

Studies on the Effects of Gamma Irradiation on the Larvae of the House Fly *Musca domestica* L. (Muscidae : Diptera)

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ABSTRACT

Studies were undertaken to find out the effect of gamma irradiation on the larvae of house fly, *Musca domestica* and the results indicate that exposure of larvae to doses from 2 to 10 kr caused prolongation in the larval developmental period ranging from 22.88 to 140.68 per cent. Irradiation of larvae did not have any marked influence on pupation and also the weight of pupae. The effect of irradiation was apparent in adult emergence, since it was reduced from 86.5 per cent at 0 kr to nil emergence at 3 kr.

INTRODUCTION

The house fly, *Musca domestica* Linn. was kept under check by the use of insecticides like DDT, dieldrin etc., in olden times. In view of the development of high resistance to insecticides by this insect since 1947, and the toxic hazards involved in the use of insecticides, attempts are being made to utilise alternative methods for the control of house flies and one such method is the utilisation of sterile male technique. Radiation induced sterilization has long been recognised as a possible means of producing sterility among insects.

While in the field of pest control irradiation studies have made much progress in other countries, relatively very little attention has been paid to this line of work in India. Nair (1960) reported about the effects of gamma irradiation on the pupae of *Musca domestica* (L)

Narayana *et al.* (1963) reported the effect of gamma rays on mortality, longevity and fecundity of some species of fruits flies. Sofi (1972) studied some aspects of the effect of gamma irradiation on the melon fly *Dacus cucurbitae* Coq. In view of the above, studies were undertaken to find out the effect of radiation on the house fly larvae and the results obtained are reported in this paper.

MATERIALS AND METHODS

The culture of the house fly, *Musca domestica* (L.) was built up from a nucleus stock of about 200 pupae (Strain IF (SRS) 59) obtained from the laboratories of M/S. Tata Fison Industries limited, Bangalore. The flies were reared and maintained on an artificial diet prescribed by the firm.

Third instar maggots of *M. domestica* were exposed to a source of Co-

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bolt⁶⁰ delivering gamma rays of doses from 1 to 10 kr. Forty maggots were subjected to each dosage level of irradiation and another forty maggots were maintained without any treatment as control. The maggots under each treatment were retained in small dishes containing the artificial medium and placed inside circular tin pots, half filled with sand and covered with a clean white cloth. The maggots under the different treatments were examined daily and the time taken for the larvae to pupate was recorded individually. The weight of freshly formed pupae as well as the number of pupae recovered from each

treatment freshly were also noted. Finally the number of adults emerging under each treatment was also recorded.

RESULTS AND DISCUSSION

Effect of Irradiation on larval period

The duration of larval stage as influenced by the different dose levels of irradiation are furnished in Table 1.

Gamma irradiation was found to have marked influence on the duration of larval stage, the duration getting prolonged with the increase in the dosage.

TABLE 1. Effect of irradiation of larvae of *Musca domestica* L. on larval period, pupation and pupal weight.

Dose (Kr)	Mean larval period (days)	Percentage of pupation (out of 40 larvae)	Mean weight of pupae (mg)
1	4.833 (22.88)	95.0 (+ 2.5)	19.0 (+ 13.77)
2	8.066 (105.08)	85.0 (— 7.5)	17.9 (+ 7.18)
3	8.866 (125.42)	90.0 (— 2.5)	16.3 (— 2.39)
4	8.933 (127.12)	82.5 (—10.0)	14.7 (—11.97)
5	9.066 (130.51)	82.5 (—10.0)	16.1 (— 3.59)
6	9.133 (132.21)	82.5 (—10.0)	14.6 (—12.57)
7	9.366 (138.13)	97.5 (+ 5.0)	16.8 (+ 0.59)
8	8.966 (127.96)	75.0 (—17.5)	16.0 (— 4.19)
9	9.266 (135.59)	75.0 (—17.5)	15.1 (— 9.56)
10	9.466 (140.68)	85.0 (— 7.5)	14.0 (—16.16)
Unirradiated control	3.933	92.5	16.7
C. D. (P=0.05)	0.693 **		0.0037 **

Figures in parenthesis represent percentage of decrease or increase over control

** Significant at 1% level

A highly significant positive correlation existed between dosage and larval period. The increase was much pronounced upto 2 kr but in the higher dosages the difference was negligible between the dosages. The increase in the duration was 28.88 per cent for one kr and it rose up to 140.68 per cent for 10kr. Similar result was obtained by Sofi (1972) on the maggots of fruit fly, *Dacus cucurbitae* when subjected to gamma irradiation. Extended period of larval stage due to X-irradiation in *Ephestia kuhniella* has been reported to be due to the absence of the moulting hormone ecdysone (Kuz *et al.*, 1968) and the same reason might also hold good for the present result.

Effect of irradiation on pupation

Data on the number of pupae obtained from out of lots of 40 larvae irradiated under each dose, as compared with the untreated control are presented in Table 1.

The per cent pupation was found to range between 75.0 to 97.5 among the irradiation doses as compared to 92.5 in the untreated set. As such, there was neither a recognisable trend of influence of increasing dose levels on pupation nor any marked difference from the untreated set, the per cent difference of pupation over control ranged between + 5.0 for 7 kr to - 17.5 for 8 and 9 kr.

Thus the effect on larval irradiation had least effect on the percentage of pupation. Though the percentage went as low as 75 in doses 8 and 9 kr it again went up to 85 in the next higher dose

of 10kr and this did not imply any significant and reliable difference from the percentage of pupation in control which was 92.5. Also, higher percentages than control were met with in doses of 1 kr (95.0 per cent) and 7 kr (97.5 per cent). As such, irradiation of larvae at dosages from 1 to 10 kr was best considered to have little influence on pupation. Studies on irradiation of the larvae of *Anopheles pharoensis* upto 4.5 kr have indicated no influence on pupation (Abdel Malek *et al.*, 1966). But adverse influence of gamma irradiation on larval survival of *Dacus dorsalis* had also been reported by Balock *et al.* (1963) and on *Dacus cucurbitae* by Sofi (1972). Thus effect of irradiation on pupation seemed to vary with species.

Effect of irradiation of larvae on the weight of pupae

The mean weight of untreated pupae was 16.7 mg while that of the treatments ranged between 19.0 for 1kr to 14.0 for 10 kr (Table 1). The difference among the treatments, though highly significant, did not subject themselves to any trend of influence by dose levels. The dose had either increased or decreased the pupal weight without any dose dependent response. The pupal weight is thus found to be indifferent to the dose levels, in spite of the significant results in the analysis of variance. However, it was interesting to note that there was a marginal gain in weight for 1 and 2 kr. while the highest dose of 10kr resulted in lesser weight of the pupae. This response was more or less unreliable when considering the indifferent response for the other

doses. Earlier report of decrease in pupal weight in the fruit fly *Dacus cucurbitae* due to irradiation (Sofi, 1972) is not fully confirmed by the present studies by virtue of the contrasting results.

Effect of irradiation of larvae on adult emergence

The data on the percentage of adults which emerged from various treatments is given in Table 2.

TABLE 2.
Effect of irradiation on adult emergence

Dose (kr)	% of emergence
0	86.5
1	71.1
2	5.9
3	0

The result indicated that the larvae irradiation had a marked influence on the emergence of adults. The percentage of emergence decreased from 86.5 per cent for control (0 kr) to 71.1 for 1 kr and to as low as 5.9 for 2 kr. At 3 kr none of the adults emerged. Thus a dose of 3 kr was found to be the lethal dose of irradiation for the house fly larvae. Even at 2 kr a reduction of 94 per cent in adult emergence was noticed. The same result was reported by Cole *et al.* (1959), that all the pupae of *Musca domestica* died when they received a dosage of 2 kr during their larval period of 5-6 days old. Similar results were reported by Balock *et al.* (1963), Mac Farlane (1966) in fruits flies. Sofi (1972) also observed that the percentage of adult emergence decreased as the dose increased, when the larvae of *Dacus cucurbitae* were irradiated.

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