RESULTS

Figures (1 to 5) show the effect of dose and age on the survival of irradiated adult male and female *Drosophila melanogaster*. Mortality in unirradiated males is observed from 8th day onwards and continues up to 25th day whereas in females the death starts from 13th day and continues up to 31st day at temperature 25°C ± 1°C under our laboratory conditions.

At 30 krad in males the mortality is observed to begin from 6th day whereas in females it starts from 8th (Fig. 1). At 100 krad (Fig. 5) males die within couple of hours while females survive for about 48 hours. LD50 values are also decreased as the dose is increased. When 24 hr-old flies are irradiated with 30 krad, the LD50 for males is about 14.8 days whereas for females it is about 23.7 days. At 75 krads the LD50 for males is about 9 days whereas for females it is about 19 days. At 100 krads the death sets in much earlier. For instance, the LD50 for male is about 5.8 days whereas for females it is 9.6 days.

Following exposure to 30 krads 24-hr-old males start dying from about 7th day onwards, whereas 72 hr-old and 96 hr-old males start dying from about 6th day onwards. Similarly, in 24 hr-old and 48 hr-old females the death
<table>
<thead>
<tr>
<th>Time interval</th>
<th>MALE 24 hrs</th>
<th>MALE 48 hrs</th>
<th>MALE 72 hrs</th>
<th>MALE 96 hrs</th>
<th>FEMALE 24 hrs</th>
<th>FEMALE 48 hrs</th>
<th>FEMALE 72 hrs</th>
<th>FEMALE 96 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 hrs</td>
<td>Nil</td>
<td>Nil</td>
<td>4.1</td>
<td>Nil</td>
<td>17.2</td>
<td>20.0</td>
<td>29.6</td>
<td>23.0</td>
</tr>
<tr>
<td>12 hrs</td>
<td>9.5</td>
<td>4.6</td>
<td>Nil</td>
<td>Nil</td>
<td>12.4</td>
<td>20.0</td>
<td>26.4</td>
<td>20.5</td>
</tr>
<tr>
<td>18 hrs</td>
<td>Nil</td>
<td>Nil</td>
<td>4.1</td>
<td>Nil</td>
<td>28.1</td>
<td>25.0</td>
<td>31.2</td>
<td>30.7</td>
</tr>
<tr>
<td>24 hrs</td>
<td>1.1</td>
<td>Nil</td>
<td>12.3</td>
<td>Nil</td>
<td>18.9</td>
<td>30.0</td>
<td>20.0</td>
<td>29.0</td>
</tr>
</tbody>
</table>
starts from about 13th day onwards whereas 72 hr-old females
start dying from 8th day onwards. Similar trend is
repeated in higher doses also viz. 50, 75, 90 and 100 krad.
The influence of age is remarkable at 100 krad where LD50
value for 24 hr-old males is about 5.8 days, for 48 hr-old
it is 4.7 days, it comes down further for 72 hr-old and
96 hr-old where it is about 0.8 and 0.6 days respectively.
In females at 100 krad for 24 hr-old it is 9.6 days, for
48 hr-old it is 8.9 days, for 72 hr-old it is 5.7 days and
for 96 hr-old it is 1.2 days.

Figures (6 to 9) and Table 1 show the effect of an
acute dose of 60 krad and the same dose administered in
two equal fractions of 30 krad each separated by 6, 12,
18 and 24 hrs. interval on the life span of 24 hrs, 48 hrs,
72 hrs and 96 hr-old males and females.

When 24 hr-old males were given a dose of 60 krad,
mortality is observed from 6th day onwards showing a
LD50 value of 8.4 days. Same dose when given in two equal
fractions of 30 krad each separated by 6 hrs interval has
the same LD50, i.e., 8.4 days. However, as the time is
increased to 12 hrs, LD50 value is increased to 9.2 days
which is an increase of 9.5% in the life span of the flies.
Further, when the interfraction interval is increased to
18 hrs and 24 hrs there is no change in LD50 value from
that of 6 hr interval studies. Females of the same age
when treated with 60 krad show LD\textsubscript{50} value of 18.5 days, when this dose is divided into two equal fractions of 30 krad each separated by 6 hrs interval LD\textsubscript{50} value is increased to 21.7 days which is an increase of 17.2% in the life span compared to the single dose irradiation. When the time interval is increased to 12 hrs the LD\textsubscript{50} value is 20.8 days, i.e., an increase of 12.4% in the life span. Further, with 18 hrs interval the LD\textsubscript{50} value reaches the maximum of 23.7 days exhibiting an increase of 28.1%. With the increase of 24 hrs time interval, the increase is 18.9%.

In 48 hr-old males the mortality begins from 6th day and LD\textsubscript{50} value is 8.6 days. There is no difference in LD\textsubscript{50} value when the dose is fractionated by 6 hrs interval. With 12 hrs interval however, the LD\textsubscript{50} value goes up to 9 days which shows an increase of 4.6% in the life span. 48 hr-old males do not show any recovery when the dose is fractionated by 18 hrs interval or 24 hrs interval because the LD\textsubscript{50} value goes down to 8.4 and 7.5 days as compared to the acute dose. 48 hr-old females start dying from 7th day and 13.2 days is calculated as their LD\textsubscript{50} value when 60 krad is given as single dose. The LD\textsubscript{50} value is increased to 15.9 days showing an increase of 20% when the dose is split into 30 krad each by 6 hrs and 12 hrs interval. There is further increase in the life span of
25% and 30% when the time interval is increased to 18 hrs and 24 hrs. LD50 values calculated are 16.5 days and 17.2 days respectively.

When 60 krad is given to 72 hr-old males, LD50 value is found to be 7.3 days. There is an increase of 4.1% in the life span when the dose is given in two equal fractions divided by 6 hrs and 18 hrs interval and the LD50 value becomes 7.6 days. There is, however, no increase with 12 hrs interval. With 24 hrs interval it goes to the maximum where it exhibits an increase of 12.3% in the life span. Females of the same age have a LD50 value of 12.5 days when an acute dose of 60 krad is given. In fractionation studies LD50 value changes. It goes to 16.2 days showing an increase of 29.6% in the life span when the time interval is 6 hrs. With 12 hrs, 18 hrs and 24 hrs interval the LD50 values increase to 15.8, 16.7 and 15.0 days showing an increase of 26.4%, 31.2% and 20.0% respectively.

Finally 96 hr-old males do not show any increase in the life span. When acute dose of 60 krad is given the mortality starts from 3rd day and LD50 value is 7.5 days. This goes further down to 6.7 days, 6.2 days, 5.6 days and 7.1 days showing no recovery. Females of the same age start dying from 8th day onwards when 60 krad is given as single dose and LD50 value is found to be 11.7 days. With 6 hrs interval the LD50 goes higher to 14.4 days showing
an increase of 23.0\%. Similarly with other time intervals of 12 hrs, 18 hrs and 24 hrs there is an increase of 20.5\%, 30.7\% and 29.0\% as LD50 values are increased to 14.1, 15.3 and 15.1 days respectively.

Figures (10 to 12) show the sensitizing effects of caffeine, cycloheximide and hydroxyurea in combination with gamma-rays. Flies first fed for 72 hrs on these test compounds and then irradiated with 75 krad have shorter life span as compared to the flies irradiated only with 75 krad at the same age. LD50 values in males are reduced to 34\% with caffeine feeding, 31.1\% with cycloheximide and 16.3\% with hydroxyurea feeding. Similarly in females LD50 value comes down to 26.2\% with caffeine feeding, 53.2\% with cycloheximide and 33.6\% with hydroxyurea.

Figure (13) shows the effect of caffeine, cycloheximide and hydroxyurea fed to the females during interfraction interval. When a dose of 60 krad is split into two equal fractions by an interval of 18 hrs there is an increase in the life span of 72 hr-old female flies. As a result of caffeine feeding the LD50 value decreases to 14.6\% as compared to the control feeding which is 16.5 days. The values are significant at 5\% level which is tested by analysis of variance. Similarly, with cycloheximide it comes to 13.8 days and with hydroxyurea it
is 15.3 days. The values are significant at 1% and 5% level.

Effects of different media, i.e., the normal Drosophila-medium, (see Materials and Methods for composition) sucrose and honey are investigated on wet weight and dry weight of adult Drosophila. In male flies (Fig. 14) the change in weight is similar in all the three media. However, in females (Fig. 15) there is an increase in wet weight with age following their feeding on the normal medium and on honey. Similar pattern is repeated in dry weights also. There is rise in body weights after 48 hours in flies fed on medium and sucrose.

Figures 16 and 17 show change in weight of the flies after irradiation with 60 krad. In both irradiated males and females there is no increase in the body weight with age as is observed in unirradiated flies. There is a marked reduction in dry weight in case of males from 60 hours onwards.

Wet weight and dry weight of adult flies of Drosophila melanogaster fed on caffeine, cycloheximide and hydroxyurea are shown in figures 18 and 19. In both males and females there is loss of weight from 36 hours onwards with all the three chemicals. However, at a later stage from
60 hours onwards hydroxyurea-fed male flies attain the same weight as untreated flies. Concomitant to wet weight, change in dry weight follow the same pattern.

Effect of gamma-rays and caffeine on soluble and insoluble protein content of Drosophila melanogaster

Soluble and insoluble protein content were estimated every twelve hours up to 96 hrs after treating newly emerged flies to gamma-rays and 0.2% caffeine (Figs. 20 to 23). In untreated males there is no rise in soluble protein content with age. Insoluble protein however, increases as the age advances. Irradiated males show a decline of about 5% in soluble protein at twenty four hours compared to control, whereas insoluble protein continues to rise. After 48 hours of irradiation both the soluble and insoluble protein remarkably increase in males.

In untreated females there is a steep rise in soluble protein content (Fig. 21) between 36 and 48 hours and it becomes constant after 48 hours. Similarly, insoluble protein shows a rise up to 36 hours onwards in untreated females. Irradiated females show high level of soluble protein content (about 26%) even after 12 hours of treatment and maximum content was recorded at 60 hrs after irradiation. This starts declining from 72 hours onwards.
Contrary to irradiation, caffeine reduced both soluble and insoluble proteins in adult flies of both sexes (Figs. 20 to 23). After 12 hours of treatment there is 28% reduction in soluble and 6% in insoluble protein content. At 96 hours there is 14% reduction in soluble and 17.5% in insoluble protein content compared to untreated flies.

Figures 24 and 25 show effect of caffeine in combination with gamma-rays on soluble and insoluble protein content of adult flies. In males there is a rise of about 18% and 8.3% in soluble and insoluble protein content respectively. When caffeine and gamma-rays are given in combination as compared to caffeine treatment alone. In females the rise is about 7% both in soluble and insoluble proteins.

Figures 26, 27 show effect of cycloheximide alone and in combination with gamma-rays on protein content. In males there is 18.9% reduction of soluble proteins and 11.0% of insoluble proteins by cycloheximide with respect to control. Combination of cycloheximide and irradiation treatment show higher protein content compared to cycloheximide alone which however, stays below the level of control males flies. In females also there is 17% reduction in soluble and 15% in insoluble
protein by cycloheximide alone. The level is increased when the two are combined.

Figures 28 and 29 show changes in protein content induced by hydroxyurea alone and in combination with gamma-rays to adult flies. Hydroxyurea alone does not change protein content either in males or females. But however, when hydroxyurea and irradiation are combined there is rise in soluble and insoluble protein content as compared to hydroxyurea treatment alone.

Changes in Glycogen and free sugars level in adult Drosophila melanogaster due to physical and chemical agents:

Actively feeding adult male flies show an increase in glycogen content from the time of emergence to 96 hrs (Fig. 30). The maximum glycogen content has been found around 96 hrs, which is almost double of what was found in 12 hrs old flies. Irradiated males register slightly lesser glycogen content compared to control around 12 hrs and the other ages show an enhancement in glycogen content. With regard to caffeine treatment a decrease in glycogen content is evident even in 12 hr-old flies. This decrease is drastic depending on the age of the flies, as 12 hr-old flies show about 50% reduction and 96 hrs old flies show around 76% compared to control.
The female flies have a slightly higher glycogen content at the time of emergence but its increase is not marked in males as the age increases (Fig. 31). The irradiated females show an increase in glycogen content from 72 hrs onwards and the earlier ages show a decrease in content. Caffeine treatment reduces glycogen content in females but the decrease is much less compared to the results obtained in males.

Free sugars level is enhanced markedly by irradiation in males and females (Figs. 32 and 33). At 60 hrs of post irradiation free sugars level nearly doubles in irradiated males and the rise is of relatively lesser magnitude in irradiated females. Caffeine induced changes in this regard are not significantly different from control values in males, but females show a marked decrease compared to control.

When caffeine and irradiation are combined the results are strikingly different (Figs. 34 and 35). Caffeine-induced decrease in both glycogen and the sugars is drastically altered and the values are close to control.

Cycloheximide induced changes are quite similar to those of hydroxyurea in males (Fig. 36). In females, however, in combination with irradiation, cycloheximide
suppresses the rise in the sugar level as observed with irradiation alone.

Hydroxyurea when given alone induces slight decrease in glycogen content in male and an increase in female flies (Fig. 38). However, in combination with irradiation hydroxyurea has abolished the enhancement of glycogen content induced by irradiation. With regard to free sugars level hydroxyurea fails to exert any influence when given alone (Fig. 39).

Effect of gamma-rays and caffeine on free amino acids content in Drosophila melanogaster

Adult male flies show an increase in free amino acids from the time of emergence to 96 hours (Fig. 40). There is enormous amount of increase after 24 hours. In comparison, the irradiated males exhibit reduction in the amino acids content at all ages. There is only about 5% reduction at 12 hours after post-irradiation, but this reduction becomes progressively larger (upto 27%) within the next 12 hrs. The total amount is almost reduced to fifty per cent of control at 96 hrs post irradiation. With regard to caffeine also there is considerable amount of reduction in free amino acid content at all stages as observed earlier with irradiation. The reduction is almost fifty per cent as compared to the control.
Untreated females also show the same pattern as observed with males (Fig. 41). There is an increase in the quantity of free amino acids content as the age advances except at 30 hrs after emergence. Generally, females show much higher quantity as compared to the males. Irradiated females show a decline in amino acid content. With caffeine also there is reduction in the quantity. The reduction becomes quite significant at 48th hr which somewhat increases by 84th hr and then it again starts decreasing.

Caffeine in combination with radiation does not reduce amino acid further; instead slight increase in the quantity of free amino acid is noticable in males as compared to irradiated ones (Fig. 42). The increase due to combination treatment is significant in females where the rise is much above that of the caffeine treat-ment alone; but it is less than the amount observed in irradiated females.

Effect of cycloheximide alone and in combination with gamma-rays on free amino acids is shown in Fig. 43. Cycloheximide alone induced a change in free amino acid content similar to irradiation and hydroxyurea. There is reduction in the quantity of amino acid which in combination with irradiation rises in males but in females the level is the same as in cycloheximide treated flies.
**TABLE 2**

EFFECT OF CAFFEINE AND IRRADIATION ON TOTAL LIPIDS OF ADULT DROSOPHILA

(lipids in mg/200 mgs. Wet wt. flies)

<table>
<thead>
<tr>
<th>Time after Treatment</th>
<th>MALES</th>
<th>FEMALES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CONTROL</td>
<td>IRRADIATED CAFFEINE</td>
</tr>
<tr>
<td>12 hrs</td>
<td>.012</td>
<td>.010</td>
</tr>
<tr>
<td>24 hrs</td>
<td>.011</td>
<td>.011</td>
</tr>
<tr>
<td>36 hrs</td>
<td>.013</td>
<td>.010</td>
</tr>
<tr>
<td>48 hrs</td>
<td>.012</td>
<td>.010</td>
</tr>
<tr>
<td>60 hrs</td>
<td>.013</td>
<td>.013</td>
</tr>
<tr>
<td>72 hrs</td>
<td>.013</td>
<td>.014</td>
</tr>
<tr>
<td>84 hrs</td>
<td>.012</td>
<td>.014</td>
</tr>
<tr>
<td>96 hrs</td>
<td>.013</td>
<td>.014</td>
</tr>
</tbody>
</table>

Dose, 60 krad; Caffeine, 0.2%.
Figure 44 shows the effect of hydroxyurea alone and in combination with gamma-rays on free amino acid level in males and females which are estimated 96 hrs after the treatment. There is notable reduction both in males and females when hydroxyurea is given alone. Further a slight rise in the level of the amino acid is widened when it is given in combination with radiation as compared to the treatment of hydroxyurea alone. The rise in free amino acid is less than the irradiated females.

Table 2 shows effect of gamma-rays and caffeine treatment on total lipids of adult, Drosophila melanogaster. Males do not show any quantitative change in lipids in unirradiated and irradiated conditions. However, with caffeine treatment there is 25% reduction in the total amount compared to control at all stages in male flies. Females have higher amount of lipids than males. In irradiated and caffeine-treated female flies there is no change in the lipid content.
Figure 1: Mortality of adult *Drosophila melanogaster* of different ages after irradiation with 30 krad of gamma-rays.

Figure 2: Mortality of adult *Drosophila melanogaster* of different ages after irradiation with 50 krad of gamma-rays.
FIG. 1

FIG. 2
Figure 3: Mortality of adult *Drosophila melanogaster* of different ages after irradiation with 75 krad of gamma-rays.

Figure 4: Mortality of adult *Drosophila melanogaster* of different ages after irradiation with 90 krad of gamma-rays.
FIG. 3

FIG. 4
**Figure 5**: Mortality of adult *Drosophila melanogaster* of different ages after irradiation with 100 krad of gamma-rays.

**Figure 6**: Mortality and sparing effect of dose fractionation in 24 hr-old adult flies of *Drosophila melanogaster* exposed to gamma-rays in single or in two equal exposures with different time intervals.
Figure 7: Mortality and sparing effect of dose fractionation in 48 hr-old adult flies of *Drosophila melanogaster* exposed to gamma-rays in single or in two equal exposures with different time intervals.

Figure 8: Mortality and sparing effect of dose fractionation in 72 hr-old adult flies of *Drosophila melanogaster* exposed to gamma-rays in single or in two equal exposures with different time intervals.
FIG. 7

FIG. 8
**Figure 9**: Mortality and sparing effect of dose fractionation in 96 hr-old adult flies of *Drosophila melanogaster* exposed to gamma-rays in single or in two equal exposures with different time intervals.

**Figure 10**: Effect of pretreatment of caffeine on mortality of adult *Drosophila melanogaster* induced by gamma-rays. The flies after emergence were fed with 0.2% caffeine for 72 hrs and were then irradiated with a dose of 75 krad.
**Figure 11**: Effect of pretreatment of Cycloheximide on mortality of adult *Drosophila melanogaster* induced by gamma-rays. The flies after emergence were fed with 0.012% Cycloheximide for 72 hrs and were then irradiated with a dose of 75 krad. (CM: Cycloheximide).

**Figure 12**: Effect of pretreatment of Hydroxyurea on mortality of adult *Drosophila melanogaster* induced by gamma-rays. The flies after emergence were fed with 1% Hydroxyurea for 72 hrs and were then irradiated with a dose of 75 krad. (HU: Hydroxyurea).
FIG. 11

FIG. 12
Figure 13: Effect of caffeine, cycloheximide and hydroxyurea on sparing effect of dose-fractionation for the mortality of adult female *Drosophila melanogaster*. 72 hr-old flies were used. Interfraction interv. was 18 hrs during which the chemicals were given (CM: Cycloheximide; HU: Hydroxyurea).

Figure 14: Mean wet weight and dry weight of adult male *Drosophila melanogaster* grown on different media. Each point is an average of 5 groups of flies having 10 individuals/group.
FIG. 13

FIG. 14
**Figure 15**: Mean wet weight and dry weight of adult female *Drosophila melanogaster* grown on different media. Each point is an average of 5 groups of flies having 10 individuals/group.

**Figure 16**: Mean wet weight and dry weight of adult male *Drosophila melanogaster* after 60 krad irradiation. The flies were irradiated just after emergence and were transferred to *Drosophila* medium.
FIG. 15

FIG. 16
**Figure 17**: Mean wet weight and dry weight of adult female *Drosophila melanogaster* after 60 krad irradiation. The flies were irradiated just after emergence and were transferred to *Drosophila* medium.

**Figure 18**: Wet weight, Dry weight changes of adult male *Drosophila melanogaster* after treating with caffeine, cycloheximide and hydroxyurea. The chemicals were administered to flies using 5% sucrose solution.
FIG. 17

FIG. 18
Figure 19: Wet weight, Dry weight changes of adult female *Drosophila melanogaster* after treating with caffeine, cycloheximide and hydroxyurea. The chemicals were administered to flies using 5% sucrose solution.

Figure 20: Changes in soluble protein content induced by irradiation (60 krad) and caffeine (0.2%) treatment in adult male *Drosophila melanogaster*
Figure 21: Changes in soluble protein content induced by irradiation (60 krads) and caffeine (0.2\%) treatment in adult female *Drosophila melanogaster*.

Figure 22: Changes in insoluble protein content induced by irradiation (60 krads) and caffeine (0.2\%) treatment in adult male *Drosophila melanogaster*.
FIG. 21

FIG. 22
Figure 23: Changes in insoluble protein content induced by irradiation (60 krad) and caffeine (0.2%) treatment in adult female *Drosophila melanogaster*.

Figure 24: Effect of caffeine and irradiation alone and in combination on soluble protein content of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 0.2% caffeine-containing medium. The estimation was carried out at the end of 96 hours.
FIG. 23

FIG. 24
Figure 25: Effect of caffeine and irradiation alone and in combination on insoluble protein content of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 0.2% caffeine-containing medium. The estimation was carried out at the end of 96 hours.

Figure 26: Effect of cycloheximide and irradiation alone and in combination on soluble protein content of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 0.012% cycloheximide-containing medium. The estimation was carried out at the end of 96 hours. (CM: Cycloheximide).
FIG. 25

FIG. 26
Figure 27: Effect of cycloheximide and irradiation alone and in combination on insoluble protein content of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to .012% cycloheximide-containing medium. The estimation was carried out at the end of 96 hours. (CM : Cycloheximide).

Figure 28: Effect of Hydroxyurea and irradiation alone and in combination on soluble protein content of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 1% Hydroxyurea-containing medium. The estimation was carried out at the end of 96 hours. (HU : Hydroxyurea).
FIG. 27

FIG. 28
Figure 29: Effect of Hydroxyurea and irradiation alone and in combination on insoluble protein content of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 1% hydroxyurea-containing medium. The estimation was carried out at the end of 96 hours. (HU: Hydroxyurea).

Figure 30: Effect of irradiation and caffeine on total glycogen content of adult male (*Drosophila melanogaster*). (Dose 60 krad; Caffeine, 0.2%).
Figure 31: Effect of irradiation and caffeine on total glycogen content of adult female Drosophila melanogaster. (Dose 60 krad; Caffeine, 0.2%).

Figure 32: Effect of irradiation and caffeine on free sugars of adult male Drosophila melanogaster (Dose 60 krad; Caffeine, 0.2%).
FIG. 31

FIG. 32
Figure 33: Effect of irradiation and caffeine on free sugars of adult female *Drosophila melanogaster* (Dose 60 krad; Caffeine, 0.2%).

Figure 34: Effect of caffeine and irradiation alone and in combination on total glycogen content of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 0.2% caffeine-containing medium. The estimation was carried out at the end of 96 hours.
FIG. 33

FIG. 34
**Figure 35**: Effect of caffeine and irradiation alone and in combination on free sugars of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 0.2% caffeine-containing medium. The estimation was carried out at the end of 96 hours.

**Figure 36**: Effect of irradiation and cycloheximide and in combination on total glycogen content of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 0.012% Cycloheximide-containing medium. The estimation was carried out at the end of 96 hours. (CM: Cycloheximide).
**Figure 37**: Effect of irradiation and cycloheximide alone and in combination on free sugars content of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to .012% cycloheximide-containing medium. The estimation was carried out at the end of 96 hours. (CM : Cycloheximide).

**Figure 38**: Effect of irradiation and hydroxyurea alone and in combination on total glycogen content of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 1% hydroxyurea medium. The estimation was carried out at the end of 96 hours. (HU : Hydroxyurea).
Figure 39: Effect of irradiation and hydroxyurea alone and in combination on free sugars of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 1% hydroxyurea medium. The estimation was carried out at the end of 96 hours. (HU: Hydroxyurea).

Figure 40: Changes in free amino acids induced by irradiation and caffeine in adult male *Drosophila melanogaster*. (Dose, 60 krad; Caffeine, 0.2%).
FIG. 39

FIG. 40
Changes in free amino acid induced by irradiation and caffeine in adult females *Drosophila melanogaster* (Dose, 60 krad; Caffeine, 0.2%).

Effect of caffeine and irradiation alone and in combination with each other on free amino acids of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 0.2% caffeine-containing medium. The estimation was carried out at the end of 96 hours.
**Figure 43**: Effect of cycloheximide and irradiation alone and in combination on free amino acids of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 0.012% cycloheximide-containing medium. The estimation was carried out at the end of 96 hours. (CM : Cycloheximide).

**Figure 44**: Effect of hydroxyurea and irradiation alone and in combination on free amino acids of adult *Drosophila melanogaster*. Irradiation (60 krad) was done just after emergence and flies were transferred to 1% hydroxyurea-containing medium. The estimation was carried out at the end of 96 hours. (HU : Hydroxyurea).