



Effects of Gamma Radiation on Pupae of *Plutella xylostella* to phytosanitary treatment

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1. Introduction

Tropical and subtropical countries such as Brazil are the ones that suffer most under the attack of insects, due to the ecological conditions of high temperature and relative humidity. The most important insect pests of stored products belong to the order Lepidoptera, which are butterflies.

The diamondback moth, *Plutella xylostella* is one of the most serious pests of cultivated Brassicaceae. It is cited as being the first crop insect to become resistant to dichloro-diphenyl-trichloroethane (DDT), and it has been found to have developed resistance to many other field insecticides, it is also reported to be the first insect to develop resistance to the bacterial insecticide *Bacillus thuringiensis*. The objective of this part of our research investigation is to determine of lethal and sterilizing doses of gamma radiation for pupae of *Plutella xylostella* and establish an appropriate phytosanitary irradiation treatment against this pest.

2. Methodology

Pupae up to 48 hours old were used, placed in plastic pots (8.5 x 7.5 x 6.5 cm) and irradiated with increasing doses of gamma radiation, at a dose of 0,845 kGy/h. In this trial, the doses of gamma radiation used were 50, 100, 150, 200, 300, 400 and 500 Gy and the control (without irradiation). Each dose consisted of 5 repetitions and the number of pupae per repetition was 10. After irradiation, the pupae were kept in plastic pots containing moistened filter paper and kept in an air-conditioned room. The adults obtained were placed in acrylic containers for mating for 24 hours and then taken to breeding cages, as previously described. The determination of the lethal dose was made by subsequently counting viable and non-viable eggs and emerged adults and the sterilizing dose, by the number of caterpillars hatched from the F1 generation, coming from crosses of adults emerging from irradiated pupae with normal adults. Data analysis The experimental design was entirely randomized. The data were subjected to analysis of variance and the means were compared using the Tukey test ($P \leq 0.05$).

3. Results and Discussion

The emergence of adults from irradiated pupae occurred within three days for all treatments, while in the control, adults emerged within seven days, on average. There was, therefore, an induction by radiation, reducing the pupae period of *Plutella xylostella*, and the effect of gamma radiation was proportional to the increase in dose. Irradiated pupae gave rise to a smaller number of adults compared to non-irradiated ones. Emerged adults and survivors from irradiated pupae were mated with the normal opposite sex. It was found that there was a significant effect of radiation, observed through the percentages of viable eggs, with no viability at doses of 300 and 500 Gy (MixFn: $F = 6.95$; $CV = 82.95$ and FixMn: $F = 4, 25$; $CV = 100.00$). These results agree with [1,2,3], when he studied the effect of sterilizing doses of Cobalt-60 gamma radiation on pupae of *S. frugiperda* in its F1 and F2 generations. The author observed that the reproductive capacity of females irradiated and mated with normal males,

with doses of 100 to 150 Gy, was reduced due to the low viability of the eggs. Irradiated pupae of different ages of *C. illepidata* and *C. ursodelta* with doses of 62.5, 125, 250 and 400 Gy of gamma radiation and observed that the more advanced this stage, the lower the radiosensitivity. Adults from 1 to 5 day old pupae treated with doses of 125 and 250 Gy did not leave offspring. On the other hand, adults of *C. illepidata*, coming from 7 to 8 day old pupae, treated with the same doses, had a survival rate of 67.7 and 52.4%, respectively and the females laid fertile eggs with the dose of 125 Gy; for the 250 Gy dose, only one female laid six eggs, all of which were unviable [4]. These data are also in agreement with [1,2,3,4,5,6] who found that 5-day-old pupae, treated with doses of up to 200 Gy, showed no significant difference in terms of longevity, compared to the control, and the irradiated females did not lay eggs.

4. Conclusions

According to the results obtained, for the phase of pupae of *Plutella xylostella*, irradiated with increasing doses of Cobalt-60 gamma radiation, under the conditions of the present experiment, it is concluded that: The lethal dose of gamma radiation for *Plutella xylostella* was 300 Gy for pupae and sterilizing dose was 150 Gy to obtain sterile adults from irradiated pupae.

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