Determination of lethal doses of gamma radiation for pupae of *Plutella xylostella* (Linnaeus, 1758) (Lepidoptera: Plutellidae) diamondback moth for phytosanitary treatment

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1. Background and Goal of the present work

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. Our work is closely linked to the safety of food during its marketing and storage time. It is cited as being the first crop insect to become resistant to dichloro-diphenyl-trichloroethane, it is also reported to be the first insect to develop resistance to the bacterial insecticide *Bacillus thuringiensis*.

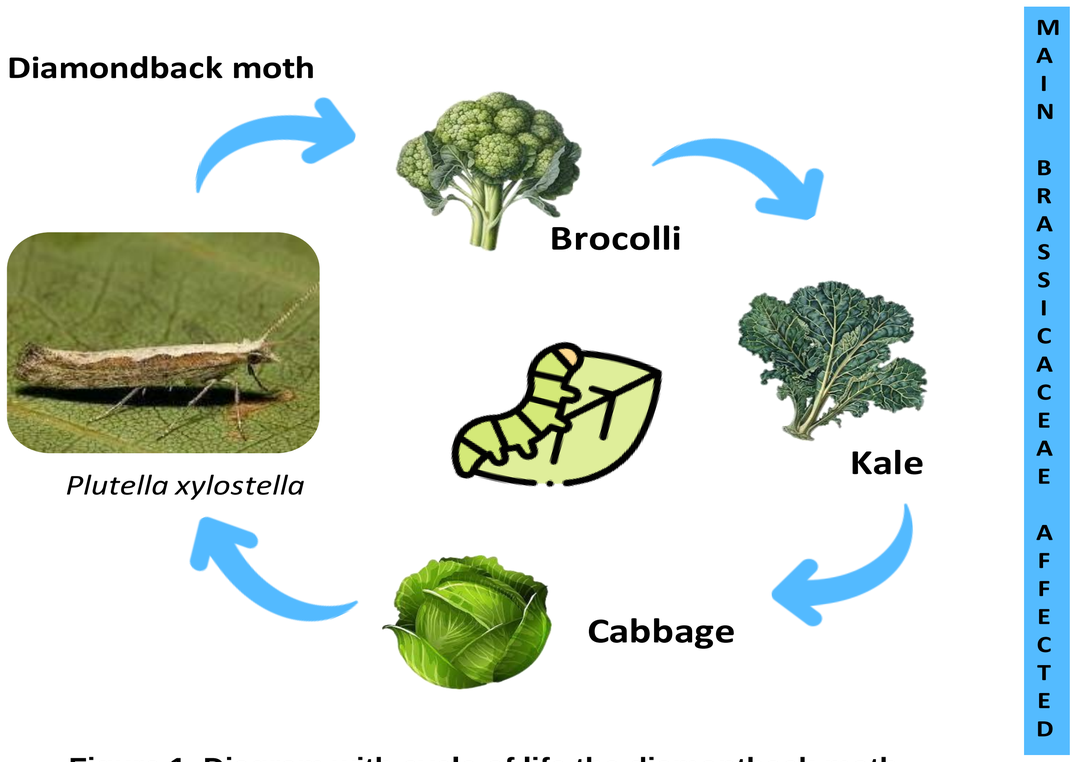

Figure 1. Diagram with cycle of life the diamontback moth.

The main objective was determining the lethal doses of gamma radiation for pupae of *Plutella xylostella* and establish an appropriate Phytosanitary irradiation treatment against this pest.

2. Materials and methods

2.1 Bioessay with pupae

Were irradiated in a Cobalt-60 source, type Gammacell 220, with dose rate of 0,876 kGy/hour. After irradiation they were in a climatized chamber with temperature around 28±2 ℃, relative humidity 70±5% and a photoperiod of 12 hours.

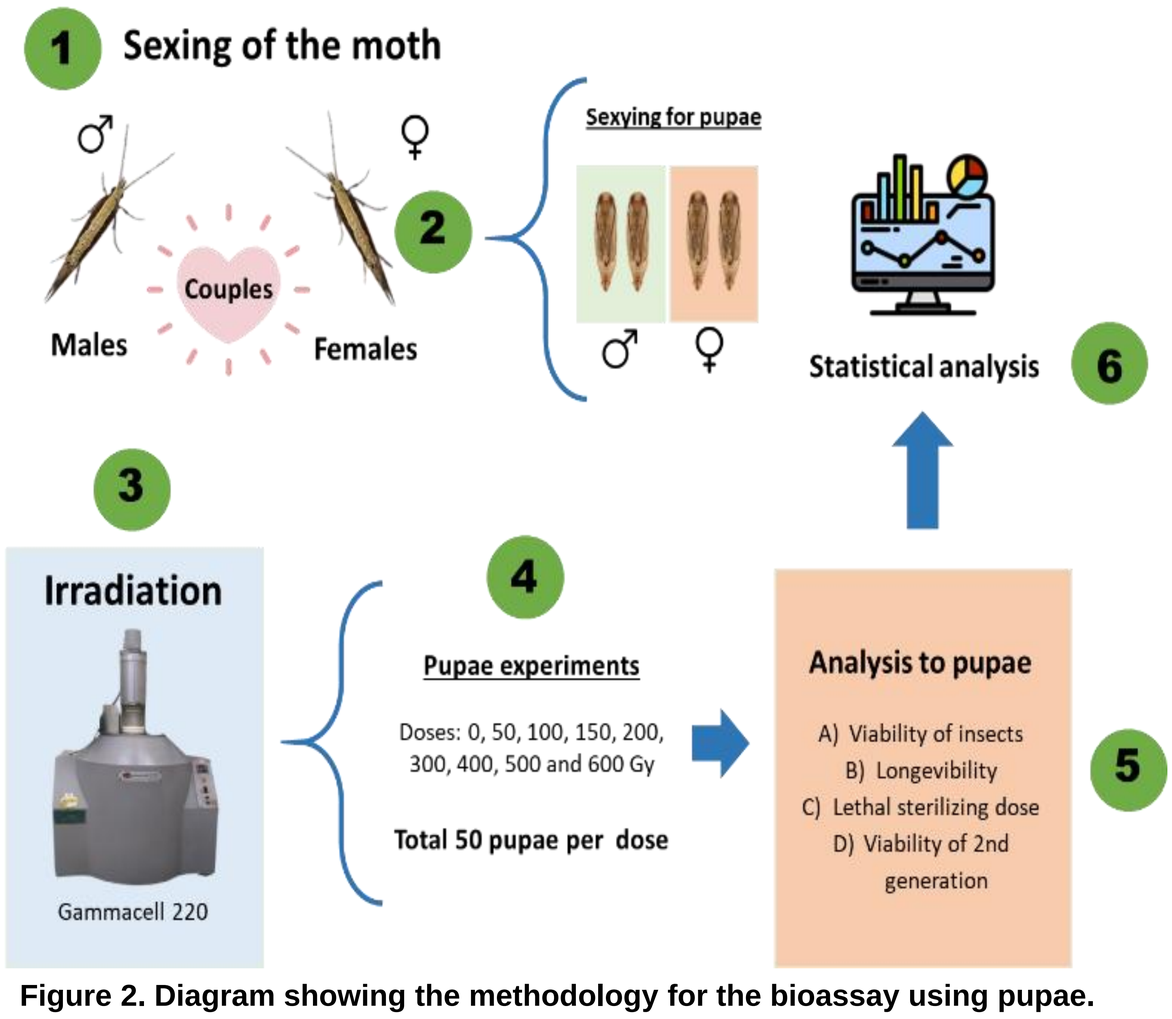

Figure 2. Diagram showing the methodology for the bioassay using pupae.

3. Results

The sterilizing dose for females was 200 Gy and for males 300 Gy. The lethal dose was 600 Gy. The emergence of adults was less than 50% at doses of 400 Gy and higher.

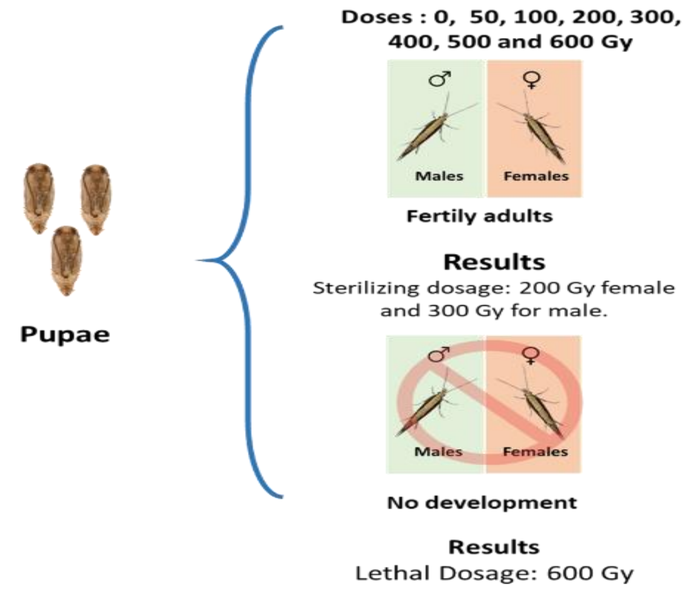

Figure 3. Diagram with the main results for irradiated pupae.

The table summarizes the data with the doses and pupae irradiated, as well as the viability of the adults that emerged. It can be seen that females are more radiosensitive than males.

Insects such as lepidopterans are the most tolerant to radiation, which demonstrates the use of higher doses.

Table 1 . Viability of the pupae irradiated and emergence of the eggs for males and female.

Doses/Gy	Total number of pupae irradiated	Total number of adults emerged	Total eggs Couples with irradiated male	Total eggs Couples with irradiated female
0	50	46	320	320
50	50	38	302	300
100	50	35	230	211
200	50	30	120	103
300	50	27	95	89
400	50	15	47	42
500	50	9	30	27
600	50	0	0	0

In the second generation, it was possible to verify that for irradiated females, the viability of the eggs evaluated was not observed. However, males irradiated with 200 Gy were sterile.

4. Conclusion

We can conclude that the lethal dose for pupae was between 200 and 300 Gy, depending on the sex of the insect. The doses obtained are safe for importing and exporting foodstuffs in compliance with phytosanitary regulations. The sterile insect technique proved to be effective, but it is necessary to analyze the proportion of irradiated insects for release in field conditions and check the cost-benefit ratio of the application.

5. Acknowledgements

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