

The Effect of Gamma Radiation on the  
Rice Moth, Corcyra cephalonica (Staint.)

Part II

Irradiation of the Eggs, Pupae, and Adults

Srisan Loaharanu, Manon Subantawong, and Ampai Ungsunantwiwat  
Biological Science Division  
Office of the Atomic Energy for Peace

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Abstract

The 1-3 days old eggs of the rice moth were exposed to gamma rays at 0, 3, 6, 12.5 and 25 Krads. The LD<sub>50</sub> and LD<sub>99</sub> for eggs was estimated as 9 and 42 Krads respectively. A dose of 25 Krads caused 100 % mortality in larvae irradiated as egg stage. Mixed ages of 1-7 days old pupae were subjected to 0, 6, 12.5, 25, 50 and 100 Krads of gamma rays. Based on number of adults emerged, the LD<sub>50</sub> and LD<sub>99</sub> for pupae were estimated as 19 and 110 Krads. Mixed sexes of 1-3 days old adult moths were also exposed to gamma rays. The LD<sub>50</sub> and LD<sub>99</sub> for adults appeared to be 60 and 170 Krads respectively. Irradiation of both sexes of adult moths at 25 and 50 Krads, led to complete infertility in eggs deposited.

## Introduction

The rice moth, Corcyra cephalonica (Staint.) was reported as one of the most destructive insect pests of rice in storage (Anon. 1962; Cotton, 1963). Rattan, et al (1960) reported the effect of Beta rays on the immature stages of this moth. Irradiation of 1-day-old pupae of the rice moth, using gamma rays, was previously reported (Atwal and Sethi, 1964). According to gamma irradiation of stored grain moths other than Corcyra cephalonica, it was found that very high doses (40 to 100 Krads or higher) were required to prevent the immature stages from developing into the next developmental stages (Golumbic and Davis, 1966).

The lethal effect of gamma radiation on the full-grown caterpillars of the rice moth was previously reported (Loaharanu, 1970). Present presentation concerns lethal and sterilizing effects of gamma rays on eggs pupae and adults of the rice moth.

## Objectives

1. To investigate the lethal effect of gamma rays on eggs and on the hatched larvae.
2. To investigate dosages for preventing the pupae from emerging into adults.
3. To investigate lethal and sterilizing effects of gamma rays on the adult moths.

## Materials and Methods

1. The rice moth culture was originally obtained from rice in markets and reared on polished rice, Oryza sativa indica at  $29 \pm 1^\circ\text{C}$  with  $64 \pm 2\%$  relative humidity. The gamma radiation used was supplied by a portable Co-60 source. The doses experimented were calculated from an average dosage per minute.

2. A. For eggs irradiation, 1-3-day-old eggs adhered to the surface of rice were counted through microscope. Fifty eggs were put in each of the No.2 plastic vials to make one replicate for each dose in each experiment. The eggs were subjected to 0, 3, 6, 12.5 and 25 Krads of gamma rays. There were 3 repeated experiments with a total of 9 replicates in each dose. The irradiated eggs were observed in 10 days and the percentages of unhatched eggs were calculated. The mortality of hatched larvae was studied in 14 days.

B. For pupae irradiation, tiny scissors were used to cut through the silken web enclosing each individual insect, to observe the formation of pupae. In each replicate of each dose, 30 pupae (1-7 days old) were subjected to 0, 6, 12.5, 25, 50 and 100 Krads of

gamma rays. Six repeated experiments were conducted with a total of 18 replicates in each dose. The number of adults emerged was studied in 14 days and the percentages of mortality of irradiated pupae were corrected.

C. Mixed sexes of 1-3-day-old adult moths were subjected to 0, 25, 50 and 100 Krads of gamma rays. In each dose there were 9 replicates, and in each replicate, 30 adults were exposed. The mortality of the moths was observed in 3 days.

In sterilization study, both sexes of virgin male and female adult moths (1-3-day-old) were irradiated at 0, 25 and 50 Krads. In each replicate, 6 pairs of irradiated moths were mated in a vial containing polished rice. Four repeated experiments were conducted with a total of 12 replicates in each dose. The moths were kept in vials for 2 weeks. Rice in vials were then examined to find out whether or not there were larvae hatched from eggs deposited.

The Abbott's formula was used to calculate the corrected percentages of mortality of various stages of the moth (Abbott, 1925)

### Results and Discussion

1. Results of irradiation of 1-3-day-old eggs of the rice moth at 0, 3, 6, 12.5 and 25 Krads were shown in Table 1. and Fig 1. The LD and LD<sub>99</sub> for eggs was estimated as 9 and 42 Krads respectively. Eggs irradiated at 25 Krads could hatch, but all the hatched larvae died in 14 days. <sup>50</sup>

2. Table 2. and Fig 1. presented the results of irradiation of 1-7-day-old pupae at 0, 6, 12.5, 25, 50 and 100 Krads. The LD<sub>50</sub> and LD<sub>99</sub> in 14 days for pupae was estimated as 19 and 110 Krads respectively.

3. Results of irradiation of 1-3-day-old adults of the rice moth at 0, 25, 50 and 100 Krads were shown in Table 3. and Fig 1. From Table 3, a dose of 100 Krads could not cause complete mortality to the moths. According to the results in Fig 1, the LD<sub>50</sub> and LD<sub>99</sub> was found to be 60 and 170 Krads respectively.

Results of sterilization study in the rice moth appeared that doses from 25 to 50 Krads induced complete infertility in eggs deposited, when both sexes of the parent moths were irradiated.

Table 1. Lethal effect of gamma rays on eggs and hatched larvae of C. cephalonica (Staint.)

| Exposed dose (Krad) | Number of eggs hatched (average) | Corrected % eggs failed to hatch (average) | Corrected % mortality of hatched larvae in 14 days |
|---------------------|----------------------------------|--|--|
| 0                   | 32                               | 0  | 0  |
| 3                   | 28                               | 12.5                                       | 48.4   |
| 6                   | 17                               | 46.9                                       | 48.4   |
| 12.5                | 16                               | 50.0                                       | 96.8   |
| 25                  | 3                                | 90.6                                       | 100.0  |

Table 2. Lethal effect of gamma rays on 1-7-day-old pupae of C. Cephalonica (Staint.)

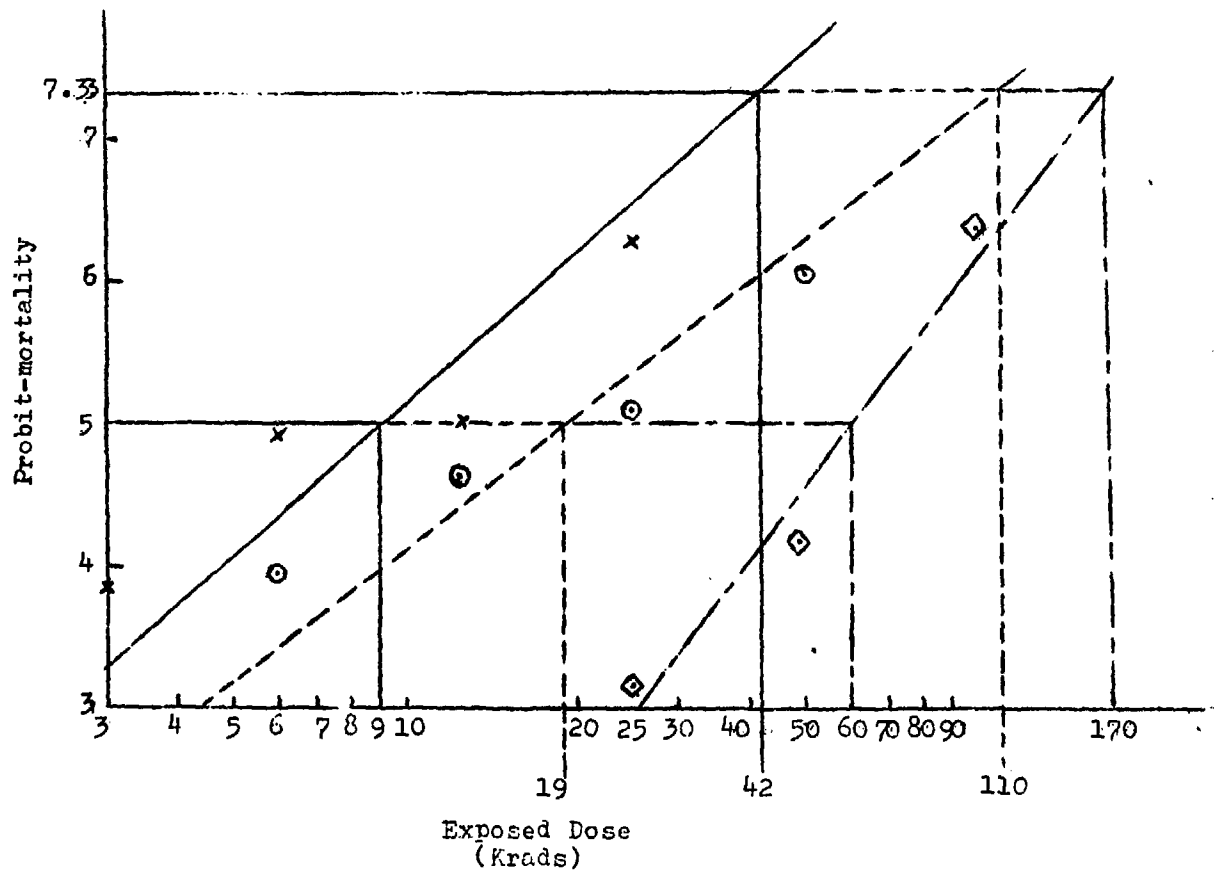
| Exposed dose (Krad) | 14 days after irradiation         |                                |
|---------------------|-----------------------------------|--------------------------------|
|                     | Number of adult emerged (average) | Corrected % mortality of pupae |
| 0                   | 26                                | 0                              |
| 3                   | 22                                | 15.4                           |
| 12.5                | 17                                | 34.6                           |
| 25                  | 12                                | 53.8                           |
| 50                  | 4                                 | 84.6                           |
| 100                 | 0                                 | 100.0                          |

Table 3. Lethal effect of gamma rays on 1-3-day-old adults of C. cephalonica (Staint.)

| Exposed dose (Krad) | 3 days after irradiation            |                       |
|---------------------|-------------------------------------|-----------------------|
|                     | Number of surviving moths (average) | Corrected % mortality |
| 0                   | 28                                  | 0                     |
| 25                  | 27                                  | 3.6                   |
| 50                  | 23                                  | 17.9                  |
| 100                 | 2                                   | 92.8                  |

Fig.1. Plotting probit-mortality VS. exposed dose

- x—x— LD<sub>50</sub> for eggs = 9 Krads; LD<sub>99</sub> = 42 Krads
- o—o— LD<sub>50</sub> for pupae = 19 Krads; LD<sub>99</sub> = 110 Krads
- ◇—◇— LD<sub>50</sub> for adults = 60 Krads; LD<sub>99</sub> = 170 Krads



4. Judging from irradiation of the rice moth at various developmental stages, it could be discussed that very high doses (100 Krads and higher) were required to provide complete lethality in pupae and adults. Similar high doses were also required for providing complete lethality in moths other than the rice moth (Golumbic and Davis, 1966). Culture of 1-7-day-old pupae studied, were not as radiosensitive as 1-day-old as previously reported (Atwal and Sethi, 1960). This could be due to the age difference. For rice moth sterilization, fairly low dose (25 Krads) could be used to induce complete infertility in eggs when both parent moths were irradiated.

#### Summary

1. The LD<sub>50</sub> and LD<sub>99</sub> for 3-day-old eggs of the rice moth was found to be 9 and 68 Krads respectively. A dose of 25 Krads caused complete lethality to the larvae irradiated as egg stage.

2. The LD<sub>50</sub> and LD<sub>99</sub> for pupae in 14 days was 19 and 110 Krads respectively.

3. For the adult moths, the LD<sub>50</sub> and LD<sub>99</sub> appeared to be 60 and 170 Krads respectively. A dose of 25 Krads induced complete infertility in eggs deposited, when both parent moths were irradiated.

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