great progress in that research type. Due to discovery of the resistance of certain pests to the chemical products, the biological unbalance and the toxicological problems caused by these products, that vein to contribute for progress of the researches in the irradiation area.

The irradiation of the grains and products stored without shadow of doubts can solve those types of problems, once the radiation ionizing doesn't induce the resistance emergence in the insects [4] and they don't leave poisonous residues to the products [1,5,6,7,8, 9].

Researched the resistance of some structures polymeric irradiated with doses above 10 kGy, and that are used for packing of foods and the conclusion that those packing presented low resistance to the attack of *Lassiorderma serricorne, Plodia interpunctella* and *Sitophilus zeamais* [10].

Studied the damages caused by *Ryzopertha dominica* in three varieties of rice *Oryza sativa* irradiated with a dose of 1 kGy, they concluded that the gamma radiation didn't alter the characteristics of the grains used for the feeding of that species[11].

They studied the influence of 3 packing types in the protection of grains of rice disinfestations for gamma radiation with a dose of 1 kGy, they concluded that the packing with great easiness of gaseous change was the more susceptive the penetration of insects of the species *S. oryzae*, and that the dose of 1 kGy was sufficient to cause the disinfestation of the grains of rice infested with that insect pest[12].

Determined that a lethal dose of 2,75 kGy, was sufficient for the treatment phytosanitary irradiation of *S. zeamais* in several types substrate[13].

Irradiated dehydrated plants infested with *L. serricorne* and determined that a dose of 1.75 kGy, was sufficient to induce the lethality in larvae[14].

In the conservation of grains and stored products, many types of radiations continue being studied as: the radiations range, electrons accelerated, infrared, rays X, microwaves, etc. due to the need of a better conservation with modern and advanced technology of high efficiency, low cost and absence of side effects, the radiation ionizing comes if turning the viable solution. That process consists of disinfestation the grains and products with a certain radiation dose, inhibiting the reproduction, or even causing the death of the insects pests.

The present research has as objective the use of the gamma radiation of the Cobalt-60 in the disinfestations and test the resistance of some types of package to attack of insects in rations used for feeding of animals small**.**

2. MATERIAL AND METHODS

The work was developed in the Laboratory of Radiobiology and Environment of the Center of Nuclear energy in the Agriculture - CENA/USP, the irradiations of the samples were accomplished in a source of Cobalt-60, type Gammacell-220, under a dose rate of 0,456 kGy/hour.

In this work were used insects of the species: *Lasioderma serricorne, Plodia interpunctella, Sitophilus zeamais* and *Sitophilus oryzae* of the Laboratory of Radiobiology and Environment, where they are created for vary generations in the following substrata: *L. serricorne* in wheat flour more beer yeast, *P. interpuntella* in maize flour, wheat flour, crumb of rice and wheat germ, *S. zeamais* in corn and *S. oryzae* in rice. These insects are maintained at room acclimatized with temperature of 27 ± 2ºC and relative humidity of 70 ± 5%.

In the research with packing of free samples were used measuring in it measured 10 cm x 20 cm with capacity of approximately 70 grams of substrata (ration) with 4 types of existent marks in I trade him: (1), (2), (3), (4). Each treatment consisted of 10 repetitions, that were irradiated with the doses of: 0 (control) 0,5; 1,0 and 2,0 kGy, to do the disinfestation of the samples.

After the irradiation (disinfestation) all of the irradiated packing and the control were conditioned in plastic boxes of 80 cm x 50 cm with cover, where the insects were liberated in a total of 400 of each insect species for each box, in a proportion of 10 insects for each packing (repetition) and they were maintained at room acclimatized with 27 ± 2ºC and relative humidity of 70 ± 5%.

The methodology of [15,16] was made to evaluate the penetration of the insects inside the packing, for the four species of insects, *L. serricorne, P. interpuctella, S. zeamais* and *S. oryzae*. The evaluations of the packing were made 60 days after the liberation of the insects in the boxes. It was observed the number of holes in the packing and number of insects inside each repetition (packing) inside of the treatments

The experimental statistical was entirely casual with 4x1 (4 treatments and 1 period of evaluate) and 10 repetitions per treatment. The results obtained in the evaluations was submitted the analyzes of variance by Test F, and the comparison of the measured by Test of Tukey to level of 5%.

3. RESULTS AND DISCUSSION

In Tables 1, 2, 3 and 4, we have the results of the rations of the types 1, 2, 3 and 4, irradiated with doses of gamma radiation of the Cobalt-60 and submitted to the forced infestation with the four types of insects, and evaluated after 60 days of the infestation. For the results of those Tables we can observe that except for the ration number 4, all the other marks were resistant for the attack of: *Sitophilus zeamais, Sitophilus oryzae, Lasioderma serricorne* and *Plodia interpuctella*, being those results similar to the of [10,11,17,18,19,20].

Table 1. Number medium of holes and emergency of adults of *Sitophilus zeamais*, coming of the samples of rations irradiated with doses of gamma radiation of the Cobalt-60 and submitted the forced infestation.

Doses/kGy	Ration 1		Ration 2		Ration 3		Ration 4	
	Insects	Holes	Insects	Holes	Insects	Holes	Insects	Holes
0 (control)	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	25,0a	10,0a
0,5	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	29,0b	13,0b
1,0	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	36,0c	15,0c
2,0	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	19,0a	9,0a

Means followed by the same letter do not differ by Tukey test at 5%

Table 2. Number medium of holes and emergency of adults of *Sitophilus oryzae*, coming of the samples of rations irradiated with doses of gamma radiation of the Cobalt-60 and submitted the forced infestation.

Doses/kGy	Ration 1		Ration 2		Ration 3		Ration 4	
	Insects	Holes	Insects	Holes	Insects	Holes	Insects	Holes
0 (control)	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	27,0a	12,0a
0,5	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	30,0b	15,0b
1,0	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	21,0c	10,0a
2,0	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	15,0d	17,0d

Means followed by the same letter do not differ by Tukey test at 5%

Table 3. Number medium of holes and emergency of adults of *Lasioderma serricorne*, coming of the samples of rations irradiated with doses of gamma radiation of the Cobalt-60 and submitted the forced infestation.

Doses/kGy	Ration 1		Ration 2		Ration 3		Ration 4	
	Insects	Holes	Insects	Holes	Insects	Holes	Insects	Holes
0 (control)	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	31,0a	17,0a
0,5	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	10,0b	9,0b
1,0	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	24,0c	14,0c
2,0	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	17,0d	11,0b

Means followed by the same letter do not differ by Tukey test at 5%

Table 4. Number medium of holes and emergency of adults of *Plodia interpunctella*, coming of the samples of rations irradiated with doses of gamma radiation of the Cobalt-60 and submitted the forced infestation.

Doses/kGy	Ration 1		Ration 2		Ration 3		Ration 4	
	Insects	Holes	Insects	Holes	Insects	Holes	Insects	Holes
0 (control)	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	24,0a	23,0a
0,5	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	20,0b	19,0b
1,0	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	17,0c	8,0c
2,0	0,0a	0,0a	0,0a	0,0a	0,0a	0,0a	15,0d	11,0d

Means followed by the same letter do not differ by Tukey test at 5%

4. CONCLUSION

For the results obtained we can conclude that the ration type number 4, was the susceptive to the attack of all of the species of insects studied.

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