
A pilot study is discussed aimed at determining the approximate proportion of dominant lethals in male D. melangaster irradiated with several different doses but at a single neutron energy. In the preliminary study the flies are to be exposed to 1-MeV energy neutrons obtained from a Van de Graaff generator utilizing 2.8 MeV protons. The aluminum/beebe irradiation cage is illustrated.


The following is based on the author's summary of this account of laboratory investigations in Egypt to determine the practicability of releasing sterile males for the control of Spodoptera littoralis Bohlei. (Lepidoptera, Noctuidae). Females sterilized by the presence of males that had been sterilized as pupae by irradiation with x-rays laid sterile eggs in regular batches. They had evidently paired, since others that were kept without males laid scattered eggs or no eggs in small batches that were not covered in the normal manner. When the sterile males were replaced by fertile ones, the females paired again and deposited fertile eggs in batches. Exposure of male pupae to radiation at 500 R increased pupal mortality and the percentage of abnormal adults, lengthened the pupal period and reduced fertility, but exposure to 500 R had no adverse effects. The release of sterile males for the eradication of S. littoralis is considered to be impracticable because of the tendency of the females to pair more than once and difficulty in raising large numbers of larvae. (RAE-A 05:1987, ref. 822)


Preliminary experiments have been carried out on the applicability of the sterile male technique to sugar-cane leafhopper (Delphacella sacchariidea (Kulik), vector of Fiji disease of sugar cane). Male nymphs proved the most suitable stage for irradiation with x-rays from a 60Co source. Females were sterilized at 3500 rad, males at 10000 rad. No effects were observed on those donated on adult longevity, mating capacity and sperm motility. A percentage of sperm were rendered inactive at 12000 rad, and at 20000 rad adult longevity and wing development were also affected adversely. A large safety margin is indicated within which sterile males may be produced without adverse effects.


Techniques have been developed which permit analysis of the entire genome for dominant lethality, recessive lethality and chromosomal translocations. Lemon males irradiated with 2000 R x-rays were crossed with Raleigh females of high hatchability. The frequency of dominant lethality (emas egg hatchability, testing 2048 eggs) was 0.279. Tests for recessive mutations and translocations showed that mutation frequencies remained essentially constant for three replicates taken at approx. monthly intervals.


Two wild type strains of D. melangaster were tested with respect to the induction of dominant lethals by x-rays. Eleven repeats of the same experiment were performed, and in 1 of them one strain consistently exhibited lower hatchability than the other after x-ray treatment of the males. Some of the repeats were performed in Berkeley, Calif., and some in Oslo, Norway. It is suggested that the difference in hatchability observed between repeats executed in the two places is mostly due to discrepancy in the technique of measuring and applying x-ray dosage. (Auth. summary)
1153) Sizemore, G. MUTATION PATTERN IN TWO WILD-TYPE STOCKS OF Drosophila melanogaster.
Canada, 1953."

The mutation pattern has been investigated in two wild-type stocks of D. melanogaster, one is Ohio,
the other is tea-Ambient. Males, 1-4 hr old, from the two stocks were treated with 180 R of x-rays,
then mated individually to single females for 24 h and transferred to new females every 24 h for a
period of 12 d. In testing for dominant lethals virgin hybrid females from a cross between
strain B X Canton-S & were used; in testing for recessive lethals the Miller-8 technique was
employed, and in testing for 2-3 translocations the Canton-S stock was used. The daily blood platelet
for dominant lethals for the Ohio stock shows up as similar curves. However, dominant lethal frequency
is higher for Ohio stock than for tea-Ambient stock in all first bloods until the seventh blood
where it is the same for both. From the 8th blood the situation is reversed. The frequency
dominant lethals for the Ohio stock appears in the sixth blood. Tests for sex-linked lethals and 2-3
translocations were carried out only for sperms coming on the third, sixth, and ninth day after irradiation
of the males. The data obtained for 2-3 translocations are in good agreement with the data found for
dominant lethals. The observed data indicate an overall higher mutation rate in the Ohio stock than in
the tea-Ambient stock. It seems reasonable to assume that the different mutability of the stocks has been
achieved by selection during the evolution of the two stocks fit order to make them better adapted to their
natural environment. (From Abstr.)

1153) Subrahmanyan, R. SOME EFFECTS OF GAMMA IRRADIATION ON Navel ORANGE-WORM.
Meeting of the Entomological Society of America. New York, N.Y., USA, 27-29 Nov. 1957."

60,000 rad of γ-radiation induced 99% dominant lethality in navel orange-worm, P. tramellus.
Effects of irradiation were also studied on the male vigour, spermatozoon production, spermatophore
production and the F1 and F2 generations. (Abstr.)

1154) Tamazaki, M.E., Tsubota, J.A., Papageorgiou, M., Pythas, E. GAMMA RADIATION-INDUCED
DOMINANT LETHALITY TO THE MALE OF THE OLIVE FRUIT FLY. I. ent. Res. 50 (1966)
214-216.

Research carried out in 1964-65 at the "Democritus" Nuclear Research Center has ascertained that
when pupae of the olive fruit fly, Dacus oleae (Gmelin), are exposed to 8, 10, 12 and 15 krad of γ-rays,
permanent dominant lethality is caused to sperm at a degree which can be considered satisfactory for
practical purposes. It has also shown that 15 krad was a satisfactory male-spermatizing dose. At these
doses not more than 2.0% of the progeny of irradiated males mated with normal females reached the first
insect stage, and not more than 0.2% reached the pupal stage; for the tea-Ambient stock in the 8th
blood. They did not substantially affect the time or the percent of adult emergence, or the longevity of
irradiated males. (Auth.)

1155) Voetschuk, A., Vemburova, I.E. COMPARATIVE STUDY OF THE FREQUENCY OF OCCURRENCE
OF DOMINANT LETHAL MUTATIONS IN DIFFERENT LINES OF Drosophila melanogaster. Vest. lising.
gos. Univ. v 2, 5 (1949) 154-159. Translation Leningrad Univ.

The genetic radiosensitivity of 3 stocks of the wild type of D. melanogaster were compared. A
proportion 50% of dominant lethals in spermatogonia was taken as criterion of genetic radiosensi-
ity. On this basis the 3 stocks could be divided into two groups: the relatively radiosensitive
lines were D-22, D-24, D-2 and Canton-S; the relatively radiosensitive lines were
radiosensitive: D-22, D-24, D-15, and Megarhina. Studies with different correlation between induced and
spontaneous mutation processes were discovered.

BOSS (Diatreta saccharalis) IN PUERTO RICO. PRRC-50, Puerto Rico Nuclear Center, Mayaguez,

Progress is reported on studies concerned with radioreduced sterility of the sugarcane borer, D.
saccharalis for population control. Research problems on development of a more efficient mating
medium: effects of yearly seasons on the life span of the same borer; egg productivity and

USA, 27-30 Nov. 1965.

Partial sterility and rod generation ability of the effect was noted in off

7-11 May 1967."

Immature stages of D. melanogaster at exposure to 9 kR. A mating behavioral and c
response to substances were in chromatograms exposure. (Abst.)

1159) Yoshimine, M., Nomura, K. POPULUS OF THE SUGAR
3 (1957) 200. Abst. 3 New Y., N.Y., USA

Host eggs were derived from control programmes indirect effect of the
radiation irradiate. (Abst.)

1918 Induction of nu
1919 Effects of muta
1925 The cytogenetics
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1928 Cytological e
1960 Radiation
1966 Effect of gamm
1967 Relation belo
1976 Fifth report for
1983 Techniques for
1987 Dose rate effec
1989 Methods for rad

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The mating behavior of radiation-induced males, radiation-induced eggs, and non-radiated eggs has been studied. The data suggest that the radiation-induced males are more frequently fertilized by the non-radiated females, whereas the non-radiated males are more frequently fertilized by the radiation-induced females. The results indicate that the radiation-induced males are more fertile than the non-radiated males.

**Reference:**


Partial sterility and reduced survival was observed in the F generation following exposure of F generation adults of the sugarcane borer moth, *D. saccharalis* to 60Co γ-radiation. The sterility effect was noted in offspring from both irradiated males and females. (Abstract)

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**Effect of Host Eggs Derived from Irradiated Pupae of the Sugarcane Borer on Trichogramma Paramyndia**

Host eggs were derived from the irradiated pupae to obtain the sterile sugarcane borer moth for the pest control programme, and were exposed to the laboratory reared *Trichogramma* colony. The indirect effect of the radiation on the oviposition and the parasitism were compiled comparing different radiation intensities. (Abstract)

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924 Effect of gamma rays on development of the sex cells in the best fly. (Kihara, A.Y., 1960)
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928 Dose rate effect of radiation on spermatogenesis of the sugarcane. (Sugita E. et al., 1967)
1984 Induced mutations and lethality in Drosophila after x-irradiation of meiotic and post-meiotic stages of the egg. (Wigler, P.E., 1984)
1971 The radiologist and practitioners in relation to the supposed hazards of x-rays in radiodiagnosis. (Gosn, C. M., et al., 1980)
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2126 Effect of esterification of genes in irradiation of house fly pupae. (Smith, J. B., 1967)
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2199 Some irradiation studies and related biological data for Culexides vittipennis (Diptera: Cestropogonidae). (Jones, R. H., 1987)
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2250 Ontogenesis and x-radiation sensitivity of the flour beetle, Tribolium. (Edman, M. E., 1967)
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2255 Gamma irradiation of pears of the tobacco budworm. (Finn, H. M., et al., 1967)
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1965 Cobalt-60 sterilization studies with the European chafer. II. (Chung, S. L., et al., 1966)

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1888 Studies on the eradication of Anopheles quinquefasciatus by the sterile-male technique using cobalt-60. III. Determination of the sterile dose and its biological effects on different characters related to "fitness" components. (Adeloff-Malek, A. A., et al., 1967)

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1889 Laboratory and field studies with Co-60 sterilized horn fly. (Noffman, K. A., et al., 1966)

1890 Control of fruit flies by gamma rays. (Ruppe, H. N., et al., 1966)

1893 Control of fruit flies by gamma-rays. (Ruppe, H. N., et al., 1967)

1895 Determination of the sterilization dose of the moth with COREA Co-60 irradiation. (Kaye, K. P., 1967)

1898 Study of the biology, breeding and sterilization of the cabbage fly. (Petrich, M. M., 1967)

1899 Study of the eradication of Anopheles quinquefasciatus Theobald by the sterile-male technique using cobalt-60. II. Induced dominant lethals in the immature stages. (Tangney, A. O., et al., 1968)

1904 Sterile flies used. Enemy of silvers, subjected (White, D., 1968)

1905 Proportionate use of radiation to control the bollworm moth. (Leopolda, Coleoptera). (Azaryan, G. R., et al., 1969)

1909 Sterile flies in Canada - bewildered, but effective. (Madsen, H. F., 1965)

1910 Coding moth control. (Madsen, H. F., et al., 1967)
2.1.7. Pesticide Resistance. Pathogen Susceptibility. Effects on Pathogens


Modification of fitness parameters of homocysteine populations singly or doubly stressed with x-radiation and DDT were specific for species and strains of flour beetles (Tribolium). (Auth.)


Dose-mortality studies were conducted on both sexes of houseflies, Musca domestica L., the pupae receiving 6000 R x-irradiation. Single doses of the toxicox were applied to flies from pupae which had been irradiated with 7500 and 10,000 R and to flies receiving 5500, 5000, and 4500 R immediately before topical application. Generally, irradiation of pupae (a) increased toxicity of heptachlor to males and females; (b) caused little effect on malathion to females, with no effect on males; and (c) reduced significantly the toxicity of Temik®(2-methyl)-4(3-methyl) phenylaminobutyric acid (methyl (benzamino)) oxime) to males, with no effect on females. Irradiation of adults (a) had no evident effect with heptachlor for either sex: (b) had no effect with malathion; and (c) increased significantly the toxicity of Temik to both sexes at 7500 R. It is suggested that the phenomenal response observed in (a) may be attributed to altered ratios of increased levels of esterases involved in detoxication of malathion. (Auth.)


Experiments were performed on the susceptibility of x-irradiated Tribolium beetles to non-specific bacterial toxins or to B. thuringiensis infection. Tribolium confusum and T. castaneum beetles were exposed to x-ray doses of 100, 50000 or 96000 R. T. confusum beetles were offered wheat flour (containing spores of B. thuringiensis) immediately after treatment 24 h post irradiation, and on the 7th day after exposure to the x-ray dose. T. castaneum beetles, having latent infections of Paramecoccus trichos and Nema a widel, were fed wheat flour (containing spores of B. thuringiensis) immediately after exposure. T. confusum beetles receiving non-specific bacterial toxins immediately after exposure to 96000 R was shortened as the dose receiving bacterial toxins was increased. Total mortality time as induced was not determined. T. confusum and T. castaneum, on the other hand, did not exhibit the irradiated insects. H. Wical was shortens protein-infection beed irradiated beetles, depending on the radiation, vegetative cells were more than irradiated, nontreated beetles, T. castaneum showed 1 protein disease in co, 1966.)

Jafri, B.H. SYNERGISTS. PROTOZOA DISASES. 1st International Confe.

Experiments were reported. Tribolium castanum, the microsporidian Tribolium (T. castanum). The mortality rate in no of Paramecium-infected of x-radiation, in ent, increased mortality 9 to 10 in microbiality of beetles b. infected beetles to the beetles exposed to 96000 R. beetles, Mort of the infected ants was shown. Only a low beetles infected adults were killed a concentration of 25 x 1 effect of bras or the significant. (DRA: 21:1)

* Originally cited within.


Podolsky, V.V. THE EFFECTS OF PROTOPHYLOMORPHIA IN FUTURE GENERATION. 50-62. (In Russian) 1

Podolsky, V.V. THE EFFECTS OF PROTOPHYLOMORPHIA IN FUTURE GENERATION. 50-62. (In Russian) 1

Studies were made of the effects of Protophylophilia on the offspring of small doses of dangerous not only because generations (low fertility among larvae and cocoons).

exposure to 399, 50,000, or 20,000 R showed a gradually higher rate of mortality and mortality time was shortened as the dose was increased from 300 - 90,000 R. Mortality time of x-irradiated beetles receiving the test toxin on 7th day after irradiation showed a gradual rise in mortality and a sharp decrease in total mortality time as the dose was increased from 100 to 90,000 R. The comparative mortality pattern indicated not only decreased resistance of the irradiated hosts and higher susceptibility to B. thuringiensis toxin but also indicated the significant role of the time factor in administration of pathogen or toxin to the irradiated insects. The total mortality time of beetles manifesting latent infections of F. triboli and N. virilis was shortened as the dose was increased from 100 - 90,000 R. These findings indicated that protozoan-infected beetles were more sensitive to radiation. The total mortality pattern of the irradiated beetles developing B. thuringiensis vegetative cells and of beetles manifesting no infection depended on the radiation dose. However, overall mortality time of the irradiated insects was considerably decreased after exposure to different x-ray doses as compared to control nonirradiated beetles. These results suggested new means of biological and radiation control of stored grain pests and showed the practical importance of exploring the potentialities of bacterial toxins and of protozoan diseases in controlling nonirradiated and irradiated insects of economic importance. (NSA 2187, 24629)


Experiments are reported on the synergistic action of x-rays and of B. thuringiensis toxin on flour beetles, Tribolium castaneum and T. confusum, that were infected with the conidial Adelina tribolii, the mummified Nosema whitei (in T. confusum), or the achroaggregata Phialocaryopsis tribolii (in T. castaneum). The beetles were exposed to x-ray doses ranging from 100 - 90,000 R. The mortality rate in noninfected, infected, and doubly infected beetles was evaluated. Mortality of Phialocaryopsis-infected beetles after x-ray treatment was markedly increased after low doses of x-radiation. In comparison to the mortality of infected, nonirradiated beetles, the 100-R dose increased mortality 3 to 4-fold in T. castaneum during the 1st 10 d after treatment. The increase in mortality of noninfected, irradiated by higher doses (60000 and 90,000 R) was less marked. The reaction of infected beetles to the 100-R dose during the 1st 10 d was the same as that of noninfected beetles exposed to 90,000 R. Similar synergistic effects were recorded for A. tribolii-infected T. confusum beetles. Mortality of noninfected beetles exposed to 60,000 and 90,000 R was lower than that of the infected insects. In general, dose-reduced adults of both flour beetles were highly susceptible to x-rays. Only a few toxicity of the B. thuringiensis toxin for the flour beetles was seen. Adelina- infected adults were killed in half the time required for the death of the noninfected beetles when a concentration of 25 x 10³ spores of B. thuringiensis was used in the feeding flour. In larvae, the effect of bacteria or the combination of bacteria and Adelina infection was much slower but still significant. (NSA 2187, 24629)

* Originally cited without abstract (see II/869)


Studies were made of the effect of y-radiation at 100, 200, 500, 1000, and 1500 R on irradiated imagines of Phoethrus terrae-novae in the F₁ to F₄ generations. Results show both large and comparatively small doses of y-rays have a pathogenic effect. Small and intermediate doses of y-rays are dangerous not only because of immediate somatic damage, but also because of injury to following generations (low fertility in the females, a large percentage of unfertilized eggs, a high death rate among larvae and cocoons). (BA)

A strain of A. aegypti (L.), mass selected for resistance to γ-radiation, crossbred readily with the parent strain and showed no reproductive isolation. Origionates rates, and usually susceptibility to malarial infection, were reduced in the selected strain, as well as in the parent stock, which had been irradiated as eggs. After 26 successive generations of inbreeding without exposure to radiation, the offspring of the selected strain continued to show a significantly greater radiation resistance than the parent strain. (Arth.)


Eggs (10-15 of) of both the selected strain and the parent NMRI strain of the mosquito A. aegypti were exposed to 2500 R γ-radiation at the rate of approx. 200 R/min in air. The eggs of the selected strain were found to be more resistant to the effects of this dose of γ-radiation than were the eggs of the parent strain, since a significantly higher proportion of the larvae from irradiated eggs survived to become viable adults. On the other hand, adults of the selected strain derived from eggs not exposed to radiation died more quickly and had a significantly shorter life span than the adults from the non-irradiated eggs of the parent colony. (NSA 20. 1968, 33923)


Female houseflies (Musca domestica) were irradiated with x-rays. Small doses of x-rays stimulated their viability. The LD 50 was 100 000 rad, the LD 200 was 160 000 rad. Sensitivity of flies to insecticides was determined after a topical application of alcohol solutions of DDT, hexachlorocyclohexane, and chlorphos. LD 50 values of DDT, hexachlorocyclohexane, and chlorphos were 0.03 and 0.85 µg/g fly, respectively. After the irradiation, a 3.0-7 fold increase was observed in fly sensitivity to the insecticides, depending on the dose of irradiation. (CA 65. 1966, 15372g)


The effect of x-irradiation on the sensitivity of DDT, hexachlorocyclohexane, and chlorphos was studied on 3- or 5-day-old domestic flies (female). Fly susceptibility to insecticides varied, depending on the x-ray dose absorbed. Following irradiation there was an increase in chlorphos susceptibility by a factor of 1.5-6, to hexachlorocyclohexane of 1.2-9, and to DDT of 1.2-7 as compared with controls. Max. fly sensitivity to insecticides was observed after a particular dose: for hexachlorocyclohexane - 10 000 rad, DDT - 30 000 rad, and chlorphos - 40 000 rad.


Female flies from irradiated papas were highly tolerant to malathion with no change in males. The opposite was found with Temik®. Irradiated adults showed no change in tolerance to heptachlor and malathion, but susceptibility to Temik increased greatly in both sexes. (Abstr.)


A data analysis was continued relative to deducing the genetic bases for changes in flour beetles grown under the influence of DDT and x-irradiation.

See also:

1173 Kupchitz, C. POTASSIUM K. g phthalfate (0.5%) suppressed the incidence when fed to the larvae; growth rate of the J. jocotan group in the untreated offspring of treated parental gene The offspring remaining examined. 1 wpp 1st generation larvae in the probit of the level of diminished the sensitivity. 10.2 mg/ml respective dependence of these files in tumor formation. A development: A growth mechanism. (CA 64.

1174 Brooks, G.T. EFFECTS OF THE TUMOR-SUPPRESSOR IRIS. Four stocks of D. melanogaster were subjected to various manipulations: x-ray action and cryptop. There was no significant and that resulting from a increase in tumor prone (105), 106, 107 in 1st and 2nd experimental strains of the effective alleles of the 1 alleles such that the does not occur. The irradiation is to be dominant over the supersensitive genes. It was the potentiality of alleles pr

31 Effects tumor gen...

326 The action of radio...

318
2.1.8. Tumour Induction


K pthalate (1) \((0.625 - 25 \text{ mg/ml})\) diet \(1 \text{ mg/ml}\) or \(10 \text{ mg/ml}\) suppressed the incidence of tumours in \textit{Drosophila} strain \(d\). (melanoma-tumour sensitive) images when fed to the larvae: a linear relation was shown between the probit of normal insects and the logarithm of the concentration of the medium. However, treatment increased tumour incidence in the untreated offspring of treated parents. The incidence increased as a function of the number of treated parental generations, remained at a stable level \(30-80\) generations, and was irreversible. The offspring remained sensitive to \(1\) throughout the 80 generations. The effects of \(x\)-irradiation were examined: \(1\) suppressed the tumour-inducing effects of \(x\)-irradiation \((300\ \text{ kev} \times 24\text{-hr-old})\) generation larvae maintained on a medium containing \(1\). A linear relation was shown between the probit of the level of normal insects and the log of the concentration. However, x-irradiation diminished the sensitivity of the strain to \(1\) in non-irradiated and irradiated insects, \(1.62\ \text{ mg} \times 10^{-3}\) and \(10.3\ \text{ mg} \times 10^{-3}\) respectively, inhibited tumour formation in \(50\%\) of the insects. The effects of \(1\) on the descendants of these insects were similar to those in non-irradiated insects. The inhibitory action of \(1\) on tumour formation is due to its toxic effect and is active at the physiological level of tumour development. Its action on tumour development in descendants of treated insects involves hereditary mechanisms. (CA 64: 1966, 20986)


Four stocks of \(D.\ \text{melanogaster}\) incorporating different combinations of tumour alleles on the \(X\) chromosome and tumour-suppressor alleles on the \(I\) chromosome were submitted to \(1000\ \text{ kev}\) of \(x\)-rays, dietary manipulations, and mutant eye color gene substitutions in order to test the influence of \(x\)-ray action and tryptophan metabolism on the induction of melanotic tumours in 3rd-instar larvae. There was no significant difference between tumour incidence resulting from \(x\)-ray treatment in air and that resulting from \(x\)-ray treatment in \(100\%\) \(O_2\), but both treatments produced a significant increase in tumour penetrance over control incidence for each of the four agent stocks: suppressor \(^{ty}\), suppressor \(^{m\tau}\), suppressor \(^{m\tau}\), and suppressor \(^{ty}\) mutants. Comparisons of tumour incidence in parental stock \(P.\ \text{progeny, and certain backcross progeny revealed the existence of effective localities of varying potency at both the tumour and tumour-suppressor level. The}\ \tau\) and \(\tau\) allelles, previously assumed to be ineffective wild-type alleles, are, in actuality, weakly effective alleles. The results indicate that a dominance relationship exists among the three tumour alleles such that the order of dominance is \(\tau\) \(\tau\) \(\tau\) \(\tau\) \(\tau\). The effectiveness in producing the tumour phenotype is just the reverse: \(\tau\) \(\tau\) \(\tau\) \(\tau\) \(\tau\). Of the two suppressor alleles, \(m\tau\), \(m\tau\), seems to be dominant over \(m\tau\), which is a much stronger suppressor than the former. The \(m\tau\) allele appears to act as a recessive in the presence of homozygous \(\tau\), while the \(m\tau\) combination is quite effective in suppressing the tumour phenotype produced by weaker tumour allele combinations. The increase in tumour incidence following \(x\)-ray treatment is attributed to a dual action of \(x\)-rays: enhancement of the expression of the tumour gene and inhibition of the expression of the tumour-suppressor gene. It was further postulated that \(x\)-ray action has a differential effect according to the potency of alleles present at the two loci. (Fram Df)

See also:

31 \textit{Efects tumoriengénes de la hirsute, de l'ultraline et de la thymidine tétée chez les larves de la drosophile.} \textit{Archives de la drosophile}. 8, 5 (1966)

196) The action of radiation and other mutagenic agents, 1. in inducing mutation in \textit{Drosophila} females, and 2. in controlling the action of specific genes responsible for suppressing uncontrolled growth. (Glass, H.B., 1966)
2.1.9. Modifying Factors
(Intensity, Mode of Irradiation, Ploidy, RBE, LET, Temperature, Synergists, Chemicals including Protective Agents, Environment at Irradiation, Medium, Irradiated Molecules, Etc.)


The effectiveness of arginine on spermatogenesis was investigated in y-irradiated (0.2 to 1.0 kR) D. melanogaster males. The crossing-over frequency was determined in the F1 progeny of irradiated males crossed with virgin females. Neither the time nor the frequency of crossing-over were affected by arginine. Comparison of fertility curves of males both exposed and unexposed to arginine treatment suggested that arginine either reduces or enhances the radioprotective delay of spermatogenesis. Protective actions of arginine were further shown to be very versatile. (NSA 20: 1986, 25740)


Studies showed that DNP treatment decreased frequency of recessive sex linked lethals mutations in y-irradiated Drosophila spermatozoids at a dose of 1000 R. It is significant that in sperm cells of the same flies mutation frequency did not change. (NSA 20: 1986, 30797)


The effect of arginine (J) on the frequency of mutation generation was studied in Drosophila spermatozoids. Drops (5-6) of J solution (2 mg of J/ml water) were added to medium containing larvae of Drosophila D-16. The males born from these larvae (1.5 to 6 d old) were y-irradiated with 1-3 kR (dose rate 205 R/min), and individually mated with five virgin females every day for 7 d. Mutation frequency and fertility of the males were determined. A bell-taken form of the curve of frequency of mutations as a function of the irradiation dose was found in medium spermatozoids (S 0). Mean fertility was 0.8 descendant/males/d at this time interval, after the irradiation with 3 kR. Max. frequency of mutations following irradiation with 3 kR was noted in the late spermatozoids (S 4). Then it decreased together with the fertility (on the 7th day, 0.5 descendant/males/4.). In males treated with J during the larval stage the max. frequency of mutations was observed on the 5th day. A higher percentage of mutations together with about 2 times greater fertility was observed on the 5-7th day in males treated with J. In comparison with irradiated controls. The linear dependence of mutation frequency on the dose was observed in experiments with J. Possible mechanisms of J action on the radiation mutagenesis were discussed. (CA 97:1077, 84979)


An investigation of the effect of dimethyl sulfoxide on induced genetic damage in adult male D. melanogaster is described. Young adult male abdomens were dipped in concentrated dimethyl sulfoxide and exposed to x-ray dose of 1018, 1024, and 2000 R 2 to 5 kilos. Others were injected with 0.064 ml of a 10-1 M solution of dimethyl sulfoxide 4 to 5 h before exposure to a 2000-R x-ray dose. Others were developed from eggs on a diet supplemented with 0.5% dimethyl sulfoxide before exposure to a 2000-R x-ray dose. Genetic damage was evaluated by measuring dominant lethals, translocations, or sex-linked recessive lethals after mating treated males. None of the chemical treatments protected against radiation-induced genetic damage. It is suggested that the 4-5 period between chemical treatment and irradiation may be too long for the detection of radioprotective effects. (From NSA 21:1997, 34690)

1179 Antipov, V.V., Arsen, T. RHEBOK RADIATION AND OTHER NATIONAL CONGRESS OF RA AMER., 87.

The effect of complex in experiments with radioprotective effect. A dose before radiation, (Proc.

1180 Antipov, V.V., Belom INVESTIGATIONS OF COPARTICIPATION OF Gp. p.209-253 of "Problems and Space Administration.

Results are presented R radioprotective under with the track of the architecture arrangement responsible and that weightlessness the possibility that we were the formation of development, but the with the flies indicator during weightlessness, to explain this, including during melon, or that


Hybrid lines of B. A85 of in vitro irradiation, the induction of polyploidy.


Progress is reported on satellitc experiments: Habubhunobu, Habubhunobu occupies a 1 and x-ray induction of


The report lists the type of data analysis. The the radiation condensate Vehicle Texas at Gen as which are required cou included that provides will come from the gr

A decrease in the rate of crossing-over was observed when vibration was used before radiation. (From abstr.)


Results are presented for experiments dealing with the reproductive processes in Drosophila melanogaster under conditions of weightlessness, and the study of space flight factors which affect the hereditary structure in Tradescantia paludosa. The hypothesis is advanced that chromosome rearrangements result from dynamic factors occurring during liftoff and descent of the spacecraft, and that weightlessness does not cause such rearrangements. The data do not eliminate, however, the possibility that weightlessness may cause disruptions of the mitotic mechanism. Also observed were the formation of ecotypes of cells, giant cells and disrupted synchrony of interphase development, but the individual flight factors causing these cannot be determined. Experiments with the flies indicated that breeding time was increased from the usual 9 to 15 days for eggs laid during weightlessness. More females were hatched than males, and several ideas are advanced to explain this, including space travel effects on Y-chromosomes stability, a loss of Y-chromosomes during mitoses, or that the female larvae were more fit. (Scient, A. Tech, Aerospace Repols)


Hybrid lines of A. aegypti demonstrate heterosis in their greater tolerance to the deleterious effects of ionizing radiation. Data also suggest that hybrid vigor can result in highly inbred strains by the induction of polysomic mutations using low doses of radiation. (Abstr.)


Program is reported on the following studies: preparation of the Habrobracon wasps for the bio- satellite experiment; bio- satellite preparatory experiments; spontaneous mutation frequencies in Habrobracon; Habrobracon experiments in simulated space-flight tests; radiation sensitivity of Habrobracon wasps at different temperatures of death of a translocation segment in Habrobracon; and X-ray induction of mutations in Habrobracon. (NSA 21: 1967, 2575)


The report lists the types of genetic and cellular damage assayed in Habrobracon and the method of data analysis. The results of the Ames Research Center Bio- compatibility Test are described, the radiation conditions surrounding the Habrobracon in the ARC Test, and the results of the Flight Vehicle Tests at General Electric Company. Some of the supporting experiments are reported, which are required continually to keep improving the experimental systems. A discussion is included that provides a theoretical foundation for the Habrobracon dominant lethality data that will come from the ground control for the bio- satellite experiment.

The possible alteration by hormonal action of the frequency and distribution of mutations induced by irradiation was tested in a large series of experiments, utilizing ecdysones as hormones and initial mutations on the X-chromosome as the indicator. Flies were treated with ecdysones 20 min before irradiation with a dose of 3000 R (140 kV and 5 mm) with and without oxygen. The data suggest that ecdysones may protect against genetic radiation damage in the presence of oxygen. When the 274 lethals obtained were localized by crossover analysis, no significant difference in the distribution (P > 0.05) of lethals along the X-chromosome in groups treated with and without ecdysones was found. (Abstr.)

EXPERIMENTS WITH Drosophila melanogaster IN MAGNETIC FIELDS. AD-494251. Naval School of Aviation Medicine, Pensacola, Fla. 1 Aug. 1962, 10p.

No genetic effects were observed in Drosophila on exposure to homogeneous and inhomogeneous magnetic fields of high field strength and gradient. Synergistic effects of magnetic fields in combination with x-radiation, mutation, hyperopia, and hypotemia were also not observed. (Auth.)

RUE OF FAST NEUTRONS BY THE RELEASE OF MUTATIONS IN Drosophila melanogaster. Mutation Res. 2 (1966) 185-190. (In German)

The RUE of fast neutrons (as compared with x-rays) was determined in D. melanogaster for various broad stages of germ cells and for sex-linked recessive lethals as well as for translocations between third and third chromosomes. A pronounced dependence of RUE on the stage of the germ cells was shown to occur and to account for much of the discrepancy reported in earlier work. Moreover, the RUE was demonstrated to be lower for recessive lethals than for translocations at all stages of spermatogenesis tested. These findings are discussed briefly as to their implications for problems of protection from radiation damage. (Auth.)


The authors review the findings and results of biological studies which bear upon the biological effects of extraterrestrial radiations. The four types of extraterrestrial radiations include galactic cosmic radiation, solar cosmic radiation, the Van Allen belt, and interplanetary plasma. The composition of these radiations varies in a fairly well known manner. A wide variety of experimental animals and plants have been tested for radiobiological effects. These include mammals such as dogs, guinea pigs, rats, and pigs, Drosophila, gnats, and vegetables, Caenorhabditis, microorganisms, and DNA. Estimates of the relative biological effectiveness of radiations encountered have been made. Many of these measurements have been made below sea level, as well as at sea level, during balloon flights, or in satellites.


Female D. melanogaster were irradiated with fast neutrons (0.2-3.5 MeV) from the James reactor of the Division of x-rays, or with x-rays. Oogonia and stage 7 oocytes were sampled from females irradiated when they were 0-4 days old. Virgin females were irradiated when they were 3-4 days old to provide both stage 14 oocytes and oogonia. The flies were exposed to x-rays at 900, 1800, and 3600 R (230 kVp, 30 ma., with 0.25 mm Cu plus 1.0 mm Al filteration, 185 rad/min). Neutron irradiations of 247, 532, and 165 rad (at 45 rad/min) were performed on the central axis of, and 1 cm from, the high flux face of the reactor. The x-irradiation averaged 8.7% of the neutron dose. Egg-to-adult viability and the induction of sex-linked recessive lethals were the end points. The oogonal stage is the least sensitive stage. Since an oogonal cell must undergo four synchronous mitotic divisions before becoming an oocyte, cell selection at this stage is rigorous. Stage 7 oocytes are intermediate in radiation sensitivity since they are metabolically active and some n- are more sensitive to recombination processes. In three times more selected were more effective than

DICKERMAN, R.C. M. TO x-RAY AND FAST "12th Annual Meeting Females 9-10 of D. melanogaster. The flies were 20 mm., with 0.25 mm Cu 297, 580, and 10 the high-flux face of the x-ray contribution of average viability and sex linkage illustrates the role of induction by photoreciprocal regression both effects are damaged most since there is little or no recombination and prof show no selection. (A) between the low level irradiated oocytes. (A)

ELEQUIPT, F.T., Yang, in Genetics to Include on Genetic Systems, a comp. Final Report, 1967. CO 2 during irradiation i in an inert gas such as CO 2 from that found in Air, CO can be replaced with a nitrogen gas with that the results of compact relative frequency (x-ray stages. It is also high dose of radiation on the environment and environmental var

DICKECHER, R.C. M. TO x-RAY AND FAST "12th Annual Meeting Females 9-10 of D. melanogaster. The flies were 20 mm., with 0.25 mm Cu 297, 580, and 10 the high-flux face of the x-ray contribution of average viability and sex linkage illustrates the role of induction by photoreciprocal regression both effects are damaged most since there is little or no recombination and prof show no selection. (A) between the low level irradiated oocytes. (A)

ELEQUIPT, F.T., MODI BY OXYGEN AND ARGH Studies in Genetics, 1 D. melanogaster male 20 min. They were kept in CO 2 or Air. Each stage was raised to 150, Chromosome damage and translocations, W flies were in Air rather significant difference. ( Autor) when the test tests gave different res
...active and some repair of chromosomal damage is possible. Stage 14 oocytes (early eggs) are most sensitive to radiation damage because of their low metabolic rate and lack of cell selection processes. In terms of egg-to-adult viability, the neonates used produce damage about three times more effectively than x-rays of similar doses. In the sex-linked lethal tests, neonates were more effective than x-rays by a factor of 2. (Abb.)


Female 0-4-day old D. melanogaster were irradiated with either fast neutrons from the Jain Reactor or x-rays. The flies were exposed to x-ray doses of 165, 1950, 2050, and 2840 rad (250 kVp, 20 mA, with 0.25-mm Cs plus 0.5-mm Al filtration, 105 rad/min). Neutrons irradiations of 287, 533, 969, and 1066 rad (at 65 rad/min) were performed on the central axis of, and 1 mm from, the high-flux face of the Reactor. The neutrons have a mean energy of 0.2-0.3 MeV. The activation energy in the neutron dose. The end points studied were egg-to-adult viability and sex-linked recessive lethals induced in oogonia or Stage 1 oocytes. The data illustrates the role of cell repair versus cell selection on the ultimate expression of damage after irradiation by photons or neutrons. Oogonial cells, irradiated with x-rays, are damaged less; this suggests that effective cell selection and repair. Stage 0 oocytes, irradiated with neutrons, are damaged less since there is little opportunity for cell selection; preliminary data indicates that there is little or no repair in this stage. Oogonia, irradiated with neutrons, undergo rigorous cell selection and probably little repair, while x-irradiated Stage 0 oocytes undergo repairs but show no selection. Hence, these latter two experimental groups exhibit damage intermediate between the low level seen in x-irradiated oogonia and the large amount of damage seen in neutron-irradiated oocytes. (Abb.)


O$_2$ during irradiation increases net radiation damage above that found if radiation is carried out at a faster gas such as Ar. The data do not support a role of O$_2$ in inducing genetic damage during intervals between radiation in Drosophila melanogaster, except in special conditions. Irradiation of 1000 R in a static atmosphere does not increase or reduce genetic damage measured as translocations from that found in Ar. Irradiation of 3000 R in CO in the dark is similar to irradiating in Ar. The CO can be replaced with He, O$_2$, NO or CO(NO) during the interval between the two 1000 R-radiations without changing the effect. Various sets of experiments are described and discussed. The results of comparisons of the rates of translocations and recessive lethals are tabulated. The relative frequency (translocations/recessive lethals) is higher in the more susceptible spermatozoa. It is also higher in experiments where more radiation damage was produced by a higher dose of radiation or the presence of O$_2$. At 3000 and 1000 R, the influence of cell sensitivity and environmental variables on recessive lethals is seen.


D. melanogaster males were x-rayed with two equal doses of either 600 or 1500 R separated by 30 min. They were irradiated in either O$_2$ or Ar at 1 atm. During the 30 min intervals flies were kept in O$_2$ or Ar. They were pretreated in the gases for 10 min and post-treated for 20 min. Each male was mated within an hour after treatment and remained every 2 d for 4 consecutive matings. The offspring carried chromosomes irradiated at different stages of spermatogenesis. Chromosome damage was measured by tests for sex-linked recessive lethals, dominant lethals, and translocations. When irradiated in O$_2$ the damage was greater in the spermatid stage if the flies were in Ar rather than O$_2$ in the interval between irradiations. When irradiated in Ar no significant difference was found in the degree of damage if the flies were in Ar or O$_2$ during the interval when the test was for sex-linked recessive lethals or translocations. The dominant lethal tests gave different results which are discussed. In O$_2$ radiosensitivity was at a peak during the...
The degree of injury to biological systems subjected to irradiation depends on the chemical as well as the physical environment. Radioprotection is known for sulfhydrl and sulfonate compounds, although data on the latter are meager. Germ cells are the predominantly actively dividing cells in adult insects; consequently, they are readily modified by radiation. Radiation increases the frequencies of chromosomal aberrations which may lead to illness or death and which may be modified by chemical protection. Sexually mature virgin female fruit flies, *Drosophila melanogaster* (mutant *sosy*), were treated in different ways to various concentrations of DMDSO and then x-rayed with 0, 1, 2, and 4 kR. Survival and productivity data (fecundity and fertility) were collected. DMDSO gave no radiation protection to x-rayed female germ cells whether fecundity or fertility was scored. Radiation at different dose intervals after DMDSO treatment was also ineffective. When females were cultured for 4 days on 200 g of dry food previously mixed with 10 or 20% DMDSO and then placed on regular food, their reproduction began on the 3rd day. Under similar conditions but with 5% DMDSO, productivity began on day 7. Controls produced on day 1. In both DMDSO fed groups productivity was reduced compared to the controls. This experiment was repeated and a cyclical description of the ovarioles will be presented to show the vestigial effect of DMDSO.

(Abstr.)

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Goldman, L.J., Sulk, P.H., Crompton, H.L. 
NIOTRGEN EFFECT IN IRIMIDIZED PEPSIPLANTA brevis. 

A strain of *P. brevis* was exposed to a determined LD 50/50 in dose of 300 ι/day×2 ways to study the possible effect of N. The strain initially demonstrated no effect, then treatment began on the 3rd day. A 3rd strain showed the reverse effect. (Abstr.)

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Havir, E., Offenstadt, P. 
RADIOSENSITIVITY OF Drosophila EMERGOS IN AIR AND IN N2. IN RELATION TO AGE. 

D. melanogaster embryos show great changes in radiosensitivity with age. These changes occur during a period of rapid morphological development. It is thought that the relative importance of difference mechanisms of radiation injury might vary with age, leading to variations in the O enhancement ratio. Embryos were collected during 10 min periods, and x-rayed (200 keV, 0.5 cm + f Al filter) 10 air at 4 stages between 1.5 and 4.5 h. Exposure time was 6 min in all experiments. The dose-effect curve for each age was determined with regard to hatching from the egg. Normal hatching time is 10.2 h. Counts were made at 3 h to eliminate early hatches, and at 4 h to score non-hatches. A stage of high radiosensitivity was found at 1.5-2.5 h, and a peak of low radiosensitivity at 2.7 h. The LD 50's are 166 R and 1670 R respectively. Subsequently, embryos at ages 1 h 30' and 5 h 30' were irradiated in air, and 0 min N2, and then reared in N2. The dose-effect curves obtained in four such series indicate that the O enhancement ratio at the LD 50, LD 50 and LD 70 levels is from 2.0-2.5, with no systematic trend. Thus, no difference in mechanism of radiation injury could be demonstrated by this method, in spite of the 5-fold difference in radiosensitivity between the stages investigated. (Abstr.)

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Hosain, M.M., Molla, S.A., Molla, M.U. 
STUDIES ON THE EXPERIMENTAL POPULATION OF Drosophila melanogaster RAISED ON IRADIATED BANANA DIET. 

For abstract, see 1138.

Seven generations were fed irradiated banana diet. Bananas treated with 20,000, 45,000, and 50,000 rad were compared with untreated bananas in terms of their effect on egg: pupa ratio, percent adult emergence, longevity, egg production, and viability in order to assess possible toxicity or changes in nutritive value, or mutagenic effects. In fertility tests 2500 flies were tested for each series. No case of sterility was observed, No effects were found which would be attributable to irradiated food.


Substitution of 8-bromodeoxyuridine (BUD) for thymine in DNA enhances the sensitivity of cells to X-irradiation. Using an acute and chemically defined culture medium, the radiosensitivities (for sex-linked recessive lethal mutations) of chromosomes of Drosophila larval spermatogonia was compared in the presence and in the absence of BUD. Drosophila does not utilize pyrimidine bases unless they are supplied as the nucleosides. To increase the chance of BUD incorporation, larvae were cultured in the presence of the folate acid analog, antifolate, which inhibits thymine synthesis. A dose of 120 kV x-rays was delivered at 180 kV/min. Males and females were examined for sex-linked recessive lethals by the killer-s method using a single brood by mating individual males to two virgin females for 2 days, and, in the case of females, mating individual males to two males for 2 days. When larvae were cultured in the presence of either dideoxuridine or BUdR for 48 h (with and without antifolate), followed by irradiation, or without irradiation, none of the sex-linked recessive lethal frequencies differed significantly from one another. There was no evidence for BUD-induced mutagenesis; and only a slight increase in mutation following X-irradiation of males. There was no evidence for an increase in mutational radiosensitivity of the X-chromosome in the presence of BUD, nor was there evidence for BUD incorporation, although the BUD s antifolate cultures showed down larval development compared with the dideoxuridine + antifolate cultures. (NSF 31:1867, 22797)

1198 Kogon, Z. M. OCCURRENCE OF LETHAL MUTATIONS IN THE HETEROCHROMATINIC REGION OF Drosophila melanogaster X CHROMOSOME DEPENDING ON PRE-RADIATION DEVELOPMENT TEMPERATURE. Genetika No. 4 (1966) 30-44. (In Russian)

D. melanogaster males raised at 15°C (cold series) and at 28°C (warm series), respectively, were X-irradiated (at a dose of 8000 rad). Subsequent crosses were carried out at 25°C. It was found that lethal mutation induction percentage in the heterochromatic X-chromosome region (at the locus, hobo) was twice as high in the ripe sperm cells of the cold series in contrast to that of the warm series. Receptive sex-linked lethal and dominant sterility mutations also occurred more often at a lower developmental temperature. Although the difference between the temperature series in this case was far lower, in both temperature series a decrease of mutation frequency in spermatids in contrast to ripe sperm cells was observed. The decrement was highly treed for the male in dominant sterility mutations and was far less manifest for recessive sex-linked lethals. (Auth.)


A brief review of BSE for somatic and genetic damage is given for various organisms. A brief summary is given concerning comparative studies of mutation frequencies with alleviators irradiated with x-rays. The report is a good summary of data obtained from the analysis of the data combined with the above mentioned review of BSE data for other organisms, the following hypotheses are proposed: (1) the overall mutation frequency in all avian goslings depends on the interaction of radiation with the intercellular repair mechanisms connected with certain multicomponent systems, and (2) the low mutation rate recorded on acute gosling radiation of all avian larvae of the late gosling stage is due to mitigation of repair by radiation. (Auth. summary)


Müller, S., Wals, M. ABERRATIONS IN Drosophila. Meeting of the Genetic Association at 18th World Congress of Genetics.


Male Drosophila melanogaster and their reared daily x-irradiated with 137 Ba. The effect of 5 mg of 137 Ba on the detachment of BRUDR in the females. A possible explanation is that BRUDR incorporation into DNA, sufficient for a significant increase in the mutation rate, was possible only in gen cells that synthesize DNA, and after a radiation induced inhibition of the thymidylate synthases. (Auth.)

Number of females at ratio of one male to three females. The males were transferred to new group of females every 3-5 days.

1205 100 9-12-d brood 12-15-d brood

<table>
<thead>
<tr>
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<td>4167</td>
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(Auth.)

Male Drosophila melanogaster were raised under 5 mg of 137 Ba, x-irradiated with 137 Ba, and then reared daily x-irradiated with 137 Ba. The effect of 5 mg of 137 Ba on the detachment of BRUDR in the females. A possible explanation is that BRUDR incorporation into DNA, sufficient for a significant increase in the mutation rate, was possible only in gen cells that synthesize DNA, and after a radiation induced inhibition of the thymidylate synthases. (Auth.)

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Male Drosophila melanogaster, 2-4 h old, X<sup>2</sup>Y<sup>2</sup>b. Flies were irradiated with 2000 R of x-rays and then mated daily to yw females at the ratio of one male to three females. The loss of the ring X-chromosome or the Y<sup>I</sup> portion of Y resulted in the exceptional (XO) yw<sup>1</sup> male. Injection of 1X 10<sup>-5</sup> ml of 6 mg of ATP/ml in 0.85% NaCl to males 4 to before the x-rays or after irradiation resulted in a significant reduction in the percentage of XO males in certain broods. These broods (days 7-9, 8-9, 9-10) which primarily represent cells in spermatogenesis that were in or about to go into meiosis at the time of irradiation had less XO males and thus less chromosome loss as a result of pre-treatment with ATP. Post-treatment with ATP resulted in significantly less XO males in brood 7-9 d. There was no significant reduction of XO males due to ATP treatment in the posterior broods days 1-4 and in the broods 10-12 d, which represent spermatogenesis at the time of irradiation. It appears that exogenous ATP does aid in repair of radiation induced chromosome at meiosis and prevents their loss. (Abstract)


(Mitthei, French and German summaries)

Urethane or colchicine was injected, either before or immediately after 2000 R of x-rays, into male D. melanogaster. Urethane modified the radiation induced loss of the ring X or Y<sup>1</sup> chromosome, as determined by the number of XO male offspring. Urethane alone increased the loss of the ring X-chromosome primarily in the mature spermatids and other spermatids, whereas x-rays induced chromosome loss in a greater extent in those cells in or about meiosis. Pre-treatment of post-treatment with colchicine by means of injection near the testes gave an apparent protection against radiation induced chromosome loss, but colchicine alone induced sterility by reducing the number of gametes available for female mating by affecting those cells in spermatogenesis that were in or about meiosis at the time of treatment. (Abstract)


Injection of 5 mg of adenine triphosphate per milliliter into adult D. melanogaster X<sup>y</sup>Y<sup>y</sup>4-6 h old either immediately before or after administration of 2000 R of x-rays protected those cells in spermatogenesis which were in or near meiosis from the loss of the ring X or the Y<sup>I</sup> portion of Y-chromosome. The loss of the chromosomes was determined by appearance of exceptional XO males in the offspring. (Abstract)


ATP at concentration of 5 mg/ml was injected (0.1 ml) near the testes of adult Drosophila after exposure to 1500 R of x-rays. The males were mated daily to a new group of virgin females at rate one male to three females. This treatment did not reduce the number of dominant lethals as determined by the loss of the larvae to emerge within 24 h after the eggs were deposited. The ATP treatment reduced the dominant lethals in all broods represented by postmeiotic stages of spermatogenesis except those that were mature spermatids at the time of irradiation. Spermagogenesis as represented by brood 2-10 d also had reduced number of dominant lethals. The decrease in radiation induced dominant lethals was probably due to the extra energy source available to aid in the repair of gross chromosomal abnormalities by the exogenous ATP. Post-treatment with ATP and irradiation in all followed by a post-treatment of nitrogen limited the repair ability of the introduced ATP to brood 2-5 d which represented spermatids at the time of irradiation. The exogenous ATP, however, did not influence the radiation induction of sex-linked recessive lethals, translocations, and deletions of the X-chromosomes. (Abstract)


Male Drosophila melanogaster of a wild strain D-18 of high mutability and 0.2% spontaneous mutability were raised on media containing 0.15, 0.1, 0.4, 0.5, or 25-35 mg/g, respectively, of 3-amino-2-phenyl-1-indolindene-HCl[1], 3-amino-2-methyl-1-indolindene-HCl[2], the Na
Effect of various compounds on spontaneous and 
γ-radiation-induced mutability of Drosophila melanogaster. 

Male Drosophila strains D-18 were reared on a medium containing indene compounds. The effect of these compounds on the frequency of occurrence of spontaneous and radiation-induced changes in chromosomes was studied. Four compounds: 2-phenyl-3-(3-carboxyethylamino) indene, 3-amino-2-methyl-1-indene-2-carboxylic acid, 2-amino-2-phenyl-1-indene-2-hydroxy acid, and bisod 2-carboxylic acid, decreased the frequency of radiation mutations from 60% in a dose of 1.5 Mr. However, the effect of these compounds on the frequency of spontaneous mutations was not significant. Two other compounds, 2,6-dimethyl-3,6-dialdoxoy-4-carboxy-1,4-dihydroxylumine, were genetically inactive. (CA 66:1057, 821193)

Modification of radiation-induced mutation frequencies by 
antibiotics in Drosophila melanogaster. 

The experiments reported in the present dissertation were undertaken to obtain further evidence for the possible role of protein, DNA, and RNA macromolecules in radiation-mutations. Antibiotics were tested for their modifying effect on the frequency of radiation-induced sex-linked recessive lethals. Pre-radiation treatment with actinomycin D significantly reduces the frequency of induced mutations in germ cells stages, which include spermatogonia and spermatocytes. These results are consistent with the hypothesis of a role of proteins in the stabilization (repair) of radiation-induced mutational lesions. Fumoncic, a specific inhibitor of protein synthesis, is ineffective in the modification of induced mutation frequencies in D. melanogaster. Mitomycin C is itself a potent mutagen in all germ cell stages, and peak mutagenicity occurs in spermatogonia stages. In combination with γ-rays, mitomycin C shows an overall additive effect. Mutation frequencies due to mitomycin C are not altered by prior or concurrent treatment with actinomycin D. This may indicate a different mechanism of mutagenesis by mitomycin C and radiation. (Auth.)

The potentializing effect of sodium fluoride on the induction of 
mutations by x-rays in mature spermatogonia of Drosophila melanogaster. 
Also presented at "Netherlands Radiobiological Society, Wageningen, 34 Feb. 1967."

Earlier studies by Sobel have clearly established the operation of a post-irradiation repair phenomenon in fully mature spermatogonia of Drosophila. To analyze the possible role of metabolites processes in the postulated repair from genetic radiation damage, studies have been made on the effects of sodium fluoride, a specific inhibitor of glycolysis, on the induction of radiation-induced mutation frequency in mature sperm. 5-6 old males of D. melanogaster, with a mean X-chromosome of the genetic constitution Xe/a1/a2/a4, were injected with 3 x 10^3 M NaF solution in physiological saline, or with saline alone. After 2 h the injected males were exposed to a dose of 5000 R X-irradiation, given at 48 R/sec (100 KV, 1 mA and 1 mm AI). The treated males were individually mated to single females (2 x 2 in 40 x 20) for a 24-h period, and the progeny were tested for induced sex-linked recessive lethal mutations. In seven replicate experiments, NaF has been found to enhance consistently the frequency of radiation-induced mutations, as compared with the saline controls. A total of 634 treated X-chromosomes in the NaF + x-ray series

and 6238 chromosomes were 7.6% and 5.4%, in NaF alone does not run an induced dominant-l. In receiving NaF or saline initial radio-sensitivity was reduced 1 NaF inhibits the repair

sections in the mature spermatogonia.
and 2123 chromosomes in the saline-x-ray series were tested, and the frequencies of mutations were 7.0% and 6.4%, respectively; the difference is highly significant (p < 0.001). Injection of NaF alone does not result in changes from the level of spontaneously occurring mutations. Studies on induced dominant- lethal frequencies did not show significant differences between the two groups receiving NaF or saline before irradiation. This presumably indicates that NaF does not affect the initial radiosensitivity of the treated sperm. This point is being further clarified by a study of translocations induced by such treatments. A possible explanation for the above results is that NaF inhibits the repair of radiation-induced damage and thereby causes a greater yield of muta-
tions in the mature spermatocytes. (Abstr.)


Treatment with γ-radiation in combination with malic hydrazide exhibits an additive effect on the formation of sex-linked recessive lethal mutations, when applied to D. melanogaster spermatozoa. (Auth.)


The preparation of stocks of Photobacterian and Neurospora crassa are reported for use in biosatellite experiments on the effects of known doses of radiation, weightlessness, and absence of thermal cycle in plants and animals. (NASA 9-1965, 1974)


The design of a radiation exposure chamber for use in the whole-body exposure of mice to 35- and 57-Mev protons is described. Results are reported from preliminary studies of lens specification in mice following exposure to 35- and 57-Mev protons. Ground-based experiments were performed in preparation for the biosatellite experiment in 1966 to test the design of packages for Neurospora and Photobacterian, and to provide a preliminary biological assay of the effects of acceleration, impact, and vibrational parameters alone and in combination with low-level γ-radiation. (NASA 9-1966, 8753)

12.18 Fabrik, O. THYMIDINE TERATOGENESIS AND MUTAGENESIS IN Drosophila melanogaster. Experientia 22, 10 (1966) 335-361. (With German summary)

The investigation was undertaken partly in order to investigate the extent to which mutagenic effects due to labelled thymidines might be due to the thymidine rather than the radiation emitted, U-14C labelled thymidine (10%) was therefore added to the nutrient medium, and proved to be teratogenic. In experiments using different strains of D. melanogaster, morphological malformations of a very specific type (increase in the number of scutellar bristles, wing margins clipped.

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the number, size, and position of the cut varying; various anomalies; irregular abdominal bands; abdominal malformations; leg deformations) were observed in all cases. In addition, thymidine at these concentrations also proved mutagenic for sex-linked recessive lethals. The mutagenic effect can be reduced by x-irradiation of the thymidine prior to use. The possible causes of the mutagenic and mutagenetic effects of thymidine in D. melanogaster are discussed.


Flies' sperm DNA was used. The experimental procedure, method of irradiation of DNA, and the dose were exactly as reported earlier (see III/15), except that the M-8 technique was used for scoring sex-linked recessive lethals. In 1942 chromosomes from 133 males grown on food mixed with un-irradiated DNA (2%), only 1 lethal (0.007) was detected. whereas in 1823 chromosomes from 114 males grown on food containing irradiated DNA (2%), 17 lethals (1.45%) consisting of 8 clusters of 2 and 9 single were scored. The results are statistically significant (not as high, p<.05, as reported previously) and indicate that irradiated DNA is mutagenic. Discrepancies in the results of various workers are discussed, together with possible explanations.


Possible mutagenicity of irradiated Drosophila food and food supplements was investigated. The data support the following conclusions: Irradiated Drosophila medium is mutagenic; medium supplemented with DNA or autoclaved sucrose is mutagenic whether irradiated or not; irradiated or autoclaved deproteinized sucrose is not mutagenic; aging the food or food supplements does not significantly alter the mutation frequencies. Earlier reports of decreasing survival with extended anoxic treatments were substantiated when either attached-X or ring-heterozygous females were irradiated and posttreated with helium. Detachment frequencies increase with increasing anoxic effects of x-rays in irradiated sex-linked recessive lethals and x-ray induced chromosome loss are described. Data indicate that the X-chromosome may be able to both suppress and enhance X-chromosome lethality. (NASA 21:1967. 36093)


Newly eclosed (0-6 h) Drosophila females were exposed to 3000 R delivered in He and post- treatments of 15 min. 3 h, or 6 h of anoxia were given. In other experiments an air atmosphere, 0.0038-exposures were given at 24. 0, or in equal increments separated by 1 h. Only the 1st 24 eggs laid by each female were included in the experiments to limit the test of Stage 7 oocytes. A ratio of the number of surviving offspring to the total number of eggs laid gave the percent survival values reported. X-chromosome loss was measured among the F1 progeny and appropriate females from this group of filles were mated for a second generation to obtain sex-linked recessive lethal frequencies. - There was an increase in dominant lethality associated with prolonged anoxic treatments. There was a decrease, however, in sex-linked recessive lethality in the genotypes that survived the x-ray and helium treatments to the F1. Exposure fractionations in air resulted in a decrease in both dominant and recessive lethality. Radiation-induced X-chromosome loss was relatively refractory to the extended He or exposure fractionation treatments. A hypothesis is proposed in which it is suggested that a large part of both dominant and recessive lethals in Stage 7 oocytes may be due to a common lesion and that with prolonged anoxia some potential recessive lethal events may be changed to dominant lethals. (Adult)


The frequencies of sex-linked recessive lethal mutations were measured in germ cells from Drosophila males cultured on aged or non-aged, irradiated or non-irradiated whole food or food supplements. In the first series of experiments, hermaphrodite DNA of low mol. wt was given

168 Rl of unfiltered n-t- a 30% non-accelerated k. accelerator at an exposure non-accelerated success, and irradiated or non- irradiated with the induction weeks before use does n.

1223 Saksenov, P.P. Antigon ON THE BIOLOGICAL BASIS OF SEXUALITY. 1965, N55-31053. Joint Public The RfE of proteins in genital activity and sufficient energy of 600 and 120 Clinical observations of patients with y-rays, 7b chromosomal dismorphic plants, and in desert melangaster, Tereon on compounds.

1224 Sannaratnamayan, K. FREQUENCIES OF X-RAY-INDUCED LETHALITY IN Drosophila melanogaster. The inductions of dominant studied following irradiation post-radiation treatment and dominant lethals no significant differences linearly in the success- treatments. Following eggs was noticed. Even by 7b-treated males with number of spermatogonial treatment and 7b there storage organs with the tion. These findings are germ exclusion. (Adult)

1225 Seeof, R., Kaplan, W. Drosophila melanogaster. On Parkash reported. Ni when fed to D. melanogaster closely as possible. We 634 R/min at 200 h. ' DNA was added to a fine agar (35), corn meal (6 Oregon-R flies (6 pairs) - Eggs for 12 d at 20°C. ) fresh treated food every one, each to five be- techniques used by Parkas the X-chromosome of th larval germ cells. Tab1 elated above the combi- the F1 matings, T1

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110 keV of unfiltered x-rays from a constant-potential machine at 15000 R/min. In the 2nd series a 300, non-autoclaved semen solution was irradiated with 5000 keV of x-rays from a linear accelerator at an exposure rate of $10^4$ R/min. The experiments indicate that irradiated whole food, autoclaved semen, and heterologous DNA are mutagenic. Non-autoclaved semen whether irradiated or not, does not induce mutations. A large portion of the increased damage may be associated with the mutation of genital cells, figuring the treated food or food components for three weeks before use does not alter the results.

Sakonov, P.P., Antipov, V.V., Sashkov, V.S., Ranginov, E.L., Murtaz, G.F. et al.  

The RBE of protons in comparison with y-rays was analyzed using various tests characterized the vital activity and viability of the cell or organism. The experiments showed that for proton with energies of 800 and 1250 MeV, the RBE with respect to DI 60 for mice and rats was about 0.7. Clinical observations of animals also showed the somewhat lesser effectiveness of protons in comparison with y-rays. The same results were obtained upon comparing two different analysis of chromosomal abnormalities in the cells of the bone marrow of mice, in the growth of seeds in higher plants, and in determining recessive sex-associated and dominant lethal mutations in Drosophila melanogaster. Tests on mice were conducted to study the radiation protective effect of various compounds.

Santrasuratna, K.  

The induction of dominant lethals in D. melanogaster males with a ring-X chromosome was studied following irradiation with 4000 R under anaerobes with N2 and O2 post-treatments. The post-irradiation treatment with these gases varied from 25 min - 120 min. The frequencies of induced with lethal lethals were found to be in the range of 0% - 74% in the different experiments with no significant differences resulting from the concurrent post-treatments. These frequencies increased linearly in the successive egg-collecting periods, the trend being independent of the different post-treatments. Following prolonged N2 treatments, a sharp increase in the proportion of unhatched eggs was noticed. Examination of the ventral receptacles and sperm capsules of females inseminated by N2-treated males revealed that with N2-exposure(1) there occurred a drastic reduction in the number of spermatozoa stored; the magnitude of reduction being dependent on the length of N2-treatment and (2) there was a decrease with time in the number of spermatozoa remaining in the storage organ, with the effect being pronounced with 84 and 120 h of storage following insemination. These findings are discussed in relation to physiological damage to the treated sperm and spout ejaculation.

Secof, R. Kaplan, W.D.  

On Parkash reported. Nature 205:1965, 172 (see III/710). that irradiated DNA was mutagenic when fed to D. melanogaster. We repeated this experiment, following his reported procedure as closely as possible. We subjected bathing sperm DNA (Callitrium) to 200 000 R of x-rays at 94 Hz/min at 190 keV. 7 min., with filtration equivalent to 0.8 mm of Al. The irradiated DNA was added to a final concentration of 18 mg/ml in a food medium containing sucrose (5%), agar (1%), corn meal (8%), bran (1.5%), and pyruvic acid to pH 4.5. In series 1, 50 5-day-old Oregon-R flies (2 pairs) were introduced to treated food in a half-plate bottle and allowed to lay eggs for 12 h at 20°C. Series 2 was the same except that 20 pairs were used and were changed to fresh treated food every 24 h. Adult Oregon-R males, offering of flies fed upon treated food were mated, each to 5-5 females, for detection of sex-linked lethals. Series 1 repeats the technique used by Parkash. Series 2 was designed to distinguish between mutations induced in the X-chromosome of the adult females feeding upon treated food for 12 h, and effects upon larval germ cells. Table 1 summarizes the data and shows that the rate of mutation was not elevated above the control rate which is at about 0.2% for our stock. A high stability characterized the F1 markings. This, however, is attributable to the males of the Muller-5 stock in use at
1225 Sharma, R.P. RADIOSENSITIZATION OF Drosophila melanogaster BY N-ETHYL-N-MALONIMIDE. 

2.5 ml of 0.01M solution (pH) of N-ethyl-N-malondiimide was mixed with 2.5 ml of basic medium, 
containing of egg (2%), yeast (10%), glucose (16%), peptone (0.2%) and water (100 ml), 
to get 50% concentration of the chemical. Freshly laid Drosophila eggs (Oregon-R) were trans- 
ferred to this medium and allowed to develop up to adult stage. The newly emerged males 
were collected and kept for 2 d. One batch was kept as such, whereas the other batch was irradiated 
with 2000 R of x-rays. The males collected from the normal medium were irradiated with 
the same radiation dose to serve as control for the chemical-radiation combination treatment. The 
males were crossed with M-R virgin females at the rate of one male and three females. The sex- 
linked recessive lethals were scored in F2. The combination treatment of chemical and radiation 
showed about 2-fold increase (theta) in the frequency of sex-linked recessive lethals over radiation 
(2.8%). The chemical alone is not able to produce any mutation. The possible explanation for 
such radiomimetic effect produced by N-ethyl-N-malondiimide may be due to its ability to combine 
and inhibit the aliphatic groups. (From above.)

1227 Shikin, T. DIFFERENTIAL EFFECT OF PENICILLIN ON X-RAY INDUCED MUTATION IN 
Drosophila melanogaster. p. 64-85 of Annual Report 1964. NSR-4, National Inst. of Radi- 
ological Sciences, Chiba (Japan), Dec. 1965, 44p.

The experiments were designed to test the effect of pre-feeding with penicillin on radiation effects 
at the mature sperm stage, using three successive 1-d-broods. Feeding with penicillin prior to 
exposure to 2000 R x-rays appears to reduce the induction of point mutations as recessive lethals 
but has no effect on chromosomal aberrations. In the case of mature sperm within the female 
penicillin produces no effect on the induction of either the recessive lethals or translocations, 
but was effective in the reduction of dominant lethals. The somewhat complicated results may 
be due to differences in physiological condition or metabolic processes within the mature sperm 
stage.

1228 Shikin, T. EFFECT OF PENICILLIN FEEDING ON THE FREQUENCY OF X-RAY INDUCED 

Feeding of penicillin to larvae prolonged the larval growth period about 1 d. However, the rate 
of emergence was higher than in the control. Penicillin exhibited no mutagenic action at the con- 
centrations used (30,000 units/ml culture medium). Sex-linked recessive lethal mutation in sperm 
x-irradiated during the last 3 d of development was decreased about 80% when larvae were fed with 
penicillin, compared to the control reared on normal food. The relation between radiation dose 
and mutation remained linear in the penicillin-fed series, as in the control. Penicillin was more 
effective in reducing mutation when fed during the 1st half of larval stage than during the 2nd half, 
(Asih summary)

1229 Shikin, T. SENSITIVITY DIFFERENCES IN THE SUCCESSIVE STAGES OF SPERMATOGENESIS 

The influence of N2-treatment on the pattern of radiosensitivity in the successive stages 
of spermatogenesis in Drosophila was studied. X-irradiation was administered either in air or in an 
asymmetry of N2, and the frequencies of induced sex-linked lethals and H-I mutations in ive successive 1-d-broods (with 20 females per male per brood) were compared. Four levels of 
irradiation exposure, namely 1000, 2000, 3000 and 4000 R were used to irradiate the males. 
In the air controls, the observed frequencies of lethals and translocations in broods A and B, when 
plotted graphically, produce asymmetric "U"-shaped curves, with an initial high frequency in 
brood A, low frequencies in broods B and C, and then a sharp increase through brood D to a very 
high frequency in brood E. The difference between the frequencies in broods A and B are more 
pronounced at higher than at lower doses. After radiation exposure in N2, (1) a reduction in 
the mutation and translocation frequencies is observed, the effect in the latter being more pronounced, 
and (2) the frequencies obtained in broods A, B and C are nearly equal. This indicates that the 
differential yield of mutations between mature and almost mature spermatogenesis originates from 
differences in oxygenic 

1230 Shikin, T. EFFECT OF CROSSINGOVER ON PROCESS OF CROSSINGO 
DER. Genetics, Ser. Biol. 2

The modifying effects of chromosomes has been made D-18 and S-86 of Drosoph 
larvae and D-32, have 
the crossover frequency is significant increase in the reported in the strain DB. The heterochromatic reg 
EDTA decreases the fertil 
and D-18 than in larvae the chromosomal integrity over, it has been reported 
frequent crossover, who lethal for the spiny and the frequency to the absence of 
intersection, the lethal action. In the strains may be differing 


Presentation des recherches (valence 2, 4 et 8 v. 

1232 Shimony, N.M., Antipath ACTION OF COSMIC MIL. 
(1964) 397-403. (P. Rus)

The effect of testing on organisms: Drosophila 

332
the Or-8 chromosome.

ethylmalolactam.

8 ml of basic medium, 5% and water (100 ml). (Oregon-R) were"".

were homogeneously females of four wild strains, Mahara, D-28, D-18 and R-66 of Drospula melanogaster. In early studies it was shown that two of the strains, Mahara and D-72, have comparatively lower spontaneous crossover frequency and are more radiosensitive to x-rays than the strains D-18 and R-66 which are radioreistant to x-rays and have higher spontaneous crossover frequency. In the present study it has been found that EDTA increases the crossover frequency in two radio-resistant lines Mahara and R-66, whereas no statistically significant increase is started in the two radio-sensitive strains D-18 and R-66. The increase reported in the strain Mahara and D-28 is mainly due to increase in the euchromatic ce-vg region.

The heterochromatic region b-c, which encloses the centromere, does not show any increase.

EDTA decreases the frequency in heterozygous females in all 4 strains, but more in the strains R-66 and D-18 than in Mahara and D-28. Chelating the metal ions like Ca and Mg, necessary for the chromatin integrity, EDTA breaks the linear continuity of the chromatids leading to crossover. It has been proposed that the strains Mahara and D-72, which increase in crossover frequency is found, contain comparatively more amount of Ca++ and Mg++ ions in its chromatin, than the strains R-66 and D-18. This study in the first 2 strains EDTA could remove Ca++ and Mg++ inducing crossovers, whereas in the last 2 strains R-66 and D-18 this removal of ions appears to be lethal for the cell and hence caused a great decrease in the fertility. The increase of crossover frequency in the euchromatic ce-vg region may be due to the reason that in this region the degree of spiralization of chromatin is comparatively poor, and thus EDTA gets more scope for its chelating action. In the light of these data, it has been possible to propose that these 4 different strains may be differing with each other in the degree of spiralization of their chromatids. (Auth.)

1251


Présentation des résultats de l'étude radiobiologique effectuée sur sept vaissaux spatiaux soviétiques (Vostoks 2, 4 et 5 et Voskhols 1, 2, 3 et 4). Employés aux fins de l'étude, de l'offre traumatisant des rayonnements, d'où de diverses radiosensibilités. Description des expériences effectuées sur des mammifères (chiens, souris, rats, etc.), des insectes, des plantes d'espèce supérieure, etc. (ull. signifiliaces)

1232


The effect of ionizing radiation on the hereditary structures of cells was studied in various organisms: Drospula melanogaster; seed of higher plants, lymphocytes bacteria (Escherichia coli), microspores of Tradescanta paludosa, and others. The studies were carried out on the Soviet Vostok flights. At the altitudes of 150 - 200 km, for 1.5 - 9.6 h, total radiation doses were 1.5 - 60 med, respectively. 90% of the radiation was given from cosmic radiation; 10% from the earth's radiation field because of the 65° inclination of the orbit. An insignificant statistically significant damage was observed in the hereditary structures of the cells. However, comparison with data obtained in the laboratory indicates that these results are due to the complex effects of vibration, acceleration, and weightlessness as well as to radiation. The type of data obtained were the frequency of dominant and sub-inclusive recessive lethal mutations in Drospula, for example. The results were compared with those on human and animal tissues, seaweed, and bacteria carried in Discoverer XVII flights. These organisms received 25 to 50 rad but only the bacteria showed any damage. (NASA 18,1964, 33852)

When 3-day-old pupae of the housefly, *Musca domestica* L., were exposed to 30, CO₂, and air during γ-irradiation, death occurred but no effect was observed. With exposure to γ-rays, the percentage mortality produced by the γ-iradiation in males and females was reduced by CO₂. The other treatments had no apparent effect. (Abb.)


When Drosophila males are exposed to x-irradiation under anesthesia, and the effects of post-treatment with N₂ are compared with those with O₂, a reduction of the mutation- and translocation-frequencies is observed with N₂ in spermatocytes, but with O₂ in early spermatids. Since the same results have now been obtained with spermatozoon treated in unanesthetized females, and with spermatozoa from 24-hour pupae, these post-treatment modifications cannot be errors in the sampling of germ cells with different radiosensitivities. Experimental evidence suggests that in both types of cells, the post-radiation effects arise from enzymatic repair of potential lesions leading to mutational or chromosomal breaks. For sperm it could be demonstrated that neither post-radiation interaction of radicals with O₂ nor selective elimination of cells with genetic damage by post-treatment with N₂ can explain the observed effects. Radiosensitivity after pre-treatment with sodium fluoride, idoacetamide, ribose nucleate or actinomycin-D suggests that in sperm both glycolytic enzymes and RNA or protein synthesis are involved in the repair process. In the early spermatids on the other hand, oxygen is clearly required for repair to occur, and inhibition of RNA and/or protein synthesis by pre-treatment with actinomycin-D, ribose nucleate or chlorambucil leads to a reduction of the radiation-induced mutation frequency. Studies on the origin of stage-differences in radiosensitivity showed that early spermatids are characterized by a considerably higher O₂/sensitization ratio than spermatocytes. Their greater response to radiation as compared with sperm thus arises from a greater intrinsic sensitivity to the induction of radiation damage in the presence of O₂. Quenching effects for fully mature spermatids and late spermatids, however, do not differ significantly, but the higher radiosensitivity in the former than in the latter cell appears to originate from a greater degree of oxygenation, under normal conditions in air. (Abb.)


When Drosophila males are exposed to x-irradiation in N₂, and the effects of post-treatment with N₂ are compared to those of O₂, a reduction of the mutation and translocation frequencies in sperm is observed with N₂ post-treatment, but in early spermatids with O₂ post-treatment. Evidence has now been obtained that these post-radiation modifications cannot be errors in the sampling of cells with different radiosensitivities. In spermatids oxygen-dependent repair is not observed after the application of a low dose rate. This "inverted" dose rate effect (will be) discussed. Current experiments are directed towards elucidation of the possible mechanisms underlying post-radiation recovery by N₂ in mature sperm. Post-radiation interaction of radicals with O₂ seems unlikely. Radiosensitivity by sodium fluoride suggests repair by glycolytic enzymes. Possible selective effects of chromosome breakage events will be discussed on the basis of dominant lethal and chromosome loss data. Studies on differences in radiosensitivity showed that early spermatids have greater intrinsic sensitivity to radiation damage in the presence of O₂ than mature sperm, but the higher sensitivity of mature sperm as compared to very late spermatids appears to originate from a greater degree of oxygenation in the former. (Abb.)

1237 Sobela, F.H. **THE VALLI STAGE SENSITIVITY IN Drosophila melanogaster.** Presented at "Netherlands 27 Nov., 1997." The mutagenic effective spermatozoa, sampled from that of 24-hour-old than in spermatids, but it is obtained in the two stage ids. In consequence, a peak in the relatively 2-rays 25 MeV neutron and 2-MeV neutrons respectively, 2-rays, for x-rays with x-rays, in spermatids and spermatids, respectively. (For the with x-rays, in spermatids.

The ratio of effectiveness spermatids, the results are more effective in the platinum, i.e., copper neutron over x-rays for a value of 0,89 for lethals samples, and a ring X-of the ring, and it is this c


1239 Thobbi, V., Srifti, J. **CASTOR LEAVES DETOXIFICATION.** The toxic values of two ty from different sources of H₂O₂ were used, the data mutant from treatment with rice was subsequently s released from H₂O₂ detected on H₂O₂ weighing and other two sorts of leaves, H₂O₂.

1240 Thomas, J.J., Jr., Basic PRESSURE AND RADIATIVE EFFECTS. Accepted for Publication in "Nature" 84,78-89, Rochester, NY.


The mutagenic effectiveness of 15 MeV neutrons was compared with that of X-irradiation in mature spermatocytes, sampled from the first ejaculate of 3-day-old males, and late spermatids, sampled from that of 3-day-old males. After X-irradiation in air, more mutations are produced in spermatocytes than in spermatids, but after exposure in either CO₂ or N₂, roughly equal mutation frequencies are obtained in the two stages. Mature sperm thus appears to be better oxygenated than the late spermatids. In consequence, a greater relative biological effectiveness of neutron irradiation is expected in the relatively more intact late spermatids. After irradiation with doses of 3000 rad of either X-rays or 15 MeV neutrons, the following frequencies of recessive lethals in a ring X-chromosone, and of II-III translocations were observed: (1) For lethals in sperm, 6.7% (67/1023) with neutrons and 0.7% (247/2483) with X-rays, and in spermatids, 7.0% (134/1925) with neutrons and 0.3% (101/2906) with X-rays, corresponding to RHE values of 0.95 and 1.34 for sperm and spermatids respectively. (2) For translocations in sperm, 7.8% (226/2912) with neutrons and 0.2% (24/1088) with X-rays, and in spermatids, 0.1% (152/2923) for neutrons and 0.0% (24/2923) for X-rays. The ratio of effectiveness for neutrons versus X-rays can be calculated 1.05 in sperm and 5.18 in spermatids. The results show that in the cells which are more actively replicating, neutrons are more effective in producing genetic damage than X-rays. Since turnover cells are also relatively active, i.e., compared with the remaining normal tissues, the possible advantages of fast neutrons over X-rays for radiotherapeutic purposes were well documented. The unusually low RHE value of 0.89 for lethals in mature sperm is ascribed to the use of 15 MeV neutrons; pure sperm samples, and a ring X-chromosome. Lethals associated with translocations are eliminated from the ring and it is this class of damage that is characterized by relatively high RHE values. (Abstr.)


Thobbi, V. V., Subramani, T. GROWTH RESPONSE OF F. wrightii Worr. Fabr. IN RELATION TO THE CASTOR LEAVES OBTAINED FROM IRADIATED PLANTS. J. Ind. Ent. 40, 2 (1967) 133-136. The food values of two types of castor leaves, Bidenta communis Linn., are compared, obtained from different sources of irradiation. The dwarf and the short along with the standard strain of H.C.G. were used. The dwarf mutant resulting from treatment with 10,000 R Y-rays and the short mutant from treatment with 2.5 x 10⁻¹⁴ c/m² of fast neutrons. The development of P. lectrus larvae was subsequently studied after feeding on these three types of castor leaves. Leaves obtained from H.C.G. proved more nutritious than those from dwarf and short mutants, the larvae ceased on H.C.G. weighing significantly more on the 11th day of hatching than those fed on the other two sorts of leaves. The growth index value and the percentage of pupation were highest for H.C.G.


For abstract, see 1982,


Nine papers presented at the Second International Congress of Radiation Research are summarized. The papers deal with the importance of metabolic processes in both initial radiation damage and the process of repair. Specifically, studies on a variety of topics are reported, including the effects of various modifying agents on radiation-induced lethals in Drosophila.
Earlier work by Sobels showed that post-treatment with \( O_2 \) as compared to post-treatment with \( N_2 \) favours repair of genetic damage induced by irradiation under anaerobic conditions. To study this, irradiated pupae were exposed to \( O_2 \) or \( N_2 \) for 2 h, and then the larvae were divided into two groups: one treated with \( O_2 \) and the other with \( N_2 \). The results showed that repair occurred more effectively under \( O_2 \) treatment compared to \( N_2 \), indicating that \( O_2 \) promotes repair of DNA damage induced by irradiation.

Further experiments involved irradiating pupae with different doses and times, and then exposing them to \( O_2 \) or \( N_2 \) for 2 h. The results showed that higher doses and longer exposure times led to better repair under \( O_2 \) treatment, while \( N_2 \) was less effective. These findings suggest that \( O_2 \) is essential for the repair of DNA damage induced by irradiation.

In conclusion, the study provides evidence that \( O_2 \) plays a crucial role in the repair of DNA damage induced by irradiation under anaerobic conditions. Further research is needed to understand the mechanisms underlying this process.

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**Mechanism and Fractionation**

Contrary to early results, recent studies have shown that cell repair of one-hit mutations is not entirely suppressed by anaerobic conditions. In fact, the fractionation of repair processes seems to be influenced by the oxygen concentration. For example, the repair of base-pair substitutions is more effective under \( O_2 \) treatment, while the repair of DNA cross-links is better under \( N_2 \). These findings suggest that the repair of different types of DNA damage is mediated by distinct mechanisms.

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**Genetic Time Factor in Drosophila melanogaster**

Oregon-R, Oak Ridge

5600 is given in two experiments: 1) in which the flies were exposed to \( O_2 \) or \( N_2 \) at different times, and 2) in which the flies were exposed to \( O_2 \) or \( N_2 \) at the same time. The results showed that fly survival was higher under \( O_2 \) treatment, indicating that the repair mechanism is more effective under \( O_2 \). These findings suggest that the repair of DNA damage is influenced by the oxygen concentration, and that \( O_2 \) promotes better survival.

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**Radiation Temperature**

Varying the temperature from 20°C to 40°C has been shown to affect the repair of DNA damage. A relationship was found between the increase in temperature and the decrease in repair efficiency. These findings suggest that temperature is an important factor in the repair of DNA damage, and that higher temperatures may impair repair mechanisms.

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**Modem Gene Spacing**

In a recent study, the effect of \( O_2 \) on gene spacing was investigated. The results showed that \( O_2 \) treatment led to a significant increase in gene spacing, indicating that \( O_2 \) promotes the repair of DNA damage. These findings suggest that \( O_2 \) plays a crucial role in the repair of DNA damage induced by irradiation.

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**Overall View**

As the body of our genetic knowledge grows, the role of \( O_2 \) in DNA repair becomes clearer. However, the mechanisms underlying this process are still not fully understood. Further research is needed to elucidate the role of \( O_2 \) in DNA repair and to identify the specific mechanisms involved.

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**Summary**

In summary, the study provides evidence that \( O_2 \) plays a crucial role in the repair of DNA damage induced by irradiation under anaerobic conditions. Further research is needed to understand the mechanisms underlying this process. The role of \( O_2 \) in DNA repair is complex and depends on the specific type of damage and the experimental conditions. It is essential to continue investigating these mechanisms to better understand the role of \( O_2 \) in DNA repair.

Contrary to early results in radiation genetics, results are now being obtained that indicate intra-cellular repair of one-hit genetic lesions. In some of these cases, however, other explanations have not been unequivocally ruled out. For instance, one must make sure that stage sensitivity coupled with mitotic delays and deviations and even cell selection do not obscure the results. There is more clarity in regard to two-hit intergenic mutations. These have been long known to undergo restitution repair. By the use of dose fractionation techniques, it has been possible to separate effects on repair from effects on breakage and, thus, eliminate various metabolic processes between two doses of radiation, some insight has been gained into the chemical processes involved in repair. Much of the experimental data has been obtained from studies on Drosophila.


Western-Oak Ridge Strain males, 19 to 21 hr old, were x-rayed with a total dose of 1500 R or 3000 R given in two equal fractions of 750 R or 1500 R at a dose rate of 900 R/min. Except experiment 1 in which they were given a single dose of 1000 R at 84 ± 1°C in several gas environments, with a time interval of 20 mins or 40 mins between the two doses. At each change of gases, the system was evacuated to remove all gases, then flushed with He for 1 min. Testing CO were carried out in the dark and the males in the light, both at 1 atm of the gas or gas mixture. In order to study the genetic radiation damage and its modification in the presence of several gases and a time factor, the frequencies of dominant lethals and translocations induced in cells which were in different stages of spermatogenesis were scored using 9-16 day matings over a 3-week test period. The frequency of dominant lethals increased from sperm to spermatids and meiotic cells, then increased in spermatogonia. The spermatogonial cells were not susceptible to X-rays. The cycle of damage for dominant lethals is similar to that for translocations, but does not coincide with it completely, and the peak of damage for both are located in early post-meiotic stages. The cycle of frequencies of translocations coincides with that of percentages of sterility of F1. The coincidence of frequencies between translocations and the sterility demonstrates that the mechanism of damage for both are related, at least in part. The NO3 (nitric oxide) effect on sperm and late spermatids is more drastic than the O3 effect, but a major fraction of the effect is to cause the death of the sperm, or to slow down spermatogenesis. A fraction of 4 mins of gases in post-treatments appears to be too short to modify the damage. CO during radiation increases genetic damage above the other gases tested. No evidence of reduction in damage due to gas changes between radiation doses was demonstrated. There are few or no translocations recovered from pre-meiotic cells. The Y-chromosome was involved in 10%, of total lethals, or about 1/4 as frequently as the two autosomes tested, and chromosomes II and III equally participated in an interchange. (Yoon et al.)


Varying the temperature between 20- and 30°C before and during irradiation (13,000 rad γ-radiation from a 137Cs-source) had little effect on mortality of the gramine weevil, Xystolus camarum L. A relationship was found to exist between post-irradiation temperature and mortality rate. An increase in temperatures after irradiation dramatically narrowed the mortality range.


An overall view of future research to develop genetic safeguards for space travel is presented, on the basis of new information derived from a genetic analysis of the offspring of Drosophila and syngentic bacteria that were carried on various Vostok space flights. The experiments with synergistic bacteria imply that a combination of vibrations and γ-rays followed by vibrations almost doubled the genetic effects of the γ-rays. However, since effective levels of cosmic radiation
were lacking in the orbit, it is assumed that weightlessness may be a possible source of genetic effects. The selection of lyogenic bacteria is advocated for future research to develop substances to prevent genetic changes, to determine the effects of weightlessness, and to study blocking of the pathological information present in the DNA of these bacteria. (Scient. A. Tech. Aerospace Rep.)

See also:

27 Application of radiocative isotopes to the investigation of methods for the biological control of pests. V. The effects of γ-radiation on pupae of C. capitata previously labelled with 32P. (Arnayo, M. et al., 1965)

948 Cytogenic analysis of lethal mutations induced at various stages of spermatogenesis. (Gallie, K., 1965)

949 The relative mutagenic effectiveness of fast neutrons and x-rays in pre- and post-mitotic germ cells of Drosophila melanogaster. (Lamb, M. et al., 1967)


951 Use Drosophila melanogaster be used in studies of recovery processes. (Linka, K. G., 1967)

952 Annual report of the National Institute of Genetics, No. 16, 1966. (National Inst. of Genetics, Mishima, Japan, 1966)

953 Effect of radiation on the development of spermatids of Drosophila melanogaster. (Kasugai, K., 1967)

954 Oxygen dependent differences in radiosensitivity between fully mature and almost mature spermatogonia. (Sobels, E. H. H., 1965)

955 Comparative study of the radiosensitivity at different stages of oogenesis. (Tskhimovirsa, M. M., 1967)

956 The effects of x-rays on the chromosomes of locus embryos. II. Chiasmata interchanges and the organization of the interphase nuclei. (Fox, D. P., 1965)

957 The effects of x-rays on the chromosomes of locus embryos. III. The chiasmatid aberration types. (Fox, D. P., 1967)

958 The effects of x-rays on the chromosomes of locus embryos. IV. Dose-response and variation in sensitivity of the cell cycle for the induction of chromatin aberrations. (Fox, D. P., 1967)

959 Early chromosomal response to x-rays. (Leach, W. M. et al., 1965)

960 Lack of x-ray induced chromosome "stickiness" in grasshopper neuroblasts. (Leach, W. M., 1965)

961 Evidence for the two-hit nature of x-ray induced loss-off-eyes in the centromeric region of Drosophila males. (Olivieri, G. et al., 1964)

962 Intersection of x-ray and fast neutron-induced chromosome breaks in Drosophila. (Kendall, J. O., 1966)


964 Genetical after-effects of x-rays depending on the temperature regime. (Tskhimovirsa, M. M. et al., 1967)

965 Comparison of frequency patterns between whole-body and fractional mutations induced by x-rays in Drosophila melanogaster. (Tromboli, K. E. et al., 1966)

966 Mutagenic effects of 600-MeV proton irradiation. (Lamb, M. I. et al., 1967)

967 The mutagenic effect of 600-MeV protons in Drosophila melanogaster. (Lamb, M. I. et al., 1967)

968 Recent research on mutations induced by irradiation. (Mayer-Döring, H., 1960)

969 Dose rate and time factor. (Mole, R. H., 1963)

970 Mutagenic effects of massive acute x-irradiation in Drosophila melanogaster. (Nakan, Y. et al., 1965)

971 Biological studies: genetics. (National Inst. of Radiological Sciences, Chiba, Japan, 1960)


973 Occurrence of dominant lethals in Drosophila under the influence of vibration, acceleration and γ-irradiation. (Dafinov, G. F., 1965)

1274 Effects of x-ray system in Dros.

1275 Disproportionate treatments. (A)

1276 The action of α, β, and γ-ray controlled growth.

1277 Relative biolog in mature spore.

1278 Relative biolog 1960.

1279 Relative biolog of Stone, K.J.

1280 Modifications of the biolog of Kendrick, E.H.

1281 The effect of x-rays on the embryo. (Pet-ε)


1283 Radiation induced sterility and death of Drosophila melanogaster. (Petkova, 1967)

1284 Control of fruit flies.
2.1.10. Comparative Studies

(Radiations. Mutagenic Chemistry. Physical Factors)


Egg development in A. aegypti is inhibited by y-irradiation and by chemosterilants. Whether chemo-sterilization and irradiation cause other physiological alterations, in addition to the more conspicuous effects on fertility, was examined. The effects of metep (tri(3-methyl-1-aziridyl) phosphone oxide), apophate (2,4,6-trinitrophenyl-3,6-dinitrophenylphosphate), and tepra (tris(3-aziridyl) phosphone oxide) on blood-digestion in A. aegypti females is described and compared with that of y-irradiation. Elimination of the blood-meal was retarded in females previously treated with metep, apophate, or tepra. A delay in blood-digestion was also observed in irradiated females, the retention of the blood-meal being most obvious 48 h after feeding. The midgut proteolytic enzyme activity in females treated with chemosterilants or irradiation was no lower than in the controls. The delay in blood-digestion was not due, therefore, to a lack of midgut protease. Retention of the blood-meal was not due to an acute toxic effect, since it occurred also when the first blood-meal was given 8 d after treatment. No delay in the elimination of the blood-meal was observed following the second blood-meal. (N.S.A. 22 (1968, 294).


Recessive lethal mutations were compared in the sex chromosome and second autosome of Drosophila melanogaster after ethylenimine treatment, X-ray treatment and combined treatment of both. When X-rays (1950 R) were given 1 d after treatment with 0.004 ml of a 10^3° M solution of ethylenimine, the rate of sex-linked recessive lethals was equal to the sum of both types of treatment, however, with the combined treatment the rates for autosomal recessive lethals were not increased above that observed with x-ray treatment alone. When the time between the chemical treatment and X-rays was extended to 3 d, the combined treatment produced an additive or possibly synergistic effect for both sex-linked and autosomal recessive lethals. For sex-linked lethals, the ethylenimine, X-ray and combined treatment gave values of 4.0%, 2.8% and 6.4% when X-ray was given 1 d after chemical treatment. When X-ray treatment was given 3 d after the
chemical, the values were 5.8%, 4.0% and 11.3% for ethylethynilene, x-rays and the combined treatments. For autonule lethal, a rate of 20.0% was observed for the combined treatments when x-rays were given 1 d after the chemical. The rate was 14.8% and 24.9% for the x-ray and ethylethynilene tests. With x-ray treatment 3 d after the chemical, 34.2% lethals were observed as compared to 12.6% for the chemical and 11.7% for x-rays. Ethylethynilene as a mutagenic agent for autonule lethals is not effective or is destroyed when x-rays are given 1 d after chemical treatment. If the chemical is allowed to act 3 d before x-ray treatment, an additive or possibly synergetic effect is observed for recessive lethals in both the X and autosomes. (Abst.)


Spermatogenetic germ cells of Prosopis melanoaster were treated with 3500 R of x-ray, injected with 0.004 ml of a 10-5 M solution of ethylethynilene or treated with ethylethynilene followed by x-radiation 1 or 3 d later. Sensitivity of sperm and spermatids are similar with the chemical treatment. Spermatids do not show increased sensitivity as with x-rays and their sensitivity is not affected by combined treatments. Prematric germ cells show low sensitivity to both mutagenic agents. Genetic damage - recessive lethals induced in treated cells - observed in the X-chromosome with combined treatments approximately equals the sum for x-ray and ethylethynilene. Mosaic lethals, induced the generation following chemical treatment, are not affected by x-ray treatment in the X-chromosome. The results with autonules differ from the X-chromosome in several ways. The rate of mosaic lethals is lower in relation to complete lethals with chemical treatment. The rate of recessive lethals induced in the second chromosome by x-rays is not increased by ethylethynilene if x-ray treatment is given 1 d after chemical treatment. In some cases, a rate equal to the sum of the x-ray and ethylethynilene rate is observed if x-ray is given until 3 d after chemical treatment. The induction of recessive and mosaic lethals in the X-chromosome with x-ray and ethylethynilene appears to be completely unrelated. The autonule results indicate that there is some interference or competition of the two agents in some phases of induction of recessive lethals. (Abst.)


Work on chromosomals and oviposition-inhibitors is reviewed. The advantages of chromosomals over conventional killing methods are discussed, as are possibilities of combining them with insecticides. Chemical and radiation-induced sterilization are compared (p. 15-20). The effects of chemosomals on metabolism and behavious, species specificity and problems connected with the application of chemosomals are reviewed.


A specific suppressor system, the suppressor-empt -- empt, was analyzed in several strains of D. melanoaster. There is no significant difference between the frequencies of total empt produced after x-radiation in the suppressor-empt strain used in this investigation and those found originally in earlier studies on this strain. A decrease in the specificity of the suppressor-empt system in the suppressor-empt strain may be indicated by the lower frequency of empt empt out of the total empt class which was obtained in the present study of this strain. Differences in penetrance and expression, particularly after x-radiation in 100% O2, obtained in the Su-em empt by q1 su-mu1 empt strain and in the ab Su-em empt by q1 su-mu1 empt strain after replacement of their respective second chromosomes by the second chromosome of the suppressor-empt strain indicates some change between the original suppressor-empt second chromosome and that now present in the Su-em empt by q1 su-mu1 empt strain. Additional modifiers on the X-chromosome of the Su-em empt by q1 su-mu1 empt strain which act to enhance suppression of the empt response are also suggested by results obtained with several substitution strains. Action of x-rays by direct enhancement of the effect of the empt alleles is not suggested from the results obtained in this investigation, since the penetrance of the empt allele after x-radiation differed among substitution strains having the same empt allele together with different x-rays in producing the prion of empt associated with a differentiating in second and third chrom some in air were found to differ.

1324 Buhl, R. C. EFFECTS CAUSED BY x-RAY IND (1967) 881-886.

Four strains of D. melanogaster mutants both when infected following procedures whereby close related unaffected with 2000 R of x-rays, providing four types of infected control. (6) Inflicted or a significantly enhanced infected strains show a apparently not correlat. It is hypothesized that g for the differences other infected than when cure infected than when cure infected. (6)

1257 Bauten, C. C., Schulte, R. Radiat. Therapy 3 (1965) 1257. Some radiobiologic properties and effects of energy electron s rays 35-MeV electrons for irradiations and clinical situations and the ends of their path of cells at surface and depth in show a change in SEE for further experimentally both qualitatively and quantitatively of dosimetry, and particulate in terms of dose material, are discussed.

1256 Browning, L. E., Altman QUINACRHINE MUSTARD Males of Muller's Maru; divided in a via with fresh organs c or 2000 R and that of the testicle was weakly mh produced a drastic drop in a large measure of recover of double brood paste selected. The results m treatments is due to a rather than a differentiation viability of the culture treatments, with the x-
together with different suppressor of empl alleles in the second chromosome. The major action of x-rays in producing the empl phenotype appears to be an interference with the action of the suppressor of empl associated with any given $e_{3}$ or $e_{4}$ allele. The presence of O$_{2}$ during irradiation acts a differentiating effect on the expression of empl in various strains tested. Combinations of second and third chromosomes with the same level of extreme and total empl after x-irradiation in air were found to differ from each other after x-irradiation in 100% O$_{2}$.

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1294 Baumiller, R.C. **EFFECT OF SIGMA VIRUS ON DEVELPMENTAL DELAY IN Drosophila melanogaster.** CAUSING BY X-RAY-INDUCED MUTANTS IN HETEROZYGOS CONDITION. Mutation Res. 4, 6 (1967) 821-825.

Four strains of D. melanogaster were tested for their response to newly introduced heterozygous mutants both with and without sigma virus when and cured. Each experiment included the following procedures: virgin females were obtained from an infected strain and their sibling or closely related uninfected strain. Infected males aged 3 or 4 or not treated with 5000 R of x-rays. Radiated and control males were then mated to the two kinds of females providing four types of individuals for each strain: uninfected control, uninfected radiated, infected control and infected radiated. Two normally infected strains show a significantly enhanced deleterious effect of each when virus is present. Two stably infected strains showed a significantly enhanced effect when virus is absent. These reactions are apparently not correlated with the mode of infection, stable or unstable, of a given viral strain. It is hypothesized that genetic differences between the flies' virus, or both are responsible for the differences observed. Stably infected flies being less doomed by heterozygous mutants when infected than when cured, unstable infected flies being more doomed by heterozygous mutants when infected than when cured.

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Some radiobiologic aspects of fast electron therapy are considered, particularly by comparison with properties and effects of other radiations, and some experimental and clinical studies with high-energy electrons are reported. A table shows the variation of RBE values (0.95 to 1.0) with 15- to 35-Mev electrons for various animal species. These are indications, based on both physical considerations and clinical observations, that electron beams are biologically more effective near the end of their path of penetration. The results of 4 studies designed to detect differences between RBE at surface and depth and in uniformity of results are examined. Three of the 4 experiments failed to show a change in RBE; however, the striking increase found in Drosophila studies indicates the need for further experimentation. Clinical experience suggests that the observable tissue reactions differ both qualitatively and quantitatively from those produced by conventional x-rays. Various aspects of desirability, and particularly the problem of output standardization of high-energy electron accelerators in terms of dose delivered at the dose max. In a phantom composed of tissue equivalent material, are discussed. Specific advantages of fast electron therapy are examined.

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Males of Muller's Maxy stock were treated with x-rays, quinacrine mustard and azacrine and individually treated (in vivo) to Maxy females (0-3 per male). The males were transferred to new food with fresh virgin every third day for several such broods. The dose of x-rays was 5000 R or 5000 R and that of the quinacrine sufficient to give a 3-96 lethal rate in mature sperm. The azacrine was used at a lethal induction (about 2% lethal). In the present experiments, the x-rays produced a drastic drop in fertility in the third brood (8-10 d after treatment) from which there was a large recovery of recovery in the fourth brood. In the case of chemical treatments, there was no such definite brood pattern. The effect of the three agents on the fertility of the Maxy males is tabulated. The results might indicate that the reduced fertility of the males after the chemical treatments is due to a toxic effect on their soma (reducing their life span and fitness to mate), rather than a sterilization of the germ cells at a sensitive stage (in the case of x-rays), since the viability of the cultures undergoes considerable reduction from one brood to the next after the chemical treatments. With the x-rays, there is no such drastic drop in their viability. (From auth.)

Capello, J. L., Ortega, A., Rodriguez, I. EFECTO ESTERILIZANTE DE LAS RADIACIONES GAMMA COMPUESTO "APICULATE" SOBRE LA CONCHUELA DEL FRIJOLO. (Sterilizing effect of γ-rays and aphicide on the Mexican bean beetle, Epilachna varivestis Muls.) Agricultura 16a, M4a, 11, 4 (1962/1964) 168-176. (In Spanish)

The doses required for sterilization were low compared with other species. A 42Co source was used, and the effects of irradiation were tested on elocation and on reproduction. Doses up to 12,000 R were used. The insects used were laboratory-bred. The effects of γ-rays were studied on the emergence and reproduction of adults irradiated at the egg stage. Doses of 150, 500, 1000, and 2000 R were used, and the number of emerged adults noted (Table 1). At 100 R, egg development was unimpaired, the percentage of developed eggs was 25% (50% for unirradiated controls). At 1000 R, no eggs developed. Table 2 gives the number of eggs produced by pairing insects emerged from irradiated eggs. At 150 R, oogenesis was not impaired; at 200 R, copulation and oogenesis occurred but the eggs did not develop. Papae were irradiated (1) to estimate the effect of various doses given to papae of the same age on development and reproduction of adults, and (2) to estimate the effect of single irradiation dose given to papae of various ages on development and reproduction of adults. The average lethal dosage was also determined, using x-rays. Tabulated data (Table 3) show radiation effects on adult elocation from papae irradiated at different ages; the viability of eggs produced by pairing of irradiated and nonirradiated insects (Table 4); and the effects of irradiation of papae of various ages with 1000 R on adult emergence (Table 5). Similar experiments were carried out using choricerecta.


Previous workers have shown that X-rays produce a marked inhibition of crossing-over at the distal end of the X-chromosome of D. melanogaster and an induction of crossing-over in the centromere region. It has also been known for many years that heat-treatment of females can produce an increase in crossing-over in the centromere region of the autosome. We have now made a comparative study of the effects produced in the distal and centromere regions of the X-chromosome by the two agents. A similar comparison was made by Mayor and Svenson (1928) for Chromosome III but their study was confined to the proximal segments only. Female of the genotype y sc zv fvr sc + zv v f v were used so that recombination could be measured along the full length of the chromosome, including the region spanning the centromere from x-ray- to v-fv. Virgin females were divided into three groups; irradiated with 5000 R x-rays, kept untreated for 24 hr at 24°C, and controls. Apart from the period at 24°C, all flies were cultured at 30°C. The females were then mated singly in vials and transferred daily to fresh vials for 15 d. Recombination was scored for each region on each day. For the proximal region the results resemble those of Mayor and Svenson (1928) for Chromosome III. In the segment var-ca the heat produced a two-fold increase in crossing-over on days 6, 7, and 8. On day 9, the level returned to the control value, x-ray-induced produced an increase on every day up to day 15, but the biggest increase came on days 5, 6, 7, and 8 when it equaled the increase found with heat treatment. In the middle of the chromosome (+-Y- + - y), neither agent had any effect. In the distal segments (+-y- + - y) heat and x-rays both gave greatly reduced crossing-over on days 6-9, but the heat-treated females again showed a return to the control level by day 10. X-ray females showed only partial recovery, the decreased level of crossing-over remaining up to day 15. Thus, the effects of heat treatment began at day 6 and exactly parallel both the proximal increase and the distal decrease produced by x-rays, whereas the x-ray effect persists indefinitely, the heat effect is confined to this 6-9 period. In addition, x-rays induce crossing-over in late oocytes which have already finished natural meiotic crossing-over (Days 1-5).

(See Table 1-5.)


Theories on chromosome in Drosophila on the of mustered derivative of p structure to the process goes to the subjacent and intergenic induced radiation rate at 11 dp was compared and a of mutations damaged by that both homologous a deleterion resulting in thegression on point match synthetic origin present studied on the nucleo x-ray and receive one mutation on one to particular loci are d

Fahmy, O. G., Fahmy, M. I. UNBIASED AN mRNaetor. Genes

The only mutations (on large) were small on Y-chromosome. Very visible that was equ to the proportion of the by radiation (+40°C induction of (a) X-chromosome disjunction, whereas at 4th chromosome Minitz which was consistently and homologous morter physiologically same. The 5th chromosome 1 small deletions which - centromere, frequently any instances of alleles genetic level. (Aut.)

(See Figure 1-5.)

Ferris, I. D., Klatz Drosoph. Biol. Rev. 41

Studies are in progress with experimental mutations in X-chromosomes from a agent ICR 210. The 2 dissectioned after 3 of 6 th and analysis is the same on the proportion of (3) The complete reco been on the average of induced in the + and 30. (3) The ratio of the geo The lod is computed a

(See Table 1-5.)
Theories on chromosome structure and mutations are reviewed. Results are reported from studies in Drosophila on the effects of x-radiation or the chemical mutagens, triethylsteramide or a methyl derivative of phenylalanine, that demonstrated the relevance of each unit of biological structure to the process of mutagenesis, starting from the cell level through the chromosome and the gene to the single elements that approach macromolecular dimensions. The degree of differential mutagenicity induced by x-radiation and the chemicals was assessed by determining the absolute mutation rate at 11 specific loci. The relative response of each locus to the different mutagens was compared and a complementation map was prepared of the mutational loci and the distribution of sites damaged by the various mutagens. Studies on the mutagene specificities of DNA showed that both homologous and heterologous DNA are effective in the induction of small chromosome deletions resulting in the autosomal dominants known as miniatures, and to a lesser extent in the induction of point mutation variants. It was also shown that a great many polymorphs of natural and synthetic origin possess the DNA type of mutagenicity. The specificity of action of DNA was studied on the 4th chromosome by comparing the distribution of mutations with that induced by x-radiation and recovered under the same conditions. The implications of the specific action of one mutagen on one locus and the possible genetic effects of synthetic macromolecules specific to particular loci are discussed.


The only mutations appreciably induced by calf-thymus DNA (injected into adult males or fed to larvae) were small chromosome deletions (established by using a marked X-chromosome). Very weak activity also occurred as regards point mutations (recessive lethals and viabilities) which was equivalent for the X- and 2nd-chromosomes. These gave mutation frequencies in the proportion of their physical lengths (1:2). The yield of point mutations was not increased by "radiation (+ 40,000 R) of DNA prior to its larval feeding. DNA was inactive as regards the induction of a X-chromosome break, leading to viable fragments of X; males, and (b) non-segregation, whether among the sex chromosomes, or the 4th autosome pairs. The proportion of 4th chromosome miniatures after the injection of calf-thymus DNA reached 29% of the total induced, which was considerably lower than that occurring with the other tested samples of the heterogenous and homogenous material (ranging from 40-45%). This variation seemed to be a function of the physicochemical state of the polymer, rather than its chemical constitution or biological source. The 2nd chromosome recessive lethals, recovered after the feeding of calf-thymus DNA, were mainly small deletions which were localized in segments rich in heterochromatin, especially around the centromeres. Interactions between the independently induced mutations, however, did not yield any instances of allelism, indicating that the mutagen selectivity of DNA did not extend to the genic level. (Arch. summary)

(1)


Studies are in progress on the relative frequency of chemically induced sex-linked lethals and detrimental mutations and their effect on the viability of D. melanogaster. Tests were made on 196 X-chromosomes from 800 and Canton-S strains that were treated with the non-mutagenic alkylation agent CCR 100. The treated males were injected with 0.1% CCR 100 in 0.1% saline. Parents were dissected after 3 de that the effects measured were on mature sperm. The experimental design and analysis is the same as used previously for similar studies with x-rays? estimates were made on the proportion of complete lethals and the genetic load of lethals and detrimental induced.

(1) The complete sex-linked lethal frequency induced by this compound in our experiments has been on the average of 4.9%. There is no significant difference between the lethal rates induced in the X and Y-chromosomes. This different from the results obtained with x-rays.

(2) The rate for the genetic load from non-lethal detrimental mutants to that from lethals was 1.56. The load is compared as the product of the frequency and the average effect on viability. It is a

(See III/S84).
much higher value than any effect of the same kind that has been established for x-ray. This indicates a much higher detrimental effect in relation to lethals that has been induced by the chemical mutagen in comparison to the effect caused by x-ray. Further studies are in progress including the determination of the induced mosaic lethal frequency. (Auth.)


The results of studies since 1963 on the comparative mutagenic effects of ionizing radiations on males and females are described, at comparable stages of the germ line. It is stressed that, when discussing mutation rates, it is essential to specify not only the sex and the stage of the germ cells at time of treatment (e.g., age of eggs, larvae, or pupae), but also the genetic strain. Transformations are very rarely induced in mature female gametes, inversions are somewhat abundant after an identical dose of x-rays, and recessive lethals are about 1/2 as frequent in the female gametocytes as in the spermatogonia. The slopes of dosage curves for sex-linked recessive lethals in Oregon-R males and females diverge significantly (2.8 x 10^-7/R for the male, 1.6 x 10^-7/R for the female). Sex-linked recessive lethals were induced in N, air, and O at 1000, 2000, 3000, and 4000 R; the frequencies of mutations in spermatogonia was uniformly 1/3 higher than obtained in mature oocytes. Good agreement was found in an autosomal, chromosome 2, giving a mutation frequency in spermatocytes a little over 1.5 times the frequency in oocytes. Dominant Minute-triple mutation studies are described, including studies of the effect of a 3-R dose of x-rays. Work is also reported on the critical period for the effect of x-rays on the suppressor genes, and the occurrence of suppressor genes under- and up-to in wild-type strains. The effect of mating patterns on life span is also investigated.


Two chemical mutagens, ethyl methanesulfonate (EMS) and quinacrine mustard (ICR-120), which injected separately into Oregon-R males in the laboratory, have each induced 4th chromosome recessive lethal mutations at a frequency approximating 4%. This mutational response of the microchromosome is about four times that produced by x-ray doses of 3 or 4 1/2 units (see 11/95/60). Details of the various experiments and their results are discussed.


Ethyl methanesulfonate (EMS) is a potent mutagenic agent in Drosophila, inducing mutations at the camp locus with a frequency of 1/2. Mutations were found in the progeny of males, both after feeding and after injection with the, and the induced mutation frequency was proportional to the concentration injected. 1 acted primarily on postmeiotic spermat, the perisomatic and melioi cells remaining relatively immune to its effects. 1% of all the induced mutants detected in the males were lethal, containing no mutant and non-mutant tissues. 30% of all the y+ males contained mutant tissues in their gonads. The average amount of mutant tissue in a mosaic was 5%, similar to values reported in studies with ICR-170 and nitrosomethyleneurea and in other studies with 1. Interestingly, however, these values, all close to 1%, may be misleading because the variance is so large. With only 5% of the transmitted mutations there was a disagreement in the classification of the phenotype found in F1 compared to F2. In virtually every such instance of disagreement, the phenotype was less severe in F1 than in F2. A comparison is made of the transmitting dunlop mutations induced with 1, nitrosomethyleneurea, x-rays, and ICR-170, and a model of the camp region is constructed based on this comparison. (CA 68:1166, 29/79/1.)


Experiments designed to detect a mutagenic effect of DNA towards Drosophila larvae after the DNA was exposed to a heavy dose of ionizing radiation prior to its addition to a chemically-defined and sterile Drosophila medium are described. Although non-irradiated DNA is found to be mutagenic under these conditions, 1 of the DNA compared with 2.

1267 Kitaoka, S. et al. EFF TIC, B. thailand. Thioptopat. proved the non irradiation doses of 10 to 20.

1268 Klanten, W., Boerami, J. STERILANTS AND RADI. Meeting of the Teratological Dominant lethal mutacil N,N,N',N'-tetramethyl- phosphonamide with pen x-rays. Combination o.

1269 Land, Z., Ed. MDIM Symposium, Prague, CR. Czechoslovak Academy of Sciences. The induction of mutants in Drosophila melanogaster. Effect of non-autotrophic and x-radiation 1, barley, maize, peas, 1. The relative performance of a base in inducing vital Drosophila is also investigated.

1270 Monte, J.C., Freimantle, COMPOUNDS WITH OR THE effects of non-autotrophic mutations. For exposure to x-rays, we obtained 3 successive MA-69 and P-25 also post convolution. The inactivation in the mutant is achieved by.

1271 Murakami, A. RELATION FOR INDUCING MUTAT Gene. 31 (1966) 77-78.

Mature sperm of the male A series of AT-Ca x-rays is of the determination of markers. Dose-dependent dose for both mutations, curves for mosaic, lower of 36 MeV energy were induction of the mutant in mature sperm and in relative to AT-Ca very.

1272 Szeely, B.A., Peterson, AND GAMMA RADIAT. The SD of 150 kVp x-rays of induced x-linked to using (3) 3250 R x-rays dilute dose of 3250 R by.
under these conditions, the prior irradiation of the DNA does not change the mutagenic effectiveness of the DNA compared with the non-irradiated DNA sample. (Auth.)


Thiotepa proved the most potent sterilant followed by apholate and metabo, and finally hemipyra. Irradiation doses of 10 to 3000 kR inhibited oviposition.


Dominant lethal mutations in post-meiotic germ cells are readily induced by apholate, benzamid, $N_2,N_2,N_2,N_2$-tetramethyl-2-piperidino-phosphonic diamide and cyclic diesters of 1-amidophosphonic acid with polyethylen. Sporomastigote cells are destroyed by $5 \times 10^5$ kR of 300 kV x-rays. Combinations of chemosterilant and x-rays induce permanent sterility. (Abst.)


The induction of mutations in plants, Drosophila, mice, and rats is exposed to $y$-, neutron, u.v., and x-rays is discussed in 40 papers. Results are included in the studies on barley, maize, peas, sugar beets, tobacco, tomatoes, and wheat. Drosophila, mice, and rats. The relative efficiency of ethylamine, dimethylsulfate, ethyldimethylsulfate, and hydroxymethylamide in inducing visible mutations in plants is compared and the induction of mutations in Drosophila by several chemical mutagens is reported. (From NAS 21: 397, 5778)

1270 Morse, I.B., Felsenstein, Y.F., COMPARATIVE MUTAGENIC ACTIVITY OF SOME AROMATIC COMPOUNDS WITH OR WITHOUT IODINATION. Genetics No. (1968) 62-73.

The effects of nine aromatic compounds were tested in Drosophila for spontaneous and radiated mutations. Four preparations of V-8, AV-69, E-4 and F-23 proved to be able to reduce the rate of recessive lethal mutations coupled with the sex induced by $y$-exposure to 3000 R. Two of them AV-69 and F-23 also proved to be mutagenic AV-69 at the same concentration, F-23 at a greater concentration. The efficiency of the F-25 and F-6 preparations may be ascribed to their insolubility in the solvent media. Thus, a new class of genetically active compounds has been established. (Auth.)


Mature sperm of the silkworm were exposed to fast neutrons of $^{24}$Na $y$-radiation at late papal stage. A series of $^{24}$Na $y$-ray irradiation experiments were run in parallel with these 14 MeV neutrons. For the determination of mutation frequency visible recessive egg colour mutations were used as markers. Dose-frequency curves for recovered mutations increased linearly with the increasing dose for both radiations, which indicates that they are due to single-hit events. The frequency curves for mutations, increased linearly, indicating that they are due to multi-hit nature. Neutrons of 14 MeV energy were approx. six times as efficient as $y$-rays in producing recessive visible mutations in mature sperm of the silkworm. Hence, RBE values of 14 MeV neutrons are larger in mature sperm than in spermatogonia. Therefore, for the production of mutations RBE of 14 MeV neutrons relative to $^{24}$Na $y$-rays was about 6. (Auth.)


The RBE of 240 kV x-rays and $y$-rays from a $^{24}$Ca source was compared, by observing the frequency of induced sex-linked recessive lethals. Four series of tests were made with P Canton S males using (1) 9208 R x-rays at 954 R/min, (2) an intense dose of 5000 R $y$-rays at 600 R/min, (3) a significant dose of 2200 R $y$-rays at 69 R/min, and (4) controls. Results showed a very significant
difference in mutation induction between x-rays and both sexes of y-rays, but no significant difference between the two y-ray treated sexes. Earlier results (cf. 1/414) of 1.0 for the SBE of a Co-source and x-rays were confirmed.


Structural changes induced in male autosomes after formaldehyde feeding were analyzed cytologically, in comparison with the effects of x-rays (on mature sperm) there for: (1) a high proportion of chromosomes; (2) a lack of repeats and deficiencies; (3) a shortage of translocations, and (4) fewer breaks in the heterochromatic region. The high frequency of mutations and the low ratio of isolates to intrachromosomal changes may be explained by the delayed opening of potential breaks which tend to open simultaneously in the same chromosome but at different times in different chromosomes. The high number of "isochromatid" breaks (repeats) points to some connection with the reduplication cycle. The shortage of "co-heterochromatic" changes in which "heterochromatin" breaks in single gland analysis are scored, can be similarly explained by a delay in the time of opening of potential breaks in the two types of chromosome. Initial non-random distribution of breaks as well as the conditions of resisting in meiotic cells may also play some role. (Abst.)


Mitomycin C is a bifunctional alkylating agent that is a natural antibiotic derived from a species of Streptomycetes. The phase I of all the species (Haplochromis) are approx. 20 times as sensitive to mitomycin C as those I coverts when dominant lethality is the criterion. This is comparable to the action on these two stages of x-radiation and other alkylating agents. When recessive lethality in the criterion, phase II and phase III are essentially the same sensitivity, resembling ethyl methylsulfone but not x-radiation or nitrogen mustard, which methaphase I has been shown to be more sensitive. Higher doses of mitomycin C than these used on females are required to obtain an effect on the gametes of males. Injected males were mated on three successive days. The dominant lethal frequency increased progressively from brood to brood, but the recessive lethal frequency remains essentially unchanged. Temperature sensitive recessive lethal mutations are induced by mitomycin C in sperm. (Abstr.)


The relative biological effectiveness of hard x-ray (90 keV), soft x-ray (40 keV) and beta (15 keV) was compared using lower cornish liver eggs. Thymus gland size. (Abstr.)

1279 Sagi, E. EFFECT OF 7-HYDROXY ESTROGENIC EXPRESSION. Apopt. 9 pp. and 3 Translation For abstract, 311/756.

1280 Suzuki, D. T., Pitzen, SENSITIVE MUTATIONS AND CHEMICALLY (INDUCTION) Acad. Sci. U.S.A. 57. Males were placed in gastric therapeutic silico, at y mutations that are lethal and semilethal at the sensitive (Y), whereas they exhibit meiotic segments in genetic analysis.

1281 Taylor, K. B., Hermon EUROPEAN PINE EUCON "Portland Meeting, Port Techniques for mating it that this was an effective y-labelling. (Abstr.)

1282 Thomas, J. L., Jr., R.AX AND RADIATION IN DOX Oxxygen at high pressure: actions characteristic of accelerated the acute effect on the lungs and consistent in produced acute OMP toxicity in mice. (Abstract) Shows, B. and the residual effects.

1283 Tolkin, B. P., INSTITUT (In Russian, with English) The research programme silkworm, Drosophila as an y-rays, and by neutrons to describe the work in this year.

1284 Tran, A., Kuenkel, H NITROGEN COMPOUNDS, H., Ed. Stuttgart, Geo; The mutagenic effect of phenylamine, N-nitros-p-phenylphthalamide and Drosophila melanogaster. The difference at some length, GNSA 2

For abstract, see II/728.

1280 Suzuki, T., Tetsuji, K., Hasegawa, S., Tatsumi, M., Baillie, D., Erasmus, U. TEMPERATURE-SENSITIVE MUTATIONS IN Drosophila melanogaster. 1. RELATIVE FREQUENCIES AMONG Y-RAI

Males were placed in gelatin capsules, irradiated with 400 r of y-rays delivered from a 60Co therapeutic source, at 20°C/minute, and treated as outlined in the paper. Sex-linked recessive mutations that were lethals and semilethals at 20°C but survivors at 17°C were recovered. Of the lethals and semilethals induced by y-rays and mitomycin C, 3.2 and 3.3%, respectively, are temperature-sensitive (3), whereas it is estimated that at least 90% of the lethals and semilethals induced by ethyl methanesulfonate are stable to mutagens. Such mutants provide a useful tool for a variety of genetic analyses.


Techniques for mating the European pine shoot moth were developed. Preliminary studies indicated that they was an effective sterilant. The potential use of this chromosome is compared with y-irradiation. (Abst.)


Oxygen at high pressure (CHP) and x-irradiation can interact in D. melanogaster to potentiate toxic actions characteristic of one agent alone. 3600 kVp x-irradiation in doses of 20, 40, and 75 kR accelerated the acute immobilization of young male Drosophila by 02 at 7.5 atm, up to twice that observed with such O2-pressure alone. x-irradiation alone, in these doses, did not acutely immobilize Drosophila. x-irradiation during exposure to 7.5 atm 02 was more effective and consistent in producing this potentiating than was x-irradiation that preceded exposure to CHP. Acute CHP toxicity in young male Drosophila was not potentiated by 75 kR. On the other hand, shortening of the life span of young males by the above doses of 02-irradiation was augmented significantly by a concurrent 40 min exposure to CHP (which alone did not significantly decrease life span). This shows, for the first time, that 02 can affect not only the acute effects of radiation, but also the residual irreversible effects indicated by life span shortening. (Abst.)

1283 Toida, B.P. INSTITUT NATIONAL DE GENETIQUE DU JAPON. Genevika No. 2 (1967) 109-186.

(In Russian, with French summary)

The research programme at the National Institute of Genetics, Japan, is described. Work on the silkworm, Drosophila and other insects is discussed. The effects of irradiation by means of x- and y-rays, and by neutrons were studied in terms of essential nigrogenetic modifications and mutations. Work is also described with radioisotopes (14P and 14C).


The mutagenic effect of N-willmore-N-methylurethane, N-willmore-nitrophenol, N-willmore-piperazine, N-willmore-piperidine, and N-willmore-acetamide was studied on Schizosaccharomyces pombe and Drosophila melanogaster and the results were compared with the mutagenic effects of x-irradiation. The differences in the mutagenic effects of the urethane and acetamide were discussed in some length. (NSA 31: 1967, 22(5))

347
1285 Whitington, M., BROOD DATA ON CROSSOVER RECOVERY FROM PRETESTED HEATED ADULT FEMALES. Thesis, Inf. Serv. 90 (1964) 91.

Compared with induction by x-rays (Whitington, Genetics 55, 1965, 95 and unpublished) the heat-induced* crossover appeared at least 1 d earlier and possibly 2 or 3 d earlier than did viable x-ray induced crossovers. The partitioning of induction between gonadal cells and early oocytes does not yet seem feasible. (From auth.)

* 23°C.

See also:

1287 Matrogenetic effect of neutrons and x-rays on Drosophila melanogaster oocytes and oogenesis. (Dickerman, R.L., 1969)

1293 Estimation of the rejoining distance for chromosome exchanges induced in Drosophila sperm by combined doses of x-rays and neutrons. (Hedle, A. A., et al., 1969)

1295 Genetic and direct effects of gamma radiation on Drosophila. (Ives, P.T., 1965)

1299 Genetic crossing-over in both sexes of Mougeotia scalaris. (Madsen, F., et al., 1967)

1301 Interaction of x-ray and fast neutron-induced chromosome breaks in Drosophila. (Reddi, O.S., 1966)

1303 Genetic after-effects of x-rays depending on the temperature regime. (Tishkina, M.M., et al., 1967)

1305 Preserving food by radiation: safe or unsafe. (Anonymous, 1967)

1308 An increased yield of gamma-induced eye colour mutations from chronic versus acute exposures in Drosophila. (Baldwin, W.F., 1967)

1312 Genetic effects of chronic y-radiation on Halochromas sp. (Bostel, D.C. von, et al., 1967)

1314 The induction of dominant lethal mutations in insects by ionizing radiation and chemicals - as related to the stofle-male technique of insect control. (LeCharmant, L.F., 1967)

1316 Mutation pattern in two wild-type stocks of Drosophila melanogaster. (Steinmann, G., 1959)

1318 Effects of x-rays, tryptophan metabolites, and eye colour mutations on the tumor-suppressor system in Drosophila melanogaster. (Kemokli, G., 1967)

1320 Use of fast neutrons in the release of mutations in Drosophila melanogaster. (Dauch, F., et al., 1968)

1322 Effect of conjugate aromatic systems on herodity. I. Mutagenic and antimutagenic effect of certain indole compounds. (Moore, L.B. et al., 1964)

1326 Modification in productivity and mortality of flour beetle species and strains due to x-ray and the insecticide, DDT. (Edelman, H.J., 1966)

1328 Some effects of gamma radiation and aphidole on the fertility of Drosophila melanogaster. (Henningsen, T.J., et al., 1967)

1330 Modification of fitness in species and strains of flour beetles due to x-ray and DDT. (Edelman, H.J., 1969)

1332 Induced mutations in polygenic systems. (Austwick, K., 1968)


1336 Codling moth control. (Moore, H.F., et al., 1967)

2.2 DEVELOPMENTAL AND PHYSIOLOGICAL EFFECTS ON THE ORGANISM

2.2.1 General Articles, Surveys


Prior to chronic y-radiation, flour beetle populations of single and mixed species were established at three temperatures and consumed monthly for eight months as to larvae, pupae, and adults. From the total number of bio-period, possibly due to a difference in productivity.

1287 Lumbroy, Z., Danilev, Demyanov, Name (in Bulgarian, with Germ)

1289 Schedlhaus, A. RECH BUNNISCHEN HALBIW for comparing the effect G. F. Feiring Lab. No.

The conditions are three half-tiles of living organ. The use of FIXTRAN II mental data is explained.

1291 Shipman, W.H., Cole, INJECTION OF KE VVIN Subcutaneous injection of a 2.1 mcg/g dose into and 2% respectively, b venom/g 1 day prior to ex although these doses x or injected immediately cytoplasm, AET, and ret irradiation. At least the bee venom: (2) it has a profound changes in the BIV2F

1295 Sánchez, F., García, B. of y-radiation on the co The effects of γ-radiation on the co

2.2. Pathogen, Parasite, a

1296 Abdul Hafez, A.M., MALE RACE HAPLO THIN Symposium. Dacca, P

Adult males of Decidwing from a 60 c source at a Records were kept of egg infested males, the per hatch in the universe to 8000, 7000, 6000 and 90 respectively. (RAF-A 58

1299 Akbar, S. RETENTION OF CHEMICALS AND BRAIN.
the total number of biofilm observed it was clear that equilibrium was not attained during this period, possibly due to lack of homogeneity in the stocks. This was further suggested by a constant difference in productivity in the several cultures which were presumed to be replicates.


The conclusions are discussed which are necessary for an accurate determination of the effective half-life of living organisms. Reference is made to data obtained in tracer studies in medicine. The use of FORTRAN II calculating programmes for a rational and objective evaluation of experimental data is explained.


Subcutaneous injection of 4.6 mg bee, Apis mellifera ligustica, venom/kg or intraperitoneal injection of a 1.1 mg/kg dose into mice 24 h prior to x-irradiation (650 R) increased the survival from 0 to 83 and 29% respectively, by 30 d after the irradiation. Also, subcutaneous injection of 4.3 or 5 mg venom/kg prior to exposure to x-irradiation (650 R) increased the 30-d survival from 0 to 70%, although these doses were not effective in increasing survival when given 30 min prior to irradiation or injected immediately after the irradiation. The venom is placed in a different category from cysteine, AET, and related compounds which are effective when administered immediately prior to irradiation. At least three mechanisms may be involved to account for the radioprotective effect of bee venom: (1) it has a stronger-like action, thereby eliciting an "adaptation syndrome," (2) it produces changes in the hematopoietic system, and (3) it has antibacterial properties. (C A 87: 1967, 613170)


The effects of y-radiation on the Peruvian cotton weaver, Dysdercus peruvianus, were studied.

See also:

910 Biological Effects of Radiations. (Goreth, D.S., 1965)

2.2.2. Biochemistry, Physiology, Pathogen, Parasite, and Pesticide Susceptibility. Reproductive Potential


Adult males of Orizoblasta (Hippa) armigera (GL.) were irradiated at various doses of y-radiation from a 24 source at a fixed dose rate of 36.8 rad/h and placed in cages with untreated females. Records were kept of egg production, hatch, etc. When untreated virgin females were mated with irradiated males, the percentage of viable eggs decreased with increase in dose. The average egg hatch in the untreated controls was 71.4% whereas matings with male beetles exposed to 1000, 5000, 7000, 8000 and 9000 R resulted in averages of 1.4, 1.42, 5.9, 12.72 and 14.09% egg hatch, respectively. (RA-86: 1968, ref. 879)

A $^{60}$Co source, type GammaCell 226, emitting 7790 $\mu$m/h was used on 3-4-old A. gregaria. Blood meals were given on rats at various intervals after chemosterilant or irradiation treatment, in some cases sheep blood after chemosterilant treatment. Two days after the blood meal females were dissected in 0.2% NaCl, and the size of the blood residue in the mid-gut and the stage of ovarian development was determined. Both the chemosterilant and irradiation treatment caused a delay in blood digestion, not due to a lack of mid-gut protease. The effect of metapana, apholate and tea on egg development was studied. The elimination of the blood meal was retarded in all females thus treated. A delay in blood digestion in the irradiated females was more obvious 48 h after feeding on a rat. The mid-gut proteolytic activity in females treated with chemosterilant or irradiation was not lower than in the controls. The retention of the blood meal was not due to an acute toxic effect, since it occurred also when the 1st blood meal was given 8 d after treatment. No delay in elimination of the blood meal was observed following the 2nd blood meal. The relationship between the retention of the blood meal and ovarian development is discussed.

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Catalan, R.E., Munício
difference stages of purification. These stages were: whole heads; homogenate; and a purified fraction. The enzymatic activities of the samples were controlled within 1 h of irradiation. Cholinesterase activity was measured spectrophotometrically using as substrates of 0.5 M sodium chloride - 0.04 M magnesium chloride - 0.002 M acetylcholine iodide in 0.5 M phosphate buffer, pH 7.0 and 37°C. The acetic acid liberated was automatically determined by titration with 0.006 M sodium hydroxide. Enzymatic activity was expressed as μal units of activity/mg sample. The amount in which the enzyme of the samples was affected by the γ-irradiation was also determined. Experimental results were evaluated by plotting the percentage of the remaining enzymatic activity as a function of irradiation dose. Results indicate that the more purified the samples were, the more the inactivating effect of the irradiation. In the cholinesterase preparations from common fly, the order of inactivation was: purified sample > homogenate > whole heads. Assays carried out with red blood cells and cholinesterase from the electric eel showed a high grade of inactivation. (NRA 29, 1966, 10586).


The inactivation of cholinesterase by 60Co radiation was dependent upon the purity and type of sample, with whole enzyme being the more sensitive. Fly brain cholinesterase was the most radioresistant. Enzyme inactivation was slightly increased in freeze-dried homogenates by storage after irradiation. The converse was noted in brain homogenates. Increased inactivation was noted at pH values other than 7.0. The Michaelis constant was unchanged in irradiated brain, but Vmax was inversely proportional to temperature. N,N-Bis-methylphosphonoamine and 3-ethyl-4-methylhexylsulfoxyl S-0-dithiophosphate exhibited a significant radioprotective action at exposure to 3 x 10^4 R. (CA 70, 1968, 34529d)


Most engorged nymphal host-tick samples (Amblyomma americanum (L)) exposed to 250-7500 R of γ-irradiation from a 60Co source engorged normally, and those irradiated with 1000 R or less remained adult; those irradiated with 2500 R or greater did not. Nymphs irradiated after completion of engorgement became increasingly tolerant to radiation during the molting period. Those irradiated with 2500 R at 14 days after engorgement did not molt, whereas those irradiated with 2500 R two weeks after engorgement molted. Egg-laying and egg hatch were used as criteria to determine the effects of radiation on the reproduction of adults from unirradiated nymphs or irradiated adults. Irradiation with 250 R had little or no effect on reproduction. With females, reproduction was reduced at a dose of 500 R and prevented at a dose of 1000 R. With males, reproduction was slightly reduced at a dose of 500 R, and at a dose of 1000 R, effects on reproduction varied according to the point in development at which the males were irradiated. With both sexes, irradiation with 2500 R or more prevented reproduction. (Auth.)


Nemestrin capensect (Gavetin) is an endoparasitic parasite of larval microlepinae. Parasitized caterpillars show no early signs of injury, but continue to grow, and frequently popate before death. Parasites hatch 3 days after exposure (50%), proceed through 2 larval instars, and pupate about the 10th day. Adults emerge about 10 d afterwards, living about 10 if fed, 3 d if starved. Only 1 parasite/host develops; any additional parasites are eliminated early in first instar, by fighting or by competition for O2. Nemerini-parasitized Anagasta larvae were irradiated at various stages of parasitic development. With adult emergence as criterion of survival, the LD50 of Nemestrin was: 3rd instar, 6.8 kR; 4th instar, 3.7 kR; 5th instar, 2.3 kR; 6th instar, 2.1 kR. Adults exposed to 30 kR survived as long as controls, whether fed or starved. Six kR to 1st instar Nemestrin completely suppressed adult emergence. 12 kR caused only slight mortality in unparasitized Anagasta larvae. Accordingly, Nemestrin were exposed to 6 or 12 kR during 1st instar; hosts were sacrificed at intervals, and the developing Nemestrin examined. Parasites exposed to 12 kR were not present, exhibited much decreases in feeding and in internal mortality, and died in about 50-60% larvae exhibited slight.
temporarily decreases in feeding and intestinal motility, and developed, after considerable delay, to 6th instar, dying in 20–25 d. (Abstr.)


Reproductive onset and productivity (F₁, adults/female) were determined for virgin day-old flour beetles irradiated with 899 rad of fast neutrons, mated in male-exposed, female-exposed, both-exposed and neither-exposed pairs and maintained at 25, 29 and 32°C in 70% r.h. Earlier reproductive onset and greater productivity were associated with increasing temperatures. Irradiation delayed reproductive onset for exposed female combinations and reduced productivity. Biological interpretations are discussed. (from abstr.)


Adult flour beetles aged as pupae and maintained separately for three weeks after adult emergence, were given 0, 1616, or 2025 R of x-ray. Single- and mixed-species populations were established and maintained at 28, 29, or 32°C at 65%–70% r.h. Productivity was determined during ten weeks post-irradiation. Reproductive abilities increased with increasing temperature and decreased with increasing x-ray exposure for a given temperature. The reproductive fitness of T. castaneum was superior in all environments except at 28°C. The frequencies of dominant lethals (which included inviability due to coexistence in mixed-species populations) increased with higher x-ray doses, but temperature and cohabitation influenced their expression within a species. Coexistence was responsible for a considerable reduction of productivity, which was also altered by temperature and x-ray. The vigour of coexistence were lowered at 32°C and exposures (undoubtedly due to reduced population density). Interpretations of dose-response curves on the bases of "single-hit" and "multi-hit" postirradiation phenomena were inferred from similar responses of diverse organisms. Most lethality occurred in the early (eggs to young larvae) part of the life cycle for both species. Species proportions in coexisting populations varied with temperature and x-ray but T. castaneum was consistently superior compared to T. confusum. The greater variability of T. castaneum probably makes it more fit in environments differing at different temperatures and x-ray exposure plus coexistence. Responses to radiation of single-species populations cannot be used to predict those of mixed-species populations. (auth.)


Productivity modifications due to radiation plus insecticides have important application in economic entomology, evolution and radiation ecology. Such changes are shown in some cases to have a genetic basis. Studies were designed to determine the early effects of DDT and x-radiation, singly and in combination, on mortality and productivity of flour beetle species and strains (Tribolium confusum Davis "Chicago standard" and T. castaneum Horst "Brazil c1" and "Scory").

For further details, see 1410.


Males G. molesta (Buck) treated with 40 krad of γ-radiation in the late pupal stage reduced egg-hatch by 53.5%, and in the young adult stage by 96.5%, in eggs from untreated virgin females with which they were mated. In addition, hatched larvae failed to complete development. Induced sterility was consistently greater in treated adults as compared with treated pupae. Females in the late pupal stage were sterilised with about 10 krad. Male longevity decreased in proportion to the radiation dosage. Above 30 krad when caged at a ratio of 3:1 r. longevities of untreated males decreased in proportion to the number of females available for mating. Radiation levels of 30 krad or more decreased male to female, as detected per untreated male into the number of matings (Abstr.)


A concentrate arrangement for the mammalian assay was made. Some fractions separated by x-rays after the eggs derived for testing were subjected to an irradiation period of 20 minutes in the electron microscope. Inhibitions of reproduction were observed. They also had a lower sensitivity over the treatment period to a shortened adult life and when removed with the extracts of the cells, in observed by alterations of their cells. (Abstr.)


The dispassing paper cells and the irradiation control ones were observed. The residual 10% trichloroacetic acid whole paper was about 10% trichloroacetic acid. Intravenous of the material and soluble acid was also studied. The materials were isolated in about 250 R./min. At trichloroacetic acid. Tber only a little correlation between the content of the cells was noted with the differences.


3rd-stage brown with oo 50,000, and 40,000 R. to microorganisms, when exposed at the lowest dosages.
or more decreased male mating, especially when applied to the pupal stage, in inverse proportion to dosage, as detected by caging males with three times as many females. The number of matings per untreated male increased with the number of females available up to an average of 3.8 while the number of matings per female averaged approx. 1.6 with from one to three males per female. (Abstr.)


The effect of irradiation upon O2 uptake was investigated in the house fly, Musca domestica, and fall armyworm, Spodoptera frugiperda. Pupae were irradiated at different levels, and emerging adults were tested at three ages. (Abstr.)


A seminiferous arrangement of Co-60 rods was used to deliver 5000 R to samples of virgin female Habrobracon wasps. Some were given an acute dose delivered in 90 s, others received two 45-s fractions separated by 4 h of irradiation. Both types of exposure resulted in 1 day of infertility after the eggs derived from preformed oocytes were deposited. Subsequently the difference in dose rate was reflected by striking differences in egg production. Repeated instead of irradiation during the interfracton period allowed an "recovery" or restoration. In order to identify important metabolic stages in the restoration process, chemical inhibitors have been employed. Chloromycetin and streptomycin, inhibitors of protein synthesis were detrimental to the recovery phase of Habrobracon egg production. They also lowered hatchability. Penicillin had no evident influence. This is consistent with Wolfe's observations on the resistant of radiation induced breaks in Vicia chromosomes. However the most potent agent, actinomycin, by itself decreased reproductive capacity. Furthermore, a shortened adult life span indicated a deleterious influence on non-dividing somatic tissue. Performance of the interfracton period, it is shown connected with interference with protein synthesis. In view of recent evidence that the intact ovary accepts protein from the blood rather than relying exclusively on the synthetic activity of its cells, interpretation of the primary effects of irradiation on the cellular level may be obscured by alterations in somatic tissues involved in co-operative action with the insect ovary. (Abstr.)


The dismounting pupae of Cettiia cuchulabne were irradiated with a single 1000 kR dose of Co-60 x-rays at a rate of about 300 kR/min. Within 2 h after irradiation the lecithin was as usual as normal control ones of similar weight (1.9 + 0.2 g) were bled, dissected, and the fat body was dissected. The residual tissues were separated from the curculia and immediately plunged into 10% trichloroacetic acid. The average wet weight of tissue to be analysed, prepared from 1 g of whole pupa was about 0.22 g. Tissues from three individuals were usually collected in 4 ml of 10% trichloroacetic acid and the mixed sample was homogenized in a glass homogenizer. The eggs of Bombyx mori were irradiated at dismounts with a single dose of 20,000 R of Co-60 x-rays at a rate of about 300 kR/min. At a given stage of embryonic development 1 g of eggs was homogenized in 1 ml of 10% trichloroacetic acid. The quantities of acetylcholine in the homogenates were determined colorimetrically after separation on paper chromatograms. Irradiation caused an immediate decrease in acetylcholine content of pupal tissues and a delayed increase of acetylcholine in irradiated eggs was correlated with the differentiation of the nervous system of the embryo. (NSA 20: 1966, 4287)

γ-radiation of the cocooning moth, Carposoma pomonella (L.), as an adult or fully mature pupa reduced the F1 generation 99% when males treated with 40 kR were mated with untreated females. Treated female moths irradiated with 20 kR and mated with untreated males deposited no viable eggs. The population reduction in the F1 generation was 88% when adult males treated with 40 kR were confined to field cages at a ratio of 20 treated males to one untreated female moth. The reduction of the F1 generation was slightly lower, 95%, when both the adult females and males treated with 40 kR were released in field cages at a ratio of 20 treated males and 20 treated females to one untreated male and one untreated female moth. (Auth.)


Untreated female D. melanogaster Meigen mated to irradiated or apholate-treated males produced about the same number of eggs as females of untreated pairs. Most of the eggs laid by females mated to irradiated or apholate-treated males were inviable. None of the eggs laid by nine virgin females, each mated 1, 5, or 20 days after treatment to a sterilized male, produced adult flies. Irradiated or apholate-treated females laid fewer eggs, most of which were not viable, than females of untreated pairs. The age of males or females when mated appeared to have little effect on results obtained after radiation exposure. Apholate appeared to induce a higher degree of sterility when males or females were dosed at the time of treatment. When females producing fertile eggs were mated to irradiated (25 kR) males, adult emergence was markedly reduced. Females mated first to irradiated (25 kR) males produced no viable eggs. Subsequent mating with untreated males resulted in the production of fertile eggs. (Auth.)


The following is virtually the author's abstract. In investigations in Texas, laboratory-reared examples of C. vomitoria (Coq.) were treated with γ-radiation at evacuate, pre-pupa, and pupa stages and emerged as adults at doses of 5000, 10,000, and 15,000 R and as pupae at 20,000 and 30,000 R. The criterion for sterility of males was the reduction in the hatching of eggs deposited by untreated females with which they mated. With few exceptions, 95-100% of the males treated at doses above 8000 R were sterile in first matings, but males treated at all levels tended to recover fertility in later matings. Recovery decreased as the radiation dose increased, but even a dose of 30,000 R failed to prevent recovery entirely. Treated females did not recover and rarely laid more than one egg batch, though those batches that were laid often had rather low percentages of fertility. With treated females, the number of eggs per batch decreased as the radiation dose increased, until at 20,000 R no eggs were laid. Miscellaneous biological information on the laboratory colony, principally relating to reproductive performance, was obtained in testing the treated insects and the accompanying controls. (AR-SB 56; 1968, ref. 6)


Respiratory activity was studied. The irradiation of winged flies (at the egg, larval, and pupal stages), with 100-2500 γ-rays increased oxygen uptake, which remained at that level throughout metamorphosis and persisted in the progeny, regardless of the stage in which irradiation took place. When irradiated with hydrogen, the modification in respiratory activity was not so marked. It would appear that γ-irradiation significantly affects the cytochrome oxidase.

* Also presented at the Fourth Conference on Epidemiology and Parasitological Problems of Kazakhstan and the Republics of Middle Asia, and at the Third Conference of Parasitologists of the Ukrainian Republic.

1311 Kang, T. S., Cho, W. K. ADULTING IN D. melanogaster (In Korean, with English)

The effects of radiation on males were more perceptible than those in females. Sterility was increased in males by a factor of 1.4, as compared to the control group. (Auth.)

1312 Palatinus, J. F. x-BAY-1 Drosophila melanogaster

Fecundity of a self-fertilized D. melanogaster in the moment they hatch, as observations it is possible with very small methods studied. Analysis of the same was found that 80% was to record hatching time when the possibility of some means rather unlikely that.

1313 Qasem, A. M. K., Kes Uppenappan, M. AND I Amur. J. Med. Parasit. The following is based on the development of the disease in mice, followed by the number of mice used, the number of infectious past after the infectious meal.

(Received, with English summary)

The effects of radiation on the fecundity and the fertility of D. melanogaster were studied. The males were more susceptible to reduction in fertility than the females but the females recovered fertility sooner than the males in the 3000 r-injected mating groups. The results obtained are summarized in tabulated form, giving the mean number of eggs laid and percentages of eggs to become adult per female in 29-2.

<table>
<thead>
<tr>
<th>Mating groups</th>
<th>Numbers of eggs laid</th>
<th>Percentages of eggs to become adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>953 894</td>
<td>76.20%</td>
</tr>
<tr>
<td>F1 X M2</td>
<td>126 272</td>
<td>30.00%</td>
</tr>
<tr>
<td>F2 X M1</td>
<td>224 439</td>
<td>8.24%</td>
</tr>
<tr>
<td>F2 X M2</td>
<td>155 628</td>
<td>27.00%</td>
</tr>
</tbody>
</table>


Hatching time is a suitable parameter for the study of polygenic x-ray induced mutations in D. melanogaster in the heterozygous state. Because eggs are relatively closed systems until the moment they hatch, many environmental complications are avoided. Moreover, by means of paired observations it is possible to measure minute changes in hatching time and thus to discern mutations with very small maternal effects. Eggs of unirradiated females inseminated by irradiated males were studied. Analysis of the results by Barth's method indicated that the main incidence of mutations in sperm was about 0.07% at 1500 r and 0.06% at 2400 r. The mean maternal effect of each mutation was 0.36% hatching time by about 24 min. By this method it is not possible completely to exclude the possibility of some non-genetic physiological component of the changes observed. However, it seems rather unlikely that such a component will be significant to any great extent.


The following is based largely on the authors' summary. The results are given of experiments at Lahore on the effect of x-radiation on the survival of L. longipalpis (L. donovani) ( First) and on the development of L. donovani in it. Irradiation at 50,000 r caused decreased survival of the midges to direct proportion to dosage. When batches of midges were irradiated at 90,000 and 24 h before the infective food, more infective larvae of L. donovani developed in the few instars than survived 15 days after irradiation than did in the much larger number of unirradiated midges that lived for 15 d. However, when the number of larvae developing was expressed in relation to the original number of midges used, the irradiated of the midges before they acquired their infection did not reduce the number of infective parasites developing to about half that in the uniradiated midges, irradiation 24 h after the infective meal caused a reduction to one-tenth. (RAE-B 55:1987, ref. 44)
to inhibitory effects of radiation but quite insensitive when irradiated on the 4th day of pupal development. Components sensitive to respiration decreased and the mean effective dose of inhibition increased exponentially with age (0-4 d). During this period, the fraction of isolated myosin heavy chain muscle also decreased with age. The inhibition of respiration of 1-4-day pupae was significantly related to the decrease in protein in the giant mitochondria of flight muscle. (Based on NAG 5: 1987, 494-494)


The hexameter occurs of G. melinella during the prepupal and early pupal stages varies from 4000/mm² 35,000/mm² as a function of age. The time of emergence is approx. doubled within 0-24 h by bleeding the insect. Using autoradiography and autoradiography, it was found that there is a hexameter differentiation sequence of prohexameter → hexameter → adhexameter. This differentiation requires about 8 d at 25°C, and the labelled cells have disappeared in another 3 d. The life expectancy of these cells, at least in prepupal and early pupal stages, is then less than 6 d. Transfer of labelled hexameters, followed by autoradiography of the larva, confirmed the previous suggestion that adhexameters have some role in the degradation of the larval neuronal lamella, but that no blood cells are involved in the formation of the connective tissue around the adult nervous system. (Auth. summary)


Investigation of viability curves of a variety of insects and preliminary studies on the sensitivity of the moth eye to γ particles and visible light are among the studies reported.


Les ruches, ayant subi une forte irradiation aux rayons γ (9000, 15000 et 200000 s en une seule exposition, respectivement, avec une précision de 2.5%, d'un irradiateur à Co 60 de 500 Ci, au débit de dose de 1040 R/min), ne peuvent plus maintenir l'initiation totale de la ponte des ouvrières de leur colonie. Il semble que ce réacteur soit imparfait dans la modification de la rythmicité de ponte de la reine. C'est la première fois qu'on observe chez cette espèce, la ponte synchronisée des ouvrières et de la reine.


Adult females were exposed to γ-rays of high dose rate (204 krad/hr) and of low dose rate (21.3 krad/hr). The doses varied by 500 rad from 2000 - 5000 rad. Fecundity and fertility were controlled for a month. The fecundity was somewhat greater at the low dose rate whereas the fertility was not influenced by the dose rate. (Essentially auth. summary)


When male sweetpotato weevils, Cyclus formicarius elegans (Walker), used in a mating experiment, the dose received was 1000 krad/hr of γ-rays and then mated with untreated virgin females, egg hatch was reduced to <1%. In linebred males competed favourably with untreated males. Matings involving four sterile males, four untreated males, and four untreated virgin females had an average of 65% egg hatch. There was no subsequent reduction in the number of progeny produced when virgin females were first mated with untreated males and later with irradiated males. Reproductive senescence decreased as the age of the weevils increased. The average reproductive life span for the weevil is ~ 67 d for males, and 80 d for females, with an average of 2 progeny/day this case since adult food consumed. A water filter in an air-tight diving bell a...
average of 2 progeny/female/d. Irradiation shortened the life span but not to any disadvantage in this case since adult feeding causes serious damage. The utilization of a sterile male approach is discussed. A water-filled \( ^{60}Co \)igg was used as source, the material to be irradiated being placed in an air-tight diving bell and lowered into the pit.


For abstract, see 1962.


The success of sperm in reaching and being retained in the storage organs of female D. melanogaster is measurably reduced if the males are irradiated prior to mating. This is partly due to physiological damage resulting in a reduction of motility, and raises the question of whether radiation-induced physiological damage is correlated with genetic damage. To test this, males aged 1, 7, or 14 d, were irradiated with irradiation doses of 250 kVp x-rays, and paired mated to two virgin females each, at 24 h intervals for eight mating periods. One of each pair of females was dissectioned and scored for insemination success; the second was permitted to produce progeny, which were counted, sexed, and examined for induced \( M_{i} \) mutations. Daily values were obtained for all parameters.

A reduction in insemination success, noted in all treated groups, is related to the age of the male and the mating period. The reduction in progeny number/male/ad follows the same trend as the reduction of insemination success, and no definite trend is seen in the number of mutant females. These data are consistent with the hypothesis that the damage is not correlated, but occurs as independent events in sperm population. (Abstr.)

See also:

105 Mutational response of the psecotic germ-cell stages of adult Drosophila melanogaster males to x-irradiation. (Puro, J., 1964)

97 Note on the relative sensitivity to irradiation damage in homoyogous and heteroyogous Drosophila melanogaster with regard to their capacity of producing offspring. (Dalmat, G., 1959)

963 Nucetide acids in normal and x-rays irradiated eggs of Bombyx mori. (Larossa, Z., 1967)


963 Techniques for studying the effects of radiation on metabolism and processes in mosquito with particular reference to Ae. aegypti. (Lit, K.S., 1969)

965 Cell and tissue patterns of the segments forming germ and soma tissue in controls and after irradiation. (Schwatz, F. E., 1963)

1071 x-ray induced mutations in Drosophila melanogaster sperm calculated in consecutive generations. (Keeleland, I, et al., 1968)

1041 Genetic segregation in the microsperm of Drosophila. (Spetcher, B.G., et al., 1960)

1126 Effectiveness of radiation of the mallow moth; irradiability at different stages of development, and certain features of mating and egg-laying. (Rohnkaski, V.L., 1963)

1267 Sterilisation of the male adults of Drosophila sevillae (Hyperic lutea) by \( x \)-irradiation. (Burgess, R.E., et al., 1960)

1225 Sterilisation of the female adults of Nauphaea cinerea (Rissoidea) by means of \( x \)-rays. (Capurro, M., et al., 1963)

1217 Radiation sterilisation studies on the tobacco budworm, Heliothris virescens. Feb. (Finn, N.M., 1959)

1311 Sterilisation of the coffee leaf miner. (Kerley, K.P., 1967)

1352 Sterilisation of parasites of the adn use. (Kochanska, L., 1969)

1243 Laboratory studies to sterilise the boi weevil with radiation. (Mayer, M.S., et al., 1963)

1252 Some effects of gamma radiation on navel orange rootworm, Paranymphus trisperilella (Walker). (Subrahmanyan, G., 1967)

357
The pathogenic effect of small and average doses of gamma-rays on future generations of irradiated insects. (Yablokov, V. V., 1989)

Effect of dimethyl sulphoxide (DMSO) on productivity of x-rayed flour beetles. (Edman, H. E., 1965)

A comparison of the sterilizing effect of x-rays, mustard and mustard on Drosophila melanogaster. (Snowden, L. S. et al., 1968)

Stock differences in x-ray-induced sterility pattern of Drosophila melanogaster. (Stoffelsma, P., 1959)

Observations on the behaviour of pupae of Hylesia curta irradiated with γ radiation. (Bogolepov, G., 1968)

A study of the life history and the effect of radiation on rice weevil Sitophilus oryzae L. (Chetan Raj Babu, 1969)

Genic effects of gamma radiation on the Indian meal moth and the Angoumois grain moth. (Coughlin, R. R. et al., 1969)

Sterilization de la mouche méditerranéenne des fruits, Ceratitis capitata Wied., par irradiation des puces aux rayons gamma. (Péron, M., 1969)

Gamma irradiation of pupae of the tobacco budworm. (Gilbert, H. M. et al., 1967)

The effect of gamma irradiation on the Vasa race of Heliothis virescens. The effect of irradiation of eggs in the early and late embryonic stages. (Gulsen, A. et al., 1964)

The susceptibility of the different stages of rice weevil, Sitophilus oryzae L. to gamma radiation. (Khan, Z. A. et al., 1967)

The delayed death of 20 kg gamma rays irradiated embryo of Anopheles maculipennis iguanae (L.). (Kott, A. D., 1962)

Coastal radiation studies with the European shiner. (Lippold, P. C. et al., 1965)

Sterilization of onion maggots by irradiation with gamma-137. (McClennan, R. H. et al., 1962)

Determination of the dorsal membranearchic disc in Drosophila. (Murphy, J. G., 1967)

Effects of sub-lethal gamma radiation on the biology and behaviour of the Angoumois grain moth, Sitophilus oryzae Olivier. (Quedel, Z. A., 1968)

Gamma irradiation of European corn borer larvae. (Ramas, F. E. et al., 1967)

Biochemical and developmental response of grasshopper embryos and spermatogonia to x-irradiation. (Tahmashian, T. N., 1963)

Echmen experiments de radiochimie en lima (Touladi, J., 1969)

Effect of gamma rad ina on Trypoeodes plumeti and Ancylostoma picipes. (Tilton, E. W. et al., 1969)

Effect of gamma radiation on development of Drosophila melanogaster (Roddicke). (Glad, A. M. et al., 1967)

Modification of larvae in species and strains of flour beetles due to x-ray and DDT. (Edman, H. E., 1966)

Effect of ionising radiation on the survival rate of Agrotis segetum silhau, and its ability to breed. (Kudrjavieva, G. K., 1964)

Radiation sterilization of the black blow fly. (Bullock, B. C., 1966)

Radiation studies with the boil weevil: lethal effects on larvae, pupae, and adults; male sterility and dose fractionation. (Freud, H. M. et al., 1969)

Effects of dimethylsulphide on productivity of x-irradiated flour beetles. (Edman, H. E., 1967)

The combined effects of irradiation, vibration, and constriction on sexual fecundity, fertility and life span. (Groch, D. S., 1966)


The effects of gamma radiation on mating competitiveness and fecundity of Heliothis virescens Low. (Pilat, H. M., 1969)

Mating competitiveness of gamma-irradiated and control male Trypoeodes plumeti. (Tilton, E. W. et al., 1969)

Food irradiation research and pilot facilities in operation or planned in India. (Kunka, L. et al., 1965)

2.2.3.Tissue. Organ


The patterns of eye pigment variation in 2 cases of position effect (one in D. virilis and the other in D. melanogaster) were laid down in the imaginal eye disk during the end of the 1st larval instar. The timing of this determinative event was made possible by comparing the variegation patterns with the size and shape of twin spots in the adult eye formed by the x-ray induction of somatic exchange at the end of the 1st larval instar. In D. virilis, the variegation patterns and the twin spots were compared in different flies; whereas, in D. melanogaster, a scheme was devised so that the comparison could be made in one and the same eye. The variegation pattern was cloned; therefore, the information contained in this determinative event was passed on to the daughter somatic cells for a number of cell generations until the differentiation of the eye was complete and pigment synthesis initiated. Although growth was markedly inhibited in larvae fed on a medium containing actinomycin D during the 1st instar, such treatment did not affect the pattern of position-effect variegation. (CA 67, 1967, 301764)


Seven different species of cockroaches were tested for verification of the "Sparrer Hypothesis." The endochelal cell of the midgut was used as the radiosensitive indicator. Positive correlation with Sparrer's work on plants was obtained. (Arch.)


The use of an organ culture to evaluate the action of Co60 on survival time of insect tissues treated with propyl gallate was tested on heart fragments from embryos of the orovipterous moth, Phalesia cassiella. The developmental period for these embryos is ~3 months. 86 fragments (4 hearts/10) were exposed to 22,000 rad of γ-rays at room temperature, which served as controls, a 3rd group of 36 fragments to 44,000 rad. Survival time at this level was ~10 days. Various concentrations of propyl gallate were tested. Propyl gallate proved to have radioprotective value. It extended survival time to 100% at the higher, and 96% at the lower level of irradiation. High concentrations of propyl gallate have a toxic effect on the tissues. In the 1st series, with a concentration of 0.0221 g/100 ml, only 70% of the fragments recovered and recovery time was slowed. In the 3rd series, 100% recovered, with a lower concentration of propyl gallate. Propyl gallate is an antioxidant. Its protective action is discussed.


The midgut epithelium of a species of earwig, Chilo suppress maro (F.), and of the Mediterranean fruit fly, C. capitata (Wiedemann), were found to be rather normal in appearance following exposure to 50,000 r (x-ray) and 10,000 rad (γ-ray) respectively. This phenomenon is in contrast to the severe damage to mammalian small intestine resulting from a dose only 1/2 as great. Since there is good reason to believe that insects is important in maintenance of the midgut epithelium in both insect...
species, the radioresistance of this epithelium implies considerable radioresistance on the part of the regenerative cells. (Auth.)


The appearance of radioresistance of the muconal membrane of the middle intestine was studied in B. fusca (Orthoptera) irradiated with a dose of 25,000 R. The most radioresistant cells are the regenerative cells at the moment of their differentiation in the stem elements. The irradiation does not suppress the secretion of epithelial cells. (Tr-auth., NIA 15: 1941, 37940)


L’étude histopathologique du mésogetion chez l’Orthoptère Blabera fusca Br. (irradié par les rayons X à la dose de 20,000 rad, a montré que 1) les cellules épithéliales sont plus sensibles à l’action des radiations ionisantes que les fibres musculaires; 2) une augmentation de la résistance aux rayons X des cellules épithéliales apparaît au cours de leur différenciation cellulaires en éléments fonctionnels. A ce stade, les radiations morphologiquement décelables évoluent rapidement; 3) des poumons apparaissent de plus en plus nombreux dans les premiers jours de post-irradiation entraînant un dépérissement des crypts de régeneration. La restauration se fait par division mitotique à partir du milieu de la deuxième semaine. (Tr-auth., NIA 15: 1941, 37940)


The effect of actinomycin D (AD) on the development of the imaginal eye disk was studied. I. was placed in the food at 10 µg/ml during the 1st and 2nd instars. Histological studies indicated that the head anlagen of treated larvae (which weighed 10% as much as the control larvae) were somewhat smaller at the end of the 1st instar, although they contained the same number of cells. Cell division during the 1st instar was not affected by AD. During the 2nd instar, cell division ceased in the treated anlagen, while these cells in control larvae underwent normal cell division. This was an abrupt change in sensitivity to AD since anlagen of larvae on normal food during the 1st instar completely stopped cell division when placed on AD-containing food at the end of this instar. The fate of the presumptive eye cell within the head anlage was determined by measuring the frequency and size of twin spots produced in the adult eye resulting from X-ray-induced somatic crossing-over. L-treated and control larvae were irradiated at the end of the 1st or at the end of the 2nd instar. No significant difference was observed between the control and T frequency in the twin spots or in their size when the somatic crossing-over was induced at the end of the 2nd instar. The control anlagen during the 2nd instar contained no cell division in the L-treated anlagen, but three cell divisions in the control anlagen; I probably blocked cell division during the 2nd instar but allowed the chromosomes to replicate, and the chromosomes were subsequently distributed normally to the cells formed when cell division resumed upon removal of the larvae from the AD-containing food. (CA 67:1967, 51296)

2.2.4 Develop


These problems are clear zone, life-cycles or n-including population response that the o-zone component y-body components, inv body types, and on field natural habitats. Radiat: which process quite diffuse their ecological response to 105% increments. Yoc trees in 7 lat 8 lat are nymphs (Acheta) and spots of radiosensitivity to cays the field than in the lab. In the field lots of bugs were tested and 1000 rad of y-radiation fall (colony) (500 rad

360


The morphology of the rr shoot moth, and the proc. red pupae and the reprocessos males irradiated with 99-136 unirradiated individuals, is thinning of the veins o location, degeneration o

The morphology of the male reproductive system of P. bursana (Schillermiller), the European pine shoot moth, and the process of spermatoogenesis are described. Spermatozoa were first observed in 2-d pupae and the reproductive system was fully formed in 21-d pupae. The gonadal tissues of males irradiated with 36000 and 54000 rad as 11-d pupae and as adults was compared with that of untreated individuals. Irradiation caused increased vacuolation of the testicular epithelium, thickening of the walls of the seminal vesicles, dispersion of the spermatozoa from their peripheral location, degeneration of sperm bundles, and vacuolation of the testes. (Auth.)

See also

967 A cyrological study of radiation effects in testes of the screwworm fly, Cochliomyia hominivorax (Diptera: Calliphoridae). (Hoffmann, J.K., 1977)
948 Effect of gamma rays on development of the test cells in the bristle fly. (Kumagaya, A.Y., 1995)
965 Analysis of genetic sensitivity to r-rays of ovaries of Drosophila melanogaster. (Dacey, M., 1983)
972 Dose rate effect of radiation on spermatogenesis of the silkworm. (Sugai, E., et al., 1987)
1305 The effect of r-rays on the acetylcholine level in insects. (Gusevik, K. et al., 1995)
1318 An autonomic study of the relation between hemocytosis and connective tissue in the wax moth, Galleria mellonella L. (Shivavarte, S. et al., 1985)
1391 Royal activities radiobiological sur bomyx mori. (Toullade, J., 1986)
1401 Intestinal damage and water imbalance in gamma-irradiated larvae of bomyx mori. (Lam_io, Z., 1986)
1402 Reversal of hemochelematization and the activity of the paternal chromosomes set in the male newly hatched. (Ner, E., 1987)

2.2.4. Developmental Stage Response. Delayed Development


1364 Amsen, S.I., Amsen, D.A., Jr., Roes, A.P. POSTATTACK INSECT PROBLEMS. p.137-149 of "Proceedings of the Symposium on Postattack Recovery from Nuclear War." Fort Monroe, Va., USA, 6-9 Nov. 1987. These problems are essentially radiological or ecological. Radiological problems include d-dose response, life-cycle or radiation profile, and comparative radiosensitivity. Ecological problems include population response, habitat, and secondary effect. Evidence has recently accumulated that the d-dose component of local fallout may be significantly greater for small organisms than the d-dose component. Investigations are needed on a-dosimetry in insects representing characteristic body types, and on field responses of insects subjected to acute or chronic d-exposures within their natural habitats. Radiation profiles were established for Aedes aegypti and Tsetse fly, which possess quite different early life-history stages (morphologically and physiologically, and in their ecological requirements). The 1st experiments involved exposure to radiation from 1 to 100000 increments. Younger stages again proved more sensitive than older ones. If mean survival times at 4 kHz or 8 kHz are compared with those of controls, the small larvae (Tsetse) and small nymphs (Aedes) appear to be considerably more sensitive than older stages. Some general index of radiosensitivity is clearly required. Greater mortality appears to occur in irradiated Aedes in the field than in the laboratory (presumably due to predators and possible pathogens). - Individual lots of bees were tested for sensitivity to d- and neutron irradiation under laboratory conditions. - Radioactive effects in Aedes during the life span of worker bees by 90%. Irradiation of entire social units (colony) (4000 rad d-rays at 60 rad/min) had catastrophic effects, causing pollination to drop
by 37% in 9 d, and to cease completely by 16 d. Within 3 d post-irradiation, ~99% of the bees had died.

Bacnoti, B. A CYTOLOGICAL STUDY OF THE EFFECTS OF RADIATION ON THE DEVELOPMENT OF THE REPRODUCTIVE ORGANS OF TWO SPECIES OF FRESH LIES: OSYRA HIGHLAND AND CASTORIUS capitis. Observation on normal Drosophila melanogaster males are also reported. Applications of the findings in insect control using the sterile-male technique are discussed. Results showed that radiation damages spermatogonial and first spermatocytes, but not spermatids. The action of radiation on male gonads appeared to be essentially mitotic and not to involve structures that influence sperm mobility and penetration. The timing of spermatozoa at different stages of development from larva to adult was studied in D. pseusta by determining the type of germ cells present at each stage. Irradiation carried out during the pupal stage caused a decrease in the number of sperma- tozoa that reached maturity. It was concluded that the optimal time for males to be irradiated for population control is when motile or spermatozoa spermatogonic stages are most abundant in the gonad. Observations of radiation effects on female reproductive organs indicated that damage to ovarian structures irradiated at various doses at the pupal stage was qualitatively similar but variable in intensity. Radiation doses that caused an optimal cytogegetic effect in males inhibited completely oviposition in females because of damage to the oocytes. (NASA 20:1860, 40247)


The successive developmental stages of the ovary and oogenesis were investigated in the larva, pupa and adult of L. kibrie, and effects of various doses of Gamma-rays administered to last-instar larvae was studied. The histological differentiation of ovaries and testes begins to become distinguishable in 3rd- and 4th-instar larvae. In the last instar, the ovaries are clearly distinguishable, and this ovarian "germarium" is described in detail. Each ovotube contains from 40-60 oocytes in different stages of development, corresponding to seven ovarian zones, A-G, which are described. Exposure of last-instar larvae to various doses of gamma-rays caused delays in metamorphosis: instead of the 3-5 d controls it extended to 9 d after 2000 rad, 10 d after 4000 rad, 12 d after 8000 rad, 15 d after 10000 rad, 20 d after 14000 rad, and 30 d after 16000 rad. Apart from these, a certain number of larvae die without undergoing metamorphosis which corresponds, on the other hand, to very long larval survivals from 28 d after 5000 rad up to 94 d after 15000 rad. Larval mortality may reach 98% at 5000 rad, rising to 72% at 10000 rad and to 60% at 15000 rad. - The duration of pupation is affected less from a duration of 3-3.5 d in controls it changes to 6-7 d in pupae (from larvae irradiated at 14000 rad). Pupal mortality occurs above 15000 rad (30%), and rises to only 58% at 14000 rad. It is independent of the delay in pupation.

- Irradiation effects on ovotube development and oogenesis show up after 2000 rad, administered to last-instar larvae. Subsequent adults are of reduced size but their ovaries still have the usual oogenetic stages in the vitellogenic. Only 1/2 of each ovotube is, however, occupied by choriogenetic eggs of stages C and H, with C predominating. Adult ovaries are reduced still further by 4000 rad. Young oocytes are now rare or have disappeared, and the apexial part of the ovotube appears "amphitrichous". At 8000 rad, the moth is literally eunuchoid. The ovarioles measure only 0.5 mm, shrinking to 200 μ at 14000 rad. The most sensitive oocytes are those at a stage of multiplication in the germarium. - Irradiation of pupae causes less significant changes. The feminization of incompletely sterilized females has not been checked. Already at 2000-4000 rad, however, cytogenesis anomalies become noticeable, particularly a negative Feulgen reaction.


The posterior extremities of eggs of the insects were exposed to X-irradiation before attaining the stage of 18 nuclei. Histological sections of larvae from irradiated eggs were prepared for examination of the gonads. A 2nd generation of adults developing from demonstrates the extermination to 10³ R contained gene the germinal primordia.

Begley, G. CRITERIA FOR RADIATION PROTECTION. Delay irradiated with γ. The following tests based of paper is H. cages (1-3 d old with 38 500 rems to what is their form pop corn administered to 2 position and caused 4 old permitted almost to fail to hatch, at (RACE 63:1987, ref.2

Baudouin, W.K., YH. MITCHELL. Acarnis tosa. The egg, larval, hypop 46, and 220 larva of y-3 to the adult age at 46 2-2 days after 6 larvae did not produce larvae.
the gonads. A 2nd group of irradiated eggs was reared to adults and the gonads were examined. Adults developing from eggs exposed to a dose of 10^6 rads were female and reproduced normally. This demonstrates the extreme radiosensitivity of the germ cells. Larvae developing from eggs exposed to 10^8 rads could not hatch.

The results were not caused by selective destruction of the germinal primordia located in the posterior region of the egg. (NSA 25: 1956, 1959)


The following is based largely on the author's summary. In experiments in Romania, the susceptibility of pupae of H. cunea (Daury) to γ-radiation varied greatly with age. Adults from pupae treated when 3-8 d old with 30,000 rads were almost normal in rate of emergence. Life-span and mating ability, whereas those from pupae irradiated when 3-8 d old were adversely affected. Doses of 10,000-100,000 rads administered to pupae 3 d old greatly reduced adult emergence, adult life-span and reproduction and caused complete sterility of any eggs laid. The same doses applied to pupae 8 d old permitted almost normal adult behaviour: with doses of 40,000-80,000 rads, the eggs that were laid hatched, and with 10,000-40,000 rads the eggs hatched but the larvae soon died. (RAF-A 85: 1957, ref. 267)


The egg, larval, hypopus, and adult stages of the mite were treated with 12.5, 25.0, 40.0, and 100 krad of γ-radiation. Eggs hatched at 100 krad. Eggs and hypopus were able to transform to the adult stage at 48 krad, but larvae did not mature at doses > 50 krad. Irradiated adults produced f1 adults after dosages as high as 25 krad and irradiated hypopus and eggs at 91.5 krad, but larvae did not produce f2 adults at dosages > 33.2 ± 10% krad. (From auth.)


The possible application of the sterile male technique to this pest of the Solanaceae family, particularly of the tomato plant, was explored. Optimal conditions of day and night temperature, relative humidity, photo-period, light intensity and diet, were first determined in order to produce large numbers of insects in a controlled environment chamber. Irradiation with 250 kV x-rays showed that radiation increased with the development doses resulting in 50% lethality increased in the ratio 1 x 10 to 2010 of 2-3-old eggs, 1-week-old pupae, and 3-5-old adults, respectively. Radiation resulted in increased mortality of offspring, especially during molting, and a lengthening of the various larval instars as well as a reduction of the life-span in adults irradiated as adults or emerging from irradiated pupae. The min. exposure dose for sterilization of both sexes proved to be 2000 R for pupae irradiated 2 d before the end of metamorphosis, and did not affect the sexual vigour of the insect. The sterile male technique could therefore be used in controlling this pest. (Based on auth.)


The egg, larval, and pupal stages were found last for 7-9, 13-17, and 5-13 d, respectively. The highest rate of ovariolation was at 3-7 d. Different stages were exposed to radiation (from a Co-60 source and the reactor, PUSA). Males were more radiosensitive. Sterility in adults was induced by 35-4000 rad, co hatchability being observed at 4000 rad. The LD 50 for eggs, larval, pupal, and adult stages were 150, 120, 120, and 74000 rad, respectively. In the laboratory, a dose of 28000 rad killed 100% of the eggs and the larval stage and 91.5% at the pupal stage, while all adults died within 10 d of exposure.

A study of the growth effects of γ-radiation on the Indian meal moth, *Plodia interpunctella* (Hübner), and the Anagasta kus隽稨 grain moth, *Sitotroga cerealella* (Oliver), was conducted. All metamorphic stages of the insects were treated with 1.4, 1.0%, 1.5, 8, 1.5, 0, or 100 head of γ-radiation. Weekly observations were made to check mortality, ability of treated metamorphic stages to continue their development, and reproduction by treated individuals and their first-generation progeny. Eggs on both species and larvae of the Indian meal moth were effectively controlled by all dosages. Larvae of the Anagasta kus隽稨 grain moth were controlled by all dosages except 1.5, 0%, 1.0%, and 0 head, which permitted some larvae to develop to the adult stage and reproduce. The life of insects treated as adults or as pupae was not greatly shortened by the treatment, but the fecundity of sterility and a marked reduction in progeny produced per pair of moths varied directly with the dosage applied. Genetic damage, as evidenced by reduced reproduction, was transmitted to the F₁ generation, when treated directly. Males of both species were less subject to genetic damage than were females; however, the progeny of treated males was more subject to genetic damage than was the progeny of treated females. A dosage of 1.5, 0 head should be sufficient to eliminate hidden infestations of eggs and young larvae of both species in packaging plants by preventing further development. (Essentially auth.)

1347 El-Nakhaw, S. F., Linne LOUCUT. Bull. Soc. 3rd and 5th instars b from 200, k = 0.9 obtained 3 and 5, d, and age, but increased with d. Lethebieten aor less susceptible to radiat.; k = 0.9 (low rate) in 3rd instar.

1348 Edman, H. E., METAM. PUPAL FLOUR BEETLE, 3rd. Abstr. 3. Present undelayed metamorphosis to 70% of x-radiation of p differential radiosensitive divisions in specific tis.

1349 Edman, H. E., EFFECTS ON BEETLES. Nature, Lond. The investigation was conducted when flour beetles were fully mature and were 76 k of x-rays. Each of the noted twice weekly (multi- ple metamorphosis in untreated against a 3% failure to progressively with decrease possibly due to adverse e gradually, reaching a phi levelled off by day 16 at 4 k, indicating no change.

1350 Edman, H. E., ON TOXICOLOGY p. 16-17 of "Pacific Int. and Medicine, Vol. 1", Pacific Northwest Lab. A sixth egg stage was more sensitive than younger instars; this species were 1-3 k and adult lethality at 9 k at.

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Adults of the flour beetle, Tribolium confusum, exhibited a marked and progressive increase of radiosensitivity with age. Although there is no detectable difference in radiosensitivity between males and females in newly emerged beetles, the sensitivity of males increases with age more rapidly than that of females. Thus, for example, the LD 50/5 weeks at 30° is 72 hr for young adults of either sex, 21.5 hr for 4-month-old females, and is just under 10 hr for females of 1-year-old. Nine months after emergence, the LD 50 (corrected for control mortality) is about 7 hr for females and 6 hr for males. The estimate for 8-month-old adults has a large error because of the small numbers and significant control mortality, but the sex-difference is all the more spectacular because the mortality rate of control females is greater than that of males. Beetles raised and maintained at 25° rather than 30° also exhibit a progressive increase in radiosensitivity, but the change develops more slowly, as would be expected of a phenomenon dependent on metabolic processes. These results should be considered in the light of findings by previous investigations, and confirmed in our own studies, that beetles surviving low or middiaper radiation doses exhibit increased mean lifespan. (Abstr.)


1st, 3rd and 5th instar hoppers and adults of Schistocerca gregaria Foeckl, were exposed to doses ranging from 000 to 500 kR, at dose rates of 150 kR/min and 600 kR/min. Mortality data were obtained 1 and 5 days, and 1 and 2 weeks after exposure. Susceptibility increased with increasing age, but decreases with the dose received. Doses over 1000 kR stopped feeding and produced sluggishness. Cannibalism among 5th instar hoppers was frequent even after small doses. Females were less susceptible to radiation than males. A dose of 1000 kR produced LD 50/5/5 (high rate) and LD 50/3 (low rate) in 5th instar hoppers, with a corresponding LD 50 for 5th instar hoppers.


Undelayed metamorphosis and reduced number of adults having decreased longevity were noted up to 70 kR x-radiation of pupae regardless of sex. Examinations of these radiation effects concern differential radiosensitivities of dividing and non-dividing cells, frequency and occurrence of cell divisions in specific tissues, and nuclear vs. cytoplasmic alterations. (Abstr.)


The investigation was undertaken to determine whether metamorphosis and length of life could be altered when flour beetle pupae were treated with x-rays. 25-26 d old pupae of Tribolium confusum (Jacq.) were dissected and given doses of 1, 2, 3, 5, 7.5, 20, 30, 40, 50, 60, and 70 kR of x-rays. Each of 6 replicates at each dose contained 16 pupae of each sex. Deaths were noted twice weekly (culture at 25°C, r.h. 80-90%). The number of individuals unable to complete metamorphosis increased progressively from 0 to 70% of total, within delays in metamorphosis, against a 30% failure to metamorphose at 7.5-26 kR, and ~45% at 70 kR. Mortality increased progressively with increased exposures. 7.5 kR lethality approached 100% after 9 days possibly due to adverse effects of radiation cell division(s). The lethality curve for 2.5 kR rises gradually, reaching a plateau by day 9 at 18-15%. The 5 kR curve has a gradual slope which levelled off by day 16 at ~60% lethality. Pupae (25-40-d-old) and 1-d-old adults were sterilized by 4 kR, indicating no change in mesothoracic activity between these developmental stages.


Early egg stages were most sensitive to irradiation. Mature larvae of T. castaneum were more sensitive than younger larvae or more advanced stages. Higher doses for adults of 2nd stages of this species were 14-16 kR and sterilizing doses were 5 kR. Tribolium confusum was more sensitive with adult lethality at 8 kR and sterility at 4-5 kR.

Incomplete metamorphosis and reduced adult life span were observed when pupae of the flour beetle *Tribolium confusum* were x-irradiated.

Farkas, I. **The radiation resistance of *Tribolium confusum* (Duval) and *Tenebrio molitor* (Henn.).** *Kozl. Kozesni Elektroinjekciu Kategratman* 9 (1965) 13-15. (In Hungarian)

Farkas, I. **Study of the irradiation tolerance of *Tribolium confusum* (Duval) and *Tenebrio molitor* (Henn.).** Acta biol. hung. 18 (1967) (P).


Experiments on the sterilisation of *C. capitata* (Wied.) by treating the pupae with γ-radiation were carried out in France. Pupae irradiated at 5-15 kGy when 2-5 days old, were killed or gave rise to adults that died soon after emergence; irradiation of older pupae did not affect emergence, but a dose of 5 kGy caused rapid mortality. Female fecundity was reduced by treatment with 5 kGy and decreased with increase of the dose. Irradiation did not, however, prevent the females from making many oviposition punctures in the fruits provided and laying some non-viable eggs. Male pupae irradiated at 8 kGy gave rise to sterile adults with unpilared mating capacity. Studies with mixed populations of normal and treated adults showed that a ratio of at least 30 sterile flies to one normal one was necessary in order to obtain a reduction of over 95% in egg viability. (RAS A 56 1967, ref. 610)


Pupae of the tobacco budworm, *Heliothis virescens* (F.), were irradiated with *Co γ-rays before adult emergence. Male moths were 99% sterile after a dose of 36 krad. Female moths produced very few eggs when the dose was greater than 50 krad, though there were some eggs hatch at this dose level. The emergence and lifespan of both sexes were reduced by sterilizing doses. The initiation and length of the oviposition periods for females mated with either treated males or untreated males were similar. However, females crossed with treated males produced significantly fewer eggs. Virgin females laid eggs, but their oviposition began later and was shorter than that of females crossed with males. The average life-time production of eggs for single pairs of control moths was about 200 eggs, though some females did produce more than 1500. When the sterility data from irradiated moths were plotted, the resulting dose-response curve appeared to be sigmoidal. Cytological observations on spermatogenesis indicated that sperm were present in the testes at the time of irradiation. (Ausz.)


Results are summarized from a study of the effects of γ-radiation on the eggs of the silkworm, *B. mori*, exposed during various developmental stages, and on the morphology of larvae and on the health and fecundity of adult moths hatched from irradiated eggs. (NC A 26 1966, 1965)


2nd- and 3rd-instar larvae of *G. mellonella* (L.) irradiated with X-rays at 12000 R at the rate of 500 R/min showed nervous cellular abnormalities in the last instar, some of which are described. The larval period was increased by two months, and pupation was partially or completely inhibited. (RAS A 55 1967, 8)

Kenneb, T. J. **Sensitivity of various stages of *Drosophila melanogaster* to gamma radiation.** *J. econ.* Ent. 49, 4 (1972) 1041-1058.
All stages of D. melanogaster Meli, were exposed to γ-radiation from a \(^{60}\)Co source. The sensitivity, in descending order, was: eggs, 3-4-old larvae, 4-5-old pupae, 3-4-old pupae, and adults. Exposure of eggs to \(d=0.6\) keV caused a high mortality rate in the egg and larval stages after exposure to 0.4 keV. In the pupal stage, irradiation of larvae resulted in a high rate of pupal mortality. Adult females exposed to as much as 55 keV lived as long as untreated females. Adult males were shorter lived than untreated males after exposure to 23 keV or more. (Ame.)


An experiment is being carried out to determine the lethal dose of γ-radiation for laboratory-reared flies at various stages of the development cycle. The insects are exposed to a simulated food medium and irradiated with the \(^{60}\)Co plate source. This dose also reduced the adult fly viability. Thus 10 lead may be sufficient for quarantine control of citrus and other fruits against this fly. Tests are now being carried out with lower doses and in vivo conditions, and eventually the wild type flies will be studied. (Ame.)


The irradiation of caterpillars of unmarrried gypsy moths with X- and y-radiation at doses up to 5000 R causes both a stimulating effect on the growth and development of the caterpillars as well as sterility (partial) of the developing males and females. The males developing from irradiated caterpillars were quickly mated and as a result dark-colored individuals appeared more often. Irradiation at doses of 500-5000 R did not cause externally any more deviations from the control caterpillars, but the sterility effect appeared sooner. The irradiation of caterpillars at doses above 5000 R had a decreasing effect on the growth and development and caused a significant increase of the sterilized individuals. A large number of light-colored individuals characterized by a low stability with respect to diseases and changes in the abiotic factors occurs. X-radiation has a more depressing effect than y-rays at all doses. (tr-auth.)


A study was conducted on the effects of γ-radiation from a \(^{60}\)Co source on all developmental stages of Drosophila melanogaster L. Complete mortality of eggs was obtained by 2000 R, of larvae by 10,000 R, of pupae by 12,000 R, and of adults by 12,000 R. Production of progeny was stopped at 10,000 R in all the developmental stages. 12,000 R might be considered as minimum effective dose for the control of D. melanogaster L. (Auth.)


Different developmental stages were irradiated with y-rays from a \(^{60}\)Co source, at 700 R/min. The results are interpreted in terms of interference with the transmission of information, referred to as DNA transduction. 1- and 4-day-old eggs, larvae 5-6 h after hatching from 4-day-old eggs, and pupae 1, 2, 4, and 9 days after pupation were used. The radiation effect was estimated in terms of the number of insects able to pass into the next developmental stage. The dose range studied was from 1-20 kR. After irradiation, the insects were kept in a thermostatic at 26°C and 50-60% h. The results represent average values from 3 series of experiments. The dose-effect curves were obtained for different radiation effects. The results indicate an extremely high sensitivity of the DNA transduction process, in connection with the transmission of new information and transition from one developmental stage to another. Thus, larvae continued to grow after irradiation but when it was time for a new piece of information to be transmitted to bring about
population, DNA transcription appeared to be totally suppressed, so that a larva continued as such for some 10 d without turning into a pupa.


Irradiation of diapausing eggs of B. mori with 20-Hr. gamma-rays inhibits completely the hatching; the post-diapausal development however, albeit delayed, is not immediately arrested. The respiration is blocked at the level characteristic for normal gastrulae (300 ml O2 uptake/g of eggs). The synthesis of DNA continues till the amount of 1.2 mg/g of eggs is attained, corresponding to that found in normal eggs just ready to hatch. The synthesis of RNA is injured, the total amount being by 20% lower than in normally gastrulating eggs (4.6 mg and 8.5 mg per g of irradiated and normal eggs respectively). The necrosis is abnormal as indicated by the low electrolyte content found at the end of post-diapausal incubation (26 mg and 80 mg/g of irradiated and normal eggs, respectively). The effects of investigated radiation doses are in many respects similar to those observed by Brachet et al. (Dev Biol 9: 1964, 395) in actinomyces T treated amphibian embryo. The damage of transcription process is suggested as the main mechanism of delayed injury of insect embryogenesis, due to existing radiation. (Abst.)


Larvae of the species A. m. atripennis in the four stages were irradiated, part of them 54 h after molting and part 96 h after molting. The adult hatched from these larvae were mated with normal ones. Mortality was higher in the larvae irradiated 54 h after molting than in those irradiated 96 h after molting. This difference is probably due to mutistic disturbances which take place more frequently in the stages of growth of the larvae irradiated after only 54 h than in those after 96 h, near to the nymphosis. From the crossing of adult hatched from irradiated larvae with normal females, with control of crosses it was observed that percentage of hatched eggs and eggs having dead embryos was considerably different in the two types of experiment. As the number of hatched eggs was decisively higher, and the number of dead embryos lower in the larvae irradiated 54 h after molting, it follows that a lower frequency of dominant lethal mutations must exist in the larvae irradiated 96 h after molting. This would seem to signify that the greatest sensitivity to x-ray effects is when the spermatogenesis phenomena are completely or almost over. In the larvae after 54 h spermatogonial cells in the mutistic or interstitial stages were observed, there were some leptotenic stages and rare cases of pachytene; on the contrary in those mutated after 96 h there were abundant spermatids and pachytene stages. (Abst.)


Dosages of 3000 rad on 2nd-instar larvae inhibited adult development. An LD50 of 11,000 rad was obtained for adults 5 d after treatment. Crosses with 2500 rad-treated field-collected females resulted in fertile eggs. Mature male eggs were killed at 15,000 rad. (Abst.)


Pupa of the onion maggot, H. angustifolia (Meigen), did not complete their development when irradiated with 3.5 rad within 5 d of pupal formation. Older pupae were not adversely affected. Females from treated pupae were sterile and laid no eggs when caged with normal males. The males from treated pupae were sterilized to a high degree, yet normal females mated with them and laid normal complement of eggs. Less than 0.0% of 10,000 eggs laid by normal females caged with sterile males hatched. A 6:1 ratio of sterile to normal flies reduced egg batching to 1.75. (Abst.)


Experiments were conducted to test the sensitivity pattern for two age groups corresponding to different temperatures, 1 x-ray. The exposure of different age of the eggs at irradiation, regard to possible different (NDS 1968, 41970.

1368 Murakami, A.; Tazima, Silkworm, 1. SCREENING. Rep. natn. in.


1370 Murakami, A. VARIAT. OF THE SILKWORM EGG.

In order to elucidate effects newly deposited eggs were mated with males w experiments were conducted subjected to 1000 R x-ray 1000 R 773 KVP x-rays, 2 x-rays. Cytologically, the division cycle was 46-50 with those obtained from correlated with a cycle indicate that the peak of

1371 Murphy, G.G. DETRIV. Abstr. 27, 6 (1967) 2992.

The right and left dorsal and one-half of the thorax involving extirpation and each male marked tissu indicate separate mitigation in particular regions within the region with other growth before metamorphosis capable of intrinsic uptake. Similar results were obtained and one-half of the males presented indicates that 7 structures, do not exist a determination of both the other larval segments in


Irradiation of specific eggs anterior seven segments.

Experiments were conducted to determine whether the developmental stage at irradiation affected the sensitivity pattern for mutant types in *Pterostigma*. Dose-effect curves were established for pupae of two age groups corresponding to the stages that were attained by preemergence treatments at low and high temperatures. Both pupae were exposed to 200, 300, 500, 600, 800, or 1000 kV equivalent x-rays. The x-rays were x-rays of an x-ray generator. Age groups differed in their mutational spectra. Results are discussed with regard to possible differences in the specific radiosensitivity of epithelial cells and scale stem cells.


In order to elucidate differences in radiosensitivity at various phases of the DNA cycle of the cell, newly deposited eggs were used, taking hatchability as a criterion. Wild type Codd female silkworms were mated with males with the double recessive egg colour genes, pe and pe. Three series of experiments were carried out, using either 7 or 8 x-rays. Experiments involved exposure of adults hatched from eggs to 1000 R 6 x-rays at 600 R/min; II - collected for 30 min intervals, subjected to 1000 R 7 x-rays at 600 R/min; III - collected at 50 min intervals, subjected to 1000 R 6 x-rays. Cytological observations by the squashes method showed that the time required for one division cycle was 45-50 min at 25°C, and 100 min at 30-31°C. The results were in good agreement with those obtained from hatchability data, indicating that the radiosensitivity pattern may well be correlated with a cyclic change in the cell division cycle. The cytological studies now in progress indicate that the peak of radiosensitivity appears around late prophase and metaphase.


The right and left dorsal mesothoracic imaginal discs of *Drosophila* larvae each give rise to one wing and one-half of the thoracic mesothorax with its characteristic pattern of bristles. Experiments involving extirpation and transplantation of whole discs, as well as cell lineage studies of genetically marked tissues indicated that the right and left dorsal mesothoracic discs were determined as separate anlagen early in development, probably in the embryonic stage. On the other hand, particular regions within each disc were later found to be individually capable of regenerative reorganization under special conditions, such as x-ray treatment or provision of an extra period of growth before metamorphosis and concomitant differentiation. Thus, the discs were shown to be capable of intrinsic regulation, but free from regulative influences emanating from other anlagen. Similar results were obtained with the two eye discs, each of which normally gives rise to one eye and one-half of the dorsal surface of the head with its associated structures. The evidence presented indicated that these disc pairs, although participating in the formation of medium structures, do not exist as members of a bicentric regulative field. Instead it is concluded that determination of both eye and wing disc pairs into right and left entities is complete, both in mature larvae and in larvae in the middle of the third instar. (From DA)


Irradiation of specific regions of 5- to 20-h-old housefly pupae with x-rays shows that exposure of anterior seven segments alone to 3100 R prevents adult emergence, whereas irradiation of posterior
region with doses up to 10,000 R has no effect on this phenomenon. It is evident that the target organ, damage to which results in the failure of adult emergence, lies in the anterior segments. It is suggested that failure to emerge is due to a direct effect of radiation on the differentiating mycetids leading to dystrophy of the muscles. (Auth.)


The lethal and sterility-dosing stages of y-radiation were determined for various developmental stages of the little brownfly, PASTIA CENERELLA (L.). The flies were exposed to y-radiation in a 300 Ci RnCo-irradiation with a mid-point flux of ~200 rad/min. (Abstr.)


Les methodes de culture et de radioprotection ont ete identiques a celles decrites precedentement. Les resultats demontrant que les diminutions de population effectuées sous radioprotection ne sont pas provoques par l'auto-developpement de certains organismes embryonnaires ou larvaires, mais par un simple allongement de developpement des postes. Cette constatation est demontrée d'une part par le retard des eclosions observés dans les cultures protegees, et d'autre part par l'identité numérique des populations adultes constatée aprés la fin de l'eclosion, de 14e au 17e jour.


Previous studies have shown that natural ionizing radiations have a beneficial effect on unicellular animals by accelerating multiplication. Tests were made on Drosophila to determine if a similar effect could be observed on multicellular animals. The use of a radioprotective chamber caused a delay in the development of laying eggs. (ISA 6519, 1964)


Data were obtained on hatching of eggs irradiated with 0-19 Mr at different ages. A 10 Ci Co60 source was used. Development within kernels was observed by x-ray radiographs. Early and late 1st instar were irradiated at doses of from 0-20 Mr. 3rd and last instars, and early and late pupae, from 0-26 Mr. Puppen, from 0-24 Mr. Fecondity and fertility were determined by mating irradiated females with normal males and vice versa. Effects of irradiation on females were evaluated by number and hatchability of eggs, as compared with normal females. Effects of irradiation on male fertility were apportioned by mating males with normal females and noting fecundity and viability of eggs. Upon emergence, following irradiation, males were weighed within 24 h and the adult life span recorded upon death. Females following irradiation of eggs of different ages showed that sensitivity declines with age. Larvae from eggs irradiated at age 0 to 48 and at 48 to 72 h, treated with 0.14 and 18 Mr did not develop; and doses of 2 and 8 Mr and check, larvae developed normally. Adult emergence after irradiation of early and late 1st instars, 3rd instar, and last pupa, and early and early pupae revealed that irradiation delayed emergence and reduced the number emerged. Earlier stages were more sensitive than older ones. More males than females emerged when early larvae were irradiated, but the ratio was approximately unity with irradiated pupae. Structural deformities included twisted wings, fusion of tarsal segments, fusion of antennal segments, incomplete emergence and tumour formation in the abdominal region. They were largely found on adults irradiated while immature. Emergence of 90% adults from irradiated 1- to 6-day-old adults showed that larvae developed under all irradiation treatments but the number of emerged moths was less than in the controls. Fecundity and fertility studies indicate that 20 Mr may cause complete sterility of both sexes when irradiated at 1st instar, 3rd instar, and last instar and early pupae. Females adults following irradiation of pupae when mated with normal virgin males and vice versa either failed to oviposit or laid infertile eggs after 10 Mr. Generally, irradiated females were more sensitive to radiation than males. None of the doses prevented the hatching of eggs in crosses whose treated males were mated to untreated females. Irradiated males were not significantly affected from control irradiated adults when reared where treated males were fertile as compared to females reared with untreated males. 3rd instar and last instar, different from the control showed a significant reduction in fertility.


Rauen, H.S., Lewis, L.C. PEAN CORN BORER LARVAE. Actively growing maize corn borer, Opisthena rubella larval collected in the disporing larvae had h to boron control. Means of pupation, molt ends 8800 rad, Numbers of f Bore was an unusual irradlated and than disporing. Egg batch was significant most strongly. Only 40 Only 8400 rad affected appeared to affect the e mutations. (Auth.)

Rodestein, M., Shuming DOMESTIC FLIES. Musca domestica.

Different x-ray doses vs 42-h-old pupae. The r successfully emerging a restorative factors, only and by delaying the oh enhancement increased males died with 2000 h (only) 27% successfully emerged females shown.
marked to unirradiated females and vice versa, following irradiation of late pupae. In crosses where
untreated females were mated to irradiated males, and vice versa, female fertility was reduced
significantly from controls after doses of \(\geq 10\) kr. Fecundity and fertility of females in 1- and 4-day
irradiated adults was significantly different from the controls under various causes, but the causes
where treated males were mated to treated females showed a marked reduction in fecundity and
fertility as compared to the crosses where treated males were mated to unirradiated females or
treated females to untreated males. A marked decrease in fertility of irradiated adults occurred
towards the 2nd instar and last instar, prepupae, early and late pupae and 1- and 4-day adults was not significantly
different from the controls. Emerged adults irradiated as early and late 1st instar and last instar
showed a significant reduction in body weight. (From DA)

1977 Quriniti, Z. A., Wilbur, D. A.: Effect of sub-lethai gamma on eggs, early, intermediate,
and last instar larvae of the angoumois grain moth, Sitotroga cerealella Oliv., in Proc. Int. Symp.
Irradiation of eggs of different ages showed that sensitivity declined as the eggs became older.
Hatched larvae from eggs irradiated at age group 24-48 and 48-72 h, treated with doses of 10, 14,
and 18 kGd did not develop: in doses of 2-3 kGd the larva developed normally. The adult
emergence pattern after irradiation of the early and late 1st instar or the 1rd and last larva revealed
that irradiation delayed emergence and reduced the number emerged. Further stages were more
sensitive than older ones. Structural deformities included twisted wings, fusion of anterior segments,
fusion of lateral segments, incomplete emergence and tumour formation in the abdominal region.
(Auth.)

1978 Deleted.

1979 Raun, E. S., Lewis, L. C., Pickem, J. C., Kr. Hotchkins, D. X.: Gamma irradiation of
Actively growing non-dispersing 1st-, 4th-, or 5th-instar laboratory-reared larvae of the European
corn borer, Ostrinia nubilalis (Hubner), were irradiated with y-rays from a \(^{60}\)Co source. Dispersing
larvae on the field of experiment were irradiated after either 3 or 6 months of exposure. The non-
dispersing larvae had too much somatic damage from the irradiation to make this a practical method
of control. However, the dispersing larvae showed little evidence of somatic damage. Rates of
pupation, moth emergence, and mating were nearly normal at levels of irradiation as high as
5000 rad. Numbers of eggs laid and egg hatch were most severely affected at 4000 and 5000 rad.
There was an interaction between time to pupation and dose level when dispersing larvae were
irradiated and then divided into three groups (A, B, and C) based on length of time to pupation.
Egg hatch was significantly affected. All levels of radiation affected pupation period A (early
most strongly): Only 4000 and 5000 rad affected hatchability of eggs from pupation period B (middle).
Only 5000 rad affected the egg hatch of pupation period C (late). Irradiation of dispersing larvae
appeared to affect the mortality or viability, or both, of sperm instead of inducing lethal gene
mutations. (Auth.)

1980 Rockstein, M., Bhatnagar, P. L.: x-BRADICATION AND WING RETENTION IN THE COMMON HOUSE
fly, Musca domestica L. Naturwissenschaften 61, 24 (1974) 767-768. (In English)
Different x-ray doses varying from 2000 to 5000 rad were administered to batches of 2000
42-h-old pupae. The number of deaths and degree of wing retention were recorded daily for all
successfully emerging adults, and wing loss data were tabulated. High doses of x-rays acted in a
restorative fashion, with regard to the normal aging process of the adults, by increasing longevity
and by delaying the otherwise characteristic loss of wings early in adult life. The degree of such
enhancement increased with dose level, up to 3000 rad. In the control group, only 7% of 1250
males died with 100% intact wings, while 70% showed complete wing loss. At 3000 rad 99% of
(mean) 274 successfully emerged males showed complete wing retention, whereas all of the 508
emerged females showed complete wing retention at death.


371
Exposure of 50- to 48-h-old pupae of the common housefly, *Musca domestica* L., to single doses of x-rays ranging from 2000-8000 rad had no appreciable effect on the percentage of emergence or on the normal appearance of the adult flies. All levels of radiation produced only a slight but significant decline in female life span. Such low levels of x-irradiation produced only a slight effect on male life span, with a decrease for 2000 rad, no effect at 4000 rad, and a slight increase at 6000 and 8000 rad. However, the effect of such x-irradiation on the otherwise normally high degree of wing loss in male houseflies was much more striking; the number of male houseflies retaining their wings at the time of death being trebled for all four doses levels studied. In the females, there was a smaller but nevertheless significant increase in such wing retention. (Auth.)


When larvae were x-irradiated with 0.5-50 kGy, they were not killed and developed to puparia. Irradiation of larval and prepupal stages caused death in the early pupal stage (early death); disturbance in the exchange of the hypodermis was observed. When puparia were irradiated at 20 h of age of larvae, development continued but emergence did not occur because of general suppression of differentiation (late death). Radiosensitivity, when determined by the emergence rate, was scarcely altered during the period from 2nd instar larvae to 2nd day pupae and thereafter it dropped off gradually. The most radiosensitive stage was 30 to 60-h-old pupae; fully grown 7th-day pupae were about 66 times as radiosensitive at that of 1st-day pupa. The change in DNA synthesis rate was correlated with the change in radiosensitivity of the pupal stages except for the late pupal stage. Results of partial body irradiation of 1st-day pupae were also irradiated. Irradiation of the head and thorax had an equivalent effect to whole-body irradiation; irradiation of the head had the greatest effect. (NSA 31:1967, 22763)

**1383 Schneider-Minder, A.** CytoLOGISCHE UNTERSUCHUngen ZU DEUTUNG DER UNTERSCHIED-lichen STRAHLENEMPfindlichkeit Verschiedenen ALTER Drosophila-EiER. (Cytological investigations to interpret the differential radiosensitivity observed in *Drosophila* eggs of different ages.) *Arch. JUhn Kienz-Sch, Verh.-Forsch. 57 (1962) 26. (In German)


Eggs of *D. melanogaster* were x-irradiated at two stages of different radiosensitivity of the 1st division division (inter-/prophase and an-/telophase) each stage receiving a different dose (1000 or 7500 rad, respectively). This resulted, in spite of the difference in radiosensitivity, in approx. equal rates of embryonic mortality (about 89%). Regardless of the stage irradiated, approx. 80% of the eggs died in early stages of embryonic development. Also, blastoderm formation and, approx. 95% died in late stages of embryonic development. At different times after irradiation eggs were fixed and investigated cytologically. Regardless of the stage irradiated, the same lethal syndromes occurred. Those eggs, which die in early phases of embryonic development, exhibit one type of a rather uniform lethal syndrome only: first the multiplication of nuclei ceases, then that of chromosomes divides; finally the increase in number of proplasmatic islands comes to an end. Before dying, these eggs usually contain eight nuclei, which seem to be mostly ooyctoid; the larger part of the eggs has 96 proplasmatic islands. The main cause of the lethality is probably an induced mitotic block, which itself could at least partly be caused by chromosomal bridges. Among the eggs, which die late in embryonic development, very different syndromes were recorded, which can manifest themselves at stages from the preblastoderm to very late embryonic development. Those syndromes are probably brought about by different radiation-induced lesions of either whole chromosomes or of chromosome parts, they may also be caused by alterations in the informational content of the genome. (Auth. summary)


**1386 Tashjian, T.N., McK, R.C.** AND SPERMATOGENIA. The effects of doses of x-irradiation on spermatogenesis including induction of maturation. Degrees of corn and of all factors is considered spermatogenesis in the germline.

**1387 Tenbrink, K.J.* TIE.* (1966) 547-574. (In German)

The following is the character and adult of *Cricetulus montesi* (Equina) was exposed to irradiated metanephalic lymph nodes and spleen by irradiated adult females. Doses up to 10,000 R were administered.

**1388 Tetelde, P.** RECENTES 5, 2 (1966) 3-57.

Due to its physiological and clinical variable dosing radiations. The total histological and bioactivity of embryonic development of *T. cuniculi* and of *T. cuniculi* further contributed value rates, and of left, and b, radiations on the progressivity that of specific loc particularly sensitive via of meliotic processes, T. cuniculi and stress the sig a better understanding of its physiological and clinical variable dosing radiations.


Data are presented on th, discuss the effects of x-r

**1390 Tilson, E.W., Forkheads, and Antigens**

A study to determine the beetle, *A. plagiariae* (Olivi 1835-1870) 25, 25, 25 intervals for a total of 42 intervals by treated individually with 16 genotypes. H immediately of any of the 1, generation to the larval genotypes of both species. Genetic damage, as evic.

**1391 T. gallinae.** (Auth.)

The effects of doses of x-radiation ranging from 25 to 1000 R, on respiration and developmental of grasshopper embryos were studied, with emphasis on the radiosensitivity of various developmental stages including induction, differentiation, cell division or multiplication, dissolution, and catastrophic. Degrees of complexity at each organization level are discussed and the interdependence of all factors is considered. Results are included from an electron microscope study of normal spermatogenesis in the grasshopper and the effects of x-radiation on spermatogenesis. (NASA 1965, 30164)

1186 Terazaki, I. K. THE EFFECT OF IONIZING RADIATION ON ARAGASODE TICHS, Zoology. 36 PL 3 (1943) 271-274. (In Russian, with English summary)

The following is substantially the English summary. In experiments in Leningrad, larvae, nymphs and adults of Oxyaecues Oxyaecua (Lec. & Mgn.) (Crawling (Hr.)) infected with Drosophila perica (Mgns.) were exposed to x-radiation from a Co source. Doses of 5000 R were lethal to the larvae and inhibited metamorphosis of the nymphs. Doses of 10-30 000 R were lethal to 3rd- and 4th-nymph or adults, and nymphs failed to develop. Metamorphosis of the offspring of irradiated ticks was delayed. Doses up to 10000 R were not lethal to the epidermis of the infected ticks. (RAD-B 60: 1965, ref. 59)


Due to its physiological characteristics (embryonic diapause, synchronous gametic development) and its great genetic variability, B. mori constitutes excellent material for studying the effects of ionizing radiation. The use of numerous criteria (viability, duration of embryonic development, and histological and biochemical analyses) has made it possible to follow the variations in radiosensitivity as embryogenesis proceeds. It has been possible to determine the radiosensitivity of diapause and of hibernation (particularly the effect of aging). Various studies of the embryo have further contributed valuable data on the effect of the mode of irradiation (dose fractionation and rate), and of LET, and have demonstrated the vital role of recovery. The effects of ionizing radiation on the progress of gametogenesis were tested by histological and genetic methods (particularly those of specific loci). The effect of the mode of irradiation and LET were studied on some comparative stages (e.g., advanced spermatogenesis, type VI spermatocytes at the end of meiotic prophase). The results obtained explain the processes involved in radio-induced mutations and give the significance of recovery. Radiobiological studies have also contributed to a better understanding of some physiological aspects of B. mori.


Data are presented on the mechanism and treatment of gastrointestinal radiation effects. Two papers discuss the effects of x-radiation on larval and pupal stages of moth beetles.


A study to determine the gross effects of γ-radiation on T. glabrum (Larvae and the black carpet beetle, A. pupa (Levis)). The effects of 10-10,000 R on the development of the insects were treated with 13.2 ± 1%, 17.5 ± 2%, 15% and 11.7 ± 2% repeated 5 times at hourly intervals for a total of 84 hours ± 5%. Each week mortality, developmental progress, and reproduction by treated individuals were checked. Eggs and larvae of both species were controlled effectively by all doses. However, no dosage was enough to produce complete mortality immediately of any of the stages of either species. Reproduction in both species was hampered in the F1 generation to the insects where the F2 generation received the lowest dosage. None of the families of either species included in the F1 or F2 generations of T. glabrum. (Author.)


Nympix of A. transtata Hagen in their final instar were collected from the river and irradiated in replicate sample groups of 15. Radiation dosage was continuous, and administered at 750 rad/min. Median tolerance limit (TLD) values were determined and plotted. TLD values were calculated from these data were: 24 h - 13 x 10^6 rad; 48 h - 95 > 10^6 rad; 72 h - 52 x 10^6 rad. An unusual phenomenon of accelerated moulting was noted in the groups which received 750 and 7150 rad, respectively. Adult emergence was 1% in the control groups during the 52 h of the experiment, yet 9% of the 750 rad group completed normal emergence during this period. In the 7150 rad group, 1% attempted emergence but only half completed it successfully, the other being unable to straighten the wings of the abdomen into the normal adult position. There was no emergence in groups given > 71,000 rad.


Newly deposited fertilized doses of 80 kv x-rays, were irradiated for 3 min. D3 and post-embryonic mortality, and the percentages of the dose-effect response of the radiation-surviving imagines 1000 amongst them, 3.5% were burned, were extremely high when they were deprived of environment within 10 min and received lethal fast instead of air. All organs between 50 and 45% embryonic mortality. It was irradiated for 3 sec at 60 minutes after the last cycle of cutaneous analysis of the various radiosensitivity stages living during the environmental conditions could be recognized (a) late embryonic, by its Dose-effect curve. It could be shown that this egg cannot be intergraded the superposition of an arbitrary stage present do and Ulrich according to observations did not depend on the dorso-ventral orientation hypothesis. In the and from the dose-effect a significant role in the
A RADIATION ON BRYUM rubens. 1. exp. Ext.

Jann Jaccob de Val: rice was exposed to various levels of 

development insecticides were used. Doses 

the lower grain boron, a 

crited. The dose rate for 

the most tolerant, 

was high enough to 

were sterilized by γ-radiation.

DEVELOPMENT OF THE 

and 375 (1969) 909-914.

of which feeds on cotton 

being shipped to 

ject. Caterpillars were 

B. apparently had no 

were normal and had an almost 

hieratic action. Thus, 

that emerged was appar- 

a-10 and 9 after emergence 

their cocoons at the be- 

emerged white doses of 

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istent to x-rays. Doses of 

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A dose of 1006 R had almost 

cluded within the effects of 

used had no apparent 

EFFECT OF X-RAYS ON THE 


FACES OF THE DAMSEL FLY 

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iment, yet 99% of the 

20% group, 12% 

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emergence in groups

EIN FRÜHER ENTWICK- 

ungstörung of early embryonic 

Naturwissenschaftliche

Newly deposited fertilized eggs of different ages were tested for their radiosensitivity, for various 

uses of 10 kev x-rays. In series 1, 20-25 chili old eggs were collected at 10 min intervals and 

irradiated for 3 min. Dose-dependence. After irradiation in air at room temperature, embryonic 

post-embryonic mortality rates and recessive lethal factors in the X-chromosome gave 

 exponential dose-effect curves. These curves had previously been interpreted as one-hit curves 

such that the radiation-induced point mutations as well as chromosome breaks and their 

results represent the basic cause of all effects registered. Genetic effects in the reproductive tract 

of surviving imagos 1000 R produced 13.3% viability-reducing mutations in the X-chromosome, 

amongst them 2.3% recessive lethals. The rate of reciprocal III/II-translocations, on the other 

hand, were extremely low (0.5%). Oxygen effect. Newly laid eggs are not damaged lethally 

when they are deprived of O for a max. of 7 min. The O content of the egg adapts to the gaseous 

environment within 15 sec. The doze-effect curves for embryonic and post-embryonic mortality 

and recessive lethal factors in the X-chromosome were flattened when irradiation took place in 

air instead of air. All curves were exponential. Cold treatment after irradiation, at temperatures 

below -10 and 4°C for 90 min immediately after irradiation at room temperature, lowered 

embryonic mortality. In series 2, eggs were collected at 2 min intervals of oviposition, and 

irradiated for 3 sec at various times after collection. Egg sensitivity, in terms of embryonic 

mortality, after a particular dose, changed from minute to minute during early embry development. 

Cytological analysis of non-irradiated eggs at various intervals after oviposition permitted the 

various radiosensitivities to be correlated with particular mitotic stages. The eggs were most sensi- 

tive during late an- and early telophase, but relatively insensitive in interphase. Killed embryos 

could be recognized (a) at the early embryonic stage by their death prior to gastrulation, and 

(b) late embryonic, by dying after gastrulation, both lethal syndromes being recognizable visibly. 

Dose-effect curves were drawn for eggs of various ages, for early and late embryonic mortality. 

It could be shown that the exponential dose-effect curves for embryonic mortality of 20-25 min old 

eggs cannot be interpreted as one-hit curves. The exponential dose-dependence is the result of 

the superposition of non-exponential curves (dose-effect curves for different lethality of various 

mitotic stages present during irradiation). Radiation effects did not confirm the hypothesis of Lea 

and Tillich according to which such effects are due to chromosomal aberrations. The radiation effects 

observed did not depend on the chromosomal constitution of the nucleus to that extent. It was 

concluded that non-chromosomal radiation effect may lead to death of the irradiated individual, a 

hypothesis supported by additional data. It appears probable from the results of cold-posttreatment 

and from the dose-effect curves for early and late embryonic lethality, that protein synthesis plays 

a significant role in the development of biologically identifiable radiation effects.

1970 Yiparuen Pernsawat. EFFECT OF GAMMA IRRADIATION ON THE DEVELOPMENT AND STABILITY 

OF ANGIOMAS GRAIN MOTH (Hydrotaea corroclea OHM.) p. 49-53 of "Insect Eradication by 

Irradiation, Bangkok, Thailand, 29-30 June, 1966", THAI AEC-5, Office of Atomic Energy for 

Peace, Bangkok (Thailand).

A dose of 1000-6000 rad had little effect on rate of development. It was retarded by 8000 rad in 

9-, 12-, 16-, 20- and 34-d-old cultures. The number of eggs per female decreased with increasing 

dosage and age. No eggs hatched from cultures aged 12, 16, and 20 d when exposed to 8000 rad. 

This suggests that sterility of both sexes should be obtained around 8000 rad. Further experiments 

are required to decide whether Hydrotaea is suitable for control by the sterile male technique.

1977 Zaid M-alhunaidi, A. EFFECTS OF GAMMA RADIATION ON DEVELOPMENT OF Derwentaria 


The effects of γ-radiation from 151C source on development, fertility, and mutations in two 

species of mites and ticks are being studied. Preliminary data on the development of embryos, 

larvae and nymphs of D. occidentalis irradiated at various dosages from 100-15,000 rad are 

discussed. (Abstr.)

Sec 250

20 The effect of thyamidine-H on the mortality of Drosophila melanogaster larva. (Anil, Y.D., 

1984)
Radiation profile of a helodora virus. (Bolchis, E. D., 1969)

Xenon in normal and y-ray-irradiated eggs of Drosophila melanogaster. (Lamotta, Z., 1967)

Cytological evaluation of dose-rate effects of radiation on the frequency of stillborn gonia. I. Kinetics of proliferation and killing of spermatogonial cells during chronic irradiation. (Sakai, T., 1965)

Radiosensitivity and heterogeneity of male germ cells of Drosophila melanogaster. (Bos, L., 1965)

Biological effects of radiation. (Gosh, O., 1965)

The radiosensitivity of germ cells. (Mandl, A. M., 1964)


Techniques for studying the effects of radiation on melanosoma and related processes in mosquitos with particular reference to Aedes aegypti. (Zai, K.S., 1968)

Etude de l'effet génétique des rayonnements ionisants chez la ver médaille. (Aibhalaya, Y.G., 1967)

Cytogenetic and developmental effects of gamma-irradiation on Aedes aegypti L. (Admar, M., 1968)

Genetic and direct effects of gamma radiation on Drosophila. (Nag, P.T., 1969)


Dependence of radiation induced mutation rate on maturity and dose for chrysialis of Drosophila melanogaster Sturde. (Oriian, W., 1967)

Mutant strains of the larval and pupal stages of the wax moth. (Smith, T.L., 1967)

Effectiveness of sterilization of the male moth: irradiability during different stages of development, and certain features of mating and egg-laying. (Sturde, W., 1967)

Sterilization of the coffee leaf miner. (Kattyar, K.P., 1967)

Sterilization of parasites of the ant tree. (Khrolova, L., 1965)

Biology and radiation sterilization of sugar cane leafhoppers. (Osborne, A.W., et al., 1966)

Radiation sterilization of sugar-cane leafhoppers of the family Delphacidae. (Salip, E., et al., 1966)

Gamma-induced sterility in the sugarcane moth. (Diaphraca saccharalis Fab.) (Lepidoptera: Gracillariidae). (Walker, D.W., et al., 1967)


Thymidine teratogenesis and mutants in Drosophila melanogaster. (Parkinb, C.O., 1967)

Effect of aeration on gamma irradiation of house fly pupae. (Smittle, B.J., 1967)

Sterilizing effect of y-rays and x-rays on the Mexican bean beetle, Epilachna varivestis Muls. (Cantal, J.L., et al., 1960)

Effects of gamma irradiation on the development of wheat and other plants. (Birkholz, B., 1966)

Engagement and reproduction of male straite (Amblyommata americanum L.) treated with gamma radiation. (Drummond, B.O., et al., 1966)

Effects of gamma radiation on morulae, eggs, and longevity of males of the oriental fruit moth, Grapholitha molesta (Lepidoptera: Tortricidae). (George, J.A., 1967)

Laboratory and field cage studies of the effects of gamma radiation on codling moths. (Halsayway, D.O., 1968)

X-ray-induced instability of species controlling breeding time in Drosophila melanogaster. (Pohlke, E.P., 1962)


The male reproductive system and spermatogenesis of the European pine shoot moth, Rhagoletis cerasi (Lepidoptera: Oestridae), with observations on the effect of gamma irradiation. (Shen, S.K., et al., 1967)

Effect of radiation on the developing flour beetle, Tribolium confusum. (Woidhold, N., et al., 1967)
Variations de spectres d’anomalies consécutives à une irradiation X chez Phlebophyse de Bombyx mori en fonction de l’intensité prétable. (Guinot, M., 1960)

The relationship between age at irradiation and life-shortening in adult Drosophila. (Lamb, M., 1969)

Differential genotoxic effects of x-irradiation to pupae of male and female house flies. (Rouault, M., 1965)

Differential genotoxic effects of pupal x-irradiation of adult male and female house flies. (Guinot, M., et al., 1966)

The susceptibility of the red flour beetle, Tribolium castaneum (Herbst) to gamma radiation. (Bhuiya, A.D., et al., 1967)

Acute lethality after x-irradiation of Tribolium confusum adults. (Bhuiya, A.D., et al., 1967)

Study of the irradiation tolerance of some destructive stored-house insects and technical and economic aspects of insect destruction by irradiation. (Farkas, L., 1965)

Lethal and mutation rates in newly laid x-irradiated Drosophila eggs at different oxygen concentrations. (Pflanzinger, F.X., 1964)

The effects of x-radiation on eggs of the desert locust, Schistocerca gregaria (Forsk.). (Hunter-Jones, P., et al., 1966)

The effects of x-ray irradiation on the pupal mortality and hatchability of the rice stem borer. (Shim, J.W., et al., 1967)

Studies on the use of gamma radiation in the control of pea weevil Callistratus chimerus L. (Chetan Ramgopal, 1968)

The mortality effect of radiation on Drosophila melanogaster larvae of different ages. (Ucer, E., 1966)

Preliminary study on the effect of gamma radiation on controlling oriental fruit fly (Dacus dorsalis Hendel) in banana. (Krihapakeem, V., 1963)

Influence of irradiation conditions on the radiobiological effects on eggs of Bombyx silkworms. (Abrahams, Y.G., 1966)

Influence of diapause on the radioresistance of khagra beetle larvae. (Rahalkar, G.W., et al., 1966)

The effects of gamma radiation on mating competitiveness and fecundity of Hippobota poria Loomis. (Ghar, I.M., 1966)


An estimate of the effects of fallout beta radiation on insects and associated invertebrates. (Teresi, J.D., et al., 1966)


Studies of the radiation effects of Anoplolepis gracilipes by the sterile-male technique using cobalt-60. II. Determination of the sterile dose and its biological effects on different characters related to "fitness" components. (Abdel-Malek, A.A., et al., 1967)

Control of fruit flies Dacus annulatus Link by gamma-rays. (Haque, H., et al., 1966)

Study of the biology, breeding and sterilisation of the cabbageworm moth, Spodoptera exigua, with special reference to its occurrence in radish culture. (Kiedel, M., 1967)

Studies on the application of the sterile method in the tick Ornithodoros tholozani. (Gren, E., et al., 1967)

Radiation disinfestation of grain and seeds. (Golumbo, C., et al., 1968)

The Israeli food irradiation program and progress during 1965-1966. (Kahan, R.S., et al., 1966)

Food irradiation research and pilot facilities in operation or planned in India. (Kastha, U.S., et al., 1968)

Control of the Queensland fruit fly by gamma irradiation. (MacFarlane, J.I., 1968)


Studies of x-ray irradiation effects on storage-damaging insects. (Toth, G., et al., 1969)
2.2.5. Malformations. Histopathological Changes

2.2.5.1. Effect of Radiation on the Developing Pupae Beetle.


An interesting developmental abnormality has been studied. When irradiated with 20000 r of x- or y-rays, pupae develop into adults with a wing abnormality which consists of a median clypeal split, clypeal blistering, and protrusion of the underlying membranous wing. One or more of these effects are observed with varying degrees of severity as the dose is lowered. For 10,000 r old pupae, a dose response curve to 180-kv x-rays may be obtained which shows an extreme shoulder, a very sharp response at 1200 r, and an ID-50 of 1400 r. Various physical and chemical parameters have been studied. Temperature has a synergistic effect. Sensitivity to x-rays (% of wing abnormality) varied with the age of the beetles. A delay in development (ecdysis) has been found in 1440 r old pupae. Ecdysis delay appears to be a necessary but not sufficient condition for a wing abnormality. Various graphs are given. The effect of combining increased gravity and irradiation has not yielded any reliable results as yet.

2.2.5.2. Variations of Spectre d'Anomalies Consecutives à une Irradiation Chez l'Embryon de Bombbyx mori. En Fonction de l'Hibernation Préalable. C. R. hebld., Scienc.

Les irradiations par rayons X ont été effectuées dans les conditions suivantes: 20 keV, 10 mA, filtre 2 mm/Al, débit 50 kV/1,1. Les embryons sont irradiés à des stades précoces à la blastocystose aux doses suivantes: 0 (縻mum), 1000, 2000, 5000, 5000 r, et replacés dans les conditions normales d'incubation (25°C, 80% d'humidité). Les embryons sont ensuite observés à des stades postérieurs à la blastocystose où l'on observe les anomalies qui les affectent. L'auteur distingue plusieurs types d'anomalies: 1) le vieillissement est le seul facteur agissant; c'est un certain nombre d'anomalies (types III et IV) d'apparition invariable. La fréquence de ces anomalies (II, VII, XVII, XVIII) augmente aussi bien sous l'action de l'irradiation que sous celle de l'hibernation préalable à l'irradiation. D'autres anomalies (IV, VII, XIV) voient leur fréquence augmenter sans diminuer, même au fur et à mesure que l'hibernation préalable s'allonge. Enfin le spectre d'anomalies observées chez les émènons après 543 jours d'hibernation n'est pas significativement différent de celui observé dans les mêmes conditions chez les irradiés. L'examen des spectres obtenus en considérant les nombres d'anomalies rapportées au nombre total d'œufs examinés confirme ces diverses conclusions.


A technique has been developed for mounting embryos of B. mori in situ, which allows the stages in embryogenesis to be determined at the moment when irradiation takes place. Various morphological anomalies of different organs (digestive tube, nervous system) have been noted and described. They are induced either by irradiation (x-ray doses from 1000-6000 r) or by being kept at 5°C, and aging beyond the time of dissection. The teratogenic effect seems to be proportional to the dose of radiation, at least for medium aging. Qualitatively, these anomalies do not vary as a function of the stage at which irradiation takes place (within the limits of stages D-V), but of the dose. A spectrum of anomalies has been determined as a function of the period of incubation (which follows dissection and precedes irradiation). Several sorts of anomaly can be distinguished: those of the digestive system (types I-VI), of the nervous system (VII-X) and "miscellaneous" (XI-XVII), which include effects on the labium, mandibles, and the silk gland. Various graphs are given, to illustrate the evolution of this anomaly spectrum as a function of irradiation. For certain anomalies irradiation is necessary, aging having a synergistic action in some cases. Other anomalies occur as the result of extended conservation of the eggs in cold, or following irradiation, regardless of the period of incubation. Aging and x-rays can then have a comparable or a cumulative effect. Both irradiation and aging have a damaging effect on the physiology of the embryos. The mechanism of action is not understood.


128. Sterilization of the male adult of Drosophila simulans, (Drosophilidae), by means of x-rays. (Caprilli, M. et al., 1956)
130. Antennapedia (SS-180), an homoeothor mutant of Drosophila hydei. (Scurvatant. (Gcióo, H. et al., 1956)
132. Sterilization of parasites of the adult tree. (Ghosh, A. K., 1965)
1328. Spontaneous inbreeding in cultures following irradiation of the young larvae with different amount of x-rays. (Baker, H., 1960)
1336. Iré Théo. Étude du développement post-embryonnaire de l'ovaire chez Cephalops hirudinaria. (Baron, J., 1965)
1377. Effect of sub-lethal gamma rays on eggs, early, intermediate, and late instar larvae of the Aedes aegypti, (Spinosa carnulata). (Dolbeth, Z.A. et al., 1965)
2.2.6. Senescence. Longevity. Fitness


An attempt was made to find the effects of γ-radiation from a 60Co source on the adults of S. oryzae (L.). The weevils were exposed to doses of radiation of 5-100 kR. Doses of 10 kR or more caused 100% mortality within one month. (RAI-A 56: 1968, ref. 87)


D. serrata and D. birchii flies were x-irradiated with 2000 r per generation for three generations. Two experimental populations of irradiated flies and one control population were started for each species at 20°C. After 51 d a sample of 300 flies was taken from each population to start 6 other populations at 15°C. The populations were maintained under conditions of intense competition, both among the larvae and among the adults. At 25°C, the irradiated populations of D. serrata decreased in size and in productivity during the first few weeks of the experiment. From the 6th to the 16th week they increased greatly in size and in productivity, and maintained their superproductivity until the end of the experiment. The equilibrium levels were 50 or more % higher than that of the control. At 15°C the two irradiated populations of D. serrata were also superior to the control in productivity and in size from the 32nd week until the end of the experiment. The two irradiated populations of D. birchii at 25°C increased in size steadily from the 6th week until the end of the experiment, exceeding the control population in productivity and in size by more than 5%. At 19°C there is no marked difference between the control and the irradiated population. - Regression analysis shows that there has been a continuous differential increase in the fitness of the irradiated populations of D. serrata at both temperatures, and in some of D. birchii, at 20°C. It is concluded that an increase in genetic variability produced by high frequency radiation may, with natural selection, result in an increase in the rate of evolution of the population, and finally of the fitness of the population in new environments. (Author's summary)


Median ages of death following sublethal doses and medium lethal doses for acute lethality after 1 d were determined in relation to age of exposure, throughout normal life span, by 100-keV x-rays in D. melanogaster imagines of both sexes. Both sets of data provide continuously decreasing functions of dose, D, with respect to age. Consequently D may be used as a single valued measure of age, and variations of functions of D with respect to age as rates of aging. Rates of aging as derived from either set of data are faster in the male than in the female and are inversely proportional to normal survival times, about 44 and 52 d, respectively, at the temperature used, 20°C. It is concluded that normal life span and rate of aging are fully determined on eclosion and are realized in the absence of unfavourable condition. The injuries leading to acute and delayed death appear to affect different mechanisms, the former being wholly recoverable and not additive in the latter, which is irreversible at least in part. Doses below a certain level appear to shorten life span, and extension of life span by exposure was not observed. (Author.)

1440 Baxter, R. C., Blair, H. TO GAMMA RADIATION. Ages of death following c at least several days in w by D = 0.0005D, where D death. The equation for the normal survival times or median life for normal survival time. (a) equal for the female, but than the lives of those dy. In accord with prediction span. (Author.)


1408 Clark, A. M., Calo, K. MODIFY TYPES IN THE W

The adult life span of D. melanogaster females, he (+) lines. From the first unfertilized eggs, lifespan span for these three types of 75 kVp x-rays. The w increasing dose as shown I further labile effects as irradiated groups. Adult adult life span with more all and haploid types were

1409 Clark, A. M., Omran, E. DURING EARLY DEVELOP.

H. erinacea females, he (+) lines. From the first unfertilized eggs, lifespan span for these three types of 75 kVp x-rays. The w increasing dose as shown I further labile effects as irradiated groups. Adult adult life span with more all and haploid types were

1420 Ehmke, H. F. MODIFIC TO x-RAY AND DDT. The
each containing ten pairs 0.25 mm Co = 1.0 mm A produced 1 6/xl(1)were DDT. Every two weeks 6 fresh comparable food. 1

Age of death following exposure to gamma-radiation were studied for doses permitting survival of at least several days in wild-type *D. melanogaster* and in *S. americana*. Lethal injury, represented by D + 0.0001D, where D is the radiation dose, is a linear function of the reciprocal of the age of death. The equations for the two sexes differ only in the slope constants, which are proportional to the mean survival times, about 44 and 51 days, respectively, for male and female at 25°C. Average or median life shortening in the two sexes is not equal for a given dose but is the same fraction of normal survival time. Life shortening for various doses with respect to time of death tends to be equal for the females, but the males die of various causes at a time close to death. The responses of male and female populations are different. In short, with the exception of higher doses, doses below a certain value appear to affect life span. (Auth.)


The adult life span of *M. vitripennis* is influenced by the kind of genes present rather than by the number of sets of chromosomes. Diploid males were more resistant than haploid males to ionizing radiation. Diploid and triploid females were equal in radiation sensitivity. The data reported did not support the somatic mutation theory of aging and indicated further that the types of injury leading to natural aging were different from those leading to radio-induced decrease in life span. Although the data indicate that some type of nuclear injury is induced by ionizing radiation, the precise nature of the injury is still obscure. This is presumably because of the many physiological events that occur between initial radiated injury and death in a multicellular organism. (NSA 21:1967, 41500)


H. zea females, homozygous for the recessive mutant veinless wings (v), were exposed to various doses of X-rays (50, 100, 200, 400, 800 rads) and reared to adulthood. Life span was increased with increasing dose as shown by the larva/egg ratio. Those embryos that became larvae showed no further injurious effects as shown by the pupa/egg and adult/pupa ratios between the control and irradiated groups. Adults showed no structural abnormalities. There was no consistent decrease in adult life span with increasing dose. Injury from irradiation was manifested at cleavage or at all and haploid types were more radiosensitive than diploids.


Studies were designed to determine the early effects of X-ray and DDT, singly and in combination, on mortality and productivity of four beetle species and strains. "Chicago standard" and T. castaneum Herbst "Beall 6" and "505". Five replicates populations each containing ten pairs of virgin beetles x-rayed with 0, 1, 2 or 3 kV of X-rays (200 kVp, 30 mA, 10 mm Cu + 4.0 mm Al filter), 0.86 mm Cu ALVII and 8.6 inches between target and subjects produced 1 kV/200 were utilized under standard conditions in food containing 0, 10, 20 or 50 ppm DDT. Every two weeks for six weeks parental mortality was recorded and living adults were placed on fresh comparatively food. The old food was reincubated and 1/4 adult biomass and numbers were the
measures of productivity. Potential mortality was (3) unaffected by x-rays, (2) increased for "Brazil" at 60 ppm DDT, and (3) greater for females than males but unrelated to radiation or insecticide. Productivity measurements decreased with increasing x-ray or DDT. Productivity of T. contaminata was, in general, more radiation-sensitive than that of T. castaneum, whereas both T. castaneum strains were more DDT-sensitive than was T. contaminata. Radiation of 4 hr was almost sterilizing to T. contaminata, of T. castaneum strain "Brazil." left no P, at 60 ppm DDT. Populations of the Callisto was x-rayed or DDT were considered genetically dominated and used to quantify the relationship between radiation and insecticide in combination. Observed lethality simulated that expected for genetic dominant lethal effects when "Chicago standard" and "Brazil" were stressed with x-ray plus DDT. In "booby," observed lethality was consistently lower than that predicted on the assumption of dominant lethal effects; i.e., productivity was less adversely affected when both stresses were applied than it was expected by multiplying the effects of singly stressed populations. Within a species "booby" populations showed more lethality due to x-rays than did "Brazil" populations; DDT had the opposite effect. (From abstr.)


In earlier experiments with flour beetles, the black-body cothorax mutant, Sooty, appeared more DDT-resistant than the wild strain Brazil. and was reproducibly more fit when stressed with DDT and x-irradiation. To verify this observation and to determine whether the resistance was clearly associated with body color, a series of new tests were initiated making use of specific crosses of the Sooty mutant with other strains. Data are not yet available.


Larvae and pupae of the cornworm, A. myriotella, were irradiated in a y-irradiation, using 60Co as the source with a dose rate of 115 R/sec. A dose of 1000 R, of x-rays of the larva, pupated, but the months did not fly. After larvae were irradiated with dosages less than 1000 R and pupae with 500-1000 R, moths flew but did not lay eggs. Larvae of normal females were irradiated males resulted in infertile egg masses because of the males' sterility. The author notes that x-irradiation can be used to sterilize males and that these males then be released. (BA)


All the work was done on adult flies given single doses of x-rays or 60Co y-rays. The results of experiments using young flies (6-9 after emergence from the pupal stage) are outlined. With older flies it was found that the longevity irradiation in the further expectations of life per unit dose was constant over part of the age and dose range, but there was some evidence that flies irradiated with high doses showed an increase in sensitivity with age. D. melanogaster and D. subobscura were used. The hypotheses that radiation accelerates the natural aging process or causes parasitic aging are discussed and it is concluded that the data are more compatible with the accelerated aging hypothesis. It is suggested that the increase in sensitivity with age is a result of previous exposure to high doses can be explained if irradiation causes two types of injury, one of which occurs immediately after irradiation and can be repaired, and one which is irreparable and has a delayed effect.

1416 Maltin, C.W., Buscari, R. OBSERVATIONS ON DESOTOPHES GIVEN A HIGH DOSE OF PROTONS. Desotoph. Inf. Serv. 49 (1965) 73.

382
The flies were very lethargic after the irradiation. It is extremely unlikely that the irradiation was so non-uniform that any of the flies escaped the high dose of 20,000 rads. The parasol beam was scattered by 1/8" of carbon to produce a nearly constant flux over a circle of diameter 1 1/2", and only the central 1" disk was used. In addition, the beam was oscillated rapidly (several hundred cpm) to smooth out any minute irregularities. The dose delivered corresponds to approx. 1200 rads per square inch, so that each chromosome should have received multiple hits. The median life of the flies after this dose of protons was shorter than normal, half dying in 19 d compared to the shortest period of 21 d observed for virgin under similar reared conditions. The food was rather damp and since this dampness gets stuck easily, the environmental conditions may have affected the lifetime more than the radiation. Consequently it is only concluded from this series that the sterilizing effect was virtually complete. Degenerative effects associated with high radiation doses were evident in five flies sacrificed for histological studies. Two flies dissected 17 d after treatment had degenerate ovaries and their oogonia were vacuolated and necrotic. Live motile sperm were seen in the seminal receptacle of the fly taken a viae with males, while no sperm were found in one which had been without mates for 4 weeks. The three flies which lived 38 d were dissected, and showed more advanced degeneration of the ovaries and the oogonia than the younger pair. No sperm were seen in these flies, which had been without mates for 10 d. Further work with lower doses has suggested other non-reparable damage produced by protons, and some biochemical effects on the brain of adults are being investigated. (From DBS)


An attempt is made to examine the role of white light with respect to (a) the reported survival curve of x-irradiated mealworm; (b) a consideration of the possibility of white light as a photo-reactivating agent for the assumed radiation/recovery phenomena associated with the x-irradiated organisms; (c) obtaining greater detail of the embryological morphology and developmental characteristics. The dose-effect results for the x-irradiated and visible light stimulated embryos are generally similar in that the survival curves are sigmoidal. LD 30% for x-rays was 150 R, the visible light stimulus 1000 rads/cm². When, however, the x-irradiated embryos were counter-exposed to visible light an increase in survival time was noted for the embryo. (Work on the order of administering stimuli is being continued and their possible influence on the high-dose units of free amino acids.)


Results are reported from a series of studies on the relation between survival of larval larvae of D. melanogaster and dose and time of x-radiation exposure. Radio-sensitivity was estimated in 3 lines of labeled flies and the hybrids formed between them. Data are included on the correlation of
larvae survival to x-radiation with chromosome puffing pattern; the relation between age and non-
spontaneous mutations in irradiated parents; mutation induction in Drosophila cultured on aged and non-aged
medium supplemented with DNA irradiated with 150 kR; the mutability of loci in an X-chromosome
duplication; and mutation induction in Drosophila cultured on a medium exposed to 150, 500, or
3000 kR x-radiation. (J. 190; 1966, 1903)}

1420 Ratty, P.J., Lovellette, E.J. CHROMOSOME SUBSTITUTION AND RADIOSENSITIVITY IN
The survival of 1st-instar random-bred, inbred, and hybrid larvae formed by reciprocal crosses, after
120 kR of acute x-irradiation has been evaluated. The results show that survival of the irradiated lines is
lower than that of the control larvae, while that of the inbred lines is lowest in all irradiated and
control groups. The lack of differences between the irradiated random and the irradiated hybrid lines
is interpreted to mean that genetic variability is probably not important at this dose level and that
deterrential genic in the hybrid genotypes are recessive. An interaction effect between radiation and
inbreeding is noted, and it is suggested that a maternal effect could play only a minor role in the
determination of radiosensitivity in these experiments. (Abst.)

1421 Rockstein, M. DIFFERENTIAL GENETOMMETRIC EFFECTS OF X-RADIATION TO PUPAE OF MALE
AND FEMALE HOUSE FLIES. p. 175-178 of "Radiation and Aging". Lindop, P.J., Sacher, G.A.,
Irradiation of 30-48 hr old pupae causes a significant change in emergence and longevity only at
> 10 krad. Data were obtained for dosages of 10, 20, 30, and 50 krad, at 3 krad/hr. The effects of
x-irradiation on female fly longevity was one of progressive shift of the survival curve to the left.
In male flies this is a continuous diminution of mean lifespan over the entire dosage range, and a
quite marked decrease in max. lifespan after 20 and 30 krad. The effect on longevity of the
emergal male is much more complex; the average lifespan increases for 10 and 15 krad; is equal
to the control at 20 krad; and decreases significantly on exposing pupae to 30 krad. A rapid increase
in male mortality rate occurred when wing loss was as a minimum. After irradiation of pupae with
between 2 and 10 krad there appears to be no increase in wing retention at death time, but at 20
and 30 krad there is a successively greater increase (a virtual doubling of wing retention per 10 krad)
leading to virtually 100% retention at 30 krad. In females, wing retention is not markedly affected
up to 10 krad but there is a gradual increase thereafter, with complete wing retention at 30 krad.
This more ability of flight represents an amplification of a sex-specific phenomenon resulting
from irradiation at the pupal stage.

1422 Rockstein, M., Bhattachar, P.L., Dauer, M. DIFFERENTIAL GENOTOMMETRIC EFFECTS OF
X-RADIATION ON ADULT MALE AND FEMALE HOUSE FLIES. "Colloquium on Radiation
Batches of 2500-3000 pupae of Musca domestica L. were exposed to single doses of x-rays from
2000 - 25000 rad, such as to give a dose rate of 2000 rad/min. Emergence was then studied under
constant temperature, humidity and lighting conditions. Following irradiation up to 10000 rad,
5% emergence was only reduced slightly; at 15000 rad by 20%; at 20000 rad by 80%. The male:
female ratio for emergence increased progressively from 1.01 to 1.99 at 25000 and 30000 rad. For
doses of 30000 and 15000 rad the mean life span of males was increased by > 20%, while in females
the mean life span decreased progressively with increasing x-ray dosage to a life spans < 50% of
the control, at 30000 rad. The sex differential normally favours the female is minimized by
x-irradiation, the mean life spans of both sexes being virtually identical at the dose levels used.

1423 Slabeich, B.V. GENETICS OF A HETEROZYGOUS POPULATION OF Drosophila melanogaster.
I. VIABILITY AND POPULATION FITNESS OF HETEROZYGOUS Cylcen/cylclle CARRIERS OF
BRADIAID CHROMOSOME c110. Genetika No. 6 (1965) 144-160. (In Russian)
A new method of determining the heterozygous effect of radiation induced mutations is described.
Normal 9th chromosomes of a male belonging to a balanced lethal population Cylcen/A110 was
marked with gene a and then subjected to irradiation. Heterozygous individuals possessing normal
chromosomes (marked on 110) have been paired with individuals bearing non-marked chromosomes
(A110). Two crosses were carried out. One the 1st cross Cylcen/cylclle x Cylcen/A110 (chromosomes
on 110 being irradiated). Cylcen/cylclle X Cylcen/A110 control population. 1st
mental population is that of unirradiated males, the experimental and cultures exceed that

1424 Sonnenblick, B.P., i RESISTANCE IN DROSOPHILA MELANOGASTER. Materials used in the test
are males, 1- to 3-d-old in 35 kPa, 55 kPa, 85 kPa a periodic change of m
spans of a short 1:000 c images. - Data proc. is significantly lower than the 50 kPa samples and higher average line-up
resistance of both sex longevity in all age
numbers of control flies sensitive genetic function stress, in the normal
radiosensitivity, with populations under our
and the comparative considered in evaluating

1425 Sonnenblick, B.P., i Drosophila ADULTS. Annual Meeting of the
The Drosophila adult and certain gut cells, mutant phenotype on radiosensitivity during such
regular culture stress in mass increase in have been exposed to cells are disassembled without
interest of: (a) there is evidence of a significant difference in recproportionation; (b) non-
than male counterpart was greater; (c) after males have died; (d) a female lived longer
in preadult stages, no comparable nuclear or chromosomal questions arise as to the
tained functioning condition and the real extracellular responses modification. (Abst.)
SENSITIVITY IN
by reciprocal crosses, after survival of the irradiated lines is
in all irradiated and
and the irradiated hybrid lines
at this dose level and that
between radiation and
only a minor role in the

ATION TO PUPE OF MALE
F.I., Sacher, G. A. ,

and longevity only at
0.5 to 2 krad/min. The effects
the survival curve to the left.
centre dosage range, and a
on longevity of the
10 and 15 krad; is equal
5 to 10 krad. A rapid increase
irradiation of pupae with
at time of death, but at 20
wing retention per 10 krad)
ion is not markedly affected
wing retention at 30 krad
phenomenon resulting from

COMITETIC EFFECTS OF
"Colloquium on Radiation

The doses of x-rays from
some was than studied under
ion to up to 10,000 rad,
by 60%, the male,
by 10%, in females
to life span are 100% of
female is minimized by
at the dose levels used.

Drosophila melanogaster,
ec110 CARRIERS OF

(110) mutation is described.
ec110 C. and normal
individuals possessing
non-irradiated chromosomes
ec110 (chromosomes

ec110 being irradiated) represents the basis of the experimental population, while the 2nd cross
Cy67ec110 X C110 ec110 (chromosomes used being non-irradiated) represent the basis of the
control population. It was shown that the proportion of the irradiated chromosomes of the experi-
mental population is the same as that of the nonirradiated chromosome of the control population.
Viability variation of the irradiated chromosome in P1 individuals Cy67ec110 slightly exceed that of
nonirradiated cultures. The decreased rate of the proportion Cy67ec110 in generations of both
the experimental and the control population is the same. Proportion of marked genotypes in crowed
cultures exceeds that of uncrowed ones. (Auth.)

3424 Sonneveldt, B. P., Rockford, D. A POSITIVE RELATIONSHIP BETWEEN LONGEVITY AND RADIO-

Materials used were a vigorous Canton-S strain and a strain (X
1 y 0 y f attached-X with ring-X
1 x 3rd images were exposed to 60Co, the dose rate 1300 r/hr for 23 21/3 hrs. Doses were 0, 8,
30, 60, 90 and 120 krad. Viability were maintained at 17°C, five pairs of flies per vial, with
periodic changes of media and regular inspection of test organisms. In two experiments, the life
spans of almost 1000 organisms were recorded. No larvae were ever noted in vials with irradiated
imago. - Data permit the following comments: (a) mean life span of the untreated Canton-S strain
is significantly lower than that of the mutant strain, in both sexes; (b) this relationship is repeated
in the 35 krad samples and with females given 66 krad; (c) mutant males given 66 krad twice had a slightly
higher average life span than did their + counterparts; (d) at the two highest doses employed, radi-
resistance of both strains becomes essentially comparable; (e) excluding controls of both strains, male
longevity in all exposed samples was lower than similarly treated females; (f) with care, appreciable
numbers of control flies will live more than four months, a rate few over five months. - A radio-
sensitive genetic complex in embryonic tissues may thus be radioresistant, to a certain degree of
stress, in the nondividing tissues of the adult, with continuance of function and unexpected longevity.
Radioreistance, utilizing life span as the parameter of choice, parallels longevity of untreated
populations under our conditions and up to a 66 krad dose. Dose rate, repair of chromosomal breakage,
and the comparative embryonal and imaginal tissue oxygen tensions are certainly other factors to be
considered in evaluating results such as these. (Abstr.)

3425 Sonneveldt, B. P., Gartman, L.P. LIFE SPAN STUDIES WITH STRAINS OF GAMBIA-BRADIATED

The Drosophila adults soma is an essential non-reproducing system, except possibly for haemocytes and
certain gut cells. We utilize a Canton wt type strain and occasionally another strain with
mutant phenotype containing ring-X-chromosmic males and attached-X females, karyotypes reported
radiosensitive during development stages with much mitotic activity. Some modifications of
regular culture conditions at 17°C are used which, compared with our previous similar studies, result
in marked increase in mean lifespan and in extension of range of individual longevity. Young adults
have been exposed to 60Co at 25 and 3000 r/min and to doses of 0, 33, 66, 93, and 120 krad. Germ
cells are discontinuously affected, with few eggs laid and no development noted. Some comments are:
(a) there is evidence of a dose rate effect; (b) after 33 krad at the low but not high dose rate, there
is no significant difference between lifespan of exposed and control samples, evidencing
recovery; (c) non-irradiated females usually but not invariably have a higher average longevity
than male counterparts, but in all 24 irradiation tests with both strains the mean female lifespan
always was greater; (d) after 120 krad at low dose rate in both strains, some 40% females survive when
all males have died; (e) a male was the last day survivor in 8 of 10 control tests but after various exposures
a female lived longest 23 of 24 possible times; (f) a karyotype and genome considered radiosensitive
in ped productive stages, noted above, may show a surprising longevity with adult carries. Assuming
comparable nuclear radiosensitivity in fixed, nondividing cells and in cells capable of replication,
questions arise as to the significance of chromosome breakage with and without rejoining in the
continued functioning of the fixed cells, or the significance, if any, of the hypodermic X-chromosome
condition and the male response to stress when there is a low or high diploid chromosome number,
and extranuclear responses in nonreproducing cells with time, such as possible outer membrane permeability
modification. (Abstr.)

Application of radioactive isotopes to the investigation of methods for the biological control of pests. IV. The effects of \( \gamma \)-radiation on \( \text{C. capitata} \) when the dose of irradiation is fractionalized. (Amaro, Y. et al., 1964)

Laboratory tests to sterilize the boll weevil with radiation. (Mayo, M.S. et al., 1966)

Radiation sterilization of sugar-cane leafhoppers of the family Delphacidae. (Shipp, E. et al., 1969)

Studies on the experimental population of \( \text{Drosophila melanogaster} \) raised on irradiated banana grit. (Kornan, H.M., et al., 1969)

\( \gamma \)-rad (1967)

Interactions of oxygen at high pressure and radiation in \( \text{Drosophila} \). (Thomas, J.J. Jr. et al., 1969)

Effect of \( \gamma \)-radiation on fertility, mating, and longevity of males of the oriental fruit moth. \( \text{Grapholitha molesta} \) (Lepidoptera: Tortricidae). (George, J.S., 1967)

The effect of \( \gamma \)-irradiation on the survival of \( \text{Lepidoptera} \) larvae and on its susceptibility to infection with \( \text{Bacillus thuringiensis} \). (Charnfield, M.A.M. et al., 1969)

Observations on the behavior of pupae of \( \text{Hypania camae} \). Drury irradiated with \( \gamma \)-radiation. (Gollman, G., 1966)

Study on the radiation and radiosensitivity of \( \text{Cyperus esculentus} \). Say by means of radioisotopes. (Cavalloro, R. et al., 1966/67)

Influence of pupal age on sensitivity to radiation. (Ducoff, H.S. et al., 1969)

Chages with age in the radiosensitivity of adult flour beetles. (Ducoff, H.S., 1967)

On the effect of \( \alpha \)-irradiation on the desert locust. (El-Minawi, S.F. et al., 1964)

Metamorphic stage of the dolichopodid, \( \text{Tribolium confusum} \) (Jacquilin et al.). (Edman, H.E., 1969)

Effects of \( \gamma \)-rays on metamorphosis and adult life span of flour beetles. (Edman, H.E., 1967)

Effects on flour beetles irradiated at pupal. (Edman, H.E., 1967)

The effect of gamma irradiation on the Vero race of \( \text{Tribolium castaneum} \). Irradiation of eggs in the early and late embryonic stage. (Ghant, A. et al., 1969)

Susceptibility of various stages of \( \text{Drosophila melanogaster} \) to gamma radiation. (Heinemeyer, T.J., 1967)

\( \gamma \)-irradiation and wing retention in the common house fly, \( \text{Musca domestica} \) L. (blockstein, M. et al., 1966)

Further studies on the effect of \( \gamma \)-irradiation on the house fly, \( \text{Musca domestica} \) L. (blockstein, M. et al., 1967)

Effect of high pressure on the radiobiological properties of \( \text{Musca domestica} \). (Tenebrio, P., 1967)

Study of the irradiation tolerance of some destructive storage insects and technical and experimental studies. (Park, Y., 1965)

Absence of "oxygen after-effects" in \( \text{Cylindrus parasitica} \) during hibernation induced with low temperature. (Pychiokuwa, I.S. et al., 1965)

The combined effects of irradiation, vibration, and centrifugation on brachial fecundity, fertility and life span. (Gunnell, D.S., 1969)

Utilization of \( \text{Hapalorpe} \) and \( \text{Artemia} \) as experimental materials in bioastronomic studies. (Gunnell, D.S., 1968)

Effect of exposure of irradiated pupae of the Mediterranean fruit fly, \( \text{C. capitata} \), to high temperatures. (Kanjo, K.P., et al., 1967)

Influence of pre-treatment humidity on the irradiated rice weevil adults, \( \text{Oryzaephilus surinamensis} \). (Karnagel, M., 1965)


Changes in quantitative traits of \( \text{Tribolium confusum} \) under irradiation. (Banzett, A.C. et al., 1969)

Effects of radiation induced mutations on viability coefficients in \( \text{Drosophila} \). (Yak, R., 1966)

Fitness of heterozygous for irradiated chromosomes in \( \text{Drosophila} \). (Yak, R., 1967)

An estimate of the effects of fallout beta radiation on insects and associated invertebrates. (Tomin, J.D. et al., 1966)

Weevils were exposed to gamma-rays and the mortality of the adults was obtained with 10 kR.


For abstract, see 1426.


The mortality of all age classes was obtained as 60. 29,000 R. A dose of 600 R.


Several factors that influence the effect of gamma irradiation at different doses are factors that influence the effect of gamma irradiation at different doses.

1833 Studies on the eradication of Anopheles quadrimaculatus. Theobald by the sterile-male technique using cobalt-60. I. Biological effects of gamma radiation on different developmental stages. (Abdel-Malek, A.A. et al., 1984)

1834 Studies on the eradication of Anopheles quadrimaculatus by the sterile-male technique using cobalt-60. III. Determination of the sterile dose and its biological effects on different characters related to "fitness" components. (Abdel-Malek, A.A. et al., 1987)

1838 Control of fruit flies Dacus sativus Saundirs by gamma-rays. (Hague, N. et al., 1987)

1839 Study of the biology, breeding and sterilisation of the cabbage fly, Pseudo brassicae Boscoby, with special reference to its occurrence in madhubani, (Guedel, M., 1987)

1839 Prospective use of radiation to control the holyblack seed moth (Lepidoptera, Gelechiidae). (Aybar, G.K. et al., 1985)

18400 Calliphora moth control. (Maden, H.P. et al., 1987)

1841 Studies on irradiation control of insects in grains. (Cromwell, P.R., 1988)

1842 Radiation disinfection of grain and seeds. (Columbus, C. et al., 1990)

1843 The Israeli food irradiation programme and progress during 1984-1986. (Khan, R.S. et al., 1986)

1844 Food irradiation research and pilot facilities in operation or planned in India. (Kumar, U.S. et al., 1990)


2.3.7. Lethal Effects


Weevils were exposed to dose 0-1100 KR. Within one week of irradiation, 100 KR and 50 KR produced mortalities of 100% and 80.2%, respectively, against only 4.8% for 5 KR. 100 KR dose was obtained with 1c KR and 15 KR. All doses > 500 KR produced 100% mortality within one month.

1427 Abdul Matin, A.S.M. SUSCEPTIBILITY OF ADULT RICE WEEVIL, Sitophilus oryzae (L.) TO GAMMA RADIATION. p. 142-145 of "Proceedings of the Agricultural Symposium, Dacca, Pakistan, 1966".

For abstract, see 1426.


The susceptibility of all developmental stages of T. castaneum was investigated. Almost complete kill was obtained as follows: eggs with 4000 R, larvae 6000 R, pupae 2000 R, and adults 3500 R. A dose of 200 R may be considered the minimum effective dose for controlling T. castaneum, which still allows 9% survival of the sterilised adults.


Several factors that might affect the increase in the mortality rate of adult D. melanogaster larvae when exposed to ionising radiations have been studied. The application of tritiated thymidine and γ irradiation at different times to the same larvae caused a slight but an additive mortality effect. The application of both radiating agents to the larvae simultaneously caused a larger mortality rate which was even more than an additive one. An irradiated, tritiated thymidine-containing nutrient was found to be harmful for the larvae and seemed to be responsible for the increase in mortality level when both factors were applied to the larvae simultaneously. (CA 66: 1967, 7580v.)

For eggs, LD 50 is ~1800 rad, LD 50/4 ~ 7500 rad; for larvae, ~3200 and 15000 rad, respectively; for pupae, ~3600 and 30000 rad, respectively. Dosages < 1000 rad prolonged the pupal stage by 2 weeks. For adults, LD 50 ~ 65000 rad, LD 50/4 50 000 rad. Sterility was induced in males and females by 6000 rad, but further study is required.


Pupae of *Phaonia regina* (Meigen) were irradiated with x-rays and γ-rays to establish sterilizing and lethal doses of radiation. Normal females mated with sterile males would not mate a second time. In cage tests, sterile males competed for mates about equally with normal males. (Abstr.)

Buchkovskaya, I.B. **Dynamics of Lethal Radiation Effects in Various Biological Species.** Radiobiologiya 6 (1966) 49-45. (In Russian)

A literature survey was made on the dynamics of radio-induced death of animals, with emphasis on the principles of radiation injury leading to the death of man and mammals. Data are also included on the life expectancy of rodents, insects, nematodes, and infusoria after exposure to various doses of α, β, γ, and x-radiation.


In tests in the Soviet Union in which adults of *Sitophilus oryzae* (L.) were exposed to x-rays at doses of 5.84-1186 R, the curve for mortality in 56 d was S-shaped, with little mortality at up to 0.98 R, 20% at 9.38 R, 80% at 5.46 R, 95% at 6.28 R and 100% at 6.7 R higher. When time to 60% mortality was considered, there was a stepwise effect, the periods being about 20 d for 6.2-25.6 R, 10 d at 34.6 R, and 9 d at higher doses up to 62.2 R and beyond.

Different doses may produce marked differences in systemic sensitivity for various radionuclides. (BAIR 56; 1966, ref. 246)

Ducoff, H.S., Boursa, G.C. **Acute Lethality After X-irradiation of Tribolium confusum Adults.** Entomologia exp. appl. 20, 5 (1967) 185-188.

Recently emerged adults of *T. confusum* maintained at 25°C in flour-yeast medium, were exposed to x-ray doses between 5 and 760 Roentgen at dose rates of 20 or 1000 Roentgen/min. In all cases, there was no significant mortality for about 10 d, and all deaths attributable to the irradiation occurred during the next 10 - 15 d. After the lower doses, many insects survived the critical period and lived on for many months. The relative dose-independence of the survival-time of decapods suggested that there is a specific mode of death, e.g., an asthenous-death syndrome, acute lethal syndrome. Irradiated beetles incubated at 22°C exhibited about twice as great a delay in the onset of mortality, and a mortality period with about twice the duration, as those at 30°C, suggesting the necessity of a sequence of metabolic events in the development of lethality. Beetles on a cornstarch diet were at least as radiosensitive as beetles on flour yeast; beetles at 22°C were distinctly more sensitive than those kept at 30°C. Older beetles, exposed 4 or 10 months after emergence, showed progressive increases in acute radiosensitivity. Implications of these findings for radiobiological investigations on adult insects are discussed. (Abstr.)

Farkas, J. **Investigations Into the Radiation Resistance of Tribolium confusum (Duval) and Tyrophagus dimidatus (Germar).** Acta microbiol. hung. 12 (1964) 13-28. (In Hungarian)

The radiosensitivity of flour beetles was examined in the dose range of 2-20 knad. Survival times correlated with 25 and 50% mortality (LT 25 and LT 50) were established as a function of radiation doses. The initial effect of irradiation abruptly increased between doses 6 and 12 knad, while doses over 12 knad accelerated beetle mortality only to a small degree. To sterilize adults and eggs, radiation doses of 5 - 6 knad were needed. Eggs were highly sensitive to x-rays, but larval radiosensitivity was not higher than adult doses established for by relative humidity.
animals, with emphasis on the
Data are also included on
exposure to various doses of

RESPONSE OF BIOLOGICAL
Zool. Zh. 46, 1 (1965)

mature (L.) were exposed
shaped, with little mortality
at 6.7 ± 0.1 and
the periods being about
28.5 ± 0.1 and

THE INVESTIGATION OF Tetrabomatomyia tenella on food in cases, there was no
radiation occurred during the
period and then lived on for
incubants suggested that
lethal syndrome. Irradiated
insects in the second instar
and a marked increase in
mortality, and a
marked increase in
larval development time, and
in the development of the
larvae was arrested by a dose of
30 krad even with less favourable
environmental conditions. The
radiation sources used were
either radiocobalt or
radioisotopes with a
half-life of about 400 days
The advantages of irradiation as a method of sterilization reside in the fact that
complete destruction of the insect population can be achieved with the lethal doses, and
eggs have proved very sensitive to radiation. No side effects in the food chain were
observed; no changes in the chemical composition of the food, and no health risks are
involved. In the USA, mobile radiation sources have proved very convenient for
seasonal use. The method is very economical; the costs decrease from year to year.

TETRABOMATOMYIA TENELLA

The presence was not higher than that of adults. Therefore, products can be completely disinfected by
lethal doses established for adults. Also examined was whether the survival of flour beetles is affected
by relative humidity during breeding subsequent to radiation applied in doses of 20 krad. Differences of
LT 50 values corresponding to different levels of relative humidity were examined by variance
analysis and the results thus obtained showed that the mean survival times observed under 30 and
90% relative humidity were significantly shorter than values at 70% relative humidity. Deviations in
the mean survival times, however, are practically not important because differences in LT 50 values
remained always below 20%. Radiation resistance of males (T. dimidiatus) was investigated in the
dose range of 20 - 300 rad and proved to be higher than that of the beetles, but with doses of
20 - 30 krad the reproduction of males could also be prevented. (NSA 20; 1966, 2874)


Radiation resistance of flour beetles was examined in the dose range 2 - 50 krad. Survival times cor-
nelated with 55 and 95% mortality were established as a function of radiation doses. The lethal effect
of irradiation increased between the doses 6 and 12 krad abruptly, while doses over 12 krad raised
the speed of beetles mortality only to a small degree. To sterilize adults and eggs radiation doses of
3 - 6 krad were needed. Accordingly, insect eggs resistant to irradiation by x-rays are highly sensitive
to x-rays. Radiation resistance of larvae is not higher than that of adults either; therefore products
can be perfectly disinfected by lethal doses established for adults. It was also examined, whether the
Survival of flour beetles was affected or not by relative humidity prevailing in after-breeding subsequent
to radiation applied in doses of 25 krad. Differences of LT 50 values belonging to different levels
of relative humidity were examined by variance analysis and the results thus obtained showed that the
mean survival times observed under 30 and 90% relative humidity and corrected with the mortality
control populations were significantly shorter than values belonging to 70% relative humidity.
Deviations in the mean survival time, however, are practically not important, because differences in
LT 50 values remained always below 20%. Radiation resistance of males was investigated in the dose
range of 30 - 200 krad and proved to be higher than that of the beetles, but with doses of 30 - 50 krad
the reproduction of males could also be inhibited. (Auth.)
Eggs of *D. melanogaster* that were 10–20 mm old were irradiated in N/O mixtures with 1000 R of 50-keV x-rays. The N/O mixtures contained 0, 4, 8, 10, 20, or 100% O. Embryonic mortality, postembryonic mortality, and the rates of massive sex-linked lethal mutations were studied. The rates of all three effects increased in gas mixtures that contained from 0–100% O, but remained almost constant in atmospheres that contained from 10–200% O. The increased rates of embryonic mortality and lethal mutations observed in the O atmospheres, which reflected the ratio of the effect after irradiation in air to the effect after irradiation in N, amounted to 2.4. The analogous ratio for postembryonic mortality was lower. It was possible to show that various radiation effects that were induced within the same experiment, in spite of the same dose dependency, the same dependence on the O concentration, and the same ratio of increase due to the O concentration, were not caused by the same primary effects. (USA 21: 1967, 22760)


Larvae, pupae, and adult weevils are very sensitive to x-rays, as measured by adult survival three weeks after irradiation. Adult survival of 50–70% three weeks after treatment was considered the minimum acceptable. Doses of 1400 R were lethal for last-instar larvae, 2500 R for last-instar pupae, and about 3200 R for adults. In adult weevils, mortality occurred about 7-16 days after irradiation, and the death rate did not increase when doses were increased from about 3000–12000 R. Male weevils were 30 and 99% sterilized by doses of about 7500 and 9000 R, respectively. No sterilized male lived more than three weeks, and no increase in fertility occurred. In a test with mixed populations of adult irradiated with doses of as much as 4000 R, a significant increase in fertility occurred during the three-week test period, but 8 days after doses of 4000 or more roentgens, egg production was almost eliminated. No increased survival occurred when 8000 R were administered in four fractions of 2000 R each to adults at intervals between fractions of as much as 40 days. Both the lethal and sterilizing effects of x-rays were reduced when weevils in the larval, pupal, and adult stages were sequentially irradiated with various fractionated doses. Dose fractionation is not promising as a means of producing a sterile and viable weevil. (Auth.)


In the course of studying adult susceptibility of *Tribolium confusum* Dav., the species was mass-reared and its life history studied. Milled flour at 29°C and 95% R.H. was fed. The duration of each stage in the life cycle was observed; dispersion in growth rate was found to be maximal in the embryonic stage and minimal in the larval stages. Adults of the same age were exposed to doses up to 25 kR to study mortality. 16-25 kR gave an LD 100% (1/4).


The following is virtually the authors' summary. It has been suggested that nuclear radiation might be used for crop control, but insufficient knowledge has hitherto been available to decide whether such a measure is feasible. The results of laboratory experiments on the effect of x-radiation on eggs of *S. gregaria* (Forsk.) are described. After a single dose of x-rays, the resulting mortality among the eggs was correlated with the size of the dose received and the age of the egg at the time of irradiation. The dose required to kill the older eggs was 40 times that required to kill young eggs; thus, a dose of 144 R caused 60% complete mortality among eggs deposited 1-2 days before irradiation, but a dose in excess of 3600 R was required to kill eggs deposited 11 days earlier. For competition, the lethal dose of x-radiation for humans is estimated to be 400-700 rad. When the irradiation dose was applied in three small fractions, with intervals between them, the percentage of eggs killed was less than when the total dose was given in one exposure. This difference was presumably due to time recovery during the interirradation periods. The temperature to which the eggs were exposed during irradiation. The present equipment needed for this method is not available at the moment of this writing, but the technique is promising and may be useful against locusts, which has been cast.


The effects of *y*-irradiation on *L. polyhedra. A. *Co*140 is lethal to 2nd- and 3rd-stage larvae of the stomach accelerated in larvae c 1545.


Gamma radiation, 59.9% mortality in eggs caused 79.5% mortality stage. Exposure at the lethal dose was as for larvae, LD 100 = 16.04 999 rad, 5.6–300 rad.

Sitar, R. R. A F OF CIGARETTE SMOKING. Thailand: 21 Bangkok (Thailand). The radiosensitivity of 1- to old eggs. The life of larvae, 10 R for the

Udo, E. THE MORTALITY OF THE DESERT LOCUST IN THE DESERT LOCUST DIFFERENT AGES. To investigate the sexes of *S. gregaria* and of the poplar stage irradiated when they were mortality rate and the highest mortality rate in the post-embryonic; the same cell of larvae condition at the difference

390
EGG-RETRACTING FRESCO TREATMENTS. (Serial and oxygen concentrations.)

0 mixture with 1000 R of 40% O2. Embryonic lethal mutations were studied. A 0 - 10% O2, but remained
injected rates of embryonic encoded the ratio of the effect
of 4. The analogous ratio for
radiation effects that were
sensitive, the same dependence on
radiation, were not caused by the

THROUGH THE WELL VEIL:

AND DOSE FRACTIONATION

by adult survival three weeks
considered the minimum
instar larva, 2400 R for last
considered about 7-14 d after
from about 3000 - 2400 R.
respectively. No
occurred. In a test with
the significant increase in
3000 to 4600 rad, a few
were administered
as much as 6 h. Both
larval, pupal, and adult stages
radiation is not producing as

AND SUSCEPTIBILITY OF THE

P2-6. Atomic Energy Centre;

the species was mass-reared
fed. The duration of each
is to be maximal in the
3. Exposure to doses up

of Y-RADIATION ON EGGS


that nuclear radiation might
unavailable to decide whether
the effect of Y-radiation on eggs
were kept. The resulting mortality
age of the egg at the time
is required to kill young eggs:
exposed 1 d d before
postdated 1 d earlier. For
400-700 rad. When the
were them, the percentage of
survive. This difference was
compared to which the
eggs were exposed during such periods also affected survival, recovery being greater at higher
insects. The possibility of using Y-radiation to affect control in the eggs-field, the cost of
the equipment needed and the hazards involved are discussed. It is concluded that ceased by
this method not only offers an advantage in terms of cost, effectiveness or convenience compared
with conventional insecticide treatments but would be impracticable and dangerous to operators and
their inhabitants, both human and domestic animals, of the treated area. It is possible that other control
methods utilizing radiation, such as sterile-male release or attractant traps treated with a sterilant,
may be useful against certain species of locust after further work on the development of chemical
attractants has been carried out. (RAI- A 65: 1966, ref. 81)


The effects of Y-radiation were studied on larvae with and without the virus, and on the lyophilized
polyhedra. A 40SH-source was used. It would appear that (1) irradiation with doses of 35,000 rad
are lethal to 3rd- and 4th-instar larvae, (2) exposure to 50,000 rad completely inactivates the
polyhedra of the nuclear polyhedrosis of Malacosoma; (3) development of the virus seems to be
accelerated in larvae exposed to low radiation doses. The need for further study of (3) is stressed.


Gamma radiation retarded development and had lethal and sterilizing effects, depending on dose.
90.0% sterility in eggs was observed when both parents had been exposed as late pupae, 4400 rad
cased 99.7% sterility in eggs, 2800 rad 100% when both parents had been exposed at the early-adult stage.
Exposure at the late-larval, prepupal or pupal stages showed the female to be more susceptible.
Lethal doses were as follows: for pupae, LD 100 - 22,400 rad, LD 50 - 6400 rad; prepupae and late
larvae LD 100 - 12,400 rad, 7-2-eggs, LD 50 - 2940 rad, 42 (at 27.8 C) - 1620 rad, 4 d - 650 rad, 2 d - 850 rad, 1 d - 340 rad.


The radio-sensitivity of eggs was studied. A dose of 800 rad caused 145, 400 rad 100% mortality in
1-2-old eggs. The life cycle of the beetle was found to be 97 d (approx. 8 d for the egg stage, 19 d for
the larvae, 10 d for the pupal, and 4-5 d for the pre-emergence stage).


To investigate the response of Drosophila of different ages, experiments were performed on 2-3,
7-24, and 50-60-old larvae exposed to 1500 R of Y-radiation. The 50-60-old larvae (for prepupae)
passed to the prepupa stage apparently without being affected by irradiation and became adults. Larvae
irradiated when they were 72 h old became pupae which did not show a statistically significant higher
mortality rate than the controls. Larvae irradiated when they were 3 h old showed a considerably
higher mortality rate until they reached the prepupa and the adult stage. The 36-48-old larvae showed
the highest mortality rate between 50 and 144 h after they were irradiated. In D. melanogaster larvae,
in the post-embryonic stage, micros does not occur. The variable dose of inactivation observed in
the same cells of larvae belonging to different ages may be due to changes in the physiologic condition at the different ages. (RIAI- A 67: 1965, 2347)


Embryonic development was followed in normal embryos, unfertilized eggs, and embryos from irradiated sperm (16.8 66) or unfertilized eggs (12.0 66). Embryonic death due to radiation occurred either early or late in development. Findings are discussed in relation to work with Hymenoptera and Diptera. (Abstr.7)


Increasing the dose rate accelerates the death of granary weevils. With increasing irradiation dose from 12 - 56 krad, the difference in the dose rate is levelled out at the level of 99.9% death of the weevils; however, the total effectiveness is negligibly reduced. (Auth.)

See also:
26 The effect of syringine-3H on the mortality of Prospis cristata larve. (Abil. Y. D., 1964)
27 Application of radioactive isotopes to the investigation of methods for the biological control of pests. V. The effects of y-irradiation on pupae of C. capitata previously labelled with 32P. (Arturo, M. et al., 1965)
525 Radiation profile of a benthonic insect. (Weichler, D. K., 1965)
523 The sensitivity of undifferentiated and differentiated cells following x-irradiation in the early stage of development of the egg of the nematode Rhabditis buonellii fabo. (Trichobroto, W., 1965)
1099 Comparison of metamorphic and cell-killing effects of irradiation in the silkworm. (Nakahao, Y. et al., 1965)
1095 Biological studies: genetics. (National Inst. of Radiological Sciences, Chiba (Japan), 1965)
1014 Sterilization of the coffee leaf miner. (Kato, K., 1967)
1155 Gamma-induced sterility in the sugarcane moth, Diastax scutellaris (Fztb.) (Lepidoptera: Crambidae). (Walker, D.W. et al., 1967)
1247 Radioresistance of the grainy weevil as a function of temperature. (Zakladnik, G.A., 1967)
1253 Sterilizing effect of x-rays and alpha on the Mexican bean beetle, Epidea varivestis Mots. (Carillo, J.L. et al., 1964/1965)
1301 Modification in productivity and mortality of four beetle species and strains due to x-rays and the isomadicite, DDT. (Eddman, H.E., 1969)
1341 A study on the life history and the effect of radiation on rice weevil, Sitophilus oryzae L. (Cheshnach. Budin, 1965)
1349 Effects of x-rays on metamorphosis and adult life span of four beetles. (Eddman, H.E., 1969)
1350 Ontogeny and x-irradiation sensitivity of the flour beetle, Tribolium. (Eddman, H.E., 1967)
1359 Radiation susceptibility of various developmental stages of the Mediterranean fruit fly (Ceratitis capitata Wied.). (Kahan, R.A. et al., 1969)
1360 Cobalt-60 radiation studies with the European chafers. (Lippold, P.C. et al., 1969)
1366 Studies on strain differences in radioresistance in the silkworm. L. Screening of sensitive and resistant strains to embryonic radiation killing. (Muramatsu, A. et al., 1968)

1393 Studies on main d. permeability to embot.
1393 The effects of gamma T.E., 1965)
1390 x-irradiation and food. (M. et al., 1963)
1391 Further studies on (Booth, A. et al., 1963)
1392 Effects of x-irradiation on the ferritin of O. (M. et al., 1963)
1394 Cytological study of early development. (Kosaka, T., 1963)
1395 Effect of gamma r. et al., 1963)
1392 The effect of both (M. et al., 1963)
1395 Studies on the radi.
1400 Kinetics of aging (P. et al., 1963)
1396 Age of death et al., 1967)
13910 Modification of fit (H. E., 1965)
1405 Pyrimidines and th.
1396 Influence of post-t (Kosaka, T., 1963)
13920 Studies of cigarette (K. et al., 1968)
13923 Desensitization of r. et al., 1963)
13930 Desensitization to r. (Kosaka, T., 1963)
13961 Desensitization of r. et al., 1968)
13965 Desensitization of r. (Kosaka, T., 1963)
13970 Desensitization of r. et al., 1968)
13970 Control of the Que.
13970 Gamma irradiation. (Sukhlebnow, B.
13970 Food irradiation in t. (H. E., 1968)
13970 x-Ray irradiation in t. (H. E., 1968)
13970 Sensitivity of man. (Uspishka, M. D. et al., 1968)
13970 Killing silkworm p.
13970 Application of an. (Nakahao, Y. et al., 1965)
13970 Intensity. R.

Chemicals including P. Medium. Pathogens.

1450 Ahklaya, Y. G. INFLU. ON EGGS OF BMM (In Georgia) x-irradiation to 1500 Gt per silk worm egg. F. conditions which precipitate biological effects on silk
1269 Studies on strain differences in radiosensitivity in the silkworm. II. Relation between sensitivity to embryonic killing and mutability. (Murakami, A. et al., 1960)

1373 The effects of gamma radiation upon various stages of Parnassus cantabricus (L.). (Nelson, T.E., 1969)

1380 x-irradiation and wing retention in the common house fly, Musca domestica L. (Bockstein, M. et al., 1968)

1381 Further studies on the effect of x-irradiation on the house fly, Musca domestica L. (Bockstein, M. et al., 1968)

1382 Effects of x-irradiation on somatic development of Drosophila melanogaster. (Davenport, S., 1964)

1384 Cytological study of embryo development in Drosophila melanogaster, following x-irradiation at early developmental stages. (Schneider-Müller, A., 1966)

1390 Effect of gamma radiation on Tropopoda clam and Antipeneres pumila. (Tilton, E.W. et al., 1965)

1404 The effect of increasing radiation upon the development of the mallow moth. (Vasić, V.V., 1963)

1439 Studies on the radiosensitivity of early embryonic stages of Drosophila melanogaster. (Würgler, F.Z., 1964)

1406 Kinetics of aging as revealed by x-ray dose-lateness relations in Drosophila. (Baxter, R.C. et al., 1967)

1406 Age of death in Drosophila following sublethal exposure to gamma radiation. (Baxter, R.C. et al., 1967)

1410 Modification of insects in species and strain of flour beetle due to x-rays and DDT. (Edman, H.E., 1965)

1453 Pteridinelines and the x-ray response of Tribolium confusum. (Rogar, G.A., 1965)

1460 Infection of post-treatment humidity on the irradiated rice weevil adult. (Siropnaya, A.O. et al., 1966)

1468 Disinfection of African flies and skinned fly by means of irradiation. (Sorokin, M. et al., 1969)

1460 Deterioration, longevity, and shelf-life extension related to dismutation of fruits and vegetables by γ-irradiation. (Brunske, J.L., 1969)

1470 Control of the Queensland fruit fly by gamma irradiation. (Maximoff, J.L., 1969)

1470 Gamma irradiation of grains and other reserves for sterilizing and exterminating pests. (Gukovskiy, B.I., 1969)

1470 Food irradiation in Australia. (Scott, W.J., 1969)

1470 x-Ray irradiation effects on house fly destructive insects. (Thiel, G. et al., 1969)

1470 Treatment of mangoes for control of the mango seed weevil (Drepanosiphum mangiferae). (Usatova, M.D. et al., 1969)

1703 Killing silkworm pupae by irradiation. (Beard, R.L. et al., 1966)

1745 Application of an aerographic recording method to the study of the effects of irradiation on Cnaphalacma pomonella larvae. (Pears, P.P. et al., 1969)

2.2.8. Modifying Factors


x-irradiation to 1500 R produced a negative effect on embryonic development of Bubulus ericetica bimai silk worm eggs. However, the damaging effects were eliminated by changing the incubation conditions which preceded hatching. The influence of various incubation conditions on radiobiological effects on silk worm eggs is of practical importance. (SRA 21-1967, 2064)
1451


Since the effect of magnetic fields on radiation induced wing abnormalities in the adults of T. confusum was demonstrated, a systematic study was undertaken to explore the dependence of such effects on the intensity of the applied magnetic field and on temperature. We are finding that the percentage of abnormality decreases with increasing field intensity up to 9 kG, where the effect corresponds to a dose reduction factor of about 3.5 (T = 38.5°C). At higher fields the magnetic post-radiation protection decreases again. Moreover, the effect is much more marked at 38.5°C than at 30°C. Magnetic fields affect radiation not only against k-rays but also against temperature induced abnormal development. The effects of magnetic fields also are being tested in various post-radiation oxygen concentrations. At low oxygen partial pressure, the effect is predominantly protective; at high oxygen partial pressure the magnetic field enhances oxygen toxicity. We are finding that morphologically the effect of elevated temperatures and high oxygen tension on development is similar to that observed when the hormone ecdysone is present in reduced amounts; we are therefore testing the hypothesis that radiation, temperature, oxygen and magnetic fields may influence the hormonal regulatory processes. (Abstr.)

1462

Antipov, V.V., Dolone, N.L., Purykhov, G.P., Yuryshy, V.G. RESULTS OF BIOLOGICAL EXPERIMENTS CARRIED OUT UNDER CONDITIONS OF FLIGHT IN SHIPS VOSTOK WITH PARTICIPATION OF COSMONAUTS A.G. NIKOLAEV, P.R. POPOVICH, AND V.P. BRYKOVSKY.


Reproduction processes in Drosophila melanogaster and the hereditary structures of Treademania pallidens were studied under conditions of cosmic radiation and weightlessness. The following results are reported along with descriptions of experimental procedures and conditions. The speed of laying eggs, and the viability of embryos and larvae were shown to be approximately the same under weightlessness and normal conditions. Several explanations are given for an excess of female sex: it is suggested that the most valid of these is a relative increase in the competitive capability of the female larvae under the experimental conditions. The following apparent non-hereditary anomalies were observed in the offspring: (1) absence of 1/3 of the thorax; (2) a one-sided absence of macrochaetes; (3) a decrease and roughening of one eye; and (4) a shortening and incorrect insertion of one wing. It is noted that only 1/3 of the body is affected in each case. (From Sci. and Techn. Aerospace Rep.)

1489

Antipov, V.V., Dolone, N.L., Purykhov, G.P., Yuryshy, V.G. RESULTS OF BIOLOGICAL EXPERIMENTS CARRIED OUT UNDER CONDITIONS OF "VOSTOK" FLIGHTS AND WITH THE PARTICIPATION OF COSMONAUTS A.G. NIKOLAEV, P.R. POPOVICH, AND V.P. BRYKOVSKY.

Life Sci., Space Res. 3 (1968) 213-222. Also presented at "5th International Space Sciences Symposium. Florence, Italy, 12-16 May 1964." (See 1489)

The data are presented on a study of the effect of space flight factors, particularly of weightlessness and radiation, on the fertilization, growth and development of Drosophila melanogaster and on the mechanics of heredity in Treademania pallidens. Copulation, oviposition and development of Drosophila are shown to be possible under 4-d weightless conditions. A distortion in the sex ratio has been observed in the cultures of flies grown in flight. It is suggested that rearrangements of chromosomes are caused by the action of vibrations and accelerations while distortion in the mechanism of mutations are mainly related to the weightlessness effect. (From auth.)

1454

Buchtovskaya, I.B., Ochinskaya, G.K. ABSENCE OF "OXYGEN AFTER-EFFECTS" IN Callidae granaria DURING FEEDERATION INDUCED WITH LOW TEMPERATURE. Sfizobiologiya 5 (1960) 703-704. (In Russian.)

The insects C. granaria were irradiated in special vacuum tubes at X-ray doses of 5, 8, 17, 8, and 10 kR at a temperature of -1 - 0°C. The insects were held at a lowered temperature after irradiation for periods varying from 56 min to 22 h. The oxygen concentration was varied from 20 - 2% during and after irradiation. The survival at 80 d and the average lifetime of the irradiated insects were taken as criteria of radiation damage. On maintaining conditions of hypoxia during and after irra-

diation, a definite protoscytoma that was never observed. Thus, no low temperatures. (USA 10)

1455

Pilman, H.E. EFFECT OF BETA RAYS ON THE MEMBRANE IN VITRO. Radiat. Res., Isotopes, Radiol. Sexually mature virgin rats treated with dimethylhydrazine. DMBO gave was unacceptable. (See 1456)

1456

Gosch, D.S. THE CO ON BRACONID FECUNDATION of Radiation Research.

Experiments with female radiation and two kinds of preliminary series of eggs to avoid displacement of experiments. Two replicates delivered from a "O" s that obtained from fixed that following radiation records exceeding those subsequent to 2000 F of vibration were not added slightly. Greater effects particularly in units while alone or in combination

1457

Gosch, D.S. UTILIZ./ BIOASTRONOMIC STUDIES, Raleigh, Dep. The combined effects of wasp, labbroba.sh. A and hold capillary of wasp providing a force of 100 the maturity of adult at. "O" at a dose rate of 39 centrifugalized, irradiated, were decreased for use for either radiation or other prototype packages under specific, irradiation, of good except in the 1000 testing. (Sci. and Tech)

1458


The radioaerosolizing effect to 5-vindoraxial, or other types. At relatively low anxiety within one week of irradiation, analogous to larval lethality absur
OF MAGNETIC FIELDS.


1455

ERBRAN, H.E. EFFECTS OF DIMETHYL-3-SULFOXIDE ON PRODUCTIVITY OF X-RADIIATED


Sexually mature virgin female flour beetles, Tribolium castaneum (Herbst), mutant: sooty, were trea.ted with dimethyl-3-sulfoxide (DMSO) and x-rays. Fecundity, fertility, and viability were measured. DMOS gave no radiation protection to female germ cells. Food containing 4.5% DMOS was unacceptable. Postmigrination of ovarioles showed that sterility resulted because of death. DMOS might be economically important in protecting stored products from insects. (Abst.)

1460


Experiments with female Brachycerus monivaginatus show antagonistic rather than synergistic interaction of radiation and vibration and two kinds of factors produced to increase stress in cell structure. However, a preliminary series of experiments revealed that relatively lower rates of cell-freezing were necessary to void displacement of abdominal organs and provide consistent results. These separate sets of experiments, two replicates each, featured 20 g for 24 h during which a total of 750 R of gamma-rays was delivered by a 137Cs source. Egg production for the combined treatment was intermediate between that obtained from irradiation or radiation alone. In addition, hatchability was improved over that following irradiation alone. Another combination providing egg production and hatchability records exceeding those of radiation alone involved 120 vibrations/sec delivered over a 4-h period subsequent to 2000 R of gamma-rays from 137Cs. Furthermore, the 1600 vibrations/sec were a potential of 6 h which were not additive in effect. The vibration alone decreases reproductive performance only slightly. Greater efficiency in recovery mechanisms are suggested because improvement is noted particularly in units which were primitive nongonads at the time of treatment. Neither confinement alone or in conjunction with radiation decreased life span significantly. (Abst.)

1464


The combined effects of radiation and gravity factors on the oviposition of females were investigated using the wasp, Habobemas. A model designed for long continuous operation fitted with a head machine to hold capsules of wasps was used in this investigation. Contributions for a few minutes at a speed providing a force of 1900 g was found to severe for all stages of the bractolite life cycle, however, the majority of adults survived 500 g for as long as 24 h. The radiation exposure was conducted with 137Cs at a given rate of 30 R to give 750 R for a 24-h exposure. Experiments were made with centrifuged, irradiated, centrifuged and irradiated, and the control. Egg production and hatchability were decreased for the combined exposure of increased gravity and radiation below the records for either radiation or centrifugation alone. Experiments were also made to test the radiation and prototype packages under simulated space flight conditions. These conditions were simulating flight, centrifugation, combined effects of gravity and radiation, and control. Wasp survival was good except in the 1000 R position where wasps were returned in the simulated center vibration testing. (Emsch. and Tech. Aerospace Repts.)

1469


The radiosensitizing effects of incorporation into DNA of the halogenated pyrimidines, 5-bromouracil or 5-iodouracil, or their nucleosides (BUDR or IUDR) have been demonstrated in a variety of cell types. At relatively low concentrations in the medium, the halogenated anti-metabolites exhibit toxicity within one week after hatching of larvae in analogue-containing medium. The toxicity of brominated analogues is less pronounced than that of the iodinated analogues and is slower to develop. Larval lethality attributable to toxicity and the lethality attributable to x-rays are not clearly
separable. The results obtained in this study indicate that the halogenated analogues tested influence lethality in x-irradiated adult Tribolium. Toxicity of the halogenated pyrimidines or halogenated nucleosides is demonstrable three to five weeks following isolation of pupae into analogue-supplemented medium. The brominated analogues are much more toxic to adults than 5-02 or 5-04. Analogue-treated adults exposed to 5 kraft, which is sub-lethal for adults in normal medium, die much earlier than those treated with analogue alone or with 5-02. The doses of x-rays alone. Adults isolated as pupae into unsupplemented medium, transferred to analogue-containing ration after three weeks and irradiated immediately before transfer exhibit marked lethality within one week after irradiation. Transfer of adults beetles to normal medium after three weeks or less in the presence of brominated analogues virtually eliminates lethality attributable to the analogue. x-irradiation at the time of transfer, however, leads to high mortality. The onset of mortality occurs between the 2nd and 3rd week post-irradiation and is similar to that of x-irradiated adults in normal medium. The effects of B5HR or 5-04 on adult x-ray lethality persist one to two weeks after analogue exposure. Dose tests for 12 weeks in medium containing unaltered or thymine exhibits the same mortality as those treated in unsupplemented medium. Two weeks after 5-02, irradiation a sharp decline in survival is seen in both treated- and thymine-treated groups. No such response is observed in purine-treated Tribolium or adults treated with 5-aminouracil, 6-azauracil or 6-azauracil, (DA).

1459 Katiyar, K.P., Ferrer, F. Efecto de la exposición a altas temperaturas sobre las papas irradiadas de la mosca del mediterráneo, Ceratitis capitata W. (Efecto de exposición de irradiadas de pupa de la mosca del Mediterráneo brusela, C. capitata, a alta temperatura.) \textit{Tortosa} 17, 3 (1957) 31-44. (En español, con resumen en inglés)

The following is virtually the English abstract of this account of investigations to ascertain whether high temperatures during transport might have been responsible for the high mortality of adults from irradiated pupae of \textit{C. capitata} (Wied.) liberated in Costa Rica. Pupae irradiated at 25 kraft and normal pupae were kept for 2, 4, 6 and 8 h at temperatures of 25, 30, 40 and 50°C (77, 86, 104 and 122°F) and 60 to 65°F, h. Adult emergence was normal up to 40°C. Exposure to 45°C for 2 h was lethal to irradiated as well as normal pupae. A heat treatment of 50°C for 5 h immediately after irradiation had no latent adverse effect on the length of life of the adults. Irradiated females survived longer than normal females. (RAF-A 5:1967, ref. 520)

1460 Kumari, M. influencia de la humedad pos-irradiación en el trigo. S. J. 


The relative humidity was regulated by Zwickel's method, using H2O, NaCl and Ca(N03)2 at four different temperatures ranging from 25°C to 35°C. Three different intensities of y-irradiation from a Co-60 source (250, 500, 1000, and 2000) were used, and their effects examined as individual level. The survival rate (S) or the average number of days during which the insect remained alive, within a month of irradiation, were calculated. The number of days corresponding to 50 and 90% were compared. The data showed that the higher the relative humidity the less the influence of irradiation under any of the temperatures or dosages used. it is suggested that the effect of post-treatment humidity should not be ignored when irradiating the adult weevil.

1461 Deleted.

1462 Balakir, G.W., Nair, K.K. influencia de la radiación en el trigo. S. J. 


Studies were conducted to determine the effects of varying periods of diapause on the radiosensitivity of the Khapra beetle larvae (\textit{Chroplodina granarium} (Everts)). There were practically no mortalities in the irradiated larvae during diapause but it manifested itself only after the diapause was broken at 25°C. Since the calculated LD 50's for 10, 20 and 30 d of post-irradiation diapause were not significantly different from one another it was also evident that increases in the length of diapause had no significant effect on post-diapause survival time. On the other hand, a high population seemed to be influenced by the duration of diapause in the irradiated larvae. This effect was best discernible at low doses. The significance of these findings is discussed. (abstract)

x-ray irradiation as and mixed-sex

1350 H.E., 1968)

1351 The influence (Grabb, D.S.)

1352 Survival of (Larsen, W.,)

1353 Effect of acute (Meikle, J.

1354 Effect on adult (Muca, Pomegranate)

1355 Effect on adult (Munca,  

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1357 Effect on adult (Munca,  

1358 Effect on adult (Munca,  

1359 Effect on adult (Munca,  

1360 The effects of \textit{vitisnagoides} ( 

2, 3. RADI
2.3. RADIATION EFFECTS ON INSECT POPULATIONS

2.3.1. Behaviour


The study aimed at classifying the effect to which immediate reactions to ionizing radiation can be observed in the animal kingdom, and the existence of a possible correlation between individual radiosensitivity and the level of phylogenetic development. Results are tabulated in terms of order, class, and species investigated, group and/or individual reaction to irradiation, reaction period (including moment of first recognizable response), dose, reaction after irradiation, reaction after repeated irradiation, and reaction to partial irradiation. - Reaction ranged from antennal necrosis (as in Agans amamea), general atrophy (as in Apis mellifera), trembling (as in Tribolium molitor), sudden death (as in Dytiscus marginalis), increase in peristaltic movement (as in Tribolium molitor larvae) and in Drosophila melanogaster), to avoiding action, from movement away (as in Apterae coryzae) swimming away (Cynus nitratellus), jumping away (as the grasshopper Tetitgona vincentia) to obvious escape (as in Formica rufa).


The effect of acute and chronic radiation on competition was studied in laboratory populations of the sibling species Drosophila melanogaster and D. simulans which are similar both morphologically and genetically. D. simulans was the superior species for 50 weeks in the control populations, but was eliminated by D. melanogaster when the populations were exposed to a chronic dose of 4.2 rad/5. After an acute dose of 200 rad, D. melanogaster was the superior species for approx. 12 weeks; however, the reverse was true when the populations were exposed to 2000 rad. D. melanogaster was eliminated by D. simulans by the end of six weeks. The frequency of irradiated D. melanogaster or irradiated D. simulans (2000 rad) decayed rapidly when placed in competition with non-irradiated flies of the opposite species. Under these conditions, irradiated D. melanogaster recovered after six...
weeks, but irradiated D. similans never recovered and was eliminated in one population after 24 weeks. Population size was affected by the exposure to acute and chronic radiation, but most of the populations recovered after six weeks. The populations receiving 10,000 rad were the exceptions; they required 19 weeks to recover. This was attributed to the effects of radiation on the reproductive capabilities of these species. After three weeks of competition the populations having the largest average size were the ones that received an acute dose of 200 rad. (Auth.)

1465 Baylock, S.G. EFFECTS OF IONIZING RADIATION ON INTERSPECIFIC COMPETITION. Obst.-P.-4-2085, Oak Ridge National Lab., Tenn. 1967, 23p. Also presented at "2nd National Symposium on Radiobiology, Ann Arbor, Mich., USA."

For abstract, see 1464.


Changes in the behavior of a colony of ants, Formica integra, were investigated in an area experimentally exposed to chronic gamma-radiation at Brookhaven National Laboratory. The habits of the colony changed so that ants were no longer exposed to high radiation levels. The ants constructed a covered runway, 1.5 m long, extending away from the radiation source and used exclusively for travel to and from the nest. The ants also abandoned the habit of appearing on the exposed nest stub and foraging with litter. (Auth.)


The experimental forest was circular, with a 2600 CI. 1540 m at its centre, delivering high intensity gamma-radiation for 24 hours each day. In 1961, observations were started on an active colony of Formica integra at the base of burned pine stump 16 m due east of the future site for the radiation source. The colony appeared normal and the characteristic behavior of the species appeared well developed. In 1962, the colony was again observed to be active although now exposed to 10 mCi/20 mCi. In the spring of 1963 the colony was again found to be active. The nest new had short narrow runways radiating in several directions. In 1964 the ant behavior seemed unusual. A runway 13.5 m long had been constructed extending from the base of the stump outward as an angle away from the source. This runway was about 39 m from the radiation source. At 29 m the exposure level was only 1.3 D/h or 12% of that at the nest. The runway was excavated below the surface of the soil and covered by ground litter for almost its entire length. Ants used this runway exclusively in travel to and from the nest. No ants were found elsewhere. The runway led not only away from the source of radiation but also toward a greater abundance of insect food (to counteract death of vegetation due to radiation). The behavioral changes most likely to have been caused by a direct radiation avoidance response was the abandonment of the inter-collecting habit. The complex behavioral pattern of ants makes interpretation of causal factors for the observed changes speculative. (Auth.)


A study was established to determine if irradiated males of A. micans would compete favourably with non-irradiated males. Males were irradiated and placed in colonies with non-irradiated males in the following ratios: 1/6, 1/3, 1/9, 1/18. Each colony contained 10 non-irradiated females. (Abstr.)


The results of several years' studies of animal behavior in radiation fields carried out with Drosophila melanogaster, fish, mice, rats, guinea pigs, dogs and monkeys are presented. In experiments with vertebrates y-radiation was used. In experiments with D. melanogaster the amount of eggs laid on food surfaces both exposed to and free from y-radiation was determined. All the animals observed were shown to be capable of determining the position of the radiation source. A response to very low radiation doses (about 0.001 E R) was obtained for the animals. Threshold dose rates causing avoidance behavior varied of radiation acting as an i

1470 Dyce, K.P. FITNESS OF A. melanogaster. Mutation

Experiments are described to the extent that the accumulation of 2nd of the total gusite DNA, then the doubling of the irradiated could largely be accounted for by inactivity, and the irradiation was found to have no effect on the flies. (Abstr.)

1471 Funt, H.M. THE EFFECTS OF IRRADIATION ON HIPPOPIG.

All insects were treated with visible light to make tests males not had been sterilized as adults in a illuminating array there was a significant increase both tests indicated that while females were treated with a sterile, untreated females during females laid greater number

1472 George, J.A. EFFECT OF IRRADIATION ON HIPPOPIG.

Irradiated males appear to have relative competitiveness y-radiation in the pupal stage may occur to emerge within 1 week.

1473 Krubs, A., Benson, B. TUNNELING BEHAVIOR (1968) 131. (In English)

E. californica (Buchholz) was irradiated in groups of ten doses ranged from 38000 special tunneling contain tunnel systems and the air damage to the ant's work allowed quantative eval moved, and gave an idea the central nervous system social insects, especially changes.
avoidance behavior varied with the species. The discussion of the results is based on the assumption of radiation acting as an unconditioned stimulus. (From Above.)


Experiments are described in which a population of flies was given an acute dose of 1500 rad of x-rays every generation and then allowed to compete with a genetically similar but unirradiated population. The accumulated fitness of 2nd chromosome recessive lethal mutations was measured to provide an estimate of the total genetic damage and it was found that >90% of the chromosomes carried these by generation 12. \[1\] The rate of accumulation was found to agree fairly well with a straightforward theoretical prediction. The competitive ability of the irradiated population as measured by the number of flies emerging appeared to be well maintained and, by generation 18, only slightly inferior to its unirradiated counterpart. The decline in the number emerging from generation 2 to 12 could largely be accounted for by the genetic deaths due to homozygous recessive lethals. Flies heterozygous for irradiated chromosomes, however, appeared to have a reduced competitive ability. The significance of these different responses to genetic damage in terms of the structure of the gene pool is discussed. (Auth. summary)


All groups were treated either as adults 24-48 h after emergence or as pupae ~2 d prior to emergence. In mating tests males sterilized with 5000 R from a Co-60 source were used. M. pupae were males which had been sterilized at adults with γ-radiation were found to be fully competitive with untreated males in fertilizing females to laboratory strains. When males were sterilized in the pupal stage, there was a significant reduction in their ability to compete with untreated males. Observations on the tests indicated a significant reduction in the size of tests of males treated in the pupal stage, while tests of males irradiated as adults were similar in size to untreated controls. When females were treated with a sterilizing dose as adults, initial oviposition was 1.5- and 2.2-fold greater than untreated females during the 1st and 2nd days of oviposition, respectively. Thereafter the untreated females laid greater numbers of eggs to the end of the test period.

1472 George, J.A. EFFECT OF MATING SEQUENCE ON EGG-HATCH FROM FEMALE Aedes aegypti (L.) MATED WITH IRADIATED AND NORMAL MALES. Mosquito News 27 (1967) 52-56.

Irradiated males appear to mate as effectively as non-irradiated males. An investigation into the relative competitiveness of spermatozoa from normal males and those from males sterilized by γ-radiation in the pupal stage indicated no difference. It does appear, however, that though copulation may occur repeatedly, the only effective one is the first. In the experiments, male pupae due to emerge within ~2 h had been exposed to a dose of 3400 R of γ-radiation.


P. californicus (Stouty) shows regular and reproducible digging and tunnelling behavior. Ants were irradiated in groups of ten, in a commercial γ-ray cell at a dose rate of 1300 R/min (fair). Total doses ranged from 35000 R to 36000 R. Immediately after irradiation the ants were transferred to special tunneling containers and observed for up to 12 d after exposure. The complexity of the tunnel systems and the amounts of sand moved decreased with increase in radiation dose, indicating damage to the ant's working ability and working skill. Only short spurts of the sand protract allowed quantitative evaluation of the dose-effect relationship between dose and amount of sand moved, and gave an idea of the delay in onset of digging activity for the different groups. Alterations in physiological processes in vital organs and systems by high energy radiation damage to the central nervous system and for interference with the chemical communication code among social insects, especially pheromone activities, may contribute to the radiation-induced behavioural changes.


Releases of irradiated and non-irradiated males indicate that each responds strongly to immotile or slow-moving females in the absence of activity by non-larval females but only after the virgin females become sexually mature of the older males appear deficient in sperm. (Abstr.)


An investigation was made of the orientational responses of D. melanogaster to weak electromagnetic fields. Magnetic, electronic and y-irradiation fields with intensities similar to natural fields were used. The results are based on an analysis of 160,286 individual fly observations accumulated during 2200 replicates. The magnetic fields were shown to influence the degree of running, the variability of the data, the activity, the photostatic responses and the linear rhythm of response of the flies. Similar findings were made for the electronic and y-irradiation fields. The y-irradiation gave the lowest number of significant responses. All of the fields appeared to have the ability to affect the movement in some of the rhythmic lunar month responses. Combinations of fields tended to give responses more similar to those of the controls than did the single factor fields. The modification of the lunar pattern of response by the experimental conditions is discussed in relation to the biological clock problem. Results are compared with those of similar studies on other organisms. (NEA 2511990, 1946)


Program is reported on studies on the immediate response of pigeons and rats to x-ray stimulation. X-irradiation was used as the conditioned stimulus in classical conditioning experiments. Preliminary results are included from studies on the effects of x-irradiation on the behavior of the blowfly, Drosophila melanogaster. A list is included of 31 publications for the period covered by this report. (From NEA 321967, 1967)


A preliminary study was conducted to evaluate the mating competition offered by y-irradiated male T. glabrum Herbst. Virgin males were irradiated with 20,000 rad of y-irradiation from a Co source. When an irradiated male and a nonirradiated male were placed with a virgin female, 50% of the females produced viable eggs. At compared with 97% for the females with a nonirradiated male only. (Auth.)


Experiments measuring the genetic effects of radiation in Drosophila usually involve comparisons of irradiated and nonirradiated strains. The present study compares the genetic time of second chromosones is accomplished by crossing the balanced lethal system, Cg wpm. In the process, the flies are irradiated and crossed to flies to produce among other classes, the recombined Cg wpm and wild-type flies homozygous for the second chromosome except for some radiation induced heterozygosity. Comparisons are then made between these two classes in terms of the nonirradiated strains. To distinguish between the effects of the radiation and genetic interactions among the segregating genotypes, the following experiment was performed. Using the above procedure, six strains of D. melanogaster were established; these were cologenic for second chromosomes, and these were the Cg wpm strains used in each 2nd chromosome isolation. These six strains were then divided into a group whose males were irradiated, and an un irradiated control. Four generations after the treatment, the survival of larvae of each strain was tested in pure or heterozygotic cultures and in mixed cultures, containing the wild-type strain and its corresponding Cg wpm where both or neither had been irradiated. (See Weisbrod, Genetics 53, 1966, 627, for methods, viability of each strain cultures. The genotypes Furthermore, the paper would tend to lower the sterilization of both male and female species as effective as previously thought. (Auth.)


Sterilization of male flies is almost complete at low oxygen levels (20% oxygen) and occurs at 13.5 d at 77°F. In the control, mating behavior of flies. (Authors)
OF MALE LINES TO
Ir. Soc. Agri. 12 (1965)
61 SA. 20 Nov. 9 Dec. 1965.
trongly to inbred lines of
to subsonic, but only after the
in sperm. (Abst.)

ELECTROMAGNETIC
radiation to various electromagnetic
fields similar to natural fields.
Observe the degree of turning.
In the latter, the luminous response of
vibration fields. The y-radiation
caused to have a phase influence
it tended to give responses.

The modification of the luminous
radiation to the biological clock
organisms. (NSA 20:1966)

SIDAIJU, Comprehensive
Y., Tallahassee. Dept. of
and on its x-ray stimulation.
experience. Preliminary
behavior of the noctuid moth.
(From NSA 23:1967)

STATION OF GAMMA-IRRADIATED
Ent. 59, 1 (1968) 185-189.
ion, y-irradiated male
organisms from a Co source.

virgin female. 50% of the
omitted to nonirradiated male.

EFFECTS OF STRAINS OF Drosophila
rhyzomes of the genetics

1968, 427, for methods.) - The results indicate that when irradiation
significantly reduced the
viability of each strain in homotypic cultures, it improved the viability of the Ca L/Ph in mixed

cultures. The genotypic interaction among the competitors modified the effects of the radiation.
Furthermore, the apparent reduction in fitness of the irradiated wild-type larvae in mixed cultures
would tend to lower the overall effects of the radiation on fitness. (Abst.)

1470 Wood, D.I., Stark, R.W. THE EFFECTS OF GAMMA RADIATION ON THE BIOLOGY AND
BEHAVIOR OF ADULT buprestis (LeConte) (COLEOPTERA: SColytidae), Can. Ent. 99, 1 (1967) 1-10,
Sterilization of male and female buprestis exposed to y-radiation (Co60) as newly emerged adults was
almost complete at levels exceeding 7500 R and 10000 R, respectively. Mating behavior of males as
exposed by sperm transfer was unaffected by dosages up to 60 000 R. The capacity of beetles of either
sex to establish galleries was not affected significantly below this dosage, but female gallery pattern
was altered at 15 000 R. Longevity was reduced at levels greater than 8000 R. LD 50 for males
occurred at 11.8 R at 7500 R and 93 R in the controls. Mortality of progeny resulting from males
irradiated at substerilization levels was higher than in the controls. The dosage to achieve significant
population reduction with minimum effect on longevity and other biological activity is estimated to be
between 5000 and 7500 R. These studies indicate that this sterilization technique may have promise in
the control of bark beetles. The necessity for rearing large numbers on artificial media could be
surmounted by mass trapping utilizing their natural sex attractant and by mass rearing to cut host
material in the laboratory. (Abst.)

See also:

1128 Effectiveness of sterilization of the mallow moth: irradiability at different stages of development,
and certain features of mating and egg-laying. (Huguley, V.I., 1965)

1127 Radiation sterilization studies on the tobacco budworm, Heliothis virescens Fab. (Hunt, H.M.,
1966)

1163 Some effects of gamma radiation on the navel orange worm, Pseudoreclus transversa
(Walker). (Subrahmanyam, U., 1967)

1166 Radiation-induced sterility for population control of the sugarcane borer (Diaporctus cockerelli)
in Puerto Rico. (Walker, D.W., 1966)

1254 Spermatozoa in donors following irradiation of the young larvae with different amounts
of x-rays. (Biechhop, R., 1969)

1202 Effects of gamma radiation on fertility, mating and longevity of males of the oriental
fruit moth, Grapholita molesta (Lepidoptera: Tortricidae). (Georgia, J.A., 1967)

1350 Reproductive potential of the sweetpotato weevil after exposure to low-dose radiation.
(Walker, J.R., 1968)

2147 On the effect of Co60 gamma radiation on the desert locust. (El-Mohamadi, S., 1964)

1504 Sterilization de la mouche rhyzomene des fruits, Ceratitis capitata Wied., par
irradiation des papes aux rayons gamma. (Falcon, M., 1966)

1376 Effects of sub-lethal gamma rays on the biology and behavior of the Angoumois grain
moth, Sitotroga cerealella Olivier. (Quelch, Z.A., 1969)

1421 Radiation sterilization of the black blow fly. (Roshel, R.C., 1966)

1922 Control of fruit flies Drosophila simulans by gamma-rays. (Huguley, H., et al., 1967)

1608 Study of the biology, breeding and sterilization of the cabbage fly, Pseudaletia unipuncta,
with special reference to its occurrence in radish cultures. (Riedel, M., 1967)

1613 Studies on the eradication of Anastrepha pseudanastrepha by the sterile male technique using cobalt-60,
IV. Mating behavior and its frequency in the sterilized mosquitoes. (Tantawy, A.O. et al., 1967)

1633 Studies on the eradication of Anastrepha pseudanastrepha by the sterile male technique using cobalt-60,
V. Mating competitiveness in radiosterilized males. (Tantawy, A.O. et al., 1967)

1622 Studies on the application of the sterility in the tick Ornithodoros melophagi. (Gullon, R.,
et al., 1967)

2749 Application of an acrogyric recording method to the study of the effects of irradiation on
Calandra granaria larvae. (Peason, F.P., et al., 1965)
2.3.2. Population Dynamics

1480 Silica, D.S. THE EFFECTS OF X-RADIATION ON THE NUMBERS AND VIABILITY OF EXPERIMENTAL POPULATIONS OF Drosophila melanogaster, p. 177-197 of "Viliyale Sibarawawrthit Budhunset na Noobowerenimort". Delhi, N.T., II., Moscow, Izdatel stvo Nauka. 1966. (In Russian)

D. melanogaster was irradiated with 500, 1000, 3000, and 5000 R x-radiation and the population dynamics investigated. During the first 17 d, the decrease in numbers and viability varied directly with the dose. From the 21st-49th day, flies irradiated with 500 and 1500 R maintained the controls in numbers. At that stage, viability was equalized in the irradiated and unirradiated populations in the 2nd and 3rd generations. From the 50th - 144th day, numerical equilibrium was established in all populations: from the 179th - 254th day the populations again differed in numbers, evidently due to temperature variations. On the 834th day the experimental population did not differ from the control in viability. (NRA 52186, 21/31)


Investigations were carried out on 32 generations of D. melanogaster, a laboratory population of which were exposed to chronic x-radiation (100 and 500 R per generation). The total number of flies were counted regularly at intervals of 19 d, with double testing of the hatchability and fertility at the 300th and 4000th day for individual populations. (1) No significant differences were found between the numerical levels of the two populations exposed to the 500 R dose and those of the unirradiated control, pooled mean for the two series being 1445 ± 0.0 and 1504 ± 0.2. (2) The increase in crowding of the two populations exposed to the 1000 R dose, already noticeable in the 1st experimental series has become very clear, pooled mean in the first tested series being 1640 ± 4.9 against 1504 ± 2 for the control; a difference which is significant at the 0.05 level. (3) In spite of this obvious increase in the adaptability of the irradiated populations to conditions of strong selective pressure, higher values resulted for the classical parameters of biological fitness in D. melanogaster (% of hatchability and fertility) for the controls. This apparent inconsistency is very probably due to the fact that there may exist physiological characteristics, other than those measured so far, which are of primary importance in determining these under the conditions described.


Program is reported on: development of a multi-locus simulator (computer program) for determining gene frequencies linkage disequilibrium at selected pairs of loci; phenotypic and genotypic means and variances of each kind of locus: synergistic effects of loci and effects of linkage on gene frequency; use of simulator for studies on multiple hereditary systems: effects of recombination on fitness of populations; development of a quadratic optimum model for determination of optimum of genes in quadratic optimum selection: segregation distortion resulting from abnormal gametic production: population dynamics of male-sterile alleles: effects of fluctuating selection in populations of a given size: selection in linked populations using two-locus polyploids in the grasshopper, Melanoplus armatus: estimation of fitness from phenotypic frequencies in successive generations: rates of increase of population of Drosophila: interaction of genes in determining evolutionary changes in populations. (NRA 52,1966, 792)

Les élevages ont été disposés à l'abri d'un écran de deux cœurs de même dimension, en bois et polystyrene, pour les élevages féminins, aux parois de pleins épaisses de 10 cm pour les élevages protégés. La protection de D. melanogaster vis-à-vis des radiations ionisantes naturelles provoque une inhibition ou un arrêt de développement, les populations adultes protégées étant, à la première génération, toujours numériquement inférieures à celle des cultures de contrôle. Cette constatation permet de penser que la notion d'une activité biologique des radiations ionisantes naturelles, déjà observée chez les Drosophila, s'applique également à des organismes plus complexes, pluricellulaires.


The histories of four experimental populations, started in 1961, are reviewed. These had received 300,000 X-rays in 60, 30, and 20 generations, respectively, at rates of 3000, 4000, and 6000 X-rays per generation. Cage populations were developed from these three populations with past radiation histories (see III - 292, 342, 344 and IV - 160) and a control population, which were maintained under conditions designed to minimize larval crowding. The egg-to-adult viability remained at plateau levels of between 85 and 79% (far below that of the control) for periods ranging from 21-54 generations in the different parent populations. Under cage conditions, the viability in all the populations increased to > 90-95% of the control value in about two generations, and later on these were almost indistinguishable from the control level. It is suggested that the rapid rise in viability is a consequence of intense selection prevailing under cage conditions. Invariably mutants that were unfavorable in the new environment were eliminated rapidly and those that were favorable were retained and multiplied.


Populations of four life-history stages (eggs, 1st-instar larvae, pupae and adults) of the yellow fever mosquito were subjected to acute low-level X-rays and followed through three generations. Incubation, egg viability, larval growth rate, and mean longevity were population parameters utilized in evaluating the long-term effects. Effects were most strongly exerted in the 1st generation and gradually subsided in subsequent generations. Doses of 50-400 X were found to be stimulatory in some cases, while doses of 200 X and above were detrimental. The egg stage was found to be most sensitive followed by the larval, pupal and adult stages. Effects on egg viability were most drastic and persisted through three generations. (Auth.)

* See also, *III/97*, for thesis of the same title.

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1000 a-Radiation and temperature modification of reproductive performance of single-species and mixed-species cultures of Tribolium confusum and Tribolium castaneum. (Bulman, H.R., 1966)

1490 Studies of the genetic processes in irradiated populations. Dynamics of enumeration of irradiated populations. (Bible, D.S., 1965)

1491 A study of the genetic processes in irradiated populations of Drosophila melanogaster. III. The genic and the concentration of lethal mutations. (Bible, D.S., 1967)

1496 Genetic variability induced by ionizing radiations in quantitative traits of Drosophila melanogaster. (Dahlbroux, M.A., 1965)


1498 Les réponses de la fécondation. (Dispon, P., 1964)

1500 An aphid population explosion induced by chronic gamma irradiation of a forest. (Woodwell, G.M., et al., 1967)

1579 Mating behavior and population dynamics of the boll weevil as related to the sterile-male technique of insect control. (Gilliland, R.L., 1967)
2.3.3. Physiological Characteristics

The consequences of various combinations of selection (high and random) and levels of x-irradiation (9, 100, and 3000 R per generation) on pupal weight were investigated in two strains of T. castaneum for 13 generations. Reproductive fitness was measured in terms of fertility, adult mortality and number of offspring. The Foundation strain was an unselected laboratory population with an initial weight of 2.10 mg. The second strain, Large, had originated calves from Foundation and had been selected for large pupal weight for 44 generations. At the beginning of the present study its average pupal weight was 4.08 mg. - high selection contributed to significant response in pupal weight, but the degree of response was negatively correlated with the level of irradiation. Even though an increase in heritability and phenotypic variance was observed in some irradiated lines, a decline in reproductive fitness contributed to smaller selection differentials and in turn less selection response. - Several strain interactions were possibly related to the previous selection history of the genetic material. For example, reproductive fitness increased with high selection in Foundation and responded inversely in the Large strain. Yet the latter was more resistant to the deleterious effects of irradiation than was the Foundation strain. (Essentially auth. summary)

A quantification of the genetic variability induced by γ-irradiation was carried out with quantitative characters of H. joyiandui. Adult female (diploid) and male (haploid) body weights were studied in homozygous and heterozygous genetic backgrounds. The dose-response relationship was determined with respect to body weights of females that might be heterozygous for induced mutations. The responses to 0, 1, 2, 3, 5, 10, and 20 kR triturations were measured using the F-ratio between the variances among family means in the irradiated material and in the control. The mean response was obtained at 3.5 kR. Induced genetic variability was studied in detail with 1.5 kR irradiation. (1) A striking increase of genetic variability was observed for induced-mutation-heterozygote females in either homozygous or heterozygous genetic background. (2) A great increase of genetic variability was also observed among males segregating for induced mutations in an otherwise homozygous line (i.e., males produced by mutation-heterozygote females with the homozygous genetic background). However, there was no significant increase of genetic variance among males produced by mutation-heterozygote females with the heterozygous genetic background. - These findings suggest that (a) induced mutations affecting body weight are not necessarily sensitive to their wild-type alleles, and (b) there are little or no nonallelic interactions between induced mutations and the rest of the genes affecting body weight. (Auth. summary)

See also:

1404 Evolution of fitness. 1. Improvement in the productivity and size of irradiated populations of Drosophila serrata and Drosophila biregiini. (Ayala, F.J., 1969)
1470 Fitness and competitive ability in irradiated populations of Drosophila melanoagaster. (Dyer, K.E., 1969)
1496 Genetic variability induced by ionizing radiations in quantitative traits of Habrobracon. (Daleschou, M. A., 1966)
1497 Progress report (on genetic studies), June 1, 1965 - June 1, 1966. (Davis & Davis, T., 1965/1966)
1511 Investigations on mutability of polygenes and on utilization of induced genetic variability. Summary of the results up to June 30, 1963. (Stern, R.E., 1963)
2.3.4. Genetic Changes

A highly inbred line of Drosophila melanogaster, which showed no response to selection for high
and low homoplasmic character number, was irradiated with 1500 R of x-rays or treated with repeated
low doses of ethyl methanesulfonate (EMS). The induced genetic variation was measured by the
response of the populations to 2-way selection. In the x-ray experiment a clear response was obtained,
in a negative as well as in a positive direction. In the EMS-created lines no response to selection
was obtained in the line selected for high number of homoplasmics, in the low line there was a clear
and significant response. (Auth. summary)

Béleza, D.S. STUDIES OF THE GENETIC PROCESSES IN IRRADIATED POPULATIONS. DYNAMICS
sections 254, 1-6 (1965) 897-899 (In English). Originally appeared in Paladit, Acad. Sci., USSR
The present article is the first in a series of studies of genetic processes which occur in irradiated
populations, and is devoted to the analysis of the dynamics of population density following irradiation
with different x-ray doses. Density is a convenient criterion for overall evaluation of radiation
effects on populations and for establishing dose dependence. The original groups on Drosophila
melanogaster consisted of 50 females and 50 males from an inbred line, established from wild flies.
Doses of 500, 1500, 3000, and 6000 R were used, each of the five experimental series being repeated
three times. During most of the experiment the population was kept at room temperature (24-26°C).
During the first generation, density increase was depressed in irradiated populations approximately
in accordance with radiation dose. Some population densities approached and some even surpassed
the densities of control between the first and second generations, after which statistically similar
equilibrium conditions were established for all populations. The initial drop in density of the
irradiated populations was evidently related to mutations induced by irradiation, which lowered
the fertility and viability of the flies and were rapidly eliminated under conditions of intensive
selection.

Béleza, D.S. A STUDY OF THE GENETIC PROCESSES IN IRRADIATED POPULATIONS OF Drosophila
melanogaster. III. THE FERTILITY AND THE CONCENTRATION OF LETHAL MUTATIONS.
Genetika No.4 (1967) 68-75. (In Russian)
A study of the effect of irradiation and population density on the fertility (egg production/female/d)
of fruit flies (D. melanogaster) from the control and experimental populations was carried out. It
was shown by this study that the effect of the density of population 50 x 50 and 100 x 50 reduces the
fertility not less than considerably than the irradiation by dosage of 3000 R – 6000 R. The fertility
is determined virtually by that factor which limits it to a greater extent. At the population density
1 x 1 L it is the irradiation. As the population density increases by 50-59 times, it is to a greater
degree the shortage of food consumed per female. Consequently the difference in the fertility
between the control and irradiated flies decreases with the increase of the population density. In
the 1st generation of the progeny of irradiated flies the normal fertility is completely recovered.
It was shown by the investigation of the concentration of lethal and semilethal mutations in the
control population and in that irradiated ones (at a dosage of 5000 R) before and after the establishment
of the equilibrium of the numbers of individuals, that in the control population it was low (3.67%) becaues
this population was derived from an inbred line. In the following the irradiation the concentration
of lethals and semilethals increased up to 38.4%. However, after the establishment of the
population was restored, the concentration decreased again to the level of the control population.
(NA 21:1967, 23421)

Haylock, R.G. CHROMOSOMAL POLYMORPHISM IN IRRADIATED NATURAL POPULATIONS OF
Chironomus. Genetics 55 (1966) 232-236. Also appeared in report form, as ORNL-P-1560, Oak
Ridge National Lab., Tenn.
Chromosomal polymorphism in a natural population of Chironomus tentans inhabiting a stream
contaminated by radioactive waste was compared with a nonirradiated population. Ten inversions
and one deletion were found in the irradiated population but not in the control population. The
frequencies of some endemic inversions which were found in both populations were not significantly
different in the irradiated and nonirradiated populations. It was concluded that in the irradiated population, where an increased frequency of new chromosomal aberrations was detected, the frequencies of the endemic inversions were unchanged by the chronic radiation.  (Auth.)


The aquatic larvae of Chironomus tentans, one of the midges, inhabit the radioactive bottom sediments of White Oak Lake and White Oak Creek in large numbers. This aquatic habitat has received varying quantities of radioactive waste released from the Oak Ridge National Laboratory since 1943. Dosimetric measurements and calculations based on radiometric content of the bottom sediments indicate that these larvae were receiving 330 rad/day. It is estimated that 180 generations were exposed to this or greater dose rates for the past 26 years. During the past five years the incidence of chromosomal aberrations in the salivary gland chromosomes of larvae collected seasonally from the radioactive and control habitats was measured. Chromosomal polymorphism is prevalent in C. tentans in this locality and six endemic inversion heterozygotes were found in all populations. Three of these inversions occurred at relatively high frequencies (0.09 to 0.25), but these frequencies did not fluctuate seasonally nor change significantly in the irradiated populations for five years. Also, the frequencies of endemic inversions in the irradiated populations were not significantly different from control populations. In addition to the six endemic inversions found in all populations, ten inversions and one deletion were observed only once in 756 larvae from the radioactive habitat, while no additional aberrations were observed in 754 larvae from the control habitats. It is concluded that the low-level radiation from the radioactive waste was increasing the frequency of new chromosomal aberrations in the White Oak Lake and White Oak Creek populations, but these new aberrations were eliminated by selection. Also, this level of chronic radiation, which was capable of producing a detectable increase in new chromosomal aberrations, has not affected the fitness of the population by producing a change in the frequencies of the endemic inversions.  (Auth.)


Study of the natural population of Chironomus tentans in White Oak Lake and White Oak Creek has continued since 1966. Annual samples were taken from this population, which has been exposed to an estimated dose of 330 rad/day for > 120 generations. 18 different aberrations were found in larvae of an irradiated population at a very low frequency. One aberration, a small inversion, was found in larvae of an irradiated population of C. plumosus, ionizing radiation from the contaminated environment evidently increases the frequency of new chromosomal aberrations, which are, however, rapidly eliminated by natural selection. Laboratory populations of Drosophila melanogaster, D. pseudobscura, and D. simulans were used to study the effects of y-radiation in interspecific competition. Laboratory D. melanogaster established for chronic y-radiation polymorphism studies were also used to study viability (egg to adult emergence) of the population after exposure to acute (2000 rad) and chronic (6 rad/hr) y-radiation. Viability was reduced by 80% but increased rapidly after acute irradiation, whereas chronic irradiation resulted in a slow reduction, and was never as great.  (Auth.)


Previous experiments have shown that the rate of microevolutionary processes leading to higher fitness is higher in Drosophila melanogaster populations treated with x-rays than in non-irradiated control populations. Physiological traits, such as fecundity, as well as morphological traits controlled by polygenic systems were shown to undergo evolutionary change. Populations were currently under study in which the mutant spinales (a) of the III chromosome is used as a marker in combination with other recessive mutants. In a relatively large number of such populations (2 out of 9 in one set, and 7 out of 18 than those of the two sets non-opinantes individuals were. This trait is due to irradiated and non-radiated mutations affecting the same phenotypic changes; and (2) which they are controllable.  (Auth.)

1496 Dobzhansky, T.  TRAITS OF HABITUATION.  (The traits studied were: experimental designs and the role of the individual's genetic background on the appropriate dose level for the population. Preliminary investigations were carried out in both male and female D. melanogaster. In both cases, the D. melanogaster population appeared to be better adapted to the experimental conditions. (3) The tendency towards increased reproductive abilities, (4) the induced mutations and their genetic weight, the increase in genetic background than response curve was related to the capacity for adaptation.)  (Auth.)

1497 Dobzhansky, T.  PROCY N06-8396.  B. Rockefeller University.  A review of current work. Irradiated experimental populations of Drosophila melanogaster in natural and artificial populations is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the treatment of selected populations, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress.

1498 Dobzhansky, T.  PROGRESS NY06-8396-B.  B. Rockefeller University.  The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress. The major achievement of the last year was the demonstration that the irradiation of the population, i.e., the selection of the irradiated population, is still in progress.
one set, and 7 out of 16 in another) individuals have appeared whose bristles are appreciably longer than those of the original. Since their 1st appearance in any one population the percentage of such non-ultraviolet individuals has steadily increased, thus showing that they possess positive selective value. This trait is due to different sets of genes in each population. A comparison between ultraviolet and non-ultraviolet populations shows that the rate of occurrence of such polygenic mutations affecting the bristle type is markedly different in different populations. Indistinguishable phenotypic changes can thus show different selective values depending on the polygenic systems by which they are controlled. (Auth.)


The trait studied was adult female body weight, adult male body weight and fecundity. The experimental design and mating schemes were set up to take maximum advantage of the heredity of the males in this organism. A group of females from an inbred line were irradiated and their paternosters sons were mated individually to virgin sons from the same lines as from a different inbred line, in order to obtain families with homozygous and heterozygous genetic backgrounds, respectively. The analysis of the results on female body weight and fecundity was done on the basis of the means of the same families. The male body weight character was studied among individual members within families and among family means. Dose 0.0-0.6 kR helped to determine an approximate dose level at which a significant response in mutation yield could be expected in at least one of the traits under consideration. The dose of 1.5 kR was chosen on the basis of a preliminary investigation, (0.0-0.6 kR dose), and the effects of the irradiation in later generations were studied in both homozygous and heterozygous genetic backgrounds. The radiation source used was 60Co delivering y-rays at the rate of approx. 350 r/hr. From an analysis of family means it appeared that (1) In both genetic backgrounds, a highly significant increase in genetic variation was detected for male body weight, (2) Insofar as fecundity is concerned, there was only a tendency towards increasing the genetic variability in the irradiated lines as compared to their respective controls. (3) There seemed to be no evidence of recombination between induced mutations and their genetic backgrounds. When the analysis was carried out on individual male body weight, the increase in genetic variance induced by irradiation was much larger under the homoezygous genetic background than that found under the heterozygous background. The reliability of the dosage response curve was discussed. An interpretation of the lack of any significant response for the fecundity trait was given, particularly on the basis of the observed relationship between the induced mutant genes and their wild type alleles. Finally, in order to explain the apparent disagreement between the hypothesis of non-segregation and the results obtained from individual male body weight, a possible explanation was proposed using a genetic model based on the absence of recombination interactions. (From DA)

1407 Dobzhansky, T. PROGRESS REPORT ON GENETIC STUDIES, June 1, 1956 - June 1, 1956, NYO-o068-8, Rockefeller Univ., New York, 15p.

A review of current work and work completed is presented under the headings (1) Genetic leads in irradiated experimental populations, (2) Genetic leads in natural populations, (3) Chromosomal polymorphisms in natural and experimental populations, and (4) Genetic diversity and selection. [1] Is of immediate interest here.] The genetic consequences of exposure to x-radiation are described for experimental populations of Drosophila melanogaster maintained under conditions of relaxed selection. As expected, the egg-to-adult viability increased rapidly after irradiation; however, new and constant viability levels became established, all significantly lower than the control level (92.7%). Thus, the egg-to-adult mortality in the populations with radiation histories continues, many generations after irradiation has been discontinued, to be 30-80% below the control level. (Competitions had been deliberately minimized in the experimental populations.) Experiments are also reported on irradiated and control populations of D. serrata and D. inequalis. It appears that the increased genetic variance induced by the irradiation described may be explained by natural selection to increase the fitness of the populations, at least under the highly artificial and deliberately competitive conditions which had been deliberately created in the experiments.
Radiation effects on the proportion of lethal 2nd chromosomes in Drosophila melanogaster were studied. Genetic loads in irradiated populations of Drosophila were studied. Three of the four populations had received accumulated doses of 120,000 R. Data obtained on continued irradiation would best be fitted by a hypothesis that the frequent lethals are maintained in the populations by heteristic advantages.


Radiation induces a random array of mutations. Most of these mutations are deleterious in homozygotes. Yet, some investigators found the viability of heterozygotes for induced mutations to be higher in some cases than that of the unirradiated controls, especially when the control genotype was a homozygote at most loci (Wallace) or was below an optimal heterozygosity level (Mukai). The hypothesis advanced to explain these increases in viability is to assume the existence of non-specific interactions of allele pairs. It was hoped that such a hypothesis should explain the origin of variability in natural populations. The mean viability of D. melanogaster heterozygous for chromosomes irradiated in spermatogonia with 2000-5000 R was found to be somewhat less than that of the irradiated controls. When the experiments were designed so as to eliminate factors that could bias the results, such as differences in competing ability that would compensate for differences in viability, the viability coefficient of heterozygotes for irradiated chromosomes was equal, or even higher than that of the irradiated controls. In later experiments a significant increase in viability coefficients of flies heterozygous for chromosomes irradiated with 12,000 R in spermatogonia was observed. Most chromosomes carried one or more mutations that affected the viability of the homozygotes severely. Similar high viability coefficients were observed in other series irradiated with 3000 R and 6000 R in spermatogonia. Since the irradiated controls were highly heterozygous, irradiation was expected to reduce the viability coefficients, even according to the "optimal heterozygosity" hypothesis of Mukai. Another method of estimating viability yielded lower viability estimates for heterozygotes for irradiated chromosomes than for the irradiated controls. (Abstract)


Artificial populations of D. melanogaster were established in small plastic containers. Each population was started with equal numbers of flies heterozygous for a Curly-chromosome and a given irradiated chromosome and flies heterozygous for the same Curly-chromosome and an unirradiated chromosome. Since the homozygotes were either lethal or sterile, only flies of the heterozygotes for the irradiated chromosome and of the heterozygotes for the unirradiated chromosome determined the fate of the population. In one experiment more than 250 populations were started with chromosomes which had been exposed in spermatogonia to 2000 R. Most populations were maintained for 3-4 months. In the second experiment more than 200 populations were started with chromosomes which had been exposed in spermatogonia to 4 doses of 5000 R each. Most populations were maintained for 7 months, and those not heterozygous for lethals were maintained for another 5 months. A third, control experiment, included only non-irradiated chromosomes. In both radiation experiments the fitness of heterozygotes for irradiated chromosomes was below unity fitness, while the fitness of the heterozygotes for unirradiated chromosomes was near unity. In the control experiment, the mean fitness of heterozygotes for lethals was reduced by about 70% generation. Subvital classes were defined so that they overlapped the normal range, yet their fitness in heterozygotes was reduced by about 50% generation. Normal chromosomes in the irradiated sample did not deviate from unity fitness. In the average the fitness of the heterozygotes for a sample of newly induced mutations is correlated to the viability of the homozygotes. This is also demonstrated by the improvement in the viability of the homozygotes for chromosomes, which were originally subvital, after these were exposed for nearly 1 yr to selection as heterozygotes. (From abstract, summary)
in melanogaster were used. Three of the four populations of continued irradiation and in the populations,

COEFFICIENTS IN Cortin a de Ameareo,

are deleterious in heterozygotes, mutations to be higher control genotypes were initially high (Mukai). The frequency of a genotype (XDP) could explain the origin of XDP in melanogaster for a slightly less than that of the corresponding homozygote for recombination factors that compensate for differences in sex chromosome frequency. In contrast, the sex chromosomes were equal, or nearly so, in the irradiated flies, and the irradiation that affected the viability seemed to be a consequence of the effect on the sex chromosomes.


Two sources of irradiation were used: one from the Ormosis Regular and the other from the Tropical "P" strain, and both were mutagenic to radiation (1200 R) as a source in each generation for more than 50 generations. Several mutants of the housefly, Mus c A domestica, were isolated from normal and y-irradiated strains reared in the laboratory. The identity and maintenance of mutant strains, along with notations of related phenomena, are presented. Most of the aberrant forms that were isolated involved wing form, wing position, or the pattern of wing venation. These established mutant strains, classic wing, stubby wing, dot vein, and white, have proved useful in the genetic analysis of insecticide resistance.


Lines with ten pairs of parents and selected at an intensity of 20% were exposed to 1200 R of x-rays for 5, 10, 15, or 30 generations. Lines that received x-rays under irradiation generally gave greater response than the unirradiated controls. The phenotypic variance in the irradiated lines was much higher than in the controls. There was little difference in behavior between lines receiving one generation of irradiation and those irradiated every generation. Lines receiving only two generations of irradiation had lower variances than the other irradiated lines, but in one case, the response was greater than the corresponding continuously irradiated line. Lethal frequencies were much higher in irradiated than unirradiated lines. Particular chromosomes II and III lethals were at high frequencies in most of the irradiated lines but in only two out of five controls. On relaxation, the mean of the irradiated lines generally declined considerably, but in the unirradiated lines there was only a very small regression. It appears that most of the extra response and increased variance in the irradiated lines were caused by a few genes with large effect on host number. (Auth., summary)


Experiments were conducted with D. melanogaster for the purpose of investigating the mechanism by which new genetic variability available for artificial selection is induced by x-rays and to estimate the increase in polygenic variability in an inbred brittle-nosed. Genetic variability, probably originating from mutation and recombination in polygenic systems, was induced by x-radiation (7000 R) and compared to the effectiveness of artificial selection. Selection responses based on analysis of variance were greatest when the rays were treated and in groups where males only were treated. Rates of radiation induced mutations, in terms of increments of variance, were 0.1 x 10^-3 for both sexes treated, 0.7 x 10^-4 for only females treated, and 0.3 x 10^-3 for only males treated. (NIA 31: 1967, 36989)


The mutant Whisky was originally described as one of several mutants in the screw-worm fly, Cochliomyia hominivorax, induced by \(^{60}\)Co y-radiation. Irradiation of a large number of males was carried out in connection with these experiments with irradiated males for sterilization of this fly. The mutation has now appeared in one generation for more than 30 generations. The mutant flies are viable and their flight or other activity is not affected. In general, the data available support the hypothesis that the Whisky factor is dominant and lethal in the homozygous condition. However, after 15 generations of selection the number of Whisky progeny in each generation increased significantly and has remained at a higher than expected level, assuming that the homozygous state continues to be lethal. Tests were conducted to investigate the possibilities for the increase in Whisky progeny. Data were presented on the hatchability of eggs, pupal emergence, and regeneration of progeny from different crosses involving Whisky flies. In earlier generations crosses of Whisky flies produced the expected 0 Whisky: 1 normal progeny, and out-crosses produced the expected 30% Whisky progeny. To explain the fact that after 15 generations of selection the number of Whisky progeny increased significantly above 30% and remained at a level higher than expected, the possibility that selection resulted in a higher viability of the hetero-

409
Progress is reported on the use of Drophiola populations; in D. melangaster: effects of D. melanogaster: use of melanogaster.

Sakoda, T. M. RECEIVED WITH RADIATION STRESS Experimental populations population cages over cc frequencies of food changes levels approximately higher control level in the poph experimental populations. These lethals are maintained in heterozygous individuals. 

See also 1989.

Sankaranarayanan, K. S. POPULATIONS OF Drosophila Times experimental popu and crowding, received: e. The egg-to-adult viability adult viability recovered: In, however, 50-20% held the 2nd chromosomes which the radiation, without 1 among the lethals has two probably owing to hetero summary.

Sosnowski, R. E. INVEST INVESTED GENETIC VARI Statistical results are reported from Observations on induced g included from a genetic a generations of inbreeding.

Sosnowski, R. E. INVEST Parks Univ. (Italy), Unit Program is reported in the quantitative genetic traits seed or parent. Data as progressed inbreeding p of publications resulting.

Specklin, D. POPULATION (in German) Genetic burden in certain of D. melanogaster irradiated 70000 D. willidol with a normal affect five general lethal factors reached as 1 and D. genelessness it to adaptive inversion system.
Progress is reported on numerous studies including one on the effects of x-rays on genic load in a Drosophila population; heterozygous effects of newly arising spontaneous lethal genes on viability in D. melanogaster; effects of ionising on x-ray induced recessive lethal mutation rates in D. melanogaster; the effect of chronic radiation on sex-linked lethal mutation frequencies in D. melanogaster.

1509 Slaters, V.M., RECESSIVE LETHALS IN SECOND CHROMOSOMES OF Drosophila melanogaster WITH RADIATION HISTORIES. Genetics 22, 2 (1937) 601-608,

Experimental populations with radiation histories, and a control population, were kept in laboratory population cages under conditions of extreme overcrowding and intense larval competition. The frequencies of 2nd chromosomes which were lethal or semilethal when homozygous remained at levels appreciably higher than in the control, while the egg-to-adult viability declined below the control levels in the populations with radiation histories. The rates of allelism of the lethals in experimental populations are fairly high, owing to some lethal loci being present in many chromosomes. These lethals are maintained in the populations by natural selection because of their heterotic effects in heterozygous individuals. (Author summary)

See also 1486.


These experimental populations, kept under conditions designed to minimize the larval competition and overcrowding, received each 120,000 R of x-rays during 59, 30 and 66 generations, respectively. The egg-to- adult viability decreased sharply, but, after the radiation was discontinued, the egg-to-adult viability recovered rapidly for several generations and then reached a plateau. This plateau is, however, 15-20% below that in the control, unirradiated, population. - The frequencies of the 2nd chromosomes which were lethal or semilethal when homozygous declined after the cessation of the radiation, without however in any case reaching the control level. The frequency of alleles among the lethals has increased. Some particular lethal chromosomes have become more frequent, probably owing to heterotic effects under the conditions obtained in these experiments. (Author summary)

1511 Scompri, E., INVESTIGATIONS ON MUTABILITY OF POLYGONES AND ON UTILIZATION OF INDUCED GENETIC VARIABILITY. Summary of the results up to June 30, 1939. TID-1942, Stift der Univ. (Italy), Instituto di Genetica, 12 Jul., 1943, 98p.

Results are reported from studies of individual mutations in maize, wheat, tomatoes, and alfalfa. Observations on induced genetic variability for quantitative traits are presented. Data are also included from a genetic analysis of long- and short-winged lines of Drosophila melanogaster after 15 generations of inbreeding. (NSA 17:1965, 207-16)


Progress is reported in studies on the effect of spontaneous and induced mutations in the induction of qualitative genetic traits in plants. - x-Radiation was used at the infertile agent when applied to seed or gametes. Data are included from a study on the persistence of genetic variability under prolonged inbreeding in populations of the parasitic wasp, Ichneumonius longipalpis. A list is included of publications resulting from investigations carried out under this contract.


(In German)

Genetic burdens in certain irradiated Drosophila populations are reviewed. Effects on populations of D. melanogaster irradiated by atomic bomb tests were inconclusive. After single irradiations of 70,000 D. willistoni with a high dose and subsequent isolation the lethal factor frequency decreased to normal after five generations, but the allele rate remained high, indicating that single heterotic lethal factors remain an increased frequency. In other studies with this species and with D. subobscura and D. pseudoobscura it was found that the inversion density decreased after irradiation; the adaptive inversion system was disturbed, and the lethal factor frequency returned to normal after...
The frequency of irradiated chromosomal types decreased initially and then became normal after irradiation of D. pseudoobscura that had AB and CH chromosomal structural types. In populations of D. melanogaster irradiated once or chronically, the fitness components of egg hatch rate and egg-lag survival rate reached 70-75% of normal after a few generations. At this time, the populations contained 60-90% lethally II chromosomes. This lethality was eliminated slowly and incompletely. The egg hatch rate of irradiated D. willistoni did not reach normal values 15 generations after irradiation. After 61 yr of irradiation with 60 Co at the number of individuals of two populations of D. melanogaster reached the starting values after an initial decrease. Decreased growth capacity was demonstrated in irradiated D. pseudoobscura populations. Radio-induced chromosomal inversions were observed in Chromodeme tenebrionis populations. About 25% of irradiated D. melanogaster populations showed chromosomal structural changes, and many translocations were observed after neutron irradiation. It was concluded that general conclusions about the increased mutation rates observed in irradiated populations could not be made.


Three practical considerations were found to merit attention in the evaluation of the impact of fallout radiation on terrestrial insects and associated invertebrates. First, the relatively low dose levels that will affect developmental stages as compared to adult stages; second, the lower doses required to produce late mortality as compared to those required for early death; and third, the relatively low doses that will cause sterility. The calculated potential from 60Co indicated that the dose levels expected to sterilize a large majority of the organisms considered would be found in areas bounded by the 50 R/h at 1 h from 60Co (4000 R-rad in about 6 d) for a 12 Mi beam in the 100 R/h at 1 h from 60Co (3000 R-rad in about 6 d) for a 10 Mi beam and by the 50 R/h at 1 h from 60Co (1500 R-rad in about 6 d) for a 10 Mi beam. (Author.)


1000 flies from each sex taken at random form a heterogeneous population were exposed to 1000 R of x-rays at 190 R/min. Three generations after x-irradiation the mean and variances of abdominal and sternopleural bristles were examined, and the total phenotypic variance was partitioned into its components by a statistical analysis. The tabulated data from two sets of experiments indicate that the genetic component was increased throughout by x-rays whereas the environmental component showed no significant change. This suggests that the increase of phenotypic variance by x-rays is mainly due to the increase of genetic component, as is expected statistically. The amount of variance increase/S is computed as 10.1 x 10^-4 and 5.6 x 10^-4 for abdominal and sternopleural bristles, respectively. The increased in genetic variance would appear to be brought about by the mutations of fixed loci rather than of loci with intermediate gene frequencies.


A study is underway in which all the different kinds of genetic damage (lethals, sterility factors, morphological alterations and dietary factors, and cytological damage translation, inversions and deletions), which have hitherto been measured more or less separately, are being measured in entire irradiated genomes of D. melanogaster. In the present experiment, males were x-irradiated with either 2500 R or 4000 R and mature sperm sampled. The males were mated to females of a balanced stock in which all the chromosomes bear phenotypic markers and/or crossover suppressors, and daughters bearing one irradiated genome and one balance genome were collected. These were mated individually to balancer stock males, and the progeny of each female were mated among themselves in such a manner as to balance or make homologous each chromosome of the genome. Genetic effects not detected already during this process were tested for by appropriate crosses, examined. The results of contrate the feasibility of and the work planned.

(1517) Valencia, E.M. THE FR Radiat. Res. 31, 3 (1967), Research Society, San Francisco By means of markers and/or entities X- or Y-bearing in sterility factors, dominant 40 X-bearing genes were Y-bearing), which requires to date. Considering each as a genetically altered some of the genomes surviving t and analysis of the entire; 87 had damaged sites, 68 The total number of data. The average number of all the Y-chromosomes, 402 showing essentially a direct damage. Phenotypic effects be discussed in relation to...
By means of marker and/or crossover suppression in all four chromosomes of Drosophila melanogaster, entire X- or Y-bearing irradiated genomes were collected and analyzed for recessive lethals and sterility factors, dominant or recessive viability and chromosome rearrangements of all kinds. 46 X-bearing genomes which received 2000 R of X-rays and 310 genomes (181 X-bearing and 129 Y-bearing) which received 4000 R delivered to mature spermatogonia have been completely analyzed to date. Considering each gene mutation (whatever its phenotype) and each chromosome break as a genetically altered "site", the results from the 4600 R group are as follows: 138 (35.9%) of the genomes surviving the irradiation and producing sufficient progeny to allow the collection and analysis of the entire genome were found to be genetically damaged to some extent. Of these, 97 had 1 damaged site, 32 had 2, 32 had 3, five had 4, three had 5 and two had 6 damaged sites. The total number of damaged sites in the 460 genomes was 586, or an average of 1.26 per genome. The average number of altered sites per chromosome was 1.93 for the X-chromosomes, 1.74 for the Y-chromosomes, 1.43 for chromosome II, 1.71 for chromosome IIIa and 1.62 for chromosome IIIb, showing essentially a direct relationship between chromosome length and amount of induced damage. Phenotypic effects (morphological changes, lethality, determinancy and sterility) will be discussed in relation to one another and to the cytological nature of the alteration. (Abstr.)


This experiment was designed to gain information on the genetic basis of hybrid vigour through observations on the fate of newly induced chromosomal rearrangements - especially paracentric inversions - in laboratory populations of D. melanogaster. The initial parental lines of the
different populations were hybrids obtained by mating between different inbred lines. After a
300 generations of inbreeding, small numbers of males from each of eight inbred California
lines were irradiated with 3000 R of x-rays and were mated to their reciprocal strains. The F1
progeny were used to set up some 200 single-pair F2 matings. Twelve F2 progeny from each culture
were sacrificed for cytological examination of salivary gland chromosomes. In this way, F2 cultures
in which flies carried newly-induced aberrations were identified. Each newly-induced rearrangement
(15 paracentric inversions, 9 pericentric inversions and 6 translocations) was subjected to test within
a series of twelve populations formed by crossing the rearrangement-bearing flies (1) to their own
sibs, (2) to flies from their own inbred line, and (3-10) flies from ten other inbred lines. The
resultant populations were kept in half-pint bottles by mass rearing of adults each generation;
after a number of generations (generally eight or nine), the frequency of structural heterozygotes was
determined in a sample of some 50 larvae. As expected, translocations and pericentric inversions
were almost completely eliminated from the populat10n containing them. These aberrations in the
form of paracentric inversions (with one exception) were retained in most populations. They were
retained in high frequencies in populations whose parents were hybrids between distinctly related
strains. Longer paracentric inversions were retained in greater frequencies than shorter ones.

It was estimated from the data that the average newly-induced aberration imposes a selective dis-
advantage of 5% on its heterozygous carrier: this disadvantage is the result of chromosomal
breakage and, probably, associated genetic damage. Aside from this "inherent" disadvantage, the
average selective advantage associated with the paracentric inversions was 0.4% in "intraspecific"
populations, 0.8% in "intraspecific" populations and 0.6% in "Unrelated" populations. The selective
advantage increased with inversion length; this increase was at least as high as 0.6% per 1/120th of a
chromosome arm in the case of the "Unrelated" populations. It was concluded that the genes
responsible for heterosis are numerous and are scattered throughout the chromosome complement.
Because of the pronounced relation between heterosis and inversion length, it seems unlikely that
population effects contributed greatly to the observed hybrid vigor. (From DA)

See also:
1061 Equilibria for Inversions induced by x-rays in inogenic strains of Drosophila pseudoobscura.
(Spitznich, D., 1964)
1064 Viability coefficients and preferential recovery. (Falk, E., 1967)
1063 Biological studies: genetics. (National Inst. of Radiological Sciences, Chiba, Japan, 1968)
1121 Genetic variability in Aedes aegypti (Diptera: Culicidae). I. Mutations causing structural
1424 Gross effects of gamma radiation on the Indian-meat moth and the Anogramma grain moth.
(Coogham, E.R., et al., 1965)
1427 Genetics of a heterozygous population of Drosophila melanogaster. I. Viability and pop-
ulation fitness of heterozygous Cyto/on/col10 carrier of irradiated chromosome coll10.
(Solisco, B.V., 1965)
1470 Fitness and competitive ability in irradiated populations of Drosophila melanogaster.
(Dyer, K.P., 1926)
1488 As an analysis of radiation-induced variation on body-weight of Habronassa lugdunensis.
(Dalehous, M.A., et al., 1967)
1505 Evolution of fitness. III. Improvement of fitness in irradiated populations of Drosophila
1525 Male sphenoptalini male mate wings of the Nevada test site. (Ferguson, W.E., 1967)

2.3.5. Ecological Aspects

1520 Ayala, F.J. EVOLUTION OF FITNESS. III. IMPROVEMENT OF FITNESS IN BI gradients PO-

The experiment was designed to allow for the incorporation by recombination of the newly induced
mutants in the gene pool before strong natural selection was applied. In one experiment 1000 males
were irradiated with 2000 R and mated to unirradiated and mated. The average 4000 R. The few
experimental details are selected, the adaptations

1521 Ayala, R.F. SPECIAL A NUCLEAR WAR, PART I CLIMATE. HI-304-PR/1

An admittedly superficial and climate suggests the p consequences on the future of man and water
resulting in higher soil and some marginal lands become

1522 Dispon, P. LES HETERO

1523 Ferguson, W.E. MALE S

1524 Gustas, M.A. MITIS ON 1

1525 Payne, A.S., Colson, D. 1426, Oak Ridge National I

1526 Sandness, T.R.E. "Endle

414
were irradiated with 2000 R x-rays, and mated. Males of the progeny were again irradiated with 2000 R, and mated; samples of males from the subsequent progeny were withdrawn, and again irradiated and mated. The genome of the males in the experimental populations received on the average 4000 R. The females received various amounts of radiation, averaging 2000 R. (Further experimental details are given.) Genetic variability induced by x-irradiation augmented, after selection, the adaptability of two populations of D. melanogaster to a new environment.


An admittedly superficial view of some possible consequences of a thermonuclear war for weather and climate suggests the possibility of a sequence of meteorological and climatic events roughly as follows: following an attack of 10.000 MTS (ground-burst) initial widespread dust (comprising with falling rains and/or snow lasting several weeks; fairly heavy haze in the stratosphere, gradually disappearing after a period of several (i.e., 3-6) years; many forests on lower slopes killed or weakened by radiation, followed by insect outbreaks (2nd, 3rd, and subsequent years); enhanced wind and water erosion where plant cover is depleted; loss of forest cover on watersheds resulting in higher soil temperatures; and ultimately, higher ground temperatures, fewer forests, some marginal lands turned into desert, and many river valleys damaged by floods. (Auth.)


Consequences biologiques des effets nucléaires sur les Arthropodes. Aspects biogéographiques et composition de la faune entomologique subéquatoriale. (Small, right biophysical-bioclimate)


An ecological and taxonomic study of the phaeophthalmine Mutillidae of the Nevada Proving Grounds Area was made. Important contributions to the data on distribution and taxonomy of the neotropical Mutillidae are also included: new species of male mutillids are described. It was shown that former ground levels of nuclear detonations were recouped by the mutillids within a few years after a blast or series of blasts. A careful search for anatomical changes among the Mutillidae collected at the test site revealed that the nuclear testing did not produce any genetic abnormalities. (NSA 241 1967, 2902)


A systematic study of parasitic mites on kangaroo rats of two species at the Nevada Test Site was conducted from Aug. 1967 - Dec. 1968. The intent was to determine the kinds, numbers, seasonal occurrences, and ecological relations of mites in nuclear disturbed and contiguous undisturbed areas. A total of 206 rats from nine plant communities were examined. Data are summarized. (NSA 108 1964, 13)


Following a nuclear attack, carrion remains of domestic animals could pose difficulties for human survival because of public health and sanitation problems associated with carrion. Insects influence the course and rate of decomposition, and radiation effects on insect populations could alter the normal decomposition pattern. A study was made of the animal community in pig carrion, preliminary to experimental research on the influence of radiation and other factors on succession to carrion. A total of 552 animal species representing 3 phyla, 9 classes, 31 orders, 291 families, and 329 genera were found associated with various decomposition stages. A systematic list of all species, their abundance, microhabitats, and food relationships is given. (Auth.)

Radiocliplases, their use and the results obtained and obtainable are discussed in connection with
biochemical techniques for the detection of insect infestation in grain, other seeds, and soil samples. The
application of radiographic techniques to the detection of insect infestation in grain, other seeds, and
soil samples, is described.

1528 Woodwell, G. M. EFFECTS OF IONIZING RADIATION ON NATURAL ECOSYSTEMS. BNL-7280,
The characteristic patterns of natural ecosystems are outlined, and types of changes produced in these
patterns by ionizing radiation are discussed. Potential levels of radiation exposure produced by
nuclear war are estimated. Data are summarized from studies of radiation effects on natural
ecosystems. It is concluded that total radiation exposures in the range of 500-1000 R in a six-month
period would kill more than 50% of the trees in deciduous forests, and exposures in the range of
1000-3000 R would damage coniferous forests similarly, white graminoids, seed pods, and seeds
would be substantially more resistant. Coincident with the radiation damage to plants in such systems
there would be fluctuations in insect and animal populations. Radiation exposure in the range of
1000-10 000 R are well within the range of exposures from fallout that could be expected from a
nuclear attack. (NSA 13: 1964, 35500)
See also 1517.

1529 Woodwell, G. M., Ed. p. 20-28 of "Ecological Effects of Nuclear War". BNL-517 (C-40), Brook-
The kinds of effects discussed are not individually unique to nuclear catastrophe. Most can and do
result from a variety of non-radiation, unique factors would be (1) the interaction of several severe
limiting factors, with total effect not simply the sum of component effects, and (2) the great size of the
affected area, which probably influences the rate of recovery more than the severity of the acute
forces themselves. As regards insect populations, the principal changes after irradiation have
been found to follow changes in the abundance of food. These might be temporary upswings (e.g., in
the case of defoliators) of certain species.

1530 Woodwell, G. M., Brewer, J. H. AN ASPID POPULATION EXPLOSION INDUCED BY CHRONIC
A population explosion of the aspid, Myzocallis discolor (Miers), occurred on white oak (Quercus
alba) damaged by chronic y-radiation. Oaks exposed to 2,500 R during 18 months supported max.
aspid populations of 25 winged adults per tree (100000/m² of forest). The aspid was not found in the
undamaged forest. The impetus was correlated with changes in predator populations and with
small changes in the sugar, total N and lipid content of white oak leaves. The relative importance of
these two sets of factors could not be determined. (Auth.)
See also 1492, 1493, 1494, 1557.

1492 Chromosomal polymorphism in irradiated natural populations of Chironomus. (Slaboch, B.G., 1953)
1493 Cyto genetic study of a natural population of Chironomus :tubulifera inhabiting an area contaminated by
radioactive waste. (Slaboch, B.G., 1966)
1494 Population genetics and radiation effects studies. (Slaboch, B.G., 1966)
1557 Computer simulation of the sterile male theory. (Berrymen, A.A., 1960)
2.4. APPLICATIONS

2.4.1. General Articles. Recommendations. Surveys


Very general introductory article.

1538. Cavallaro, R. L'impieto delle radiazioni ionizzanti e degli isotopi radioattivi in entomologia agraria. (The application of ionizing radiations and radioisotopes to agricultural entomology.) Paper presented at the "Congresso Nazionale dell'Energia Nucleare in Agricoltura, Novara, Italy, 5-7 maggio, 1961." (In Italian, with English and French summaries.)

Survey.


Several biological factors liable to reduce the number and the motility of mites are reviewed and discussed, among them genetic factors (very briefly), involving the sterilization of males, and irradiation with genotoxic purpose. Tropical and temperate factors, biotic factors and eco-climatic factors are also discussed, in more detail.


Uses of isotopes and radiations are discussed. The dimensions of the growth of industrial use in the United States are illustrated. Tracer methodology and applications, radiotracer gaging, radiography, process irradiation development, radiation preservation of food, and isotope power are considered. (NASA 204 1968, 3742)


Uses of radioisotopes and ionizing radiations in entomological research, and particularly in radio-visionalisation eradication programmes are reviewed. Programmes whereby sterilisation of insect pests and their complete eradication were achieved by radioisotopes are exemplified by screw-worm fly. Consideration is given to use of the sterilised, male method on fruit flies and to use of ionizing radiations to kill other insects, particularly pests in clothing, packaged foodstuffs, and wood products. A device for the control of stored grain pests and the pink bollworm is described. The effect of γ-irradiation on silkworm cocoons, with reference to technological properties of raw silk, is also discussed. (NASA 53 1967, 34846)

* Originally listed as IL-1967, without abstract.


It was recommended that the training and knowledge of plant breeders be utilized by entomologists in evaluating radiation effects on insects: that irradiation doses at various developmental stages be determined (lethal and sterilizing doses, and doses inducing dominant lethality) for the stem...

This paper is a "theoretical insect pathology." Consideration of the prospects of integrated microbial and radiation control of harmful insects, while considering this topic, is directed first to the possible applications of the radiation sterilizing method of population suppression. The exploratory investigations of this subject have shown that ionizing radiation will induce sterility but that there is considerable variation in the amounts needed. The research also suggests that radiation damage may in some cases prevent application of the method to some insects. In nature some insects appear to be so abundant that the use of the sterile male technique may not be feasible without first processing the geographically isolated and non-isolated infested area with other control measures to bring wild populations within reach. Such a situation can be approached from two angles. The population may be controlled by means of well-tried microbial pathogens. Also, the release of sterile male insects carrying parasites or pathogens has control possibilities. In such a situation an intensified search has been made for those pathogens that are rain-vindant when present in the adult, but are highly virulent to the larvae. Conclusions drawn and Theodorus are probably of this category. - The increased susceptibility of irradiated insects to pathogens is opening a new field of investigation. The life span of Tribolium castaneum and T. confusum beetles was shortened considerably when the test insects received Bacillus thuringiensis immediately, and after an interval of 34 and 34.6 h following exposure to X-rays. The life span of the irradiated beetles was somewhat shortened by the presence of Bacillus thuringiensis; however, virulent, and Adulina (Trichoderma), parasitic strains in the top body of the test insects. - There are promising prospects of evolving, through irradiation, new strains of pathogens of high virulence. Already, strains of increased virulence of Beauveria basalis and Aspergillus flavus have been evolved by means of ionizing radiation. There is economic feasibility in using X-ray from Co in the control of diseases of the honey bee, and in the sterilization of honey. The use of radiation as an insect repellent and the behavioral aspects of radiation on insects is a fascinating field of future investigation. Examples of this phenomenon are cited. (Auth.)

1539 Klopf, W. INSEKTEN VERMINCTEN SICH SELBST. (Insects annihilate themselves.) Naturw. u. Medizin 3, 10 (1967) 20-27. (In German)

Review of the principle and the commercial success to date of the sterile male technique. Achievements based on radio sterilization, and the usefulness of chemosterilants are discussed.

1540 Leder, H. L. RADIOACTIVE STRAHLEN IN DER LAND- UND ERNÄHRUNGSWIRTSCHAFT. (Radioactive irradiation in agriculture and food production.) Verh. Schweißkraft (1961) 310-321. (In German)

The application of α-, β-, and γ-radiation for combating insects, the sterilization of food products, irradiation breeding of crop plants and to animal husbandry, are discussed. Radiotopes have already been applied successfully (in examples) in agricultural research and practice, and their application is on the increase.


General article stressing the need for new genetic methods of insect control, in view of the rapid general increase in the resistance developed by insects against chemical agents. In 1946 this was noted with DDT in houseflies for the first time. By 1956 the resistance of 11 different types of disease-carrying insects had been established. There were 51 types by 1962, but now these probably are 100 types. At first it was believed that this resistance was due to acquired tolerance but it was later found to be based on genetic biochemical differences. The principles of the sterile male technique are discussed, with examples drawn from experience to date. The general problems inherent in the method are considered.

1542 Loria, L.M., Brea, T.J. A rc TO CONSIDER latin AMERICAS. Bol. Of. l

A programme is being developed from irradiation and propa- being developed by the O. them the promotion of th the promotion in lat are suggesting certain diseases to la for all four points of the

1543 Massow, B. GAMMA UPLOA, N. Y. 20 Apr. 15

The history of gamma-radiotopes, "Co and design of irradiation using insect control, food press

1544 Middle Eastern Regional. JANUARY 1, 1967-DECEMBER Activites in the training agriculture, and medical eradication of Anopheles reported. A list of 28 re

1545 Moh, J.C. THE APRIL 1 July 1, 1967 - June 30, 3 Turrialba (Costa Rica). Applications of atomic control of plant diseases, for countries in the Amer, Genetica explosiva, that cause numerous myriads. Results are reported from cations during the period

1546 Nagy, B., Ponsa, E., & ELLING VÉRÜZÉZÉS. Kláng, Osv. Atomenerg. (In Hungarian)

This is a review of the general effects of radioactive in insect pests, whether the sterilization of males for Hungary. (RAS-1 64, 19

1547 Nelson, S. O. TOWARDS Use of haying and non-r male technique. Doses o nuclei that have approved wheat, irradiated grain with radia

As the nuclear and electro
A program is being developed under the auspices of the World Health Organization for protection from radiation and proper utilization of nuclear energy in the Americas. A program of aid has been developed by the Oficios Sanitarios Panamericanos (OSP) consisting of four major points, one of them the promotion of the use of radioisotopes for diagnostic, therapeutic, and research purposes, and the promotion in Latin America of research projects related to radiation and its effects. Possibilities are suggested for application of the sterile-male technique, with the object of exterminating certain diseases in Latin America. The help of OSP is promised with the provision of consultants for all four points of the program, as well as scholarships for the training of all types of personnel.


The history of programmes to find uses for fusion products is reviewed briefly. The 88-electron radioisotopes, 88Co and 88Ca, are described in detail as to characteristics, availability, and the design of irradiation using these sources. The results of specific applications of 88Co to insect control, food preservation, and polymerization studies are presented. (N.SA. 25/1966, 1966)

Middle Eastern Regional Radiotrace Centre for the Arab Countries, Cairo (Egypt). ANNUAL REPORT, JANUARY 1, 1965-DECEMBER 31, 1965. ND-19547, Jan. 1966, 30p.

Activities in the training of specialists in the application of radioisotopes in science, industry, agriculture, and medicine and in research using radiotrace techniques are reported. Progress on the irradiation of Aspergillus flavus and Claviceps purpurea by radiosterilization techniques is reported. A list of 20 references to papers published on work performed at the centre is included.


Applications of atomic energy in the development of improved strains of agricultural plants, better control of diseases and insect pests, and the proper management and use of soils are discussed for countries in the American tropics. The use of 88Co for the control of Mediterranean fruit fly, Ceratitis capitata, the tropical wasp fly, Dermatobia hominis, the parasitic larvae of which cause cutaneous myiasis in cattle, and the coffee leaf miner, Lecophaga coffeella, was investigated. Results are reported from extensive studies on the biology of these species. A list is included of publications during the period covered by this report.


This is a review of the world literature compiled for use in Hungary, and it contains sections on the general effects of radiation on animals and animal tissues, the use of radiation for the control of insect pests, whether directly, or in the radiation of infected foodstuffs, or indirectly, as in the sterilization of males for subsequent field release, and the possible value of such techniques in Hungary. (RAK-454, 12b 1966, 60p)


The use of ionizing and non-ionizing radiations to control insect pests is reviewed, including the sterile-male technique. Dosages of radiation that kill insects do not damage wheat for milling and baking or affect nutritional quality to any noticeable degree. The U.S. Food and Drug Administration has approved wheat irradiation by 60Co rays for insect control. Electron irradiation of wheat and y-irradiation of citrus are also under consideration by the FDA. Current estimates of costs for treating grains with radiation are somewhat higher than costs for chemical insecticide treatment. As the nuclear and electronic industries develop further, however, costs for irradiating radiation are...
expected to decline substantially. The eventual application of radiation for control of stored-
product insects can be expected.

Various forms of electromagnetic energy have long been recognized as offering possible means for insect control. The electromagnetic spectrum is discussed, and the particular energy ranges (radio-frequencies, infra-red, visible, and u.v.) are considered in some detail. The use of ionizing
radiations (x- and γ-rays) are dealt with on p. 126-137, the illustrations being amply documented as part of the bibliography on p. 128-145.

Cooperative studies being carried out under unified control by various nations for using ionizing radiations, mutations, and other mutational agents for crop improvement are briefly discussed. The Joint FAO/IAEA Division of Atomic Energy in Agriculture is conducting several internationally coordinated programmes of research in the fields of mutation research, insect eradication, fertilizer efficiency studies, and food preservation. Participating scientists in each of these programmes work on the same general problems and coordinate their approach to solving them. This is done in some cases by having all participants run identical field experiments, in other cases by the distribution of specific tasks of or by combined efforts to solve certain problems as appropriate. Once a year the participants in these programmes meet to report on their research activities and to coordinate their research programmes for the ensuing year.

1550 Zeeuw, D. de. FOOD IRADIATION - AN IMPROVEMENT TO HUMAN DIET. EURATOM Bull. 3, 3 (1964) 15-17.
Research carried out in the past 20 years to evaluate irradiation as a tool for food preservation is summarized. Attention is given to studies on spoilage inhibition in potatoes and onions, extension of shelf life of fresh fruit and vegetables, insect control in cereals and flour products, and improvement of dairy products. (ISA 18; 1964, 30702)

Research activities of the Association EURATOM-ITAL (Istituto Fori pastori van Atomenergie De Landhoulse Wageningen) are directed towards the practical application of radiation and radioactive elements and compounds in the field of agriculture, particularly in the sphere of food technology. Growth and development of plant and animal, pest and disease control, and breeding. Results achieved thus far and new perspectives for the use of nuclear techniques in the field of agriculture are outlined. Pilot plant agricultural applications of ionizing radiations are in advanced stage in various countries, in particular the USA, Turkey, Argentina, for the control of insects in the products (fruit, grains, cereal products). There is an increasing interest in the disinfection of tropical fruit, such as papayas, mangos and pine-apples. Emphasis is to be placed on the application of the sterile-male technique to Ceratitis capitata. Dacus oleae, and the onion fly.

See also:
42 The use of radiocollides and their radiation in the plant pest control. (Jansch, A. et al., 1968)
910 Biological effects of Radiation. (Grosse, D.S., 1965)
1529 Control and sterilization of pests of grain storages by gamma rays. (Dockst, J., et al., 1967)
1688 The Israeli food irradiation program and progress during 1964-1966. (Khan, R.S., et al., 1965)
1988 Food irradiation research and pilot facilities in operation or planned in India. (Kurnt, U.S., et al., 1968)
1976 Recent advances in food irradiation research in Japan. (Matsumiya, A., 1966)

1700 Ionizing radiators
1770 Ibid (1968)
1040 International exp...

1552 Smith, C.N., NEW APP "Pesticides and Their Efl. Wks., USA, Soil Science "Annual Meeting of the 3.
An introductory article to certain species of insects.

information gained from certain characteristic is system of insect control b of terms of number of in inefficient to the p... However, the latter, who runs a farm for the... population. The application for the con... problem of the bill week. The integration of profit affect different stages of... than either system employer... omit to discuss the chemical aspects.

1554 Altmann, G., Galun, R. METHOD. Am. ent. 56.
Formulae are derived for... and sterile individuals, of... control of population, is above. (Auth.)

1555 Anonymous. BRADIAT ROLLER AND CODING L.

1556 Arroyo Varela, M., RICE ISOTOPE TO THE INVo... IV. TESTS WITH P-32 250-259, (In Spanish)

A computer program b the determination of rules
2.4.2. Population Control

1552 Smith, C. N. \textit{NEW APPROACHES TO THE CONTROL OF PEST ORGANISMS}. p. 145-150 of "Pesticides and Their Effects on Soils and Water, ASA Special Publication No. 8". Madison, Wis., USA, Soil Science Society of America, Inc. 1966, 100p. Paper was also presented at the "Annual Meeting of the Soil Science Society of America. Columbus, Ohio, USA. Nov. 1965".

An introductory article, dealing with induced sexual sterility and its usefulness for eradicating certain species of insects. The importance of research on attractants is stressed.


Information gained from the screw-worm population control program is discussed. The author contends characteristic trends of insect populations subjected to different systems of control. The system of insect control by the use of conventional insecticides is subjected to be highly efficient in terms of number of insects destroyed when the insect population density is high but highly inefficient when the population is low. The contrary is true of the system of sterile insect release. However, the latter, when used in conjunction with the insecticide system of insect control provides a means of reversing the law of diminishing returns in dealing with the elimination of insect populations. The application of the basic principles of integrating chemical treatments and sterile insect releases for the control of a specific insect is discussed, theoretical models being used. The problem of the bull weevil is considered, and the projects under way for dealing with the pest. - The integration of predator (or parasite) released and sterile insect releases, which independently affect different stages of the host insect provides a more efficient system of insect population control than either system employed alone. - The integration of cultural control and release of sterile insects for tobacco hornworm (Manduca sexta [Lepidoptera] control is considered. - The author deliberately omitted any discussion here of the basic principles involved in the use of insect attractants and chemoattractants.

2.4.2.1. Sterile Male Technique


Formulas are derived for the expected number of fertile eggs laid by a population containing fertile and sterile individuals. It is concluded that introduction of sterile individuals of the two sexes, for control of populations, is never inferior, and sometimes even superior, to the introduction of one sex alone. (Auth.)


A computer program based on the mathematical description of the sterile male theory facilitated the determination of release strategies and prediction of the effects following release. The theory

Survey article on associated control measures, pointing Craig’s (WHO) review article on how one might attack the problem of certain insect vectors of (human) diseases. These measures are discussed. Sterility may be induced by irradiation or chemically. The principle of genetic drive is described.

Coutoup, L.K. PROGRESS IN INSECT CONTROL BY IRRADIATION INDUCED STERILITY. PAHS 12, 1 (1967) 61-70.

Requirements, advantages and disadvantages of the sterile male release technique are discussed. The major important insects studied in relation to the possibility of employing the sterile male technique are summarized in a table. Those states have research support by the IAEA. Except where stated, host damage is attributable to the immature or larval stage.

### A. Progress good to excellent

<table>
<thead>
<tr>
<th>Pest</th>
<th>Hosts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw-worm (Cochliomyia hominivorax)</td>
<td>cattle, livestock</td>
</tr>
<tr>
<td>Mediterranean fruit fly (Ceratitis capitata)</td>
<td>citrus and other fruits</td>
</tr>
<tr>
<td>Melon fly (Dacus cucurbitae)</td>
<td>cucurbits</td>
</tr>
<tr>
<td>Mexican fruit fly (Anastrepha ludens)</td>
<td>citrus, mangoes</td>
</tr>
<tr>
<td>Oriental fruit fly (Dacus dorsalis)</td>
<td>most fruits</td>
</tr>
</tbody>
</table>

### B. Considerable progress, but application of technique either small scale or requiring further study

<table>
<thead>
<tr>
<th>Pest</th>
<th>Hosts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olive fly (Dacus oleae)</td>
<td>olives</td>
</tr>
<tr>
<td>Codling moth (Cydia pomonella)</td>
<td>apples, pears</td>
</tr>
<tr>
<td>Pink bollworm (Pectinophora gossypiella)</td>
<td>cotton</td>
</tr>
<tr>
<td>Gypsy moth (Lymantria dispar)</td>
<td>forest and shade trees</td>
</tr>
<tr>
<td>Codlethofa (Malbolognus vilgata) - Larvae</td>
<td>grasses</td>
</tr>
<tr>
<td>- Adults</td>
<td>deciduous trees</td>
</tr>
<tr>
<td>Bell weevil (Anthonomus grandis) - Larvae and adults</td>
<td>cotton</td>
</tr>
<tr>
<td>Tine bres (Glionidae sp.)</td>
<td>cattle, livestock</td>
</tr>
</tbody>
</table>

### C. Application may be feasible, but much more research needed

<table>
<thead>
<tr>
<th>Pest</th>
<th>Hosts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dacus jonathai</td>
<td>olives</td>
</tr>
<tr>
<td>Dacus ellipsis</td>
<td>apples, pears</td>
</tr>
<tr>
<td>Corn earworm (Helicoverpa zea)</td>
<td>cotton</td>
</tr>
<tr>
<td>Tobacco budworm (Heliothis virescens)</td>
<td>forest and shade trees</td>
</tr>
<tr>
<td>Tobacco hornworm (Manduca sexta)</td>
<td>grasses</td>
</tr>
<tr>
<td>Tomato or Tropical Ctr Wafe (Dermolepida hominica)</td>
<td>deciduous trees</td>
</tr>
<tr>
<td>Segarae beetle (Distara sacchari)</td>
<td>deciduous trees</td>
</tr>
<tr>
<td>European corn borer (Ostrinia nubilalis)</td>
<td>deciduous trees</td>
</tr>
<tr>
<td>Oriental fruit moth (Chilo cinctus)</td>
<td>deciduous trees</td>
</tr>
<tr>
<td>Rice stem borer</td>
<td>Chilo suppressalis</td>
</tr>
<tr>
<td>Typosia inaequivalis</td>
<td></td>
</tr>
</tbody>
</table>


Kaltzen, J.P. CONCISE MACED ESTERZLLE. (6 (1) Presented at the Sym.) Organized by CIPA (Cont.) Also published as report (Essentially a survey).

Kibee, W. ATOMN EnergEBERGLANDSVERBLLAND (Atomic energy for this or the release of radiation-a Würtzburg, M.P. 1962).

Kuying, E.F. THE ST "Research in Pesticide Use of Agricultural Chem Chichesier, C., Ed. N Review of the principles: the pest before control m is discussed. Examples of actions of certain pests in weevil populations on 101 theoretical trend of a low subjected to sterile male illustrates the estimated 1 subjected to sterile moth vertebrate pests.

Kuying, E.F. MORE STERILE INSECT RELEASE An attempt is made to in releasing into the natural in terms of increasing egg additional information in.

Kuying, E.F. KNOLLIN at the Symposium on "Sc survey.
1561 Hurpin, R. RESULTATS ET PERSPECTIVES DE LA LUTTE BIOLOGIQUE CONTRE LES CYCROTS.
Various methods of combating the insect (particularly Crytos rhinoceros) are discussed. Before even the possibility of eventually applying the sterile male technique could be considered certain basic research would be required and is indicated briefly (p. 80).

Two insect rearing rooms with controlled light, temperature and humidity were installed for the rearing of Mediterranean fruit flies and olive flies. Radiation research is being conducted to compare the dosage of neutrons and γ-radiation required to sterilize Ceratitis capitata. Results to date indicate that there is little difference in either the amount of γ-radiation or neutron radiation necessary for sterilisation.

1563 Kaliyan, K.P. CONTROL DE UNA ProlACIOn DE INSECTOS, UTILIZANDO EL METODO DE MACHOS ESTERILES. (Control of an insect population by means of the sterile male technique.)
Also published as report (2) NYO-5041-151, U.S. Essentially a survey.

1564 Klopfe, W. ATOMENERGIE ZUR SCHARNINSEKTEN-ABROTTUNG, BERICHT ÜBER NEUTRONE REAKTIONSMÄßIGE UND MITTELS FIXIERUNG STEHLINSEKTE IN USA. (Atomic energy for the eradication of insect pests. Account of novel methods of pest control by the release of radiation-sterilised insects in the USA.) Sonderheft über die Arbeit der Universität Würzburg, M.P. 12, 2, 1964. (In German)

Review of the principles involved, and the basic knowledge required of the biology and ecology of the pest before control measures can ever be considered by the sterility method. The current status is discussed. Examples of ways in which sterile insect releases might be employed to regulate populations of certain pests are given. A table illustrates a hypothetical model showing trends of bold weevil populations on 1000 acres of cotton when subjected to various treatments. The theoretical trend of a low-density host fly population, averaging 200 flies/miles², is shown when subjected to sterile male releases at rates and for periods indicated in the table (1). A third table illustrates the estimated trend of the tobacco hornworm population east of the Mississippi river subjected to sterile moth releases in a 5 yr. programme. - Some consideration is also given to vertebrate pests.

An attempt is made to predict population suppression due to parasites and predators. The effect of releasing into the natural population large numbers of sterile males and sterile egg-laying females in terms of increasing egg parasitism and/or predation, and the various assumptions made and the additional information required are discussed.


The author discusses the general principles involved in the control of insect populations by release of sterile insects and briefly reviews the current situation in regard to research in this field and the practical application of the methods. Reference is made to the screw-worm fly (Calliphora vicina) (Coqett).


Comprehensive review article. The article first considers the development of the sterile-male technique, the components of sterility, the physiological and cytogenetic basis for various kinds of sterility (sterility, sterility, stability in male, sperm inactivation, dominant lethal mutations, accessory, types of sterility induced in various male insects, and the types of sterility desired for insect control programmes). The section on applications deals with the screw-worm eradication programmes, and field trials for control, broken down into work on Dibeta (fruit flies, Lucilia sericata Meig., Musca domestica, and mosquitoes), Leptoptrula (Ceripropogon pyxidalis), and Drosophila (Melanogaster, variegata). An entire section (p. 182-188) is devoted to research needs: the comparative radioactivity of various species is discussed illustrated by a table (p. 184-187); also, factors relevant to the success of future field trials, which include satisfactory and economical rearing methods, quantitative data on natural populations, a practical method of inducing sterility, and a knowledge of the components of sterility.


Review article. Recent progress in inducing sexual sterility in insects by chemosterilants and the results of trials carried out on Leptoptrula serricata and Cephalopogon pyxidalis are discussed. The chemosterilants are classified, and the conditions under which the technique can be applied are given. The comparison between irradiation and chemical sterilization of Musca domestica L., and future work in this field is done in the Institute of Insectology in Prague are briefly outlined.


In the review of experimental data the sterile male releases is used in the eradication of the meal fly, Drosophila (Duddon's Coop., from Guam are discussed. The bulk of the article is not concerned with sterilization but views the problem of pest control as one requiring a co-ordination of various techniques.


The theory of control of insect populations by the release of sexually sterile males or by treating field populations is examined by establishing basic premises and deriving algebraic equations. The effect of multiple mating is shown to depend on the fertility of females mated to both sterile and fertile males. The effect of release of males alone will be the same as release of both males and females when the released females are sterile. The effect of release of females alone will depend on the number of times males can mate. If a population is sexually seasonal, the timing of initial releases will have no effect on the number of sterile adults and the time required for extermination, but the initial reduction will be greater and the population before extinction will be lowered if releases are started when the increment of increase is least. The increment of increase of a population and the factors determining the increment are important in determining plant capacity and cost of control. When the cost of the rearing plant, the cost of operation, and the number of generations required to reach extinction are considered, we appear to have an optimum size of plant and rate of release for both males and females in a natural population if both males and females are sexed in the field that survive treatment, and if both males and females have two sex ratios in the field that survive treatment, as well.

1573 Makowsky, J.R. M. Schweiz. Z. Fortschr. 11

This paper describes the use of classical methods, such as diphtheritic hemorhamia, in the sterilization and sexing of insects and is discussed. (From abstract.

1574 Mehrotra, K.N., Sethi, C. MALE TECHNIQUE. p.

The history and basic prin described. A critical review aspects of nutrition research being performed and future lines of work are.

1575 Shipp, E., Osborn, A.W. PROGRAMS. Bull. ent. 1.

The benefits derived from the size and duration of the studies of predator and prey populations in an area as follows: 1) The cost of and by elimination of pests for which sterile-r insect population may be; there is an additional safety; The use of predators in the sugarcane leaf cutter's of which eradication technique predator effectiveness is co.


General survey. Some me

This paper describes the practical and experimental methods being used to fight annoying insects. Classic methods, such as biological control by Bacillus thuringiensis and the use of DDT (dichlorodiphenyltrichloroethane) insecticides, are reviewed. Emphasis is placed on the newer methods of sterilization and sexual attraction by synthetic hormones. Sterilization by γ-rays from Co is discussed. [From auth., summ., trans.]


The history and basic principles of the sterile male technique for the eradication of insect pests are described. A critical evaluation of various methods for induction of sterility in insects and the aspects of nutrition concerned with mass rearing of insects are discussed. A brief account of research being performed in different parts of the world on various aspects of the technique is given and future lines of work are indicated. [NSA 31, 1967, 22790]


The benefit derived from predators will be related to their effectiveness at different prey densities, the size and duration of natural population fluctuations, as well as the relative length of the life cycles of predator and prey species. Advantages gained through the efficient use of parasitoids or predator populations in eradication programs based on releases of sterile insects may be summarized as follows: (1) the cost of some programs may be reduced by the combination of these two factors and by elimination of selective and handling procedures; (2) there may be an increase in the range of pests for which sterile-male release programs are feasible. The decline of a naturally fluctuating population may be hastened, thus increasing the duration of the low-density period; (3) there is an additional safeguard to the availability of predator pressure when sterile releases cease. — The use of predators in sterile-male eradication programs is being investigated in a study of sugarcane leafhoppers of the genus Pseudocoris. Increasing the effectiveness of Knipping's sterile-male eradication technique by the possible supplementation of both "flushing" and increased predator effectiveness is considered.


General survey. Some mention is made of insect sterilization by irradiation.

See also

497 Some applications of radioactive isotopes in ecological research. (Noodtink, J. P. W., 1965)
908 Atomic energy in the control of insects. (Bacetti, A., 1962)
909 Studies on the inherent variability of radiation insects and the biological control of (X) sterilized insects. (Chiang, T. H., 1965)
1115 Radiation sterilization in controlled insect pests. (Andrews, S. V. et al., 1967)
1334 The induction of dominant lethal mutations in insects by ionizing radiation and chemicals as related to the sterile-male technique of insect control. (LaChance, L. E., 1967)
1335 Radiation-induced sterilization. (LaChance, L. E. et al., 1967)
1547 Towards better insect control. (Kelson, S. O., 1960)
2.4.2.1.1. Coleoptera


The sterile-male technique, utilizing radiation, was tried on the bean weevil, Bruchus obtectus, the Colorado potato beetle, Leptinotarsa decemlineata, and the corn earworm, Heliothis zea. Bean weevils and corn earworms were irradiated, using a 60Co-source: 8000 or 8000 R, respectively, proved sterilizing doses. An x-ray unit was used on Leptinotarsa: 8000-10,000 R resulted in the complete sterilization of males. An investigation into the effect of different ratios of sterilized to non-sterile insects upon population density gave a population decrease down to 30% after introducing 20% of sterile males, compared with the control, and only 9% after 20% of sterile males. The optimal sterilizing doses ranged from 8000 to 10,000 R for the above-mentioned insects. A detailed analysis of the whole complex of conditions necessary for the successful application of the sterile-male technique shows that costs are lowest when it is applied to control insects whose complete life cycle takes place under field and farm conditions (e.g. for the pea and bean weevils). It is possible to achieve the total eradication of such insects as early as in the third generation. The research report is preceded by a brief analysis of work on some of the main problems connected with this technique, e.g. the effect of γ-radiation on the reproductive organs, the determination of optimal sterilizing doses subject to the developmental stage considered, and the selection of economically important insects whose biological characteristics make the technique particularly appropriate.


Sterilization doses for field and laboratory-reared beetles were determined. Sub-sterilizing doses resulted in enhanced egg production with some crosses. Egg production was dependent on female-male ratio. Improved techniques for rearing and holding stages after treatment were developed.


These studies were conducted to investigate whether certain aspects of the mating behavior and population dynamics of the boll weevil, Anthonomus grandis bohemanii, would affect effective application of the sterile-male technique for the control and/or eradication of this pest. It appears that the female is primarily responsible for controlling mating frequency under normal field conditions. However, as population density increases, the influence of males in controlling mating frequency also increases. Results of alternate mating studies showed that when an equal number of matings with sterile and normal males occurred, both equally influenced overall egg-batch. The initial mating in the sequence had little effect on overall egg-batch, while the last mating prior to oviposition was most influential on subsequent egg viability. Only slight differences were noted between egg fertility from single and double matings, an indication that little additional sperm is transferred in the 2nd mating if it occurs within a few hours. The developmental rate of the males did not influence subspecies release experiments, the week. Emergence of the in the average rate of ovipositing and peaked during weak population density of the the female, generation was only slightly egg deposition was found incurred in the act of only males failed to achieve o to normal males present, possible future success v. of spermatophore used here.

Herber, E. MAKAPR (Herbis des Feldmais) (Cochleisera against cascades (L.) (Collembola L.)), by the a German with English sum A field trial is described in periods, in 1965 and 1966. Gradation in that area as in 1959, for the 2nd treatment, a population of A. Schenk was also observed in S. C. In 1965 no treatment was number had increased in a complete eradication in a sterile-male technique in isolated geographically, in large quantities is not and destructive stages of

Herber, E. USE OF ALT of the FAO Symposium on and Agriculture Organization Among the topics discussed radiation, (His work experiments with insects, sterilants, antimitofable described; they are divided by host plants, repeller and competition and crop

Jermy, T., Nagy, E.L., Folchkhohi L.,) BY THE (In English) Cochleisera adults dug out respectively. The sterilized and γ-rays showed the san