2011 International Nuclear Atlantic Conference - INAC 2011
Belo Horizonte,MG, Brazil, October 24-28, 2011
ASSOCIAÇÃO BRASILEIRA DE ENERGIA NUCLEAR - ABEN
ISBN: **978-85-99141-04-5**

EFFECTS OF GAMMA RADIATION ON DIFFERENT STAGES OF *Brevipalpus phoenicis* (GEIJSKES, 1939) (ACARI:TENUIPALPIDAE) AS A PEST CONTROL ALTERNATIVE

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ABSTRACT

Mites are present almost everywhere, being harmful to people and also an agricultural pest of various crops, causing serious economic losses, like the mites of the families *Tenuipalpidae*, to which the citrus leprosis mite *Brevipalpus phoenicis* (Geijskes) belongs, being the main vector of the citrus leprosis virus in crops. The objective of this study was irradiated the all stages of mites *B. phoenicis* with gamma radiation. The mites were irradiated in a source of Cobalt-60, Gammacell-220 type, at a dose rate of 0.486 kGy, with doses of 0 (control), 100, 200, 300, and 400 Gy with sixteen replicates per dose for this mite specie. After the irradiation experiment was conduced in Climatic chamber with temperatures of 25 ± 3 ºC and 70± 5% RH. For the study, were used Petri dishes containing leaves of jack-bean (*Canavalia ensiformis*) surrounded by hydrophobic cotton to prevent mites from escaping. Posteriorly with a paint-brush, the mites were transferred in its phases or stages respective of (eggs, nymphs and adults) in the different petri dishes 24-hours before being irradiated.Counting of eggs, nymphs, and adult mortality during experiment were done and evaluated daily. The results showed that the lethal doses to eggs, nymphs and adults were: 100 and 200 Gy.

Key words: *Brevipalpus phoenicis*, citrus leprosis mite, Gamma radiation

1. INTRODUCTION

Mites are present almost everywhere, being harmful to people and also an agricultural pest of various crops, causing serious economic losses, like the mites of the families Tenuipalpidae, to which the citrus leprosis mite *Brevipalpus phoenicis* (Geijskes) belongs, being the main vector of the citrus leprosis disease caused by a rhabdovirus of localized action in crops [1].

The citrus leprosis mite is a polyphagous species found in hedges and weeds and on and around citrus groves [2,3]. In Brazil, the management of *B. phoenicis* is based entirely on the use of acaricides since it seems to be the most efficient strategy for its control [4,5]. Many studies agree on the use of radiation as a quarantine treatment. The objective of the treatment should not be the mortality, but the emergence prevention of adults and immature forms found in the fruits, or the sterilization of adults. The ionizing radiation is also used in the disinfestations of fruits and vegetables and may be the best substitute for fumigants.

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In the review of applications of irradiation phytosanitary treatment for quarantine pests states that a dose of 400 Gy is sufficient to control most species of mites [6].

Other countries in the region of South Asia are encouraged to contribute to the international effort to develop pesticide treatements for other major groups of insects, such as several families of lepdoptera, weevils, insects and mites [7].

The objective of this study was irradiated the all stages of mites *B. phoenicis* with gamma radiation.

2. MATERIAL AND METHODS

The present research was carried out at the Radiobiology and Environment Laboratory of the Center for Nuclear Energy in Agriculture, University of São Paulo (CENA/USP). The colony was started with *Brevipalpus phoenicis* specimens kept for about two years after inoculation in jack-bean (*Canavalia ensiformis* (*L.*) in Piracicaba-SP. This colony was established on the same host plant and kept in a cages (100 x 100 x 120 cm) in the laboratory.

For the study, were used Petri dishes containing leaves of jack-bean (*Canavalia ensiformis*) surrounded by hydrophobic cotton to prevent mites from escaping. Posteriorly with a paint-brush, the mites were transferred in its phases respective of (eggs, nymphs and adults) in the different petri dishes 24-hours before being irradiated.

For the evaluated of the mites phases, were made counting of eggs, nymphs and adults mortality during the experiment (15-day period) after irradiation.

The mites were irradiated in a source of Cobalt-60, Gammacell-220 type, at a dose rate of 0.486 kGy, with doses of 0 (control), 100, 200, 300, and 400 Gy with sixteen replicates per dose for this mite species (eggs, nymphs and adults) of the mites. After the irradiation the experiment was conduced in a climatic chamber with temperatures of 25 ± 3 ºC and 70± 5% humidity relative (RH).

3. RESULTS AND DISCUSSION

After of irradiation the mites were observed during a 15-day period and were evaluated until the complete cycle of all stages (Table 1-3).

Table 1. Counting of mortality of eggs

Treatments	Mites
Doses	Eggs
0(Control)	2,9±1,0[a]
100 Gy	0,0± 0,0[b]
200 Gy	0,0±0,0[b]
300 Gy	0,0±0,0[b]
400 Gy	0,0±0,0[b]

*Numbers with different letters in columns differ in level of 5% (Tukey)

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The viability of the eggs in treatment control was of 19%. When eggs were irradiated in dose occurred the desiccation, induced by gamma radiation, with the lethality of the eggs in all doses. Studies with radiation effects on *Acarus siro* L. showed that doses above 200 Gy [8] [9].

Table 2. Counting of mortality of nymphs

Treatments	Mites
Doses	Nymphs
0(Control)	4,7±1,0[a]
100 Gy	1,5± 0,5[b]
200 Gy	0,0±0,0[b]
300 Gy	0,0±0,0[b]
400 Gy	0,0±0,0[b]

*Numbers with different letters in columns differ in level of 5% (Tukey)

The effect of gamma radiation in phase the nymph with the dose of 100 Gy was of 90% in the mortality. Above dose of 200 Gy were lethal for this phase of the mites.

Table 3. Counting of mortality of adults

Treatments	Mites
Doses	Adults
0(Control)	6,7±1,0[a]
100 Gy	5,2± 0,5[a]
200 Gy	0,0±0,0[b]
300 Gy	0,0±0,0[b]
400 Gy	0,0±0,0[b]

*Numbers with different letters in columns differ in level of 5% (Tukey)

The mortality of adults in treatment control was of 44%, when compared with dose of 100 Gy the mortality was of 34% of the adults. The lethal dose was of 200 Gy to adults. Studies using X-rays in *Brevipalpus obovatus* and *Brevipalpus chilensis* showed that similar results occurred when there is the increasing of the radiation [8] [9].

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In A. siro the mortality rates ranged from 15% to 78% in adult females in 12 days after exposure to 40 krad (400 Gy) of Cobalt-60 gamma radiation. Such variability in mortality rate in this case was expected because the sensitivity of the arthropods to radiation can vary greatly between within a taxonomic order, or within a species, or because occur variations in a taxonomic order, species [8].

4. CONCLUSION

The lethal doses to eggs, nymphs and adults were: 100 and 200 Gy.

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