
During normal development about 80% of the eggs develop into second instar larvae, 95% of which develop into third instar larvae, and 96% of which develop into fourth instar larvae. The remaining 0.1% of the eggs develop into fifth instar larvae, which are not observed. In the present study, we observed that about 98% of the eggs develop into second instar larvae, 95% of which develop into third instar larvae, and 96% of which develop into fourth instar larvae. The remaining 0.1% of the eggs develop into fifth instar larvae, which are not observed.


The tumor cells of the tumor-bearing strain of Drosophila melanogaster were grown in vitro. The cells were then transferred to a fresh medium and the growth rate was determined. The results show that the growth rate of the tumor cells is not affected by the presence of the protective agents.


Irradiation of the embryos or larvae considerably increases the incidence of melanotic tumors in these flies. Irradiation of germinal cells does not influence development of tumors in flies developing from the eggs. The presence of the presence of the tumor gene in the genotype of the egg or larva is an essential condition for the melanogenic action of irradiation. The statistical distribution of tumors in irradiated populations conforms to Poisson's law, and it is independent of the stage of development at the time of irradiation. The effects of several irradiation treatments are additive, and the incidence of tumors increases with the dose to an upper limit of 600 to 800 r. Beyond 1200 to 1600 r the incidence of tumors decreases as mortality increases. Between doses of 200 and 800 the incidence of tumors rises linearly from 10% to 50%, respectively. In contrast, the slope of the curve of incidence of tumors depends neither on the incidence nor on the level of tumor gene; it seems to be influenced by the age and the environmental factors. When irradiation increases the number of tumors, it simultaneously increases their size and rapidity of their appearance. Irradiation does not modify the histologic appearance of the tumors. Occasionally tumors were observed in the hemocyte cells of the larvae. The phagocytic activity of these cells was not affected by irradiation. The increased incidence of tumors in irradiated Drosophila melanogaster cannot be attributed to selective mortality or to inhibition of defense factors against tumor cells. The failure of irradiation to lead to a pronounced effect in older larvae indicates that it does not affect the development and growth of tumors once formed. It is suggested that irradiation increases the sensitivity of larval cells to a tumor-inducing agent controlled by the tumor gene.


If x-rays and excess tryptophan both increase tumor penetrance in the rnu-1 strain by inhibiting the action of the suppressor gene, it should follow that strains not carrying the suppressor would have a different reaction to environmental treatment. Tests with germ-free, synthetic diets containing excesses
or deficiencies of individual nutrients show that the majority of treatments affect tumour persistence in the same way, whether or not the svr gene is present. This suggests that these treatments influence the expression of the tumour gene directly, rather than through the suppressor. Since many metabolically unrelated treatments are similarly effective, it also seems unlikely that they operate directly through a specific metabolic pathway. The general implications of these results for tumourigenesis will be considered. See also

840 The "brown spot" character in Drosophila melanogaster and their response to x-rays. (Di Pasquale, 1969)

1-A-10 SPECIES, STRAINS, LINES (COMPARATIVE STUDIES)


From 808 wild inbred strains of Drosophila melanogaster were obtained. At the 5th generation, 36 strains were divided in each strain with 15 pairs of flies. For each strain, two cultures were submitted to 600 r of a Co60 x-ray source. After the irradiation, the same 36 strains were divided in 8 strains with 15 pairs of flies. The relative efficiency of the strains with a 60% increase in the control (X) was obtained. A paired analysis of variance showed no significant difference between treatments (p=0.002, f=0.851, 1944, 0.69). The same non-significant result was obtained at the most inbred strains in a total of 24 150 flies in the control and 27 190 flies of irradiated strains. A paired analysis of irradiated-control failed to show any significant overall increase in the irradiated or the control. Considering all the paired strains in which a noticeable performance was observed after irradiation, a paired of 51, 25% among 120 strains and 46, 16% among 236 strain, contributed to a significant I value. We have indications that several strains do increase performance after irradiation. The average effect on the total population is certainly counterbalanced by the others that shows a significant decrease.


A critical review and assessment of the problems presented by social parasitism in ants is presented. The chances of using radiation-induced mutations for investigating the evolutionary and species aspects of differentiation are discussed (p. 407-).


Two experiments which exploit some of the peculiar genetic properties of D. melanogaster were conducted to study the nature of the interaction of genotype x environment. All possible crosses were made among 4 isogenic lines, each representing a different mass-mated stock. A sample of virgin females from each line, line cross, and original mass-mated stock was replicated (6000 r or 4000 r) at about 48 h of age. A similar non-irradiated sample was also replicated. The larvae produced by mealy eggs and eggs were produced by days 1, 6, and 8, and the number of adults emerging from eggs deposited on days 9, 10 and 11. The analysis provides a comparison of breeding types, and estimates of inbreeding depression, heterosis, and also the genetic components of the interactions between the two environments. Differences in general combining ability were observed for egg and larva number but not for number of adults in both experiments. Large interactions of treatment x breeding type, treatment x mass mated stock, and treatment x isogenic line were observed for all traits at 6000 r, whereas at 4000 r only 2 of these interactions were significant. (NBA 18: 1960, 5049).


Salivary gland chromosome I was originally collected from the colony of three pairs of synapsis and asynapsis regions have been in definite patterns. All clones consist of an indistinctly banding, proximally equal length, 4a ceratome, 26, right arm, 26 centromere, 36, right arm, 2B. Following the Drosophila cerevina substitutions of each region 26 to 50 and chromosome III 8 provide distinct identification. This region has recently been suggested as a reversal of repeat 13, 15, with median centromeric homologues. The arc are being used for comparison.

1212 Oda, H. DIFFERENCE OF RAI THE SILK WORM. (Abstr.) J.

1213 Shapiro, N.L., Sernashenko, S. OF THE INJURIOUS EFFECT OF SOVIET BLUE MAINLAND CHINA 74. The rate of the formation of de 2 1-8 month-old male mule with S females for 3-8 months. On the bodies, implantation sites and determined, due to dominant 1 maximum and minimum radio studies. Comparison of the rat that mice are 6-9 more radios.

1214 Sokoloff, A. PRELIMINARY'S GENETICS 58 (1956) 791.

3-4-old images of D. castanea 6000 r administered in 2, 3, 5, 6 group. (1) Productivity (mae) non-irradiated male was great 70% and 6000 r in 100% deep (effect of the high dosage of 1 sex of irradiated males) X then of larvae from without irradiation until 6000 r 69% more sensitive to x-rays than productivity of the latter was c corresponding values were 8, 9, one generation after exposure males X non-irradiated females were 30, 50 per female for the 490. One visible instar (p.

1215 Sokoloff, A. IRRADIATION S The main effect of x-rays in bees Although they may survive at 1
letus affect tumour presence in the brain. These treatments influence the effect of many metabolic and growth factors present during tumour growth, and their response to x-rays. (Di Pasquale, 1964).


Salyroid gland chromosome maps have been prepared for the mosquito Culex p. pipiens. The strain was collected in the field in Champaign, Illinois. The salivary gland chromosome complement consists of three pairs of syrphid, polytene, banded chromosomes. Each pair is usually composed of a single chain of bands. The chromosome pairs are: I, left arm, 150; centromere, 20; right arm, 150; II, left arm, 170; centromere, 20; right arm, 225; III, left arm, 260; centromere, 35; right arm, 225. The shorter arm has in each case been arbitrarily called the left arm. Following the Drosophila convention, each chromosome has been divided into numbered regions, with subdivisions of each region designated by letters. Chromosome I contains regions 1-2; chromosomes II, 23-40; and chromosomes III, 41-60. Each arm contains several prominent banding sequences which provide distinct identification. Each chromosome contains a central, "double band", with distinct bands. This region has tentatively been identified as the centromere region, and good preparations show bands suggestive of a reversed repeat pattern. Metabolic chromosomes (tails, metaphase I) measure 6.2, 7.5 and 8.5 microns, with median centromeres and arms of approximately equal length. There are no recognizable heterochromosomes. The salivary maps herein reported have been designated as "standard" maps and are being used for comparison of the patterns in Culex p. pipiens and in several a-x-ray mutants.


The rate of the formation of dominant lethals was used as an indicator of the effect of radiation. Gonads in a 1-4 month-old male mice were irradiated with x-rays at 154, 268, 402 and 670 r, followed by mating with 3 females for 3 d. On the 14-16th day of pregnancy these were opened and the number of yellow bodies, implantation sites and embryos assessed. Embryos killed both before and after Implantation had no determination due to dominant lethals in the spermatocysts or the irradiated males. Similar data for maximum and minimum radiosensitivity in different lines of D. melanogaster were used from previous studies. Comparison of the rate of formation of dominant lethals in mice and D. melanogaster indicated that males are 5-8 times more radiosensitive than D. melanogaster. (Abstr.)

1214 Sokoloff, A. PRELIMINARY STUDIES ON THE EFFECT OF X-RAY ON Tribolium IMAGOSIS. (Abstr.) Genetics 42, 8 (1961) 596.

3-8 old imagos of T. castaneum and T. confusum were exposed to x-ray dosages of 1500, 3000 and 6000 r administered in 2, 5, 10, and 15 min, respectively. The various results lead to the following conclusions: (1) Productivity (measured in terms of F1 adult productivity) of T. castaneum irradiated females x non-irradiated males was greater for the 1500 r experiments than for the controls; 6000 r resulted in 70% and 6000 r in 100% drop in productivity (assuming productivity of controls to be 100%). (2) The lethal effect of the high dosages of irradiation takes place at the egg stage. Mortality of larvae emerging from eggs of irradiated males x non-irradiated females or from eggs of the reciprocal cross is not greater than of larvae from non-irradiated controls. (3) Dominant-lethal frequency generally increases with heavier irradiation until at 600-750 r 99% or more of the eggs fail to hatch. (4) Males of T. castaneum appear to be more sensitive to x-rays than females, and T. confusum males more sensitive than T. castaneum males: productivity of the latter was only 11.6% of the controls at 500 r and 0% at 6000 r for T. confusum corresponding values were 8.5% and 0% of the controls. (5) The drop in productivity persists for at least one generation after exposure; T. castaneum controls produced 90% F1 per female, F1 of 3000 r irradiated males x non-irradiated females produced only 63% F1 per female. Comparable values for T. confusum were 90% F1 per female for the controls and 20 for the experimentals. (6) No sex-linked lethals were obtained. One viable mutant (pink eye) was probably induced by x-rays.


The main effect of x-rays appears to be in the egg stage. Females are highly susceptible to high doses, although they may survive at 6000 r x-rayed eggs, none of these proves viable. To study recovery pheno-

Literature on the type and frequency of radiation-induced mutations in Drosophila is reviewed with particular reference to the variations found among various strains. (NRA 16, 11735).

1217 Vostrobnik, L. E. COMPARATIVE STUDY OF RADIATION SENSITIVITY OF DIFFERENT STRAINS OF Drosophila melanogaster. Ploj. Acad. Nat. Sci. 125 (1960) 599-614. (E. Sennan) The radiation sensitivity of 5 strains of wild type D. melanogaster was compared. In experiments with 50- to 500-r irradiation doses, 500 r was shown to be sufficient for 100% death of the flies in a time suitable for comparative studies. Average lifetimes of irradiated flies varied from 11.6 to 18.5 days; with statistically significant differences. The 7 strains were considered classifiable into 2 types: one relatively radiation-resistant and the other, relatively radiation-sensitive. The curves of percentage of death versus time were studied for all strains, the rate increasing slowly at first, then very rapidly, but slowing down again near 100% mortality. The results of coefficients of regression were calculated for the first two parts of the curves, and showed that the average length of life and rate of dying were inversely dependent on the 1st part but were not obviously related in the 2nd part. (NRA 16, 1981).


Stocks of single chromosome interchanges between the Ohio and Is-Ambient strain of Drosophila melanogaster were constructed in an effort to localize factors responsible for differences in sensitivity patterns. Comparative measurements of the rates of induction of sex-linked recessive lethal mutations were made in basal reproduction from 500 c of X-radiation exposure made on sequential samples of sperm from males stocks of the sex chromosome interchanges between the two strains. The stocks were maintained in such a way as to bring the single chromosome of one strain through the male line, thus placing it in the cytoplasmic environment of the other strain. Thus chromosome interchanges stocks do not differ in sensitivity patterns from the Ohio and Is-Ambient strains, i.e., the Ohio damage peaks precedes the Is-Ambient peak, in the X-chromosome interchanges stocks the damage peaks coincide. There is a marked decrease in peak of damage between the second chromosome interchanges stocks. This X-chromosome seems to have an effect on the time of occurrence of the mutation sensitive cell stages, while the second chromosome affects the level of sensitivity.


A comparative study of the cycles of cytochrome c oxidase activity during pupal and adult life of two strains of Drosophila showed that the cycle of enzyme activity in the more rapidly developing strain precedes the slower strain, thus alternating the relationship of the enzyme activity during the time of development of the irradiated germ cells. The relationship of the differences in radiation sensitivity of the developing cells to the enzyme cycles is discussed. It was necessary to postulate at least two factors other than the protective effect of the cytochrome system in order to explain the entire sensitivity pattern of the two strains. (Abert.)

This paper has been included since the genetic control of the cytochrome oxidase system, either directly or indirectly, is of considerable interest in relation to genetic sensitivity to irradiation. The numerous experiments indicating the effect of CO and cyanide pointing on the genetic sensitivity to irradiation and the results of irradiation in Os? certainly would suggest that some of the differences in level of genetic damage in strains and in cell types may well be determined by the activity of the cytochrome system.

Cytochrome oxidase determinations on the chromosome interchange stocks of the Oslo and iso-Ambient strains of D. melanogaster show that the activity level of the terminal oxidase system is generally higher in the strains carrying the Oslo second chromosome. However, the homologous iso-Ambient X chromosome in the strain otherwise derived from the Oslo female seems to reduce the effectiveness of the Oslo second chromosome in producing an organism with a higher level of cytochrome oxidase activity.

See also:

755 The effects of irradiation on the genetic systems of organisms in relation to their physiological and pathological systems. (Alexander, 1959)
772 The susceptibility of the cast-off flour beetle, Tribolium castaneum (Herbst.) to gamma radiation. (Crawford, 1982)
806 Some effects of gamma radiation on the lesser grain borer, Sitophilus oryzae (L.), tropical warehouse moth (Cramoedus cautella Wlk.), Indian meal moth (Plodia interpunctella Hbn.), and the cigarette beetle (Lasiodera serricorne F.). (Tauliany et al., 1988)
819 R-locus factor homologies in Monomorium (Whittington, 1982)
837 Differences in sensitivity to gamma radiation in Drosophila of the williamson group. (Carvalho and da Cunha, n.d.)
844-6 Mutation rates at specific loci in Drosophila melanogaster. (Hanawal-Allawi, 1982)
844 Interspecific hybridization and genotypes in male insects. (Nur and Chanda, 1965)
910 The mutation rate at specific autosomal loci in different species of Drosophila. (Turku Univ., Finland, n.d.)
940 Mutation rates at specific autosomal loci in different species of Drosophila. (Hanawal-Allawi, 1963)
947 Studies on the distribution of bristles in terms of natural and radiation-induced chromosome dislocations in Drosophila melanogaster Cu1. (Koue-Zubeli, 1961)
982 Increased recombination from female Drosophila irradiated as larvae without exposure. (Whittington and Davis, 1981)
982 Unchanged recovery of crosses after x-irradiation of pupal Habrocestom (Whittington and Allen, 1961)
991 Continuous radiation-induced mutation rates at different genetic loci. (Whittington, 1961)
1018 Speciation of the silkworm and its bearing on the radiation induced stability. (Sado, 1981)
1028 Considerations on the changes in observed mutation rates in the silkworm after irradiation of various stages of gametogenesis. (Tsukui, 1961)
1040 The effects of nitric oxide on radiation damage in Drosophila virilis and Drosophila melanogaster. (Cappa, 1961)
1186 Virus-host relationship and the effects of x-ray induced mutants in heterologous condition. (Bebalin, 1963)
1310 Changes in quantitative traits under selection and irradiation. (Bartlett, 1960)
1370 The importance of competitiveness of irradiated males in mosquito control program. (Dana and Schmidt, 1962)
1389 Research in genetics, (Chen, 1962)
1394 Resinification, without selection, of balanced genetic load by irradiation of Drosophila Melanogaster. (Cordes, 1962)
1457 Les possibles d'emploi des radiations dans le lutte contre les insectes. (Nelond, 1963)
1479 Utilisation des radiations gamma (#Co) pour la protection des denrées contre les insectes nuisibles. Recherches relatives à la détermination des doses utilisées pour assurer la radiation des insectes. (Pavon, 1963)
1-B Developmental Effects and Effects on the Organism

I-B-1 DEVELOPMENTAL STAGE RESPONSE, DELAYED DEVELOPMENT
I-B-1-a GENERAL


The radio-resistance of adult, pupae and larvae of an insect is discussed. Sufficiently high doses of x-rays given at larval stages have been shown to (1) prolong the larval period, (2) produce phenocopies, (3) cause some death during the subsequent pupal or imaginal stages, and (4) reduce fertility in the surviving adults. Work in the field is cited.


Some of the variables affecting the results of radiation treatments are discussed. The female of Cochliomyia hominivorax (Coquerel) has proved ideal for determining the correlation between reproductive development and radiosensitivity. All egg development of the same stage of development (very different from the case of Habrobracon jugnadi (Ashmead)), from studies on these two hosts exhibits very different stages of development, and from many other studies two general conclusions may be drawn: (1) development of the egg can be inhibited more easily if radiation is administered at that sensitive period of oogenesis when the nurse cells are becoming polyplid, and (2) as soon as the oocytes have differentiated, their development is not readily arrested by even large doses of radiation, but egg hatchability will depend on the genetic stage of the nucleolus at irradiation. In the irradiation of males, the relative sensitivity of the various stages of development poses similar problems. It also remains to be determined whether viability is due to: (1) genes containing dominant lethal mutations causing hypoxic death in the embryo or (2) mutation inactivations of the sperm, or (3) damage to the immature cells of such extent that mature sperm are not produced at all. Fractionation, dose rate and temperature also affect the results of irradiation, and particular environmental atmosphere may act as radiation protector or enhancer.

1223


Eggs of species of the genus Spopa were irradiated with Co60. 3.6% of the eggs failed to develop at doses of 3000 r, with 7.6% of the eggs preventing larvae. About 5% of the eggs remained outright at doses of 5000 to 10000 r, with larval development entirely absent. A total of 1.4% of the eggs failed to develop in the control group, while 15.9% produced larvae. (BA 45:1064, 46081)

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Baleck, J.W., Jr., Burditt, A.K., Chamberlin, L.D. EFFECTS OF GAMMA RADIATION ON VARIOUS STAGES OF THREE FRUIT FLY SPECIES. Circus Ind. 44, 8 (1963) 9-12.

Dacus dorsalis, D. cucurbitae, and Ceratitis capitata are considered.

1228

Bridham, E.J. THE FUSCIN GAMMA RADIATION, Air Research Div., Washington, D.C.

The susceptibility to γ-radiation under controlled environment (4000 r/hr) with respect to the more resistant than Sinobugula radiation sterilization. A di- wobugula, is equally effective

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Barlett, A.C., Bell, A.E. SELECTED STRAINS OF TRIB

The effects of various levels of T. castanum and its isolate selected for increased body 91000 µg for the unselected and number of resulting progeny the unselected strain had hop beetles were partitioned so that the third and fourth generation were not produced. The production was not affected beyond that level. A decline 600 r. The initial suppression of the response to irradiation batching (radiometabolic effects an

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Barlett, A.C., Bell, A.E. Tribolium castaneum (Heeber). The effects of x-radiation on Tribolium castaneum and its isolate selected for increased body weight. The two strains differed in 91000 µg for the unselected and number of resulting progeny the unselected strain had hop beetles were partitioned so that the third and fourth generation were not produced. The production was not affected beyond that level. A decline 600 r. The initial suppression of the response to irradiation batching (radiometabolic effects an
Radiation effects on development of eggs, larvae, and pupae were determined for the oriental fruit fly (Dacus dorsalis Hendel), the medfly (D. cucurbitae Coquillett), and the Mediterranean fruit fly (Ceratitis capitata Wiedemann). Increasing doses were required to prevent hatching as eggs became more mature except that eggs at the final developed stage were more sensitive than younger ones. The LD₉₀ for hatching of newly laid eggs was about 1300 r and for nearly mature eggs from 84,000 to 123,000 r. Fecundity was reduced 95% when eggs were exposed to 32,000 r and 1- to 3-day-old larvae to 30,000 r. More than 200,000 r was required to prevent pupation of mature larvae. Pupation required to prevent 50% emergence of adults was 80,000 r or less when eggs, larvae, or 1- to 3-day-old pupae were irradiated. Other pupae became more resistant to radiation, and when fully developed required more than 100,000 r to prevent emergence of adults. Emerging adults were sterile after exposure as mature pupae to 10,000 r. Adults from irradiated larvae exposed to 3200 r developed and laid eggs but hatched was reduced 95% in the parent stock and pupation 38% in the F₂ generation. When irradiated in water, 1000% CO₂, or N₂, the effect on eggs and larvae was 40% to 47% less than in air. The results suggest the feasibility of using comparatively low dosages in the range of 15,000 to 20,000 r as a quarantine treatment for fruit fly-infested fresh fruits and vegetables. (Auct.)


The effects of various levels of γ-radiation on reproductive fitness of a plateaued population of T. castaneum and its unselected base population were investigated. The plateaued population had been selected for increased body weight for 44 generations and weighed approximately 0.050 g in contrast to 24 kg for the unselected strain. Two components of fitness (eggs laid during a standard 48-h period and number of resulting progeny) were measured. While the two strains did not differ in egg production, the unselected strain had superior hatchability. Within each of 9 doses (ranging from 200 to 6000 r) the beetles were partitioned so that in one set only males were irradiated, in another set only females and in the third both males and females were irradiated. Irradiation of males was shown to have no effect on the ability to excite females in their mates, but number of progeny was reduced with the higher doses. Egg production was not affected for doses up to 1000 r applied to females but a marked decrease was seen beyond that level. A decline in number of progeny from irradiated females was observed at doses as low as 500 r. The initial fertility of the unselected strain for number of progeny persisted over all doses. A linear response to irradiation was not shown for either egg production (dominant effects) or number of pupae hatching (dominant effects and dominant lethal effects) for the dose range employed in this study.


The effects of γ-radiation on the reproductive performance of two strains of T. castaneum were measured. The two strains differed in body weight, one strain being 2.5 times as heavy as the other. Females of the heavier strain were more resistant to somatic damage than were females of the light strain. Genetic damage, as measured by a reduction in fertility of irradiated individuals, was not so great in the heavy strain as in the light strain, especially when both parents were irradiated. When only one parent in a mating was irradiated, no sex differences in response to increasing doses were found. The effect of irradiating both parents can be predicted from the results obtained when only one parent is irradiated. The response curve for somatic damage showed a linear decline at high doses (1000 and 5000 r) but no significant effect at low doses (0 to 500 r). The response curve for genetic damage, as measured by an orthogonal polynomial analysis, was sigmoidal with a linear decline at low doses and a curvilinear decline at the high doses. The genetic response curve over all doses can be fitted to a function of the type
Y = a + bX + cX², where the different coefficients of X and X² change with the strain. The coefficients also depend on whether one or both parents are treated. The drop in fertility at doses over 2000 r was an average of 65.9% for irradiated foundation adults (summed over mating combinations) and an average of 38.9% for irradiated selected adults. (From Auth.)


The effect of exploding and near-exploding heterozygous mutants in D. melanogaster has already been studied in the egg and larval stages separately. The present work studies both stages in the same individual in order to estimate the minimal total effect of such mutants. Wild-type, Oregon-B males were treated (1) or not (C) with 2000 r of x-rays and mated to virgin, untreated, sibling females. Eggs were collected at 4-hour intervals, and each hour, starting the 21st hour after oviposition, the number of larvae hatching were scored. Of all larvae, the percentage hatching late (more than 1 h after the largest hourly percentage hatched in C) were: C, 0.2 ± 0.2 (of 2000 larvae); L, 5.6 ± 0.7 (of 1505 larvae). The induced difference is delay, by 0.1 ± 0.1 h, is attributable to newly arisen (near-) exploding mutants in heterozygous condition. Not-delayed larvae (obtained from the hour when the largest percentage hatched in C) and delayed larvae were studied for retarded papillation and for death before papillation. The induced difference between not-delayed C and L was 5.1 ± 0.9%. For retarded papillation and death for death before papillation. Among delayed larvae the induced difference between C and L was 23.6 ± 9.7% and 19.4 ± 0.7%, respectively. Thus, about 15% (6.1 ± 0.7) of the larval population which carry x-ray-induced, explod and near-exploded, heterozygous mutants show a detrimental effect of these mutants in either the egg or the larval stage, of which approximately 1.4% were affected in both stages.


This study required the development of techniques by which the duration of the egg and larval stages as well as the ability of larvae to pupate could be employed as criteria for detecting these heterozygous effects. In untreated crosses these mutants were found to produce delay in pupation in about 5% of larvae under nutritional stress, and the killing of approximately 10%. The effect was less, about 1% delayed and 9% killed, when there was excess nutrient. Irradiation of specific eggs caused approximately equal amounts of retardation, doubling partly by different types of mutation; no effect of delay or death in the larval stage was detected when oogenesis was irradiated. In untreated crosses about 5% of all hatching larvae were delayed in the egg stage by the mutants produced by x-rayed F1 males who were mated to sibling females. Of larvae not delayed in the egg stage, about 12% were delayed in the larval stage, of which 7% were killed. Of all larvae hatching, about 1% showed an effect in either the egg or the larval stage, while 1.4% were affected in both stages. After males from stocks containing heavier than normal genetic loads were irradiated, a greater than additive effect of heterozygous mutants was noted upon egg hatching. Thus, newly induced heterozygous mutants produced about 15% of effect when added to the heavier genetic load, but produced only about 1% this effect when added to the smaller (normal) load. The detrimental effects of explod or near-explod mutants in heterozygous condition detected were quite large. No evidence was found in support of the balance hypothesis of heterozygous advantage. However, all the results obtained could be explained by the classical hypothesis.


D. melanogaster males were treated with 3000 r x-rays, and the first released sperm were used to produce the FI. The FI, that hatched from the egg comprised the population studied with respect to times of egg hatching and delay and death prior to pupation. Results of the egg-hatching experiments were analysed by 2 methods. By the first, the curves were compared with respect to only one extreme. This showed a radiation-induced effect of about 5% more individuals with delayed egg hatching. The second method of analysis compared the total curves, and indicated a radiation-induced delay in egg-hatching time in about 20% of the larvae. The effects of delay and death studied here are attributed to explod and near-exploded mutants in heterozygous condition. The basis for this conclusion is discussed briefly, as is the relation of these results to the detection of a heterotic effect of x-ray induced mutants.

330

Beek, J.S. EFFECTS OF RAD 74 (1961) 641-649. T. contumax, a holometabolous and of aberrations in development shown to cause a sexed P of 6000 r, with smoothly varying during the 7-8 day pupal life has about 20% for papilla retardation beyond 30 an onset in larval life of this sensitive site within the or peak of heavy ion beams. Cn deformities. (From Auth.)

Beek, J.S., Martin, T.R. DEVELOPMENT IN A BEETLE 1 In order to quantitate differences development, a method was Tribolium castaneum. Neuron of pupal and early adult stages, 0.058 ± 0.002 µ of F. The I crosses with loss of cells. 

See previous reports of wor

Brandt, J., van den, Wessentlicht FLOUR MOTI Ectobius kuehni nationaler Kongress fir Entomol. Forsch. Wien, Organisat. 1962. (In English). A CO2 source was used 30 pa above. The influence of y-It's A 50000 rad results in co sterility, the sterility produces of irradiation, the greater the population occurs after 40% to have a small visible appearance: this with 60000 rad, the experiments with full grown larv do not seem to have any unrad generation) above 4000 and a grown larvae with 9000 rad, a

Brownell, L., Yodolkovitch, LARVAE IN GRAPEFRUIT. p. Symposium, Somnay, 5-9 Des A limited study has been made past fruit fly, Anastrepha ludens after infestation to explore the fully grown larvae and larvae examination and dissection of presence of pupae and puparia during the egg or after-instar larvae, produced numerous pup from 5000 rad or more. 3 Limited tests of 2000 rad will usually greater damage. A dead (From auth.)
with the strain. The coefficients
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AND NEAR-REPLACED MUTANTS


Mutant gene has already been studied
in the same individual in
Oregon-R males were treated (f)
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(f larvae). The induced difference
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(7% for death before pupation,
7% at 6, 7% at 14, 6% at 16, respecti
y-x-ray-induced, replaced and
mutants in either the egg or the

NEAR-REPLACED MUTANTS IN

*noptila melanolopha, Dis. Abstr.

of the egg and larval stages as
detecting these heterosexuals ef
population in about 9% of larvae
it was less, about 7% delayed and
rates increased approximately equal
effect of delay or death in the
tissue about 9% of all hatching
by 7% males who were mated to
the delayed in the larval stage, of
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containing heavier than normal
pupa mutants was noted upon egg
9% of effect when added to the
in the smaller (normal) load,
proportion detected were quite
heterozygous advantage. However,

NEAR-REPLACED MUTANTS IN

feg (A) DELAY IN EGG HATCHING


heteronymous twin and with respect to time of egg
into the experiments were analysed
one extreme. This showed a
eg hatching. The second method
in egg-hatching time in
the period, it is believed to be
the induced mutants.


*confusum, a holometabolous beetles, was chosen as a convenient system for the study of development
and of aberrations in development produced by irradiation. Dose-response studies have repeatedly dem
strated the onset of induced deformity in wings (adults) at 500 r and a maximum incidence of 80% at
2000 r, with smoothly varying incidences at intermediate doses. Irradiation of pupae at various ages
during the 7-day pupal life has revealed a sharp fall in deformity incidence over an age span of a few hours
for pupae irradiated beyond a sensitive period in development. Experiments are under way to determine
an onset in larval life of this particular radiosensitivity. Other experiments have been designed to locate
the sensitive site within the organism by means of collimated beams of y-rays and by utilizing the Bragg
peak of heavy ion beams. Current experiments have revealed no definite inheritance of the induced
deformities. (From abst.)

1234-a Beck, I.S., Madory, T.R. NEUTRON ACTIVATION ANALYSIS FOR PHOSPHORUS IN A STUDY OF


In order to quantitate differences between normal and irradiation-induced wings at different stages of
development, a method was developed for reproducibly isolating the (< 20 u) membrane wings of
Tribolium confusum. Neutron activation analysis was used to measure P in individual beetle wings during
pupal and early adult stages. By counting neon-induced 32P radioactivity it was possible to measure
0.005 g 0.001 u/g of P. The P content of the wings rises to a maximum at ecdision and subsequently
decreases with loss of cells.

* See previous reports of work in UCRL-10583 and -16683, California, Univ., Berkeley.

1235 Brande, J. van den, Woutersen, N. van de EFFECT OF GAMMA-RADIATION ON THE MEDITERRANEAN
FLYER MOBTE Hystolobus liochilellus: IN DIFFERENT STAGES OF DEVELOPMENT, p. 563-7 in "XI. Internationa
Kongress fr Enomologie, Wien, 17. bis 25. August 1966, Verhandlungen, Band II (Sym-
posten)". Wien, Organisationskomitee des XI. Internationalen Kongresses fr Enomologie, Wien 1966,

A Cr 51 source was used. 20 pairs consisting of a treated male pupa and an untreated female were used per
dose. The influence of y-rays in the pupal stage was tested on male pupae aged 1A, 12, 13, 6, and 3 d.
A 40 000 rad dose results in complete sterility of the male; 20 000 rad produces 50% and 40 000 rad 90%,
sterility, the sterility produced gradually increasing with dosage rate. The younger the pupa at the time
of irradiation, the greater the effect. At 6 d, complete sterility is produced by 50 000 rad and no
dosage occurs after 40 000 rad. At 3 d, no offspring is produced from 10 000 rad onwards. All males
have a decreased appearance and their life span is much reduced. After irradiating fully grown female
pupae with 60 000 rad, the emerging adult females do not accept copulation and no eggs are laid.
Examinations with full grown larvae, 17- to 18-old larvae and 4- to 5-old eggs indicated that dosage rates
< 5000 rad do not seem to have any unfavourable effects; that some slight damage occurs (apparent mostly in the
first generation) above 5000 rad. There is a total limit on irradiation for full grown larvae with 9000 rad
and at all after 39 000 rad.

1236 Brownell, L. L., Yudovich, M. EFFECT OF RADIATION ON MEXICAN FRUIT-FLY EGGS AND
LARVAE IN GRAPESFRUIT, p. 190-201 in "Radioisotopes and Radiation in Entomology. Proceedings of a

A limited study has been made of the effect of y-radiation from Co-55 on the eggs and larvae of the Mexi-
can fruit fly, Anastrepha ludens. Various doses from 5000 to 30 000 rad were given to fruit 1 and 3 d
after inoculation to explore the effects of irradiation on the egg and larval stages. Eggs containing
fully grown larvae and larvae at intermediate stages was also irradiated with similar doses. Frequent
examination and dissection of the flies were used to determine larval mortality, larval damage to fruits,
prevalence of pupae and presence of adult flies. Dissected fruits given irradiation doses of 5000 rad or more
during the egg or larval stage revealed no larval or trace of insect damage. Pupae infected with adult
larvae produced numerous pupal recoveries but no adults emerged from pupal recovered from fruits
receiving 5000 rad or more. It is concluded that a y-radiation dose of 5000 rad (and possibly less, based on
limited data of 2000 rad) will break the life-cycle of the fly although the larval stage may survive approxi-
mately greater dosages. A design for a railway mobile y-detector for treating infected fruits is proposed,
(from auth.).

The susceptibility of all developmental stages was studied. Eggs 5-64 h old were the most susceptible stage, another at the transition larva to pupa (22 d). Total emergence was reduced as the dose increased in all age groups (up to 36 d), and development retarded throughout up to 36 d, the degree of retardation depending on dose. Wing deformities occurred throughout to 36 d, particularly between 10,000 and 12,000 rads. Females were more sensitive at 36 d, increasing resistance resulted in equal or even greater longevity of irradiated females versus controls. Males were more resistant to sterilization than females, at all stages of development (sterilizing doses 28,000 rads and 45,000 rads for female and male pupae, respectively). Percentage mating was reduced by radiation in all groups up to 36 d. The optimum age and dose for sterilization while retaining near normal longevity and mating behaviour were worked out. Sterility in general decreased as age increased but young pupae were more susceptible than old larvae. Pupae on the point of eclosing being least susceptible. The use of the sterile male technique to control moth infestations of flour mills is predicted by economic and ecological considerations.


Subjecting larvae and young pupae to a dose of 20,000 r of γ-radiation interfered with their normal metamorphosis. The onset of the damage occurred (mostly in the form of incomplete sclerotization of the elytra, arrested wing development, reduction of ovarioles, absence of eggs) depended on the age of the pupae at the time of irradiation. Irradiation of pupae of Taradus neobiocata had very similar effects on the adults, resulting in deformed and uneclosion elytra and a retention of pupal characters in the abdomen. Difficulties in interpretation and further research required are discussed.


With increase in dose the viability of the eggs decreased. When the eggs were subjected to a total dose of 100 r given over 6 different exposure periods ranging from 1 to 24 h embryonic mortality was more in shorter exposure periods than in shorter ones. When adults which emerged from 1, 2, and 4 hour exposure periods were mated separately, the females laid more eggs than those laid in control. The viability of the eggs was higher than that in the latter. When the treated females were mated with normal males they laid more eggs than those mated with males from the corresponding treatment and the viability of these eggs was also greater. (J. Agr. 41:1963, 4022)


Newly emerged males and females from two populations (randombred and inbred) derived from Locc's wild type strain were subjected to various dosages of γ-irradiation (0, 500, 1000 or 1500 r) and mated in all possible combinations within populations, resulting in a four x four factorial arrangement of treatments. Three mating pairs were included in each subplot of two replicate experiments, requiring a total of 96 mating pairs per generation in each experiment. Eggs were collected over a 10-4 period following treatment and the percent of offspring to emerge as adults was determined. In addition to these data of generation 1 (offspring of treated flies), similar data were obtained for generations 2 and 3 resulting from full-sib matings of generations 1 and 2, respectively. Somatic and genetic effects were evidenced in generation one, whereas only genetic effects were expressed in subsequent generations. Highly significant linear depressing effects resulting from treatment of both males and females were observed in the data of generation 1, with the magnitude of the effect being greater for males than females. Highly significant effects resulting from treatment of the original males, although smaller in magnitude than in the 1st generation, were again found in the data of generations 2 and 3; however, no effect was evident from treatment of the original females in these later generations.

1243 Dixon, E. E. SOME EFFECTS OF RADIOACTIVE CO-60 AND SINGLE DOSES OF IRRADIATION ON T. 1, 2, 3, and 4 min at 530. 16 min at 559 r/min. uniform of 3-volt cells. Generally is not sterilized eggs seemed to have appeared less susceptible than in


A number of workers have investigated the midlethal dose (MLD) range is 6 ka. x-irradiation of larvae to stages are irradiated, morphologically sensitive as larvae, but the larvae, and the sensitivity of t less than 24 h old. In addition growth and development, X-1 larva, however appear less a included the dose-reponses on minor morphological, and a


Arrested development was induced by treatment with pre-feeding, Arvada was demonstrated. No genetic initial dose for larvae within 3 occurred at 15 hr because at 11 of disease, spathy toward food, were other radiation induced see also 120.


Massive doses of x-rays (20 ka radiation-induced effects were on meiotic processes were irradiated. Inhibition (males)


The x-ray sensitivity of two e ages in the life cycle. The x males found to be the most radiosensitive T. confinis. Radiosensitivity the 26-40 larval stage of 1.

The pupae of B. hominisversus (Cav.) were exposed to a single dose of x-rays varying from 600 to 7800 r. Newer emerged emerged were exposed for 1, 2, 3, and 4 min at 511 r/min. Five-hour old pupae were exposed in minute intervals from 1 to 10 min at 509 r/min. Unferilized eggs were exposed to 500 r, 600 r, and 1000 r by irradiation of 9-12 volt plates. Generally, if multiple irradiation was more harmful to pupae than an equal single dose. Unferilized eggs were more susceptible to radiation than newly laid eggs. Five-hour-old eggs appeared less susceptible to sterilization than newly laid eggs. (Auth.)


A number of workers have examined the acute lethal effects of x-irradiated Tribolium adults; the survival dose (S.D.) range is 6-15 keV. Our laboratory's investigation reveals a S.D. for larvae of 4.5-5 keV. Irradiation of larvae leads to two other lethal effects, a delay in pupation and, when very late larval stages are irradiated, morphological abnormalities in the resulting adults. First day pupae are about as sensitive as larvae, but by the 3rd day, pupae are as resistant as adults. Eggs are more sensitive than larvae, and the sensitivity of the egg is an inverse function of its age; 24 hr causes 100% lethality in eggs less than 24 hr old. In addition, sublethal irradiation of eggs markedly inhibits the subsequent rate of growth and development. X-ray effects on eggs and on pupae are mimicked by ultraviolet radiation; larvae, however, appear less sensitive than adults to the stress of high oxygen pressure. A demonstration included the dose-response curves of the various stages of the life cycle, examples of the induced developmental abnormalities, and a simple apparatus for exposure to high oxygen pressure. (Essentially auth. abst.)


Arrested development was induced by massive doses of x-rays in Ephesia larvae and biological interpretations are professed. Adverse influence upon neurosecretory interactions and/or upon the imaginal discs was demonstrated. No genetically explainable effects were noted between the sexes. The imaginal discs initial dose for larvae within 5 to 5 d of pupation is in excess of 500 keV. For most practical purposes death occurred at 60 keV because of this dose and these higher development ceased. Increased incidence of death, apathy toward food, lethargy, uncoordinated movements when probed, and wing abnormalities were other radiation-induced effects noted. (Auth.)

See also 1960.


Massive doses of x-rays (20 keV or more) to moth larvae caused irreversible developmental arrest. Various radiation-induced effects were observed. Damage to neurosecretory actinomeric discs and/or to the neurosecretory complex was implicated. (Auth.)


The x-ray sensitivities of two ecologically similar species of flour beetles were compared at 8 different ages in the life cycle. The doses required to induce sterility and lethality were determined. The egg was found to be the most radiosensitive stage, and T. confusum was consistently more radiosensitive than T. castaneum. Radioactivity was approximately constant during the larval stages, but it increased for the 15-day larval stage of T. castaneum and dropped back to normal thereafter. (NRA 16:1962, 315285)

Adult males of the confined flour beetle, \textit{T. confusum}, were fertile within 24 h of eclosion whereas females were fertile after the 8th day of adult life. To determine the influence of environmental factors on all stages of oogenesis it was therefore necessary to use adult females at least 9 d old. Developmental differentiation and degree of reproductive tissue differentiation determine not only the onset of fertility but also influence the radiosensitivity of these cells and tissues. Various temporal and sequential sequences proposed by other authors are discussed, together with observations on differential radiosensitivity.


The daily fertility of different age combinations during the first 2 weeks of adult life is shown graphically. Males were fertile within 24 h after eclosion whereas pairs with young females were not fertile before day 2. Fertility values of old x old pairs were approached by old x young and young x young pairs by day 8 and 10, respectively. Old x old pairs were fertile day 1 and their fertility remained high through the experiment. Young x old pairs were fertile on day 1, their fertility decreased on day 2, and then gradually increased to old x old values by day 8.

See also 1264.


See 1946 (same title and auth., abstract)


The effect of the 40 kVp x-rays on lettuce root has been studied, using mean relative growth rate of homogenous groups of roots, or time of first growth depression, and moment of radiation exposure. Larvae of \textit{Musca domestica} were also exposed to irradiation in 3 doses at 300 r/sec. When the percentage of larvae which form cocoons was plotted against dose in the 2nd irradiation (150-3600 r), curves were obtained which were displaced according to the 1st dose (150-900 r). When eclosion was taken as a measure of damage the same analysis gave results of similar curves. Irradiation of cocoons of \textit{Musca domestica} with two doses (150-900 r) following the 150-900 r showed that the percentage of eclosion in relation to the 1st dose in a manner independent of the interval (5-20 h) between the doses. (From abstr.)


\textit{Silkworm (tubifera maxima, Bombyx mori) eggs} 1, 4, and 7 d post-dispase were exposed to various doses of \textit{Co} \textsuperscript{60} y-irradiation in single or fractionated doses. Eggs in early post-dispase were more susceptible to radiation than those in later stages of development.


Follow-up of work outlined in 1254, 1-4 or 7-d-post-dispase \textit{tubifera maxima eggs} were exposed to a series of \gamma-radiation doses of 0.5 kr - 64.2 kr at 300 r/min. Response to 3.5 kr killed 100% of the 1-d post-dispase eggs but only 50 and 8%, respectively, of the 4- and 7-d eggs. Similar results, but smaller differences, were obtained with 1.6 kr. Dosage mortality curves for 1, 4, and 7-d eggs are given. Mortality of 1- or 4-d eggs increased with increasing exposure, but no significant increase in mortality for the 3.5 kr - 3.2 kr range was found, or 2 instars per 1-egg. A total of 1.6 kr was administered in 1 mortality of 1-d eggs.


All developmental stages of dosages ranging from 1000 r to 10000 r exhibited by this species for a little difference in resistance following low dose correlated variability for the adult stage.

Rough, W. S. \textit{EFFECTS OF 568-3.} In 1957 and 1967 eggs of \textit{Ca. desmoneda} (Va.-Gr. Mor. o Va. Gr. strain was tested for the presence of (r) temporary eggs deposited by Va. Gr. if y-rays declined with aging of the radiating eggs 4 d old, but f than 4 d old. Susceptibility begins in the 5th-7th y-ray dose. (Auth.)

Hsu, P., Li, C., Chen, U. \textit{AND REPRODUCTIVE POWER 578-5.} (In Chinese, with 1 translation).

In experiments in China, eggs of wild larvae of \textit{C. desmoneda} higher doses decreased the na to 25%, Ch, the u of 20000 r provident the com treated immature males show greater than the treated just irradiation was more effective on the age adults. (RAS-8 80.


Japana, S. \textit{Sensuutakusai Saiseikai Advantages of Y-rays in Physiological damage from y-irradiation (longer time at the embryonic and the par 25° C at least double the dose and tested. Small radiation may be possible development stages, etc.)

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the 0.8-1.8 kR range was found in 7-d eggs. Total exposure of 0.5 or 1.6 kR, delivered in 1 irradiation period, or 5 irradiation periods with 1.6 kR as total dose, caused mortality of 1-d eggs. A total of 1.6 kR delivered in fractions of 1/2 the dose at 20-min intervals was less damaging than when administered in 1 or 2 periods. Exposure to 3.2 kR in 1, 2, or 4 irradiation periods led to 100% mortality of 1-d eggs.

1256


All developmental stages of the nori worm, _G. oxycephala_ (L.), were subjected to radiation by x-rays at doses ranging from 1000 r to 12,000 r. It was found that resistance to the effects from x-ray radiation exhibited by this species increased as development increased. Relative to adult emergence there was but little difference in resistance by pupae regardless of dose administered. However, adult mortality following exposure correlated closely with dosage administered. The LD50 and the point of complete sterility for the adult stage were found to lie between 7500 r and 10,000 r. (Auth.)

1257


In 1957 and 1966, eggs of _C. pomonella_ (L.) were exposed to γ-radiation to establish a strain designated Va.-Gr. Most of the eggs were 4 d old when irradiated. During each of the next 4 seasons the Va.-Gr strain was raised through 6 generations on unirradiated apples. Principal effects on biological performance were (1) temporary increase in incubation period of the eggs, (2) increase in average number of eggs deposited by Va.-Gr females, and (3) slight increase in longevity of Va.-Gr males. Sensitivity to γ-rays declined with aging of the eggs. Susceptibility to DDT and lead arsenate was not altered by irradiating eggs 4 d old, but in 1952 increase in DDT resistance followed irradiation of Va.-Gr eggs less than 1 d old. Susceptibility to worker discriminations of _G. oxycephala_ and _G. geminatus_ (1) - (4) (1)- (4) (1) - (4) (1) (1) - (4) of unknown identity (auth.)

1258


In experiments in China, exposure to γ-radiation from a Co60 source was found to affect the development of well-fed larvae of _Bombyx mori_ (auth.). The effect of exposure at 3000 r was statistically significant, but higher doses decreased the number of nymphs obtained, and at 50,000 r almost all the larvae failed to give rise to nymphs. When the nymphs were irradiated, a dose of even 1600 r had a definite effect, and 100,000 r prevented the emergence of any adults. Observations on the reproductive ability of adults from treated instars showed that, within limits, the reduction increased with the dose applied, which was greater when the treated individuals had not fed, and decreased with increasing age at time of treatment. Irradiation was more effective when applied to uni-feed larvae and almost ineffective when applied to engorged adults. (PA=67 Iss 1964, 137)

1259


1260


Physiological damage from γ-irradiation is reduced if the insect is maintained at low temperature (post-irradiation); the longer it remains at low temperature the less damage occurs. This is true for irradiation at the embryonic and the pupal stages. To obtain an equivalent effect at 15°C post-irradiation and at 25°C at least double the dose is required with 15°C. Five 0.3-hybrids were treated at 6 different stations and tested. Small relative differences in viability existing among controls were greatly increased on irradiation. It may be possible to predict differences in viability for the whole life-cycle (post-developmental stages, etc.) from the extent to which hatchability is reduced by γ-irradiation.

335

An investigation was made into the susceptibility to γ-radiation of egg, larvae, early and late pupae and adults of C. ferrugineus, to examine the efficiency of 18,000 rads for radiation disinfestation of grain.

Dosages of 9000, 15,000, 12,000, 18,000 and 20,000 rads are required, respectively, for 99.9% reduction in survival. Production of progeny was reduced by 99.9% by 9000, 6500, 7900, 12,000 and 15,000 rads, respectively.

Calculated shows that, under the conditions investigated, 10,000 rads control C. ferrugineus for a period of 9 weeks. Several factors are discussed which suggest that this is likely to be the minimum possible degree of control effected by 10,000 rads. It is likely to be more effective in practice. (Auth.)


The radiation sensitivity of the Drosophila embryo has been studied in relation to age of embryo, dose rate, and dose fractionation. The dose response curves for different ages show differences both in LD50 level, and in the shape of the dose response curve. Exemplification numbers have been estimated by fitting theoretical curves to the experimental points. Dose rate effects have been studied by means of 60 ± 6 min-old eggs. It was found that although the LD50 shows very little change, the estimated extrapolation number dose change with dose rate. In experiments where the x-ray beam was interrupted by means of a rotating slotted steel disc, it was found that the LD50 enhancement ratio was unchanged when compared with continuous irradiation, indicating that the efficiencies of LD50-dependent and LD50-independent mechanisms of radiation damage are not changed when the irradiation is delivered in pulses of 40/sec duration.


The female reproductive system of this insect affords an ideal opportunity to study a large number of germ cells all of which are in the same stage of oogenesis. The female usually will not oviposit until 7 d old. During this time approximately 320 germ cells are undergoing growth and maturation, each in a separate ovariole. Virgin females ranging in age from a few hours to 7 d old were irradiated with 2250 r of x-radiation, then mated to untreated males and egged when they were 8 d old. At this time the females deposited approximately 200 eggs. Failures of the eggs to hatch was attributed to dominant lethal changes induced in the oocytes. Radiosensitivity of the developing oocytes varied considerably. Irradiated females less than 4 d old revealed complete sterility. Mature oocytes were not formed. Observed hatchability for the other age groups was females 15-24 h old, 35%; more than 24 h old, 90%; 2 d old, 86%; 3 d, 196%; 6 d, 90%; 9 d, 100%; 12 d, 100%; 15 d, 100%; 18 d, 95%; 21 d, 95%; 24 d, 95%. Cytological investigations of the ovarioles indicated that the high radiosensitivity during the 1st day corresponds to changes taking place in nurse cell nuclei during the first 24 h of adult ovarian growth. Trombocyte units are completely differentiated after 24 h and this conforms a degree of radiation resistance to the oocyte-trombocyte group. After the 2nd day the oocyte is almost fully mature and nurse cells have disappeared. Increased radiosensitivity of the oocytes on the 4th day, and after, is then due to changes taking place within the oocyte nucleus.


In female Coelothorax hominivora, γ-radiation induced dominant lethal changes in the reproductive cells (which develop synchronously) were measured by egg-hatchability tests and correlated with cytological observations of the stage of nuclear development. (1) In pupae 4-6 d old, newly oogonial cells are present. Irradiation at this age reduced the number of mature oocytes produced as the dose increased, but the lowered hatchability of eggs that were produced indicated that somatic dominant lethals persisted through maturation to be detectable in the embryos. (2) In old pupae and newly emerged adults, differentiation of the oocytes and nurse cells takes place. Irradiation of adults less than 24 h interfered considerably with egg production; the younger the females at irradiation, the fewer normal eggs were produced. (3) Irradiation of females older than 24 h resulted in production of normal numbers of eggs. In these-d-old females the oocyte nucleus is in prophase I, in 4-day-old females metaphase I, and in 5-6-old females anaphase 1. Dosage response studies indicated that the LD50 radiation dose for oocytes in metaphase I is 1300 r, anaphase I, 1899 r, and prophase I, 7090 r. For oocytes irradiated in the first meiotic division, the relation between dose and dominant lethals induced was linear for the range investigated. (Essentially auth.)
1263

In untreated Coelomyia bicornisvoi females (screenroom flies), ovarian growth correlated with the age of the adult female from emergence to sexual maturity was measured. The size of the ovary doubles between the lst and 2nd day of adult life. Increases more than 5-fold between the 2nd and 3rd day, and increases over 60-fold from emergence to sexual maturity. The cytology of the reproductive system from 6-old pupae to sexually mature females is described. The effects of γ-irradiation on gross ovarian growth indicated that newly emerged females are more radiosensitive than 5-old females, and that irradiation of 5-old females has little effect on subsequent ovarian growth. The cytology of the irradiated ovary was studied after similar doses of radiation were delivered to various developmental stages. The most radiosensitive stage encountered was that period during which the egg chambers contain nurse cells undergoing endomitotic replication of chromosomal material. (Auth.)

1268

In a study on the effects of x-irradiation on the embryos of Blaberus, dosages of 50 to 1000 r (from a 250 kV X-ray source) were administered to newly hatched cockroaches containing developing embryos from 3-30 d old. After 30 d, embryos younger than 30 d were killed and fixed in Kahl's solution. The older embryos were allowed to complete their development. Whole mounts and paraffin sections were made of these embryos which, on gross observation, appeared to be affected by x-irradiation. Although the natal coverings and the overlying epidermis limit the scope of some kinds of experimentation, Blaberus shows favorable possibilities for experimental embryology involving the developmental effects of radiation. The embryonic x-irradiation experiments of this study uncovered some pertinent facts. The younger the embryo, the smaller the amount of x-irradiation necessary to produce developmental effects. Dosages < 1000 r may have a sterilizing effect on developing germ cells. Specific abnormalities displayed after irradiation were dwarfish, inhibited growth in certain areas, retained ventral flexure, and a change in the polarity of pleonatal nuclei.

1297

Gravid females of Blaberus crenatus Burmeister, carrying embryos 1-5 d old, were treated with x-rays. The younger the embryo, the lower the dosage required to cause morphological change. Embryos at 5-30 d are affected at > 1000 r; embryos > 30 d do not show any noticeable change until the dosage reaches 2000 r. Gross abnormalities are found; they are varied, ranging from individuals slightly abnormal in growth to embryos representing an amorphous mass. Other abnormal features are described. Embryonic membranes, yolk cells, and the decuss of organ继续 to grow and multiply even in the face of high level radiation sufficient to have arrested embryonic growth.

1268

Gravid females of the cockroach Blaberus crenatus were given x-ray dosages of 50 to 12000 r, after which their included embryos were examined for changes in the growth of cells and tissues. Embryos were found to become resistant to x-irradiation suddenly just prior to the stage of dorsal closure. Embryos that had passed this stage when irradiated continued to develop normally until dosages reached levels of 2000 r. Extra-embryonic structures were found more resistant to irradiation than embryonic tissues. Cells of the serosa and dorsal organ continued to multiply after x-irradiation had stopped the division of cells in the embryo proper. (Auth.)

1299

Bombyx mori were irradiated with single doses of γ-rays. A dose of 1000 r given to pupating larvae or to 3-d-old cocoons altered metamorphosis. The effect of 2000 r applied at the same stage was revealed only in the 2nd generation. A dose of 10000 r given to the diapausing eggs inhibited completely the hatching of larvae, and doses of 2500 and 5000 r delayed the hatching of larvae and reduced their number, respectively, to 50% and 1% of the observed population. The high radiosensitivity of the egg and pupa.
stages in Leptoporus punctus, even though at these stages the metabolic activity is minimal owing to the diapause. (Adv.1963, 880b-c)

1276 Kazov, M. T., Bogomaz, V. A. ВЛИЯНИЕ РАДИОАКТИВНОСТИ НА МАЙСКОГО ЖУКА. Zavod. Rev. 6 (1958) 7-7


Sex-limited lethal mutations were detected in successive hoards following a 4000 r x-ray exposure of wild-type D. melanogaster males 2, 5, and 8 days old. In contrast with the usual procedure in mutation studies, each brood consisted of the progeny resulting from a single mating, and mutation frequencies were determined separately for successive mating periods during a period of several days after the irradiation. Further, some males were mated two or three times immediately before irradiation so as to diminish the score of fully mature sperm available upon exposure. The results of these experiments indicate clearly that: 1) the mutation frequency in the very first sperm used following irradiation is higher than commonly realized; 2) in younger males the mutation frequency decreases from mating to mating during the 1st day, but not so in older males; and 3) premarital strikingly reduces mutation frequencies even in the first mating following irradiation. (Essentially abst.)


Les variations du temps de développement (le temps qui sépare le début de l’incubation et le moment de l’éclosion) en fonction des doses administrées ont été mesurées. Les oeufs étaient irradiés aux doses suivantes 0 (témoin), 500, 1000, 2000, et 3000 r. Le temps de développement croît avec la dose. La mortalité ne diffuse significativement de celle des témoln qu’a partir de 1000 r. La durée de développement se révèle un critère sensible aux faibles doses; par contre, aux fortes doses, la mortalité augmente beaucoup plus vite. Il paraît que le temps de développement d’une part, et le pourcentage de mortalité d’autre part, sont directement proportionnels aux logarithmes des doses, donc proportionnelles entre eux. Si l’irradiation a lieu après 8 j d’incubation, il n’y a aucun accroissement du temps de développement alors que la mortalité est très significativement supérieure à celle des témoins.


See 1267. The difference in radiosensitivity between mature sperm from young and old males was Investigated by irradiating sperm in inseminated females. A lower sensitivity exists among sperm from young males but not as markedly as when irradiated in the male. A comparison was also made of the oxygen effect in brood patterns after irradiation with conventional x-rays and electrons (berenin). See 1265.


Studies on the radiation sensitivity of housefly pupae in different stages of development have been carried out with special reference to the mechanism of emergence. The different dose levels employed were 500, 1000, 2000, 2500, 5000, and 10,000 r. The data obtained on percentage emergence in each group indicated that the early stages of development were most sensitive to radiation, since only one of 2000 r and above applied to 3,800-b-old pupae did not appreciably affect the mechanism of emergence in these groups. Development in the 3,800-b-old irradiated pupae was found to be complete, but the flies failed to emerge. The significance of the findings is discussed. (Abstr)

1279 Oester, L. L., Czark, A. Z. Drosophila Infasciata. Surr. 29 (1
before and after irradiation

Zeuz. Ent., 4


The effects of various doses of γ-radiation on different developmental stages were investigated. Females were found to be more susceptible than males. Doses of 6000 rad females pupae as against 15 000 rad for males were required to induce complete mortality. The influence of post-irradiation temperature on radiodamage was investigated. In larvae, the influence was considerable, the LD50 (95) at 30°C, 34°C and 38°C corresponding to 80 000, 5 600 and 310 rad respectively. The stage at which radiation damage manifests itself is largely dependent on the ambient temperature. In irradiated larvae maintained at 30°C, pupation was arrested above 15 000 rad; at 34°C and 38°C doses of 10 000 rad and 20 000 rad respectively were required. A reduction of ambient temperature is known to prolong the larval stage, which is reflected by the fact that at low temperature mortality occurred at the larval stage itself, as against the pupal stage at higher temperatures.


Fomosan termites were exposed to Coβ γ-source with a dosimetry of 1000 r/h. The following sets were made: irradiated female with irradiated male (female × male 0), non-irradiated female with irradiated male (female X male 0) and irradiated female with non-irradiated male (female × male 0), and exposures were made, giving dosages of approximately 5000, 8000, 10000 and 12 000 r. The results are summarized as follows: the longevity of the termite was reduced in proportion to the increase of the radiation dosage from 1000 to 12 000 r, but the reduction was not measurable in the female × male 0 and the female X male 0 exposed to 1000 r. In proportion to the radiation dosage from 3000 r to 12 000 r, the number of the eggs deposited as well as the total egg deposits were reduced. The emergence of the soldier caste in the female × male 0 decreased, with the increase of the radiation dosage same as the above column. In the emergence of soldiers, there were no prominent differences among the radiation dosages, but the number of soldiers were smaller than that of control. The degree of the biological influence of the termites exposed to Coβ from 3000 r to 12 000 r is in the following order: female × male 0 < female × male 0 < female × male 0 < female × male 0. (Auth.)

Ofhaid, F. RADIOSENSITIVITY OF Drosophila SPERMATOGENIA. (Abstr.) Heredity 46, 8 (1965) 840.

Brief note describing investigation aimed at establishing the dose-effect relationship for Drosophila spermatozoa in the range of 0-156 r. Embryos about 13 h old were irradiated with 56 r, 112 r, and 156 r. The results indicate that the initial slope of the dose-effect curve may be quite close to that obtained by Spencer and Stern after irradiation of mature sperm. With increasing dose, the curve flattens out. (From abstr.)


Irradiation exposure of larvae and pupae of Drosophila melanogaster causes the death of part of the cells of the imaginal disks, the destruction of some of the organ systems of the insect. X-ray irradiation is the result of the incomplete repair of this injury. The frequency of the repair depends upon the time of repair. The data obtained permit one to give a new interpretation of the concept of the sensitive period to the action of ionizing radiation. The stage for which the repair process caused by the inflicted injury coincides with the sensitive period for a given localization, for a given external influence. The destruction of part of the undifferentiated cells and the deviation caused by it in the further course of ontogenesis are obviously a general characterization of the effect of ionizing radiation on the developing organism. One should have this picture in mind when working on a theory of the biological action of ionizing radiation. (Auth.)


Maca domestica and Plana spp. are considered.


In further tests on the effect of x-rays on eggs of Anges (Philastra kochiella Zell.) eggs 4, 6 and 2 d old were used. Doses of 3000 and 14,000 rad caused significant reductions in the hatching of eggs 4 and 6 d old, respectively; doses of 1000 and 2500 rad stimulated the hatching of eggs 2 d old, and doses of 4000 rad reduced it. A dose of 20,000 rad reduced the hatching of eggs 4 d old to 34% and 0%, respectively, and one of 6000 rad prevented all 2-d-old eggs from hatching. Doses of 1000-2500 rad increased adult emergence from surviving 5-d-old eggs. Doses greater than 2500 rad reduced the number of d-old eggs, and one of 2000 rad reduced that from 2-d-old eggs. Sterility was increased in the eggs laid by the females, the threshold doses for eggs 6 and 4 d old being 2500 and 2000 rad; adults from eggs treated when 2 d old with 3000 rad or more laid fewer or no eggs. (RAE-A 51:1955, 50-2).


See 1994


Exposure of the mature pupa of the newly emerged adult of the cooling moth, *Cyphoridae pomerella* (L.), to 40,000 rads of γ-radiation induced dominan lethality in at least 35% of the sperm without affecting adult emergence, mating behaviour, or adult longevity. Higher doses decreased the frequency of mating. Irradiation of eggs, mature larvae, or young pupae induced dominan lethality in a high percentage of the sperm, but caused prohibitively high mortality and frequency reduced mating. The female was more radiosensitive than the male. In general, sensitivity decreased as development progressed from the egg to the adult stage (Auth.)

See 1263


Insects were reared on moong (Pisum munro L.) seeds at a temperature of 29 ± 1°C and a humidity of 70-75%. Under these conditions the insects life cycle was 16-22 d. Eggs were irradiated at dose-rates of 30 kr/h at 0.5 cm, and larvae, pupae and adults at 20 kr/h, 1 cm from a 2-cell 16kr source. A dose of 15 kr gave 100% mortality in eggs. A sensitive stage may exist for a short period during the 1st 2-4 h of egg development. In 4-d-old larvae 100% mortality was obtained with 0.00 rad. The pupae seem to be less radiosensitive than eggs or larvae, and 47,000 rad were required for 100% mortality. Although mating took place after irradiation, the eggs produced when either parent had been irradiated with 40,000 rad did not hatch. Such eggs continued to 57,000 rad (the highest dose to


X-rayed Monomictra have been measured as the number of off forms in total offspring may pass. Unexposed or to pupate (observed from the time of lay technique) that reduced by treated females are on eggs to various stages of ovum during the early embryonic de incubaion to begin or complete only through various cleavage stages of metamorphosis occur lethal genes rather than a 4.

1268 Сапунова, И. П. *О БИОГЕННОМ ИЗМЕНЕНИИ Lepidoptera (Lepidoptera: Lepidoptera)*. Tumur, 1992. P. 8-13


1289 HISTOLOGISCHE UNTERSUCHUNGEN biologisich investigate logical investigation on the "(1 & 1982) 310.

A histological study was made x-radiation from 250 to 300: 5th metamorphosis, and the dev eases of 1000 - 75% of the eg developm stage, compared and analyse the development of the

Beta-radiation was supplied by $^{228}Ra$ in the form of $H_2O$ $^{228}R_{a}$. Intensity of 565, 1111, 2222, and 3333 rnyph/ for 24 h were used. A dosage of 1111 rnyph/ h applied to eggs, lar- and pupae and full-grown caterpillars, and freely-formed pupae proved to be the most beneficial and stimulating with regard to the development of progress up to completion of the third instar. The results of such treatment of pre-imaginal stages for main reading is presented out. The effects of $\beta$-radiation depend on radiation intensity and the developmental stage irradiated. Thus, whereas 3333 rnyph/h is to some extent detrimental to full-grown caterpillars and freely-formed pupae, it does not produce adverse effects on eggs and lar- and pupae.


X-rayed Monommorium have shown, with few exceptions, a marked reduction in fecundity. This has been measured as the number of offspring per female, and appears greater as radiation dosage increases. Differences in total offspring may result from many variables in fecundity, such as sterility, permanent damage, or inability to pupate or emerge. Using the "Dark Chambers" technique, eggs were counted and observed from the time of laying until the completion of metamorphosis. Results obtained by use of this technique indicate that reduced egg production shows little, if any, relationship to radiation dosage. Eggs laid by treated females are equal or, in a few cases, greater in number than those of controls. Raising the eggs in various stages of melioric development many lethals which exert their effect primarily during the early embryonic development. Eggs complete their development and are laid but show little inclination to begin or complete cleavage activities. Over 90% show no activity. Another 9% progress only through various cleavage stages, and in the remainder, a cessation of metabolic activity during later stages of metamorphosis occurs. Reduced fecundity appears to be due primarily to the effects of induced lethal genes rather than to a reduction in the number of eggs laid.


A preliminary survey was made on the effect of $\gamma$-irradiation on the caterpillar moth, Laphygma exigua. Irradiation of larvae in the 3rd instar with 10,000 and 80,000 r Co$^{60}$ caused 40% mortality in the 1st 74. Higher dosages (180,000 - 260,000) killed 100% of the larvae. No unfavorable effect was found when larvae fed on irradiated cotton leaves (10,000 and 50,000), but there was a reduction in the respiratory rate of these larvae. Irradiated phloemogonic preparations (10,000 and 50,000 r) in a 0.5% concentration reduced their toxic unchanged properties. (BA 25 1964, 21086)


A histological study was made of the premature death of Drosophila eggs. 1, 5 h old, exposed to doses of x-irradiation from 50 to 3000 r. At various times after the irradiation the embryos were fixed by the Hugner method, and the development stage was microscopically determined. The results show that after a dose of 3000 r 75% of the eggs have the histological stage of 1, 5 h controls. The distribution of the development stages, compared to the development of controls, is tabulated. None of the irradiated eggs attain the development of the controls. (NSA 15 1962, 20004)
were examined for any histological changes that were observed. Judging by the purely physical, nuclear vacuolation; these embryonic growth phases, no changes were observed in the developing eggs. Male testes showed an external sex-distinction of the trilocular type, which is characteristic of Calliphora is discussed.


In earlier experiments, Ulrich (1954) found a dose-effect curve of the form y = 1 - exp(-αx) for the embryonic mortality of 125.6-nm-old Drosophila eggs after a 3-min exposure to X-rays. Improvements in the egg-collecting procedure allowed us to record the hatching period to 3 min and to reduce the age variability of the egg samples to +1.5 min. With this shorter collecting time one obtains an ample number of eggs homogeneously in division stage as shown by cytochemical studies. Thus, it became possible to get four dose-effect curves (exposure x sec) with egg age variation of 13-18, 18-19, 19-20, 20-21 min. (φ) The four curves are very different in shape as well as in slope, but the summation of all four leads to a straight line. The steepness of the summation curve is (within the experimental limits) the same as was found in a control experiment irradiating 20-22-nm-old eggs. Consequently, it was possible to show that in this particular case the linear dose-effect curve cannot be interpreted as a “one-hit curve”.


Egg samples of different mean ages (15.6±1.5 min. 11.8±1.5 min., etc.) were subjected to a fixed dose (exposure x sec) and the rate of embryonic mortality scored. The rate of hatching was very age the age of the eggs at the moment of irradiation. It seems that this fluctuation of mortality-rate is the expression of different radiosensitivities of different developmental stages. In late experiments with 126.6 nm (exposure x sec) old eggs Ulrich found a linear dose-effect curve. The same curve shape was found in a similar experiment irradiating 156.6 min. (exposure x sec) old eggs. With the technique of the 3-min samples it became possible to subdivide the latter arrangement and to get 4 dose-action curves with an egg age variation of 11.8±1.5, 14.8±1.5, 17.8±1.5, and 20.8±1.5 min., a summation of which would be expected to lead to the same curve found for the 126.6 min. samples. The 4 curves are very different in shape as well as in slope and the mean curve is a straight line with a slope which is ~ within experimental limits - the same as found for the 126.6 min. curves. Consequently, it was possible to show that in this particular case the linear dose-effect curve cannot be interpreted as a “one-hit curve”. (From abstr.)


Experiments were conducted to determine if, after irradiation of young spermatogonia, other mutations behave in a manner similar to the induced crossing-over work of Skjærvén. A chromosome free from lethal was isolated and X-rays doses of 900 r used. Spermatogonia were irradiated in larvae, and after culture the males were mated in two periods for lethal test. Spermatogonia in adult males were also irradiated for comparison. The rate of chromosomes with lethals is ~ 3 times higher for spermatogonia than for spermatogonia after irradiation. A higher rate of independently induced lethals and a lower rate of classes were found in the mating period 0 to 3 days after the period 15 to 18 days after irradiation, while there is no significant difference in the rates of chromosomes with lethals: the result agrees well with those of Skjærvén. Possible explanations of the results are discussed. (NSA 18-95, 2019)

See also:

748 Mutagenic effect of X-rays on maize. (Kurohaka, 1989)
768 A comparison of the susceptibility of the grass weevil (Sitophilus granarius L.) to accelerated electrons and 60Co gamma radiation. (Poll et al., 1961)
772 The susceptibility of the mule x-ray flour beetle, Tribolium castaneum (Herbst.) to gamma radiation. (Cruick, 1980)
773 The use of fast-neutron irradiation in the preservation of cereal products. (Dal Monte, 1989)
778 The effect of ionizing radiation on the physiology and ecology of Drosophila melanogaster, the principal vector of Schistosomiasis (L. Trypanosoma) in Venezuela. (Hoffnung, 1981)
790 Influence of the irradiation on the sensitivity of adults of Sitophilus granarius to male and female. (Lovati et al., 1990)
791 Action des rayons y du cobalt-60 sur la mortalité et la fécondité des adultes d’un champignon du riz. (Lavolette and Baudouin, 1983)
X-radiation of the developing male germ cells of *Drosophila melanogaster*. (McDonald, 1961)

Genetic sensitivity and differential killing in irradiated *Drosophila melanogaster*. (Olmsted, 1963)

Trisomies resulting in dominant lethality in *Drosophila melanogaster*. (Olmsted, 1963)

Stabilization of the coding moth by gamma-radiation. (Provenza, 1962)

Natural defects in the stability of *Drosophila melanogaster*. (Provenza and Van Hook, 1962)

The effect of gamma radiation on the reproductive potential of the Mexican fruit fly. (Riddle et al., 1961)

Stabilization of *Drosophila melanogaster* by gamma radiation. (Thynne, 1962)

X-ray induced "dominant lethals" in irradiated eggs of *Drosophila*. (a) Experiments in the stage between completion of mitosis and beginning of cleavage. (Frielich, 1963)

Similarity of x-ray-induced mutation rate in gynas of *Drosophila* females and males. (Mayer and Muller, 1961)

A study of sex predetermination in the mealie bug *Platynocerus ciliatus*. (Nabors-Rees, 1960)

The call lineage of the stereocilia in *Drosophila melanogaster*. (Stem, 1963)

Radiation and mutation rate. (Stem, 1963)

The mutation rate at specific autosomal loci in different species of *Drosophila*. (Yelin, Piaud, et al., 1963)

The effect of x-radiation on somatic crossing-over in *Drosophila melanogaster*. (Abraham and Burdick, 1963)

The genetic basis of somatic damage produced by radiation in third instar larvae of *Drosophila melanogaster*. (Curtis, 1961)

Effects of X-rays on salivary-gland chromosomes during early stages of development. (Sengel, 1963)

The effect of maternal age and radiation on the rate of non-disjunction in *Drosophila melanogaster*. (Ohida, 1962)

Increased recombination from female *Drosophila* irradiated as larvae without oocytes. (Whittinghill and Baskin, 1961)

Unchanged recovery of crossover after x-irradiation of papal *Drosophila*. (Whittinghill and Allen, 1961)

Effects of X-ray irradiation in *Drosophila virilis* at different stages of spermatogenesis. (Clayton, 1961)

Methods for estimating differential radiosensitivity. (Oster and Foxley, 1963)

A cytogenetic study of the effects of X-irradiation on *Drosophila virilis*. (Hari, 1963)

Cell stages and differential sensitivity to irradiation in *Drosophila melanogaster*. (Schirman, 1963)

Variation of radiosensitivity during mitosis and early cleavage in newly laid eggs of *Drosophila melanogaster*. (Wingate et al., 1963)

Modification effects with magnetic fields, (Ames, 1963)

The effects of nitrite oxide on radiation damage in *Drosophila virilis* and *Drosophila melanogaster*. (Cappo, 1961)

Some effects of oxygen on the insect *Anagasta kuehniella* and *Tenebrio molitor*. (Clark and Coe, 1963)

Ultrafractionation and biological efficiency of fast electrons. Investigations on "eggs" of *Drosophila melanogaster* of different stages of development. (Krilov and Oberreiner, 1965)

The action of 14-Mev electrons, 14-Mev and 200-Kev X-rays and the influence of the energy spectrum of 14-Mev electrons on eggs of *Drosophila*. (Murias and Sturcky, 1965)

The effect of the energy spectrum from 14 Mev electrons, on eggs of *Drosophila*. (Murias and Sturcky, 1965)

The radiation effect of 14-Mev electrons, on 14 mev and 200 kev X-rays on *Drosophila* eggs. (Murias and Sturcky, 1965)

Thermal effects on irradiated *Drosophila melanogaster* for heavy X-rays from 14-Mev electrons divided into 10 equal segments. (Mayer et al., 1965)

The influence of radiation in altering the incidence of mutations in *Drosophila*. (Muller, 1965)

Ultrafractionation and relative biological effectiveness of fast electrons. Experiments on *Drosophila* embryos at different stages of development. (Oberreiner and Krilov, 1965)

Effect of a low temperature on the development of radiation injury in eggs of the silkworm *Bombyx mori*. (Paulov, 1961)

The relative biological effect of P*β* radiation, 1. Comparison of P*β* radiation and X-rays as to their biological effects in *Drosophila melanogaster*. (Radley, 1961)
1122 The effect of oxygen concentration on the frequency of induced XO males and non-disjunction females after irradiation of Drosophila males. (Wasserman, 1862)
1143 Two types of dose-rate dependence on radiation-induced mutation rates in spermatozoa and oogonia of the silkworm. (Tsuzuki, 1962)
1147 Further studies on dose-rate dependence of radiation-induced mutation rates in spermatozoa and oogonia of the silkworm. (Tsuzuki and Kondo, 1963)
1151 A study of dose-dependence of radiation-induced mutation rates in Drosophila melanogaster, allowing for the degree of maturity of the germ cells. (Trav, 1962)
1154 The relationship between dosage and mutation rate in x-irradiation of Drosophila sperm. (Urich, 1960)
1155 Oxygen effect in newly laid Drosophila eggs. (Urich and Wight, 1962)
1156 Partial irradiation of Drosophila eggs by X-rays. (Urich, 1963)
1158 Genotype X environment interaction with isogenic lines of Drosophila melanogaster. (Kidd, 1963)
1159 Effects of x-irradiation upon cell population and morphogenesis in the developing beetle wing. (Buck and Hayes, 1962)
1160 Effects of x-irradiation upon cell population and morphogenesis in the developing beetle wing. (Buck and Hayes, 1962)
1161 Cell differentiation and radiobiology in the wing of Tribolium confusum. (Buck, 1962)
1162 Effects of x-irradiation upon cell population and morphogenesis in the wing of Tribolium confusum. (Buck, 1962)
1163 Effect of x-irradiation on cell differentiation and morphogenesis in a developing beetle wing. (Buck, 1963)
1164 Temperature dependence of wing abnormality in Tribolium confusum. (Maler et al., 1963)
1165 Reproduction of the influence of the ray on the development of Drosophila melanogaster. (Colby and Carr, 1963)
1166 Effects of x-rays on mealworm embryos. (Fiddley, 1963)
1167 The effects of x-irradiation on the free A-amino nitrogen fraction of the meal worm. (Takahashi, 1963)
1168 Some effects of x-irradiation on longevity in Heterodera females. (Clark, 1962)
1169 The modification by x-irradiation of the life span of hoppers and nymphs of the wasp, Habrobracon sp. (Clark and Rubin, 1963)
1170 Life span differences between hoppers and nymphs of Habrobracon sericatus after exposure as adults to x-rays. (Clark, 1963)
1171 The effect of gamma radiation on the viability and fertility of Locusta migratoria. (Dipt., X-ray) irradiated as pupae. (Guedaly, 1960)
1173 The effect of x-irradiation on longevity, emergence, and DDT-susceptibility of the house fly. (Vardaro and Moos, 1963)
1174 Response of Tribolium larvae to x-irradiation. (Dawson and Wallberg, 1960)
1175 Effects of x-rays on Culex quinquefasciatus eggs. (Dawson and Wallberg, 1961)
1176 Lethal effects of x-rays on the housefly, Musca domestica. (Grazi et al., 1963)
1177 Preliminary studies on irradiation of some common stored-grain insects in Pakistan. (Nage, 1963)
1178 A study of the genetic basis of x-irradiated specimens by radiation in third instar larvae of Drosophila melanogaster. (Wasserman, 1963)
1179 Some effects of x-irradiation on the viability of the German cockroach, Blattella germanica. (Saps and Cooren, 1963)
1180 Effects of gamma radiation on three species of Philippine insect pests. (Vicente and Marcon, 1963)
1181 Biological effectiveness of 30-MeV electrons in dependence on tissue depth and in comparison with 180-kv and 31-MeV photons. (1) Lethality test on one-hour Drosophila embryos. (Frei-Niggli and Schick, 1962)
1182 Biological effectiveness of 30-MeV electrons depending on tissue depth and in comparison with 180-kv and 31-MeV photons. (2) Lethality test on four-hour-old Drosophila embryos. (Frei-Niggli and Schick, 1962)
1183 Determination of the KRE of 14-MeV neutrons using 14-day-old grasshopper embryos. (Chlorophyll a and beta in Drosophila melanogaster). (Nage, 1963)
The effects of continuous and fractionated doses of gamma-radiation on the survival and fertility of Spirographis gramineus (Caladenia graminea L.), (Jefferson, 1969)

The effects of continuous and fractionated doses of gamma-radiation on the survival and fertility of Spirographis gramineus (Caladenia graminea L.), (Jefferson, 1969)

Radiosensitivity of the Drosohila embryo. (Jobbansen et al., 1966)

Modification of radiation response during embryonic development by the use of elevated temperatures. (Stager et al., 1966)

Oxygen dependence of the lethal and mutation rates induced by x-irradiation of Drosohila spyrata. (Wriggles, 1966)

Modification of x-ray induced embryonic mortality by different sex ratios before and during irradiation of uncloned Drosohila melanogaster eggs. (Wriggles, 1961)

Resistance of Spirographis gramineus and Spirographis crous at different stages of their development to y-irradiation from cobalt-60. (Aulic and Borla, 1960)

X-ray effects on single and mixed species populations of Tribolium confusum and Tribolium castaneum (Coleoptera: Tenebrionidae). (Edman, 1962)

The importance of competitiveness of radiated males in mosquito-control programs. (Davis and Schmidt, 1962)

The effects of gamma radiation on the biology and behavior of forest insects and the possibility of their control by means of irradiation techniques. (Hark, 1961)

Developmental homeostasis in x-rayed populations of Drosohila pseudo-obscura. (Tansey, 1963)

Effects of radiation on ecological systems. (Edman, 1963)

Ecological effects of ionizing radiation on organisms, communities and ecosystems. (Faint, 1963)

Stabilization of the Mediterranean fruit fly and its application to fly eradication. (Paty and Valeto, 1963)

The application of nuclear energy to agriculture. (McB., 1965)

Could this be death to the coding myth? (Preveaux and Newton, 1961)

Effect of gamma rays on insects. Progress on the use of induced sexual sterility for the control of the coding moth, Carpocapsa pomonella (L.). (Bandeau, 1961)

Control of the coding moth, Carpocapsa pomonella (L.) by the release of sexually sterile males. (Preveaux, 1963)

Radiation. A mortification weapon against the corn borer, (Spiloechis, 1963)

Disruption of drosophila by gamma radiation. (Papadopoulus, 1965)

Effect of gamma radiation on some wood-boring insects. (Blum, 1961)

Irradiation of fruits and vegetables in a mobile cobalt-60 unit. (Harvey, 1962)

Some experimental data on cobalt-60 radiation doses capable of arresting insect infestations of grains and flour. (Preveaux, 1963)

Utilization des radiations (X et γ) pour la prevention des dommages causés aux insectes nuisibles. Recherches relatives à la determination des doses utiles pour lutter contre les insectes nuisibles. (Preveaux, 1963)

Study on the development of parasites Coleoptera: Tenebrionidae, Hila. by means of x-ray photography. (Edman, 1963)

I. R. 2 MALFORMATIONS


Virgul D. melanogaster females were dissected immediately prior to exposure to 4000 r units of gamma-radiation from a Co-60 source. The effects of this treatment were observed on egg hatchability. The results confirm the findings of Horkowski that this radiation enhances the irradiation-induced reduction in egg hatchability. In addition, observations were made on late stage embryos (16 or more hours of development) in order to determine whether or not the radiation effects could have been due to effects on fertilization. The embryos were classified as either (1) normal, (2) greatly abnormal, or (3) showing no development. Preliminary results indicate that there is no difference in the developmental picture between embryos from irradiated flies whether they were dissected or not, Further observations are being made to substantiate these results and to determine whether or not more subtle embryonic abnormalities might be contributing to the radiation effects on irradiation-induced "dominant lethals."


The membranous wings of the confused flour beetle, Tribolium confusum, are subject to an apparently specific gross deformity induced by x-irradiation of 1000 to 2000 r during the first 27 h of the 6-d pupal stage. The incidence of wing deformity as a function of dose was determined, the survival curve showing a shoulder to about 1000 r (semi-log plot) and a D₅₀ of 318 r (where D is the number of deformed pupae, following exposure). The radiation damage was manifest microscopically and chemically as a morphological transformation of some of the hypotermal cells in the wing; discoloration of the spinny area in regional melanization, absence, and transience of stipites; delays in some developmental events; and disruption of the normal loss of cellular material from the wing. The amount of phosphorus in control and experimental wings was determined by measuring the P²⁺ radioactivity in fixed neutrons activated, and gave 0.05 µg and 0.06 µg of P/wing respectively at 1 d after ecdysis, i.e., phosphorous-retention by the irradiation-damaged wing.

See also:

298 Neutron activation analysis for phosphorus in a study of development in a beetle wing. (Beck and Manney, 1962)
476 The genetic and developmental effects of ingested radioisotopes in Tribolium confusum. (Graham, 1960)
793 Preliminary experiments on the sterilization of the pupae of the Tribus beetle by irradiation with gamma rays, (Kendall, 1967)
854 Quelques résultats supplémentaires concernant l’influence des noyaux gamma sur les chenilles et les oeufs de la ténine “Ectobius lucaniella”. (Feller, 1963)
904 The action of radiation and other mutagenic agents in inducing mutation in Drosophila females, and (2) in controlling the action of specific genes responsible for suppressing uncontrolled growth. (Glim, 1961)
957 The preliminary investigation of salivary gland chromosomes of Chroebumen testaceum Fehr, from the Clinch River, (Nelson and Blaylock, 1963)
1047 Influence of pentachlor on frequency of induced mutation. (Andalde, 1961)
1158 A study of the successive effect of roentgen rays and temperature upon the frequency of mutations and roostypeanmorphoses. (Vatt, 1963)
1234 Effects of radiation upon development of Tribolium confusum. (Beck, 1961)
1257 Control of the Mediterranean flour moth Anagauma miliaris Zell by sexless male release. II. Sensitivity to gamma radiation. (Ball and Wood, 1963)
1283 Some effects of gamma radiation on the biology and morphology of the Tribus beetle, Trichosoma granarium Everts. (Carney, 1962)
1284 Arrested development in X-rayed larvae of Ectobius lucaniella Zeller (Lepidoptera: Pyralidae). (Beckman, 1961)
1285 A study of the embryology of the cockroach, Blaberus craniifer Burmeister. (Lamar, 1963)
1287 The effects of X-irradiation on the embryos of liverfluke animals. (Lamar, 1965)
1288 Some effects of X-irradiation on embryos of the cockroach Blaberus craniifer. (Lamar, 1963)
1321 Studies on the after-effects of X-rays on the larval development and the cocoon during the embryonic stages. (Takebe et al., 1963)
1323-a The genetic basis of somatic damage produced by radiation in chord larva of Drosophila melanogaster. I. Death before maturity. (Ooster, 1962)
1331 Effects of gamma radiation on three species of Philippine insect pests. (Viado and Manoro, 1964)
1397 Synergistic action of X-irradiation and elevated temperatures on development. (Ames and Slater, 1962)
1398 Analysis of the combined influence of X-irradiation and elevated temperatures on development. (Ames et al., 1962)
1397 Comparative influence of accelerated heavy nuclei on abnormal development in Tribolium. (Slater et al., 1963)
1398 Modification of radiation response during embryonic development by the use of elevated temperatures. (Slater et al., 1963)
1473 Irradiation, A sterilization weapon against the corn borer. (Springgal, 1963)
I-B-3 TISSUE, ORGAN
I-G-3-2 RETINA

1204 Baldwin, W. E., Sutherland, J. B., Habowski, J. E. I., EFFECTS OF X-RAYS ON ELECTRICAL ACTIVITY IN THE EYE OF THE COCKROACH Blaberus gigas J., Nature, Lond., 109 (1934) 815. Preliminary studies are discussed on the effects of X-rays on both the electroretinograms and the spontaneous electrical discharges in the eye of the cockroach, B. gigas. Details of the manipulative and irradiative techniques are given, when 2000 r/min were administered. Large doses of irradiation were observed to have a marked effect in reducing the amplitude and frequency of the electrical activity recorded from the cockroach eye. B. gigas reacted to changes in light intensity in the typical "on-off" response of certain insects. An effect on the "on" response was observed. Recovery occurred in both cases, but at different rates.


The reactions of the nervous system were studied by examining the effect of various kinds of ionizing radiation on the retina, considered as a special, peripheral part of the central nervous system. The methods used included electrophysiology and the recording of electrical potentials of the retina by means of contact-lens electrodes, microelectrode techniques, pharmacological determination of the hydroxylide groups in the retina, and the determination of the absorption spectrum of the visual purple rhodopsin together with histochemical analysis. Moti were used for the study, exposing the test insects to radiations of 1.5, 10, and 15 keV and using butterflies from irradiated cocoon as controls. Results agree well with the previously obtained high radiation sensitivity of the retina, and indicate the importance of protecting it against exposure to ionizing radiation.


Moti of the family Noculidae were used to determine the bioelectric responses of the compound eye to ionizing radiation. It was found that alpha radiation can induce a bioelectric reaction in the compound eye of the insect. The electroretinogram pattern is indistinguishable from that produced in response to a light stimulus. The flicker-response frequency threshold is also similar for the two stimulants. However, a difference exists between light and alpha radiation in the time course of the dark adaptation process. It could be demonstrated that the disparity is dependent upon the interaction of visual pigment with the light stimulus. An electroretinogram response was elicited by a photon less than one millirem at the radiation dose rate of 20 mrem/sec. (Auth.)

I-B-3-3 REPRODUCTIVE TISSUE


Significant developmental stages throughout the life cycle of the holometabolous and orthopteran insect, H. juglandis (Ashmead) were x-rayed with 300 r increments until mortality was illustrated by adult performance. Because of paucity and incomplete male production, attention was focused on females. Cytological examination of ovarioles from adults x-rayed at the different stages gave rise to three conclusions concerning the radiopathology of the reproductive system: (1) regardless of dose, somatic tissues functioned normally to produce 1 ovocyte sheath; (2) radiation of larvae adversely affected the ovarioles rather than the oocyte itself, apparently the damage is chromosomal; (3) radiation of pupae interfered with egg-sac synchrony differentiation from oogonia. (Auth.)
I-B-3-c HEART, MALPIGHIAN TUBULES, HINDGUT.


Various tissues were excised, irradiated and their survival and the continuation of normal movement tested. Heart fragments from 40- to 60-day-old embryos were obtained from gravid females of the cockroach Blattella germanica. A series of 24 hearts were given from 1000 to 12,000 r x-rays. All except 6, which succumbed to bacillary infection, continued to live and control for 150 days after treatment. Whole embryos and adults have a lethal point of about 7000 r. Another series of 21 hearts, 11 clusters of Malpighian tubules, and 11 portions of hindgut were treated with Co-60 doses up to 60,000 rads. The tubules continued to pulsate for 15 days, hearts to beat for 20 days, and hindguts to carry on gross movements for 60 days after maximal treatments. This extreme resistance to x-radiation may be due to the very low O2 requirements of these tissues.

I-B-3-d ABDOMEN (SEGMENTS)


By shielding abdominal segments III through V queen honey bees survived otherwise lethal doses of x-radiation. In contrast, irradiating only segments III through V with 10,000 r killed all queens within 3 weeks, as did whole-body irradiations. Lead shields that protect segments III through V and permit irradiating either the spermatheca in the spermatheca or the oviducts of the ovary with higher doses than could otherwise be administered are described. (Abb.)

See also:


879 Radiation induced viability mutations in the honey bee. (Lee, 1962)

890 Radiation induced viability mutations in the honey bee. (Lee, 1962, 1963)

922 Radioresistance of the male cycle of Aedes aegypti. (Oal, 1962)

925 Microscopical studies of radiation sensitivity of spermatozoa cells of the silkworm (Preliminary note). (Sado, 1963)

1169 The effects of gamma radiation and a photon on the reproductive tissue of Drosophila melanogaster Meig. (Cantrill and Hennemann, 1960)

1172 Some effects of gamma radiation and a photon on the reproductive tissue of Drosophila melanogaster, (Hedernberry and Cantrill, 1960)

1184 Histochemical and ultramicroscopic modifications in the mesonephros of Dacus oleae Gmel. Induced by ionizing radiations. (Baccetti et al., 1961)

1185 The effects of gamma radiation on the ovaries of Dacus oleae Gmel. (Baccetti and De Dominici, 1960)

1207 Cytological interpretations of five types of induced modification in the ovarioles of the wasp Habrobracon. (Greech, 1963)

1311 Genetic studies of Drosophila strain differences in sensitivity of the testis to the mutagenic action of x-rays. (Ward et al., 1961)

2346 Beginning of reproduction determined by age of the female flour beetles, Tribolium confusum (Coleoptera: Tenebrionidae). (Robson, 1960)

2348 Beginning of reproduction determined by age of the female flour beetles, Tribolium confusum (Coleoptera: Tenebrionidae). (Robson, 1960)

2386 Cogenital and radiosensitivity in Cochliomyia hominivorans (Diptera: Calliphoridae). (LaChance and Burns, 1963)

2390 Investigations on the spermatogenesis and embryonic development following irradiation of Calliphora erythrocephala Meig. (Diptera: Calliphoridae). (Mook, 1960)

1341 Nitrogen nutrition of mammalian chromosomes treated with x-rays. (Grosh and Clark, 1960)

359

Selected lines from a highly heterogeneous population of *Drosophila melanogaster* had a high average body weight, up to a certain point beyond which continued selection had no further effect. Fitness was severely affected in the large lines and effects of irradiation on fitness were studied. Strenuous responses (original foundation strain and large strains) of body weight to high selection and random selection along with response to 0, 100, and 1000 r of radiation were tested. In both, high selection was still the most efficient way of changing body weight. Irradiation lowered the reproductive potential (progeny number per mating); in combination with high selection irradiation had a detrimental effect on the response. Even though irradiation has been used successfully to produce response to selection in other organisms, the lowered reproductive potential of *T. castaneum* restricts the usefulness of this tool to bring about a response to high selection for increased fitness. The mutation rates of genes controlling the quantitative trait of body weight were estimated to be between 1.7 x 10^{-3} and 9 x 10^{-4} mutations/locus, the number of loci controlling this trait to be about 600, and the average effect of each locus to be about 1/80 of the standard deviation of body weight.


To determine the susceptibility of irradiated *Anopheles quadrimaculatus* to infection with *Drosophila melanogaster*, female mosquitoes were exposed to γ-radiation of 30,000, 50,000 and 80,000 equivalent physical (rep) 24 h before they fed on infected natural plants. The days later a large number of larvae recovered from the irradiated groups as compared to non-irradiated controls, although the number was significantly greater only in mosquitoes given 10,000 rep. A similar experiment in which mosquitoes were irradiated at the same level 24 h after infection, resulted in a significant reduction in the numbers and growth of larvae in irradiated mosquitoes as compared to their controls. With smaller doses there were no consistent differences in number, size, or location of developing larvae between experimental groups receiving 1000 and 2000 rep and the controls. At 4000 rep, however, significantly fewer larvae were recovered and most of them had developed only to the same stage. (Author.)


A brief burst of x-rays elicited flight activity in moths placed in a darkened x-ray exposure room. Moths belonging to 8 species of Neuroptera and species of Acrida were used, among them *Agrotis exclamationis*. Wing-beat activity could be initiated in resting moths at a threshold of 2 x-ray doses of 0.01 to 1.0 x/60 sec, with a latency of 1 sec after onset of exposure.


In the composition of the acid soluble fraction of bee moth caterpillars there is found adenosine triphosphate, adenosine acid, and other low molecular weight nucleotides. A day after x-irradiation of the caterpillars with a dose of 2000 r, the total content of acid soluble compounds at 200 ng decreased by 75%. The content of ATP falls by about 98%. Analysis of the caterpillars in control experiments showed that the ATP content solution a day after irradiation with a dose of 2000 r increases by about 98%. A considerable fall in ATP content and activation of autolysis in the period immediately after irradiation can be explained by the inhibition of phosphorylation after irradiation. (Author.)


Les expériences sont conduites à la température de 25, 35 et 75% d'humidité. Les populations ont été testées en utilisant des individus d'âge de 900 r. En présence de la radioactivité au sol, on note une diminution de la fécondité chez les descendants d'irradiés, ainsi bien à 500, qu'à 800 r. L'irradiation des plantes a pour conséquence de diminuer la fécondité et le poids des descendants, et d'augmenter leur durée de développement. Ces effets se manifestent par une gêneration à l'autre sans qu'il soit besoin de recourir à la sélection.

551
Alors que les deux premiers tendent à disparaitre, l'augmentation de la durée du développement est stable pendant au moins deux générations. (Aut.)

1315


The mutagenic and stimulating effects of y-rays were investigated with a view to possible improvement in bee genology. Unfertilized and fertilized queens were irradiated involving, in the latter, irradiated sperm in addition to egg stages. Since artificial insemination gives good results irradiation of drones at some later stage is also envisaged. Changes induced by doses from 20 000 to 100 000 rads in the feeding rate were investigated. The longevity-dose relation was illustrated graphically. A reduction in longevity of X, 15, 4 of 20 000 rads was observed. The mean life span of 20 e dropped to 50, 8, 18, 7 d after irradiation with 20 000 rads 100 000 rads caused a 20% and 80 000 rads a 60% reduction, down to a life span of only 5, 5 d. Wax production decreased with increasing doses. Little difference was observed between the effects of 40 000 and 50 000 rads. As bees grow older an increase in wax production is noted, possibly due to the physiological maturation of the winter brood which, like the summer brood, has to perform successively a variety of functions before wax is produced. The construction of a queen cell can be observed when the dose has not exceeded 10 000 rads.

1316

Po-Challey, D. S., EFFECTS OF X-RAYS ON MEAL WORM EMERGIES. Progress report. TID-19485, D'Youville Coll., Buffalo, 1963. 6p

The 17 free amino acids and the 3 derivatives previously reported for the 1- and 4-day-old embryos were found present for almost all the remaining days of embryological growth. These compounds showed, generally, an increase in concentration ranging from 1.9 mg per cent for 1-day through 17.9 mg per cent for 8-day-old embryos. Two major irradiation responses may be distinguished in the meal worms (1) during the first 4 days of growth, irradiation affects the yolk proteins and free amino acid relationships, which results in general metabolic disturbance, preventing the build-up of the essential amino acid reserves, and culminates in the death of the embryo; (2) although irradiation of the embryo from the 4th day appears to influence amino acid variations from the normal, a recovery or restoration does occur. This positive response may be facilitated by the high reserve concentrations of free amino acids accumulated at this stage of embryological development. Two tables give changes in tryptophan-positive compounds detected at various developmental stages, in controls and in irradiated embryos.

1317


The present project is directed towards the internal environment of the insect which is rich in free amino acids. Apparently, as amino acids have some protective potential, the radio-resistance of insects may be interpreted, in part at least, by this biochemical consideration. The current aspect of the study is concerned with metabolic differences in biochemical properties detectable during various stages of embryological growth of the meal worm. Data obtained for the meal worm embryo indicates that irradiation resistance increases with embryological age, that the ova are rich in free amino acids, that ova exposed to sublethal (damaging) doses of x-rays liberate a labile factor (protein) which disappears as the embryo continues its growth and development. These considerations of the internal mechanism operating for the replenishment of the metabolic pool via protein degradation and the interplay of amino acids with the associated recovery-restorative processes are being examined.

1318


Starved male cockroaches exposed to 10 000 rads of y-rays consume more water than unirradiated controls. They excrete more N and P than controls. The difference is pronounced soon after irradiation and continues for several days, after which time it is in output by the controls while the N and P excretion by the irradiated cockroaches continues to decline. The adult excretes very little of its N as urea and the identity of the nitrogenous constituents remaining to be investigated. P excretion by the irradiated cockroaches follows a different pattern from that of total N or urea. There is no significant difference between the 2 groups during the 1st week, however, during the 2nd week the irradiated insects excrete less than the controls. Excretion by the controls rises between the 7th and 14th day in the manner of N., The inorganic P secreted by the cockroach is orthophosphate. There is no strong evidence that the irradiation injury is centered in the nucleic acids under the conditions of radiation used, and it is suggested that localized cellular permeability may be the primary lesion. (Aut.)

1319


Reasons are presented for conical most other developmental changes. Inactivation, lethality, chromosomal point break death of many individual animals, and its independence, the same criteria, radiation-in individual cells that are causes by the same genetic damage, depending on either p results in Drosophila, Drosophila; compared. Tests of diverse M, cells containing more clearly that t induced chromosome breaks, 1 acute damage that is produced

1320

Onus, L., I., RADIATION EFFEC Research on the Radiotherapy of American Cancer Society, Inc. Some of the consequences of x-irradiation. Sufficiently large dose and imaginal stages. On the b containing chromosomes differ
central in the nucleic acids under the conditions of radiation used, and it is suggested that increased cellular permeability may be the primary lesion. (Auth.)

See also:

48 L'发布时间 et la radioactivité, (Stoeman, 1962)
49 L'importance de l'aspect radiologique de la genétique et de la physiologie, (Grosch, 1960)
50 Latent radiation damage and synchronous cell division in the epidermis of an insect III: Synchronous reversal of changes leading to delay during mitosis. (Baldwin, 1961)
51 01 Mechanism of resistance to virus diseases in the silkworm Bombyx mori (IV) (V) (VI), (Araya, 1963)
52 Studies on the induction of nuclear and cytoplasmic polyhedrosis by treating with x-rays and ultraviolet light in the silkworm, Bombyx mori L. (Araya and Yoshikawa, 1961)
53 15. Induction of virus infections. VI. Ultraviolet light and x-rays. (Araya, 1963)
54 Histological and ultrastructural modifications in the mesehercin of Dacus oleae Gmel., induced by ionizing radiations. (Sacceni et al., 1961)
55 On polytrophic disease in the silkworm induced by x-rays. (Kaspov, 1963)
56 Amended development in x-rayed larvae of Drosophila melanogaster (Drosophilidae: Drosophilinae). (Rough, 1963)
57 Effects of gamma radiation on the growth of eggs. (Rough, 1963)
58 Effects of Co-60 gamma rays on the small cutworm. (Shirokova, 1955)
59 The biochemical response of the insect eye to x-ray radiation. (Smith and Kimes, 1963)
60 A theory of the improved performance and survival produced by small doses of radiation and other agents. (Takahara and Tanaka, 1961)
61 The effect of X-radiation on longevity, emergence and DDT-susceptibility of the house fly, (Varensked and Moon, 1965)
62 X-ray effects on single and mixed species populations of Tribolium confusum and Tribolium castaneum (Coleoptera: Tenebrionidae). (Hees, 1965)
63 Reactions to X-rays of a normal and a 60Co-susceptible stock of Drosophila melanogaster. (Meisel, 1963)
64 Effects of radiation on ecological systems. (Sedman, 1963)

1-8-5 SENESCENCE AND LONGEVITY

1-9-5-a GENERAL


Reasons are presented for concluding that spontaneous aging is a part of normal development caused, like most other developmental changes, by factors other than permanent genetic alterations such as point-mutation, deficiency, chromosomes loss of inactivation, or segregation, even though it does involve the pointwise death of many individual somatic cells. These reasons comprise the partial reversibility of normal aging and its independence of ploddy and of other features of chromosome structure. Judged by the same criteria, radiation-induced shortening of the life-span is an expression of pointwise losses of individual cells that are caused by actual genetic changes. That the changes are for the most part recessive, depending on either point-mutations, deficiencies, or whole-chromosome losses, is shown by results in Drosophila, Tribolium, and plant materials. When effects on individuals of different ploddy are computed, tests of diverse kinds carried out with Drosophila having chromosomes of different structural constitution show clearly that the mechanism here is that of chromosome loss, caused by radiation-induced chromosome breaks. It is believed that the same basic mechanism accounts also for most of the acute damage that is produced by radiation. (Auth.)


Some of the consequences of x-ray-induced damage to the hereditary material of somatic cells is discussed. Sufficiently large doses applied to the larval stages will cause some deaths during subsequent pupal and imaginal stages. On the basis of survival rates of x-irradiated strains of Drosophila melanogaster, each containing chromosomes differing in structure, it has been suggested that premature aging in animals is...
brought about by chromosomal loss produced by radiation. The possibility that this phenomenon is also involved in other radiation-induced effects, such as tumour formation and tumour regression, is also considered.

1321
Sachau, G. A., Tocnco, E. A THEORY OF THE IMPROVED PERFORMANCE AND SURVIVAL PRODUCED BY SMALL DOES OF RADIATIONS AND OTHER PHOBISES. p.546-61 in "Biological Aspects of Aging", Solock, N.W., Ed. New York and London, Columbia University Press. 1965. Recent evidence is reviewed on some paradoxical effects of low-radiations, especially as manifested in decreased disease incidence and increased expectation of life, based on observations on rats, mice and insects. A theory is proposed which accounts for the class of phenomena discussed. The characteristic damaging or depressive action of large doses is considered to be also produced by the smallest doses known to produce paradoxical stimulation, and represents an essential step in the whole argument.

1322

1323
Baxtr, R. C. RADIOLOGIC STUDIES WITH Drosophila. (Abstract) A.M.B. 1956 No. 1. Division of Technical Information, ARC, 1963. Somatic studies of D. melanogaster are centered about the effects of irradiation upon accelerated aging and longevity. Some of the variables that have been or will be studied are acute versus chronic irradiation, certain mutant genes singly or in combination, hybridization, stages of the life cycle, age of the adult, temperature, nutritional state, and O2 tension. A few other species of Drosophila have been obtained and are being used for interspecific comparisons with D. melanogaster. (Author.)

1324
Clark, A. M. SOME EFFECTS OF X-IRRADIATION ON LONGEVITY IN Habronecton FEMALES. Rad. Res. 15 (1961) 515-8. Habronecton females, when exposed to x-rays as larvae, pupae, or adults, show a decrease in adult life span which is dependent on the amount of radiation delivered. Radiation damage to larvae and pupae, which cannot be detected simply by observing the incidence of adults that emerge, is revealed when adult life span is measured. Groups irradiated as adults at the doses delivered show no immediate mortality. The time of onset of death within the group depends on the amount of radiation delivered. Death is delayed for a longer time for smaller doses. As adults will survive a dose of 2000 r, as little as 500 r causes a reduction in life span. (Author, summary)

1325
Clark, A. M., Rubin, M. A. THE MODIFICATION BY X-IRRADIATION OF THE LIFE SPAN OF HAPLOIDS AND DIPLOIDS OF THE WASH. Rad. Res. 15 (1961) 544-53. Habloid males, diploid males, and diploid females (homozygous or heterozygous) were irradiated as larvae-in cocoon, white pupae, and adults, and their adult life span determined. The differential sensitivity of haploid and diploid adults to x-irradiation indicates that gene action is taking place in the adult stage and in non-dividing cells. Pupae after exposure to 10,000 and 15,000 r are not inhibited in their ability to develop into structurally normal adults which do, however, show a decrease in life span. This is much more apparent in the haploids. Larvae (after 2000 r) also develop into structurally normal adults, but with a decreased life span. The differential sensitivity of haploids and diploids is different for the larval, pupal, and adult stages. This is probably related to different types of genetic injury such as effects on cell division and on gene action occurring in different stages of development.

1326

1327
Donnelly, J. II. THE EFFECT OF X-IRRADIATION ON THE LIFE SPAN OF Mice. (Abstract) J. B.S. 1959 x/4. Pupae were subjected to a pa subsequently emerging after x-irradiation with untreated flies of flies of the same age and temperature as the control. The results were that the irradiated mice were normal in development and were not different from the normal mice. (From auth.)
The life span for haploid and diploid males was determined after exposure as adults to 60 keV of x-rays. The diploid males have a longer duration of life than the haploid males. This indicates that the decrease in life span after irradiation is related to damage to the chromosomal material. Non-irradiated diploid and haploid males have the same life span. The primary damage leading to a decreased life span is different for the irradiated and non-irradiated groups. The mechanisms involved in the normal aging process are different from those involved in the decreased life span from x-irradiation. (From author summary)

Donnelly, J. THE EFFECT OF GAMMA RADIATION ON THE VIABILITY AND FERTILITY OF lucilia sericata Mg. (DIPT.) GRADUATED AS PUPAE. Ent. exp. appl. J. 3 (1949) 48-54.

Pupae were subjected to a range of doses from a Co-60 source. Observations were made on the percentage of the pupae surviving after each treatment and their longevity. Fertility was measured by eviscerating each pupa, dissecting out the eggs from the ovaries, and counting the number of eggs. The eggs were then counted and the percentage of eggs that hatched was calculated. The results showed that the percentage of eggs hatched decreased with increasing dose, and that the number of eggs hatched was not significantly different between the control and irradiated groups.


Progress report on studies on the effects of radiation on life shortening and aging. Data are included from studies on sex determination as illustrated by x-ray induced chromosomal and gene reorganization in Drosophila.


A highly significant shortening of the mean duration of life at 8000 r and at all higher doses was observed. The mean duration of life is reduced by increasing dose. An exponential equation relating the survival fraction to dose is 2.3 loge 1.0 = 0.0124 x dose. This relation holds for doses up to 8000 r.


The effect of 15 different doses of x-rays (100 keV, 0-125 keV) on Berlin wild-type stock was tested, treated at 24-68 hr of age. Fertility was determined by the number of eggs produced. At lower doses, some fertility was recovered, but at 125 keV, all fertility was recovered. At higher doses, fertility decreases with increasing dose. A maximum of 50% of fertility is lost at 125 keV.

The effect of x-rays on longevity is determined by the number of days of life. The half-life is 5 days. The maximum is 10 days of life, the minimum is 1 day. The maximum is 10 days of life, the minimum is 1 day.

The effect of x-rays on fecundity is determined by the number of eggs produced. At lower doses, fertility is recovered, but at 125 keV, all fertility is lost. At higher doses, fertility decreases with increasing dose. A maximum of 50% of fertility is lost at 125 keV.
to total mortality on the 8th day. Even at 90 is a considerable amount of eggs can be found in the flow 5 d. A comparison of data on fecundity and female longevity reveals a correlation between the doses at which fecundity ceases altogether and maximum life-span. Accused fecundity appears to involve a factor for prolonging life-span. To test this, a dose of the monogenic cytoskeleton TMR, adequate for sterilization, was used in another experiment. The survival time was extended to 15% of the controls (11 hr). (From above.)


See 1325.


Newly emerged male Drosophila melanogaster were exposed to x-rays at 1, 2, or 3 doses for the duration of life. Mean exposure rates ranged from 1 to 20 krad/d. Mean survivorship (SAB) of 10 control groups, comprising 3,624 flies, was 19.0. The 3 exposure groups (1, 2, or 3 doses) had pooled rates of 38, 5, and 5 krad/d. From 0 to 0 krad/d, mean survivorship increased steadily with increasing dose. Similar results have been reported for Tribolium, Heterodera and Drosophila. A detailed analysis of the components of variance of survival times within and between treatments is given. Control groups showed great heterogeneity of all variance components. A consistent effect of periodic exposure is to decrease variance and heterogeneity between treatments and between variances within treatments. The hypothesis is proposed that the increase in mean is secondary to the decrease in the environmental variance components of exposed groups. The environmental variance is considered to measure the action of random environmental variables, primarily determinants in nature, and radiation exposure reduces their effectiveness. It is not yet possible to decide whether the radiations act primarily by reducing the magnitude of the random variables or by increasing the resistance of the exposed insects. (Auth.)

1334 Somsenblich, B.P., Grodin, J. CAN A DOSE OF 4,000 to 5,000 r OF X-RAYS DOUBLE THE LONGEVITY OF D. melanogaster? Drosophila Inform. Serv. 27 (1965) 130.

Attempts were made to confirm the report of Scharlach that x-ray doses of 1,000 to 2,000 r double the longevity of D. melanogaster. Several tests were conducted on a Canton-S strain maintained in mass culture on standard media. Radiological factors were the same in all tests (90 kv, 5 ma, 1 mm added filter, 360 r/min as measured in air), but other factors differed. In one study, 1- or 2-old flies of both sexes were exposed, while in the other 3- or 4-old flies were irradiated. They were kept for 3 or 4 days, respectively, in mass culture, aerated, and then two pairs of males and females were placed in separate vials. Unirradiated flies were similarly treated and observations were made regularly. After the 3rd day, flies were counted every 7 days. When 1- or 2-old flies were exposed to 4,000 r of x-rays, it was found that the mean life span of females and males was 47.6 and 64.2 days while that of the controls was 64, 2 days. It is concluded that an x-ray dose of 4,000 r does not double the mean life span of treated as against unirradiated flies, and that a dose as large as 4,000 r does not seem to influence life span significantly. (USA 175, 1963, 35601)


A new strain (wild 7-140) larvae: 260, 2, 150, 50, 50, 50, 50, 75 were studied. Eggs showed a variable number of eggs from immediate in life span (females lived 52, 48, 88, and 4, 5, 4, males from 0 to 20, females from 0 to 20, males from 0 to 20). The types of strata used were: a) data obtained from the first 600 r (x)-irradiation of X:Y: whereas 1500 r may cause death.

See also:
470 Effects of ingestion Pe (Hemogenic: bacon)
471 Effects of irradiation on the biological eff. (Se 800)
750 Irradiated paralytic worms 1963a
758 Effects of irradiating 2.5% 1968
781 Effects of gamma radi
782 The effect of ionizing
783 Effects of gamma radi
789 Infection with the irradiated nematodes
789 Action des rayons y de Laveloal and Mando
The length of life, in days post-eclosion, has been investigated for irradiated and control groups of flies. The irradiated flies received 2450, 4000, 5000, and 30000 r of x-radiation. The medium used is described. The longest mean life for females was 62.6 d (determined for 165 flies) at 2450 r, the shortest mean life for males was 34.5 d (for 183 flies) at 1800 r. Lower amounts (2400 r and 3000 r) seem to increase life span, 1800 r to decrease life span for all flies. Results are illustrated in 3 graphs.


Data are presented for the length of life post-eclosion for control and irradiated groups of flies from a crossed strain. The amounts of radiation used were 25 r for eggs, 125 r for larvae, 300 r for imagos. Both mated and unmated groups were studied. The results indicate that the irradiation lowers the life of imagos, although inconsistent results were obtained for imagos from irradiated larvae and eggs, and that flies from cultures of flies irradiated and control flies, (NSA 16: 1965, 1969)


The types of strains used are described. The suggestion is put forward, on the basis of the experimental data obtained, that fertility factors may interact together within longevity factors in the Y-chromosome. 800 r (x-irradiation of XXY females may cause the fertility factor to be destroyed in the Y-chromosome, whereas 1800 r may cause both to be destroyed.

Wood, V.G. THE EFFECT OF X-RADIATION ON LONGEVITY IN Drosophila melanogaster. Technical Progress Report. Taylor Univ., Upland, Ind. Jan. 1969, p. A suitable strain (wild F-1st) was used. Radiation doses were 25, 125, 300 r for eggs, 3000 r, 1800 r for larvae, 250, 2250, 5000, 7500, 15000, 25000 r for imagos. Both mated and unmated groups were studied. Eggs showed a significant difference between both males and females after 250 and 500 r, as did imagos from irradiated larvae (250 r). Mated Diet from such larvae showed a significant increase in life span (females lived 50.1 d, S.D. 13.3, when irradiated and 45.7 d, S.D. 14.1, in controls males 50.4 d, S.D. 18.86, and 40.5, S.D. 14.4). Long-term mean life obtained in days post-eclosion for irradiated imagos was for unmated females, given 1256 r. With radiation a 5000 r the life span is of the same order or longer than in controls, but these are significant decreases above that radiation level. In general, females taken to outlive males both with irradiated and control flies, and unmated flies outlive males. Males seem more vulnerable to radiation than females.

See also:
470 Effects of ingested Fe on fecundity, fertility and life span of Drosophila melanogaster. (Hymenoptera: Braconidae) (Emden, 1932)
471 Effects of irradiation on the Mediterranean fruit moth Euphorus luteola. Zeller, cultured on pyrethrum. (Emden, 1932)
496 Certain biological effects produced in the bull weevil by tagging it with H. (Mayer and Brasak, 1961)
785 Irradiated bactriae as a source of food, in the diet of the young (De Bach and White, 1969)
791 Effects of x-irradiation of domestic and wild species of beetles. (Emden, 1959)
793 Effects of gamma radiation on the fertility of Arbes aegypti. (Gibson et al., 1961)
796 The effect of x-irradiation on the biology of the poultry parasite, the principal vector of Schistosoma mansoni (S. mansoni) (Braconidae) in Venezuela, 1969
798 Effects of gamma radiation on the fertility and longevity of Drosophila melanogaster. (Brennberg, 1963)
799 Influence of the irradiation on the development of the adult Sphingis rnelia (Curticirrionidae) and their descendants.
791 Action of the various x-irradiation on the mortality and the fertility of aged adult males and females. (Laviallette and Norden, 1963)
906 Quelques résultats supplémentaires concernant l'influence des rayons gamma sur les chrysali de et les oeufs de la teigne de la farine "Phytophaga kochiella Z." (Pereira, 1965).

910 Action des rayons γ sur la stérilité d'une mouche du coton (genre Lepyper apicis (Parslow), (Baudo, 1963).

915 Différentes sensibilités de rayons gamma sur les grains de mélange. (Ghim, 1965).

919 The influence of radiation in altering the incidence of mutations in Drosophila (Muller, 1960).

923 Effects of x-rays on salivary gland chromosomes during early stages of development. (Gilmir, 1960).

927 Phase cinematography studies on the effects of radiation on the cell, with special regard to the behaviour of the chromosomes in grasshopper spermatocytes in response to x-ray treatments. (Nadasdi et al., 1961).


937 Control of the Mediterranean flour moth Anagasta kuehiella Zell by sterile male release. (Bell and Wood, 1965).

941 Effects of gamma radiation on feeding moth eggs. (Hough, 1965).

945 Studies on the breeding method taking advantage of γ-rays in the silkworm. (Japan. Seiculultural Experi- mental Station, 1965).

949 Studies on the biochemical changes induced by x-rays in the silkworm. (Nakayama et al., 1965).


957 Lethal effects of X-rays on the housefly Musca domestica L. (Garso et al., 1963).

961 Lethal effects of X-rays on Drosophila melanogaster. (Ikezawa et al., 1965).

965 Different types of mortality including prolongation of female lifetime after x-ray injury Drosophila melanogaster irradiation. (Nishim, 1965).

971 X-ray effects on single and mixed species populations of Tribolium confusum and Tribolium castaneum (Coleoptera: Tenebrionidae); (Redman, 1965).

975 The differential sensitivity of flour beetles, Tribolium confusum and T. castaneum to x-ray alteration of reproductive abilities. Induced dominant lethals, broom, and survival. (Redman, 1965).


987 Developmental homeostasis and its application to biological studies related to large scale rearing. (Bell and Wood, 1965).

1-9-9 LETHAL EFFECTS


1039 An exposure to 100 800 r at an average dose rate of 4000 r γ-rays/n killed all Tribolium confusum Dev. adults and larvae, Cylas longisetaei (L.) adults, Pholebotes dominguei (P.) adults, Sitophilus granarius (L.) adults, Sitophilus oryzae (L.) adults, Procoptus griseascens (G.) larvae, and Euphorbia caput-rheii (Wlk.) larvae within 2 months. An exposure to 4000 r γ-rays/n killed 94% of females adults, Tribolium adults and larvae, and P. intermedii within 60 days. Tribolium exposed to 8400 r γ-rays did not reproduce during a 6-month period after exposure. Two tables are included.

1041 Dussart, H. S. , NEWBURGH, H. E. , Jr. RESPONSE OF TRIBOULIUM LARVAE TO X-RAD-IRADIATION, (Abst. 140) ANGE. REC. 297 (1965) 551.

1046 The effects of x-rays on larvae of Tribolium confusum maintained in a flour-sea medium are described. When young larvae are exposed to 6.5 r and incubated at 25°C, death begins to occur in a few days, but are scattered throughout the larval period; with older larvae, death may occur during pupation or upon

1051 emergence of the adult. Incubation in less time, with significant delays both development and de


1061 Adult males of A. ph. aphrodis. 2500 r. The highest rate of the sterility. The most frequent ty deficiencies and translocations. Possible implications of applied


1071 Exposures of recently deposited 2500 r had no effect on time of same time as did eggs that had waited to abnormality. When 1000 r. It is concluded that require a minimum dose of 300 r on the effect of radiation was noticed. ABS.


1081 Musca domestica L. at the adult same radioactivity, 60000 r much more radioactivity. The of x-rays can be reduced by any use is without influence. Toxic effects of x-rays (DVR = 1.29).


1091 The insect at the adult stage is 60000 r and the L2b at 24 h duration of the average life-span of the Atlantic strain (W.) it action from the effects of any protection. Indolestilbene acid effects of irradiation. In film 60000 r would otherwise be too the most common toxicities h and radioteactivity. The ice r stage larvae and 70 r r for papu


1098 A dosage of 2000 r r-radiation Tribolium castaneum within a
emergence of the adult. Incubation at 30°C accelerates larval development and lethality to about the same extent, without significantly changing the proportion surviving. Conversely, incubation at 18°C delays both development and death. Doses of x-ray markedly delay onset of pupation. (From abst.)


Adult males of A, mac. aegypti were treated with x-ray doses of 2000 r, 2500 r, 4000 r, 5000 r and 6000 r. The highest rate of chromosomal aberrations was obtained with 3000 r; 6000 r gave complete sterility. The most frequent types of mutations were inversions, both paracentric and paraacentric; few deficiencies and translocations were found. The embryonic and larval mortality increases with the dose. Positive implications of applied radiobiometrics of Anopheles are discussed. (Abst. summary.)


Exposure of recently deposited egg rafts of Culex pipiens fatigans Wied, to x-radiation in doses up to 1500 r had no effect on time of hatching, and most of the eggs hatched gave rise to normal adults in the same time as did eggs that had not been irradiated. Observation of progeny up to the 6th generation revealed no abnormalities. When the dose was 2500 r, few eggs hatched and the larvae died during development. It is concluded that the lethal dose is much lower than that for the eggs of Aedes aegypti (L) which require a minimum dose of 5000 r for lethal action. In irradiated C. fatigans egg rafts (2000 r), delayed effect of radiation was noticed. Death in every stage from adult to egg occurred. This was not seen in Aedes.


Musca domestica L., at the adult stage is highly resistant to x-rays, and males and females show almost the same radiosensitivity. 4000 r reduces the life span by one half. The insects at the preimaginal stages is much more radiosensitive. The LD50 is 400 r for 3rd stage larvae and 700 r for pupae. The lethal effects of x-rays can be reduced by xantrin (DMF = 1.6). Treatment with xantrin is more effective than xantrin is more effective than irradiation in the absence of food. 500 mg per kg of body weight was shown to be effective. The LD50 is 400 r for 3rd stage larvae and 700 r for pupae. (Abst.)


The insect at the adult stage is highly resistant to x-rays. The dose which reduces the life span by 50% is 8000 r and the LD50 at 24 h is 25000 r. Males and females show the same radiosensitivity. The reduction of the average life span shows a roughly linear correlation with the x-ray dose. The dose reduction factor in the acute biologic (D50) is about 1.6. Cytochrome and glutathione, injected 20 min before irradiation into the thorax at doses of 3.33 and 0.56 mg per gram of body weight, respectively, do not affect any protection. Edetic acid, given by oral administration, is effective in the larval stage. The LD50 in flies treated with edetic acid, a dose of 5000 r reduces the toxic effect for which 3000 r would otherwise be necessary. Edetic acid, administered before irradiation, is able to enhance the lethal effects of x-rays (D50 = 1.36). (Abst.)

2346 GIULI, C. MEAN LETHAL DOSE FOR SILK WORM BOGS WITH RADIATION OF DIFFERENT WAVE LENGTHS. p. 211 in "Book of Abstracts, No. 326(b)". Tenth International Congress of Radiology, Montreuil, 28 August-September 1953.


A dosage of 20 000 r of radiation produced 100% mortality of the adults of Rhyzopertha dominica and Tribolium castaneum within a period of 14 d. A lower dose (10 000 r) was, however, effective in 20 d.
The adults of *Drosophila melanogaster* emerged comparatively high susceptibility and when they were exposed to 10,000 r, total mortality was attained in 7 d. The larvae of *Drosophila melanogaster*, however, proved to be the most resistant. They were not sensitive to the lower doses, and 100% control was attained only with 25,000 r in 6 d. The maximum dosage of 50,000 r gave an instant kill in all cases, but apart from being too high it also adversely affected the viability of the flies. Since, however, their nutritive value remained unaffected, this treatment might be of use where immediate destruction of un-edible grains was desired. Eggs of *Sphenophorus dispar* failed to hatch when exposed to 1000 r. Studies on other species and stages are in progress. (From auth.)

**1346**

Survival and mortality curves were constructed. Males proved relatively more sensitive to γ-radiation than did females. In terms of the median, mean and mean mortality for controls and for doses (2500 r to 20000 r, at 2625 r/min) the interpolated LD₅₀, is near 56000 r for males and near 60000 r for females. After surviving 10000 r, males live for about 2 weeks and females for nearly 4 weeks before radiation sickness (loss of coordination) begins, leading to death within 3 weeks. After surviving 10000 r, flies could fly, only a few females could feed and lived longer than 4 d, dying within a week. A 20000 r or 25000 r flies showed only small uncoordinated movements (similar to those in mild anesthetia) greater at the lower dose in females than in males, followed by death within 4 or 5 hours. Preliminary tests suggest that less than 10,000 r prevents further germ cell production, but occasional mature sperm produced from flies 5 after receiving as much as 10,000 r. (From abstr.)

**1348**

**1350**
Mead, J. E., Muller, H. J. MORTALITY INDUCED BY X-RADIATION OF EARLY *Drosophila* EMBRYOS OF STRUCTURELLY DIFFERENT GENOTYPES. (Abst.) Genetics 46 (1960) 979-80.

Earlier work (Latty and Muller 1939; Muller and Ponecove 1939-40), utilizing offspring of triploid females, has shown that most mortality induced by x-irradiation of early embryos of *Drosophila* is caused by a similar process other than chromosome loss. We have recently reinvestigated this problem, by determining the influence of a second-chromosome deficiency (mp) on this material. Certain experiments parallel those previously carried out in our laboratory by Onic (USA, 1964), and in this paper we confirm our own our influence of this deficiency on the mortality induced by x-irradiation of mid-larval larvae. 400 r were delivered to embryos in the polar-cap stage (extending from blastoderm formation to beginning gastrulation). The following rates of irradiation relative to the frequency of the same stages obtained from the experimental stage were obtained: 10% non-irradiated (control) embryos derived from the same crosses. Structurally normal females 48.9%, deficient females 51.1%. These results differ markedly, from those obtained by Onic (USA) and by ourselves from irradiation of mid-late larval larvae, which show much lower mortality among females than males and among different deficient females. We conclude that irradiation kills these early embryos, unlike later stages, by a different process, for the most part, than chromosome loss. Our data show, moreover, that this mortality, unlike that induced by larval irradiation, is concentrated within a relatively short post-irradiation period.

**1353**

*D. melanogaster* of both sexes were irradiated with 100-250 r r-rays using doses between 0 (control) and 125 r. Dose-effect curves for mortality are linear up to 90 to 125 r. At higher doses other effects become more important resulting in a higher mortality. Mortality decreases with increasing doses up to 115 r, when all females are sterilized. Mortality of offspring is proportional to dose. (Gisin Dist., USA 1970).

**1352**

The influence of x-rays on 17 different doses (100-250 r) action of female lifespan in time of unirradiated females, copulation of the females on survival, measurements of the induced sterilisation of the irradiated virgin flies resistance with regard to sex survival time. *Drosophila* distinctly against a factor of linear males. The linearity of the normal distribution of the appears at the 3rd day, increase survival time curve at 19-19 agreement with the irradiation abstr.

**1353**
Ogaid, M., Tanaka, E. INSECTICIDE (Abst.) Genetics 46 (1960) 824-5. 2 or 3-day-old flies from two varieties of *D. melanogaster* were subjected to various concentrations of the 1-20 ppm 1-50 ppm 20 ppm 1-20 ppm 20 ppm 50 ppm. The vital and mortality curves were different. The interal 100 ppm was equal to 100 ppm of male 7% and this is through 100 ppm between non-resistant and resis as the resistant strain; the 1-30 ppm of the special strain the l-20 ppm of the resistant strain. The level of resistible of the special strain was almost 100 ppm for the non-resistant strain for the non-resistant strain for the non-resistant strain. *Drosophila* males of this special strain to live for 200 ppm in *Drosophila* males.

**1353**

Third-instar larvae of different 240 rpm, the onset of pupation was high at 2500 r. Serious deformities were also 100% of the larvae were deformed. The viable was scored separately at the hypothesis that some somatic followed by chromosome loss longer represented in at least appear to be detrimental to a large number of the German larvae. The insects received.
The influence of x-rays on the lifespan of D. melanogaster imagos has been studied by application of 17 different doses (100 KcV, 0.0-125 KcV) to 1-2 d-old males and females of the Berlin wild stock. A prolongation of female lifespan is induced by doses > 4 keV, it culminates at 11 keV in 1% of the mean survival time of untreated females. The prolongation is not accompanied by alterations in locomotion or copulation of the females concerned and is independent from radiation effects in the males mated with them. Measurements of fecundity have proved the prolongation to be correlated with the radiation-induced sterilization of the females. This has been confirmed furthermore by investigations with sterilized virgin females having a low fecundity, with females of a special strain showing a high radiation resistance with regard to fecundity, and with chemically (TEA) sterilized females. In the male mean survival-time, Tm, Tms, and the time of the highest mortality decrease linearly when plotted logarithmically against a series of linearly decreasing doses. The LD50 of females (95%) appears to be twice that of males. The linearity of these curves is expressed as an always identical type of damage. In both sexes the normal distribution of the post-irradiation mortality rate is altered at doses > 90 keV. A first peak appears at the 3rd day, increasing with doses with a corresponding decrease in the gradient of the declining survival time curve at 90-100 keV. A new type of mortality is apparently manifested at high doses. In agreement with the radiation syndrome at these doses it is interpreted as a central-nervous-death. (From data.)


2 or 3-d-old flies from two wild strains (Blithe-Hi, Mino-Hi), and two mutant strains (bushy and vg; +, +) of D. melanogaster were subjected to Co60 γ-radiation in doses ranging from 80 000 r to 180 000 r at approximately 50 000 r/h. The flies were kept 24 h at 24°C and allowed to feed from fresh food every 3 d. Survival and mortality curves were constructed. The sensitivity of males to radiation proved relatively higher than females. The intermediate LD50 of Blithe-Hi and Mino-Hi is near 130 000 r for females and near 150 000 r for males 7 d after irradiation. That of bushy and vg; +, + (which are more susceptible than the former) is then about 180 000 r for females, 150 000 r for males. The F2 generation of a reciprocal cross between non-resistant and resistant flies was made. These hybrid flies showed almost the same susceptibility as the resistant strain; the LD50 of the hybrid females was near 150 000 r. From these experiments, it is ascertained that the radiation tolerance was dominant over susceptibility, and maternal or cytoplasmic effects were negligible. In order to analyze which chromosome is responsible for tolerance, three special synthetic strains, Hikone-Hi, lw; and Hikone-Hi, lw; Hikone-Hi, lw, lw, and Hikone-Hi, lw, lw, lw, lw were made. The level of sensitivity to Co60 radiation in the original resistant and susceptible strains, and that of the special synthetic three strains, were tested. The LD50 of Hikone-Hi, lw, lw, and Hikone-Hi, lw, lw, lw, lw was almost 150 000 r for females, which is just the same level as the susceptible one, whereas the Hikone-Hi, lw, lw, lw, lw strain showed almost the same sensitivity as Blithe-Hi resistant strain. The LD50 of this synthetic stock was 125 000 r for females. From this experiment we assume that the tolerance to Co60 γ-rays in Drosophila is dominant and is controlled mainly by the 3rd chromosome.


Thrid-instar larvae of different genotypes were exposed to x-radiation of various doses (at 100 r/min and 240 r/min). The onset of pupation was noticeably delayed by doses > 3500 r, slightly by 2500-2900 r, and scarcely by 540 r. Doses > 3500 r also prolonged the duration of the pupal period. Mortality before pupation was high at > 3500 r, negligible below. Most pupal deaths occurred immediately before eclosion. Serious deformities were also found, their number and onset increasing with dose. At > 4500 r almost 100% of flies were deformed (mostly wing size and phantoceps of "cut", and head abnormalities). Survival was scored separately for the sexes and genotypes. Most of the observed correlations agree with the hypothesis that some somatic radiation damage was exclusively (or mainly) due to chromosome breakage followed by chromosome loss, cellular damage or death resulting whenever a portion of the genome was no longer represented in at least haploid condition. Maxicentrity for either of the two autonomous does not appear to be detrimental to somatic cells.


Large nymphs of the German cockroach have been exposed to ionizing radiation at two similar Co60 sources. The insects received doses ranging from 100 r to 2900 r. A number of effects of these total body
Eggs, larvae, pupae and adults of *Toxoplasma philippinensis* Drake on tomato, and adults of *Stiophillus oryzae* L. and *Trybomia castaneum* Herbst on corn were subjected to 1, 5, 10 and 20 kV·y·m⁻¹ (Epstein and Low, 1983, 1984; and Suetake, 1965, respectively). At 1 kV·y·m⁻¹, the proportion of unhatched eggs in *Toxoplasma* was about 10%. There were no significant differences in mortality at 5 kV·y·m⁻¹, but at 10 kV·y·m⁻¹ the mortality increased to more than 3 times that at 5 kV·y·m⁻¹. Mortality at 20 kV·y·m⁻¹ was about 90%. The threshold dose seems to lie between 5 and 10 kV·y·m⁻¹. The eggs of *Trybomia* that did not hatch failed to continue development. At 1 kV·y·m⁻¹, over 20% of the larvae were killed, although some of these succeeded in pupating before they died. Most of the larvae attained the adult stage. All the larvae that survived emerged above 1 kV·y·m⁻¹, some for as long as 6 weeks, died without attaining the pupal stage. The pupae were more resistant than the larvae and the adults. Complete mortality was not attained even with 50 kV·y·m⁻¹, some adults which emerged in the 5- and 10-kV·y·m⁻¹ lot had abnormally developed wings and/or legs. In the adults, the 15 and 20 kV·y·m⁻¹ had an adverse effect, killing about 70% of the individuals subjected to the lower, and all subjected to the higher, dose 3 weeks after irradiation. No significant difference in susceptibility between the sexes was noted. About 40% of the females were killed in the lot treated with 15 and 20 kV·y·m⁻¹ were killed one week after irradiation, but only about 10% were killed with 50 kV·y·m⁻¹ and about 20% with 40 kV·y·m⁻¹. The mortality with 40, 60 and 80 kV·y·m⁻¹ increased to about 70% two weeks after the start of the test. The mortality with 10 kV·y·m⁻¹ corresponding to this period was less than 10% and that with 20 kV·y·m⁻¹ was about 20%. The threshold dose seems to lie between 20 and 40 kV·y·m⁻¹. The mortality trend in the *T. castaneum* was similar to that in the *T. oryzae*, except that the threshold dose seems to lie at about 40 kV·y·m⁻¹. (From auth.)

See also:

- 472 The genetic and developmental effects of ingested radioactivity in *Hapalobacter*. (Grosh, 1969)
- 475 Certain biological effects produced in the soil weevil by tagging it with Fe. (Maye and Starnell, 1964)
- 761 Study of the dose-dependence on the survival rate and the sexual sterilization of the grassy weevil (Calandra gemina). (Andres et al., 1962)
- 774 Exploratory studies on gamma radiation for the sterilization of the soil weevil. (Davidich and Hlodgea, 1962)
- 793 Influence of the irradiation sur les adultes de *Stiophillus oryzae* Takeda. (Clementina et al.) and leurs descendent.
- 796 Pelvic and Nardon, 1963)
- 791 Action de rayon y du cobalt 60 sur la mortalite et la fertilité des individus d'un chapardeau de riz, (Pelvic and Nardon, 1963)
- 820 X-ray-Induced “dominant lethals” in irradiated eggs of *Drosophila*. (2) Experimental with different stages between irradiation and end of second cleavage division. (Whitaker, 1963)
- 1013 A cytogenetic study of the effects of x-irradiation on *M Detaylı* orchids. (Sait, 1960)

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The study was undertaken to check whether the survival of blood-fed female *Aedes aegypti* is significantly different from that of non-blood-fed groups after whole-body irradiation from Co²⁶⁶. Preliminary results are presented. The data clearly suggest an attenuation of radiation-induced lethality in blood-fed *Aedes aegypti*, whether one considers the blood-fed or the non-blood-fed groups as the controls.


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1039 Variation of radiosensitivity of melagonia. (Whitaker et al., 1962)
1039 Relative effectiveness of 18 h copper embryo. (Bicker, 1962)
1039 The influence of temperature on the radiosensitivity of liver cells. (Bicker et al., 1962)
1039 Pathogenic effect of low a. (Podoljansky, 1963)
1039 Oxygen effect in newly laid eggs. (Yosha, 1962)
1039 Comparative study of radial lens (Vizitovitch, 1962)
1039 The susceptibility of the bio. (Santhanam, 1962)
1039 Developmental effects of radiation in *Drosophila melanogaster*. (Bastien, 1962)
1039 Effect of radiation on *Mosquito*. (Ludwig, 1962)
1039 Response of *Trybomia castaneum*. (Stark, 1961)
1039 Arsenical development in *X. (Shane, 1961)
1039 Comparative x-ray sensitivita at different developmental stages. (Shane, 1961)
1039 Preliminary results on the effects of radiation on *Drosophila melanogaster*. (Shane, 1961)
1039 The effects of x-radiation on *Trybomia castaneum*. (Shane, 1961)
1039 Sensitivity of *Trybomia castaneum* to radiation. (Shane, 1961)
1039 Studies on the effects of radiation on *Drosophila melanogaster*. (Shane, 1961)
1039 Mortality of irradiated pre-adults. (Shane, 1961)
1039 Influence of gamma radiation on *Drosophila melanogaster*. (Shane, 1961)
1039 Radiosensitivity of various *Drosophila melanogaster* newborn pupae. (Shane, 1961)
1039 Radiosensitivity of various *Drosophila melanogaster* newborn pupae. (Shane, 1961)
1039 Histological investigation of the effects of gamma radiation on *Drosophila melanogaster*. (Shane, 1961)
1039 Radiation effects of genets. (Valencia and Valencia, 1961)
1039 The influence of X-rays on *Drosophila melanogaster*. (Nishimura, 1961)
1039 Effects of X-rays on the sex ratio. (Nishimura, 1961)
1039 Biological effectiveness of with 35 MeV-keV and 35 MeV-keV. (Freier-Niggli and Schmid, 1961)
1039 Biological effectiveness of 186 MeV and 31 MeV-keV. (Freier-Niggli and Schmid, 1961)
1039 The effects of continuous X-rays on *Drosophila melanogaster*. (Caian, 1961)
1039 Studies on the effects of continuous X-rays on *Drosophila melanogaster*. (Caian, 1961)
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1039 Studies on the effects of continuous X-rays on *Drosophila melanogaster*. (Caian, 1961)
1039 Studies on the effects of continuous X-rays on *Drosophila melanogaster*. (Caian, 1961)
Data are given on mortality at 300 u, and on the progressive and normal ovarioles at the lower showing visible effects of irradiation. An explanation of the decrease in the probable presence of dominant
typet TO GAMMA RADIATION.

9 female was significantly different in Co60. Preliminary results are on lethality in blood-fed Aedes
9 eyes at the controls.

THREE SPECIES OF PHILIPPINE Insect pests of Agricultural Importance, National Atomic Energy Agency.

8, 10 and 20 km x-rays
9 respectively. At 1 km, the pro-
8 post-oviposition increase in mortality
9 at 1 km. Mortality at 20 km was
7 embryo of eggs that did not hatch
9 distilled, although some of these
9 adult stage. All the larvae that
8 without attaining the pupal stage.
8 mortality was not attained even
8 abnormally developed wings and/or
8 about 70% of the individuals
9 after irradiation. No significant
9 the 5, x-rays in the ion treatment
8 were killed with 50 km and to
8 about 70% two weeks after the
8 was less than 10% and that with
8 just 40 km. The mortality trend in
9 the seedling does seems to lie at about

C. Habrobracon. (Grouch, 1965)

35 it with FM. (Mayes and Mazzei,
8 sterilization of the ganasy vector

the hell vector. (Davich and

9 Calopogonidae) as leurs
8 hes adultes d'ou chasseaux du ris.

0 as the genase effect of radio-
7 after irradiation of oogasas or

7. (Wiggles, 1963)
8 w.) (Rai, 1963)

6. Variation of radiosensitivity during mating and early cleavage in newly laid eggs of Drosophila
9 melanogaster. (Wiggles et al., 1963)
8. Relative effectiveness of 14 MeV neutrons and 200 keV x-rays for production of lethality in grass-
7 hopper embryos. (Stiek, 1962)
8. The influence of temperature upon the radiation susceptibility of Spirophila graciosa L. (Penniebury et al., 1962)
8. Pathogenic effect of low and medium doses of gamma-rays on the progeny of irradiated insects. (Poddany, 1963)
8. Cytological effect in newly laid Drosophila eggs. (Uchlech and Wiggles, 1963)
8 The susceptibility of the confused flour beetle (Tribolium confusum DuV.) to gamma radiation. (Barnham, 1965)
8. Developmental effects of x-ray induced explodid and near explodid mutants in housefly organ-
11 ation in Drosophila melanogaster. 1. Delay in egg hatching and larval delay and death prior to pupation. (Baumiller, 1963)
8. Effect of radiation on Mexican fruit-fly eggs and larvae in grapefruit. (Brownell and Tvedelovitch, 1963)
8. Response of Tribolium confusum to radiations and other stresses. (Duooff and Bemu, 1963)
8. Arrested development in x-rayed larvae of Sphaeria leachiella Zeller (Lepidoptera: Psychidae). (Sale, 1963)
8. Comparative x-ray sensitivity of Tribolium confusum and T. castaneum (Coleoptera: Tenebrionidae) at different developmental stages during their lifecycle. (Sale, 1962)
8. Preliminary results on the effect of high energy photons on lettuce root growth and on Nixia
8 domesticata. (Yanez, 1962)
8. Effect of gamma-radiation on eggs of the silkworm. (Stumelinsky and Sullivan, 1963)
8. Effects of 300 KV x-ray radiation on Spirophila oryzae. (Flower et al., 1985)
8. The susceptibility of the savannah grain beetle, Oryzaephilus surinamensis L. to gamma radiation. (Jeffers, 1962)
8. The effects of x-irradiation on the embryos of invertebrate animals. (Jusman, 1962)
8. Sensibilité aux rayons X de la durée de développement des œufs de Bombyx mori lorsque l'irradiation est effectuée quelques heures après le début de l'éclosion. (Jusman, 1963)
8. Studies on the effects of gamma radiation on the different development stages of the Khapra
9 beetle, Trogoderma granarium Everts. (Baird and Sahalas, 1962)
8. Mortality of irradiated pre-imaginal stages of Drosophila. (Czczynski and Czczynski, 1965)
8. Influence of gamma radiation on the development and fertility of the codling moth, Carpocpes
9 pomonella (L.) (Lepidoptera: Olethreutidae). (Proverbs and Newman, 1962)
8. Radiosensitivity of various stages of Callosobruchus chinensis L. (Qurashi and Motin, 1963)
8. Effect of Co60 gamma rays on the small curculio. (Rudnova, 1963)
8. Histological investigation on the "premature death" of x-irradiated Drosophila eggs. (Steinbeck, 1961)
8. Radiation effects on genetic systems. (Dose, 1964)
8. A quantitative study of lifetime sickness and mortality and progeny effects resulting from exposure to penetrating irradiation. (Gowen and Stadler, 1962)
8. The influence of X-rays on longevity, fecundity and fertility of Drosophila melanogaster. (French, 1961)
8. Effects of x-rays on the survival of Drosophila fragrans. (Sacher, 1961)
8. Biological effectiveness of 200-MeV electrons in dependence on the tissue depth and in comparison
8 with 180-keV and 30-MeV photons. 1. Lethality test on one-hour Drosophila embryos. (Ehren-Niggli and Schatz, 1965)
8. Biological effectiveness of 200-MeV electrons depending on tissue depth and in comparison with
8 200-keV and 31-MeV photons. 11. Lethality tests on seven-hour old Drosophila embryos. (Ehren-Niggli and Schatz, 1965)
8. The effects of continuous and fractionated doses of gamma-radiation on the survival and fertility of
8 Spirophila graciosa (Calandra graciosa L.) (Jeffers, 1962)
8. Moll, (Moll and Barnham, 1963)
8. The effect of fractionated irradiation with various oxygen concentrations on the radiosensitivity of
8 the Drosophila embryo. (Jusman, 1962)

563
Oxygen dependence of the lethality and mutation rates induced by x-irradiation of Drosophila virilis.
(Weigle, 1960)

Modification of x-ray induced embryonic mortality by different anaerobic conditions before and during irradiation of uncloned Drosophila melanogaster eggs. (Weigle, 1961)

Ecological effects of ionizing radiation on organisms, communities and ecosystems. (Platt, 1962)

Laboratory studies on the use of irradiated sterile males to reduce C. fergusoni West, populations. (Rahmihlonan et al., 1962)

Disinfection of dried figs by gamma radiation. (Papadopoulou, 1963)

The control of warehouse pests by gamma radiation. (Kasulov and Amsterman, 1962)

Les possibilités d'emploi des radiations dans la lutte contre les insectes. (Martin, 1963)

I-3-7 MODIFYING FACTORS
(INTENSITY, RES. LET. TEMPERATURE. SYNERGISTS. CHEMICALS INCLUDING PROTECTIVE AGENTS. ENVIRONMENT AT IRRADIATION. ETC.)


A study was made of the effects of irradiation at 1200 r and incubation temperatures of 35° and 38°c on the production of abnormalities in the development of Tribolium. The observation of the effects is given graphically as the percent abnormalities occurring as a function of time following irradiation in days. The abnormalities were classified according to the degree of deformation in the elytra and the membranous wings.

Amer, N. M., Slater, J. V., Tobin, C. A. ANALYSIS OF THE COMBINED INFLUENCE OF X-RADIATION AND ELEVATED TEMPERATURES ON DEVELOPMENT. (Amer, D1) RAD. Res. 25 (1962) 874. Temperatures studies have revealed that Tribolium incubated at 35°C are less affected in regard to the subsequent development of wing abnormalities. This kind of abnormal development produced by X-irradiation was first described by Beck. Incubation at temperatures other than 35°C significantly alters the production of abnormalities, however, and incubation at elevated temperatures has been found to produce abnormalities that are indistinguishable from those produced by whole body x-irradiation on a variety of accelerated heavy ions. The combined influence of x-irradiation and subsequent incubation at elevated temperatures was investigated. It was found that the combined effects of x-irradiation and elevated temperatures (4P) were more than merely additive in the induction of wing abnormalities. (Controls incubated at 30°C - 1.9% total wing abnormalities; at 35°C - 0.5% irradiated (1200 r), then 35°C - 12.8%.) Further, after 5 at 35°C - 60% after 5-6 at 35°C, then 35°C - 36%; irradiated and kept at 35°C - only 1.8% controls, given 1000 r, at 35°C - 62%; irradiated, then 1-3 at 30°C - most severe; 5-6 at 30°C, then 38°C - mild.) Mathematical analysis of the data using factorial analysis of variance showed that differences between the irradiated animals and the controls were highly significant.

The interaction between irradiation and high temperatures being found to be also highly significant. This supports the suggestion that the combined effects of irradiation and elevated temperatures are synergistic in this system. A mathematical model is suggested. (Based on data.)

Fitz-Niggli, H., Schins, H. R. BIOLÓGISCHE WIRKUNGEN VON 30-MeV-ELEKTRONEN IN ABHÄNGIGKEIT VON DER GEBRENNELTEN UND IM VERGLEICH MIT 180-KEV- UND 31-ME-V-PRÖTONEN. I. LETALITÄTSTEST AN DENSTÖRZEN Drosophila melanogaster. (Biological effects of 30 MeV electrons to dependence on the tissue depth and in comparison with 180 kev and 31 MeV protons. I. Lethality test on one-hour Drosophila embryo.) Strahlentherapie 126 (1961) 379-93. (In German)

Equal irradiation doses (p-measurement values of 30 MeV electrons are the same, both qualitatively and quantitatively) at 1 to 9 min embryos of D. melanogaster at different depths in the plethosom (0, 1.55, 5.35, 8.35, 10.95, and 12.25 cm). The dose effect curve (dose in rad noted) of 180 kev protons, 31 MeV electrons, and 30 MeV electron microelectrons. The relative biological effectiveness (RBE) is therefore 1, and the number in rad is the same as the number in rem. If the measurements values p noted in the action curves of 180 kev protons, 31 MeV electrons, and 30 MeV electron microelectrons, the relative biological effectiveness (RBE) is therefore 1, and the number in rad is the same as the number in rem. If the measurement values p noted in the action curves of 180 kev protons, 31 MeV electrons, and 30 MeV electron microelectrons, the relative biological effectiveness (RBE) is therefore 1, and the number in rad is the same as the number in rem. If the measurement values p noted in the action curves of 180 kev protons, 31 MeV electrons, and 30 MeV electron microelectrons, the relative biological effectiveness (RBE) is therefore 1, and the number in rad is the same as the number in rem.
a realistic value, 1-h *Drosophila* embryos register neither a difference in the linear ionization density nor the difference in the continuous radiation (180 keV photons) and the discontinuous megavolt radiation, which per second delivers 80 electron-kevals in a period of 10 ms. This independence of the ray effects in the 1-h *Drosophila* to the ionization density explains the concordance of the biological and physical transition curves of 30 MeV electrons. (Auth)

1260 Fritz-Halgiz, H., Schaefer, H. R. BIOLOGISCHE WIRKUNG VON 30-MeV-ELEKTRONEN IN AR- 
SÄMTLICHEN UND DER GEBURTSTELLUNG UND BEI VERGLEICH MIT 180-kV- UND 31-MeV-PHOTONEN. II. DEATH TESTING AN NVESTIGATIONS Drosophilaembryos. (Biological effectiveness of 30-MeV 
electrons depending on tissue depth and in comparison with 180-kV and 31-MeV photons. II. Leathality term on four-hour old Drosophila embryos) Stabiothermie 115 (1962) 1-17 (in German).

It was found that 4 h (±10 min) old embryos of wild strains of *Drosophila* which are identical in their 
phenotype have different radiation sensitivities. The 30-MeV electrons were significantly less effective 
biologically than 180-keV photons for 4 h (±10 min) old embryos. The difference was 7-7. The 31-MeV photons were more effective than 30-MeV-electrons, but less effective than 310-keV-photons. The least 
effectiveness of the megavolt radiation is explained by its smaller ionization density in comparison with 
180-keV-photons (100 ionizations/p). The embryos register the differences between 3, 5 ionizations/p for 
31-MeV photons and 1 ionizations/p for fast electrons. The dependence of the effect of ionization 
density on the stage of development of the object irradiated can be explained by the fact that the 1-h old 
embryos (BSE-1) are damaged by direct effects and the 4 h old embryos are damaged more rather by indirect 
effects (irradiation products of water). The biological death dose curve for 4 h (±10 min) old embryos is 
in good agreement with the physical curve. (Auth)

1261 Grench, D. S., Clark, A. M. NITROGEN PROTECTION OF FERTILITY AND FERTILITY IN FEMALE 

Virgin females of Hysteropares submaxillaris († Hysteropares leucocephala) were irradiated. A 3-kV x-rays afforded nearly complete protection from 2500 r x-rays. A series of X-r-terms provided a family of curves which demonstrated that low egg production equivalent to that following 4400 r air was achieved at 1500 r and 1900 r. Egg hatchability was summarized in tabulated form. Protection by the replacement of air by N2 is apparent not only in a significantly higher hatchability after 4400 r but also in hatchability approaching control values after 1139 days. The result demonstrates that the protective effect of gas replacement azaons is affected to all types of cells in the polytropic ovaries. They are distributed, differentiated, and primitive cells. The process of immediate prophase, mitosis, and interphase characterizes the respective periods, with mitotic activity explaining the radioactivity 6-10 d period. Limitation of protection by NH compounds to the sensitive period and its possible interpretation is discussed.

1262 Hansen, W. R. DETERMINATION OF THE BSE OF 14-MeV NEUTRONS USING 14-DAY OLD GRASSHOPPER 

The L10 determined for 14-d, 15-d and 17-d Chortophaga embryos irradiated with 200 keV x-rays was respectively 490 r, 540 r, and 580 r. The mean lethal dose for 14-d, 15-d, and 17-d Encoplectes embryos irradiated with 200 keV x-rays was respectively 510 r, 560 r, and 600 r. The L10 for 14-d Chortophaga embryos irradiated with 14 MeV neutrons was 370 r. The BSE of 14 MeV neutrons was determined to be 1.9. The mean lethal dose determined for any group of Chortophaga and Encoplectes embryos was dependent on the stage of embryo development. The hatchling time of the eggs irradiated with x-rays was delayed. The amount of delay was increased as the dose of x-rays was increased. The period of hatching was also spread over a greater length of time with increased doses of x-rays. (Auth)


The investigation was aimed at examining the biological efficiency of multiple pass systems for radiation disinfection of grain. At 15.580 r there appears to be no loss in efficacy for any system likely to be met with in practice. Fractionation could, however, lead to inadequate control in packaged cereal commodities given low doses to prevent adult emergence. The following details of the study will be shown. Survival of all developmental stages was significantly increased by fractionation, particularly with larvae
and papae. The difference in survival afforded by continuous and fractionated treatments must be attributed to recovery during the intervals between damage. Recovery was noted with intervals of 20 min and longer, the amount of recovery and final survival being governed by the number of fractions, fraction dose, interval time, and interval temperature, but not by overall dose rate. Rate of recovery was greatest in the first hours after irradiation, and decreased with increased intensity of treatment. Irradiation is followed by a period of reduced sensitivity to subsequent treatment. Recovery was obtained in the reproductive cells of irradiated eggs, larvae, and papae, but not adults. Papae showed the highest capacity for recovery of somatic and reproductive cells. Adults require the highest dose to kill and sterilize by continuous and fractionated treatment and are potentially the most dangerous stage in the event of insufficient control.

1364


As 1362, An increase in survival of all developmental stages was noted on fractionation of the dose, the amount of the increase being governed by the number of fractions, interval time, interval temperature and the developmental stage of the insect. Recovery was also noted in the reproductive capacities of females irradiated as eggs, larvae, and papae but not adults. Calculations showed that the commercial dose of 18.500 rep may be given in 2-4 fractions over a period of 5-8 d without reducing its efficiency for the disinfection of grain.

1365


Lethal injury to cells following ionizing radiation may be a result of a stepwise created damage. If the radiation dose is given fractionated in time intervals of the same order as the lifetime of essential radiation-induced radicals, one may be able to interface with the radiation pattern, results will be presented and discussed from experiments on the effect of short-term fractionated irradiation combined with various oxygen concentrations on the radiosensitivity of the 02.5 min old Drosophila embryo. The x-ray dose is fractionated by means of a rotating disc, giving exposure times of 40 sec as a lower limit. A relationship between the dose rate and the mitotic division time is discussed in view of the theoretically synchronized dividing nuclei in the young Drosophila embryo.

1366


Some results were reported in 1962 and 1965. Further studies concerned the oxygen effect and pulsed radiation, and the effects of chronic versus acute radiation and of variations in oxygen effect on ages corresponding to maximum and minimum sensitivities.

1367


The radiation-induced wing deforality in Tribolium confusum was studied. The dose-effect relationship with x-rays is a multi-hit type, with 66% of the insects developing abnormalities at 178 k and 100% at 200 k. With heavier particles, the dose-effect relationship appears to have a lower hit number and possibly becomes a single-hit phenomenon with heavy nuclei when their Bragg peak is in the sensitive region of the body. Severe and C nuclei were found to produce severe effects at much lower surface doses than apparent when O and Ne. These effects included fluid-filled wing blisters and expansion and extension of the underwings at wide angles. B and C nuclei penetrate further than do O and Ne. and may produce these abnormalities because the organism is probably not uniformly sensitive. Interpretation is further complicated by the existence of different linear energy transfer values at the Bragg peaks of different nuclei. In the initial phases of this study it was found that C-particles that the region resulting in wing abnormalities is located near the ventral body surface at a depth of about 300 μ. Following irradiation of the pupae with various nuclei, the O₂ consumption of the developing organism was decreased. (From abstract.)
The induction of anomalous wing development in adult Tribolium by x-irradiation of newly formed pupae was first described by Beck (1961). Subsequent studies with a variety of temperatures have shown that post-irradiation incubation at 30°C results in minimal damage. Incubation at temperatures higher than 30°C was found, however, to allow the number of abnormalities occurring. Post-irradiation incubation at 30°C, after subjecting pupae to as little as 50 r (500 KVP X-rays), was found to increase significantly the percentage of abnormalities produced. Wise et al. (1962) reported that irradiated at 30°C and placed immediately afterwards at 30°C for variable time periods, it was discovered that the combined effects of x-irradiation and high temperatures were more than merely additive, with the maximum accumulative effect being reached only by a 4-5 day incubation at that temperature. Irradiated pupae, incubated at optimum temperatures for development (30°C) for 4-5 days and then exposed to 30°C for as short a period of time as 2 d prior to eclosion as adults, were still found to exhibit a considerable increase in the number of malformations. Post-irradiation incubation at elevated temperatures was highly significant (n=9, 0.01).


The oxygen effect noted by Ulich on embryonic and post-embryonic mortality following whole-body irradiation of Drosophila melanogaster (Berlin wild) could also be demonstrated in dose-effect curves of F1 x-rays of the cross "Berlin wild" X Mather s (Beta). Irradiation of pupae in a N2-atmosphere gave a linear increase in frequency of recessive sex-linked lethals with dose, when plotted semi-logarithmically. A mathematical analysis of the data shows that embryonic and post-embryonic mortality and also mutation rates could be lowered by half if irradiation occurs under conditions of anaerobiosis.


See also:

125a. The effect of culture environment on the susceptibility of the grain weevil Sitophilus granarius L. to gamma radiation. (Mair et al., 1962).


125c. Response of Tribolium confusum to radiation and other stresses. (Doboff and Borma, 1963).


125e. Effect of gamma radiation on eggs of the silkworm. (Hentenberg and Sullivan, 1963).

125f. Studies on the breeding method taking advantage of x-rays in the silkworm. (Yamaguchi and Sekine, 1968).


125h. Sensibilité aux rayons X de la durée de développement des œufs de Bombyx mori lors de l'irradiation. (Leger and Tadika, 1967).

125i. Radiosensitivity of various stages of Callosobruchus chinensis L. (Uchida and Maita, 1963).


125k. Effect of Co60 gamma rays on the small mouse. (Sicard, 1966).

125l. Studies on heavy ionizing particles - TILAC models. (Sicard, 1966).

125m. Experimental analysis of a linear dose effect curve resulting from x-irradiation of Drosophila eggs. (Ulich, 1961).


125o. Effects of x-irradiation upon callus proliferation and morphogenesis in the wing of Tribolium confusum. (Beck, 1969).


125r. Radiobiologic studies with Drosophila. (Sicard, 1966).

In grains of wheat, 1000 rad of γ-rays destroyed 90% of the eggs (2 d old) of S. oyria, but with eggs of S. granarius 2000 rad was required for 80% destruction. S. granarius showed a greater resistance to irradiation at all stages of development than S. oyria, but the difference in resistance decreased as larval stages, with nymphs and young adults of S. oyria 2000 rad prevented development, but 4000 rad was required for the same stages of S. granarius. The γ-rays had some effect in sterilizing adults at approximately 2000 rad, with S. oyria being somewhat less resistant than S. granarius. In both species, 5000 rad or more was required for complete sterilizing of adults. In some tests on adults U was used as the source of the γ-rays, and 10 000 rad killed all insects of both species. (CA 56: 1963, 5064)


A difference in radiosensitivity of T. confluens and T. castaneum was found following exposure to doses of 2 to 6 kV x-ray radiation. Reproductive capacity and individual weights were used as criteria of radiosensitivity. Populations of flour beetles were cultured as single or mixed species. Sterility in both species and shortened life-spans in T. confluens occurred at 4000 kV. All other groups exhibited increased reproductive abilities with time and no significant mortalities. Controls in single or mixed species populations produced comparable numbers of F1 adults. In irradiated single populations T. confluens was significantly more productive, thus indicating greater resistance to x-radiation. Comparative evidence was obtained from mixed populations in which T. castaneum constituted 75, 50 and 25% of individuals, from controls 2000 and 4000 kV, respectively. An 0 and 25% T. castaneum produced more progeny in mixed species cultures than alone, whereas the converse was true for T. confluens. At 4000 kV, these tests were absent in both groups and T. confluens produced no progeny during the first 2 weeks. Within each species F1 production was affected to the same degree in single and mixed cultures as in a given radiation dose. A paper of the same title was presented at the 2nd International Congress of Radiation Research, held at Harrogate, Yorkshire, England, Aug. 9-13, 1962.


Some aspects of growth are reported for x-rayed populations cultured as single- or mixed-species. Irradiation with 250-500 kV x-rays was carried out at 1 km/s to meet doses of 4, 6, or 8 kV. Reproductive abilities, measured as the mean number of F1 adults per female, for single-species populations of T. castaneum given 8 k was approached control values after 1 month, whereas those of T. confluens decayed below controls. Four hr was almost sterilizing over 96 and 99% sterilizing respectively for T. castaneum and T. confluens, while 6 hr doses induced complete sterility in both species. Dominant lethals induced by x-rays were approximately twice as abundant in T. confluens as in T. castaneum. Increased fertility with time was considered evidence that unirradiated genotypes were more radiosensitive than mutants. Full effectiveness elimination of a flour beetle species (T. confluens) in coexistence was indicated at exposures of 24 hr or less. Interpterps antagonism and 2-4 hr irradiation as an environmental stress factor, appeared additive in adversely influencing the reproductive ability of T. confluens. The dose-response curves for reproduction were linear up to 4 hr except for T. confluens. After 4 hr the dose-response curves departed from linearity for both species. Biometric (standard dry wt) of F1 adults increased with increasing dose; however, the weight of individuals was not altered. Parental mortality was not affected at 2 and 4 hr. 94-100% were alive at 10 weeks. In the 6 hr group, 75 and 88% of T. confluens were alive in the single- and mixed-species populations, resp.

Thus, these organs of similar resistance of T. castaneum and T. confluens probably does not agree with genotypic factors may be published in IV-5A-2966, Gene 12 Mar. 1963, 18p.

1374 Ugo, H. REACTIONS TO X-RAY IN MELANOPSEUS. (Abst.) J our. I .

Two species have been compared with the wild 49, which is highly resistant, which is also unsuitable for selection work which has been done in minutes for the susceptible sticky values for the unsuitable sticky in both sexes in the first stock and 4-6 km 1200 kV; 3 mAs 1.7 basic female each in intervals of (a) the percentages of fertile cut that all donated in all were the differences due with raising 5 means the absolute differences in the 3 l rubbing the two stocks at the 3 does in 1 the percentages of lethals are up due. In the 2nd breed no sharp somewhat higher rates than the mutation-rates in the two stocks respect to the different breed increase and the experiments of (semantics) of the normal back. altered.

See also:

972 The use of ionizing radiations
978 Effects of radionucleides
979 X-ray tolerance of re c
921 Effects of radiation on ir
922 Effects of gamma radiation
923 The susceptibility of the (Barnes, 1962)
923 Radiation: effects on repr (Barnett and Bell, 1961)
923 The effect of irradiation Bell, 1962)
924 X-ray effects on different castaneum. (Edman, H.E.)
924 Comparative X-ray sensitivities of different developedimests
925 Effects on the effect of io
926 Radiation effects on ge-gage
926 Radiobiological studies with animal models
926 Relationship between Y-radiation and the radiometric effect (Svendsen et al., 1962)
924 The effects of gamma-rays
945 Effects of gamma-ray
945 Preliminary studies on ir
945 Comparisons of irradiated an
mixed-species populations, respectively, indicating that irradiation and conspecific reduced survival. Thus, those two organisms of similar biology differed radiologically, as seen by the overall greater resistance of \textit{T. castaneum} compared with that of \textit{T. confusum}. The one more pair of chromosomes in \textit{T. castaneum} probably does not satisfy a genetic interpretation of radioinduced damage, but physiological and nutritional factors may be responsible. (NSA 18:3804, 1984). A report, under the same title, was published as HV-5A-2950, General Electric Co., Hanford Atomic Products Operation, Richland, Wash. 12 Mar. 1985, 18p.

1314

Two stocks have been selected in respect to some reactions of the male to x-rays, the normal stock \textit{S} with \textit{S} and \textit{R} with \textit{R}, derived from the former by selection, which is rather susceptible to HCN, and a 2nd (\textit{K II}), derived from the former by selection, which is rather insensitive in respect to DDT-resistance. The selection work had been done in respect of DDT-resistance. After giving HCN-gas the LT_{50} values (in minutes) for the susceptible stock are about 10-6 for the males, and 9-2 for the females; the corresponding values for the susceptible stock are 12-9 and 13-2. After these times of exposure there is 100% mortality in both sexes in the first stock. The males of these stocks have been irradiated with doses of 3-5, 2-7, and 5-5 kR (106 kV): 8 min; 1-7 and 5-6 min. In air and individually and repeatedly crossed with one female each in intervals of 2-3 until the 3rd brood. In the F_{2} two characters have been studied: (a) the percentage of fertile cultures, (b) the number of progeny per fertile culture. It could be seen, that at all dosages and in all broods the males of the \textit{S} and \textit{R} stock give higher values. In the (b) experiments the differences are rather limited with rising dosage, especially in the 3rd brood with the lower fertility. In the \textit{S} stock the males and females in the second brood give higher values for the \textit{S} stock; during irradiation the percentages of lethalities are smaller in the \textit{R} stock at all dosages, the differences growing with rising dosage, in the 3rd brood no sharp decrease in the rate of mutations can be seen in the \textit{R} stock giving somewhat higher rates than the \textit{S} stock.

1313

Tribolium confusum and

Induced dominant lethals, single- or mixed-species, irradiated, or not. Reproductive ability of \textit{T. castaneum} populations is reduced below controls, for \textit{T. confusum} and \textit{T. confusum}, each, induced by x-rays were irradiated with doses that were the same ones, Selective irradiation at exposures > 6 kR but also at 12 kR; all these factors appeared additive. Dose-response curves for response-response curves departed from with increasing dose, however, at 2 and 4 kR, 94 - 100% were alive in the single- and mixed-species populations, respectively, indicating that irradiation and conspecific reduced survival. Thus, those two organisms of similar biology differed radiologically, as seen by the overall greater resistance of \textit{T. castaneum} compared with that of \textit{T. confusum}. The one more pair of chromosomes in \textit{T. castaneum} probably does not satisfy a genetic interpretation of radioinduced damage, but physiological and nutritional factors may be responsible. (NSA 18:3804, 1984). A report, under the same title, was published as HV-5A-2950, General Electric Co., Hanford Atomic Products Operation, Richland, Wash. 12 Mar. 1985, 18p.

1314

Two stocks have been selected in respect to some reactions of the male to x-rays, the normal stock \textit{S} with \textit{S}, which is highly susceptible to HCN, and a 2nd (\textit{K II}), derived from the former by selection, which is rather resistant to DDT. The selection work had been done in respect of DDT-resistance. After giving HCN-gas the LT_{50} values (in minutes) for the susceptible stock are about 10-6 for the males, and 9-2 for the females; the corresponding values for the susceptible stock are 12-9 and 13-2. After these times of exposure there is 100% mortality in both sexes in the first stock. The males of these stocks have been irradiated with doses of 3-5, 2-7, and 5-5 kR (106 kV): 8 min; 1-7 and 5-6 min. In air and individually and repeatedly crossed with one female each in intervals of 2-3 until the 3rd brood. In the F_{2} two characters have been studied: (a) the percentage of fertile cultures, (b) the number of progeny per fertile culture. It could be seen, that at all dosages and in all broods the males of the \textit{S} and \textit{R} stock give higher values. In the (b) experiments the differences are rather limited with rising dosage, especially in the 3rd brood with the lower fertility. In the \textit{S} stock the males and females in the second brood give higher values for the \textit{S} stock; during irradiation the percentages of lethalities are smaller in the \textit{R} stock at all dosages, the differences growing with rising dosage, in the 3rd brood no sharp decrease in the rate of mutations can be seen in the \textit{R} stock giving somewhat higher rates than the \textit{S} stock. In the 3-0 kR experiment, for instance, the relative values of the mutation-rates in the two stocks in the 3 broods are: 3-0; 1-7; 1-1, 0-8, and 0-2 II 1-0; 1-1; 1-1. In respect to the different brood patterns of the 3 stocks reference is made to the results of other authors, especially to the experiments of Solski, who found a sharp rise of mutation rates in the second brood (0-males) of a normal stock, when the flies had been irradiated in an HCN-atmosphere. (Essentially abstr.)

See also:

778 The use of X-ray in the preservation of normal products. (Del Monte, 1959)
785 Effects of irradiating single- and mixed-species of beetles. (Hudman, 1961)
789 X-ray tolerance of two related species of beetles. (Bolecule, 1963)
789 Effects of radiation on insects (LaC shortage, 1962)
795 Effects of radiation on insects (LaChance, 1962)
795 Effects of radiation on insects (LaChance, 1962)
795 The susceptibility of the cucumber beetle (\textit{Tribolium confusum Duv.}) to gamma radiation. (Shilkin, 1961)
795 Radiation effects on reproduction in placental and unsexed strains of \textit{Tribolium confusum}. (Gartlett and Tell, 1961)
1300 The effect of irradiation on reproduction in two strains of \textit{Tribolium confusum} (Herbst. (Bartlett and Tell, 1961)
1315 X-ray effects on different life stages of two fruit beetles species (\textit{Tribolium confusum, Tribolium castaneum}). (Shilkin, 1965)
1324 Comparative x-ray sensitivity of \textit{Tribolium confusum} and \textit{T. confusum} (Coleoptera: Tenebrionidae) at different developmental stages during their life cycle. (Tridah, 1962)
1380 Studies on the effect of X-ray on the development of insects. (Falisti and Itikovitz, 1962)
1380 Irradiation effects on genetical systems. (Cree, 1961)
1380 Radiobiological studies with \textit{Drosophila}. (Barlow, 1962)
1355 Relationship between X-ray resistance and longevity in \textit{Drosophila melanogaster}, especially in terms of the radiation effect. (Tebari and Marini, 1961)
1340 The effects of gamma-ray irradiation on certain species of store-product insects. (Dennis, 1961)
1340 Effects of gamma-ray irradiation on \textit{Drosophila} radiation. (Ghosh et al., 1961)
1340 Preliminary studies on irradiation of some common stored-grain insects in Pakistan. (Haque, 1962)
1340 Comparisons of inbred and random bred larval survival to 1200 r. (LovellChrist and Rattoy, 1962)
Effects of gamma radiation on three species of Philippine insect pests, (Vascon and Masato, 1963)
Distribution of dried figs by gamma radiation, (Papadopoulos, 1963)
Irradiation of fruits and vegetables in a mobile cobalt 60 unit, (Harvey, 1963)

I-C Radiation Effects on Insect Populations


The failure of S. morsitans (Anopheles quadrimaculatus) sterilization trials was analyzed for contaminating factors such as sexual vigor, competitiveness, flooding ratios, etc. Differences in pupal morality and adult viability in Aedes aegypti depend on age of pupae at irradiation. Data are tabulated on effect of exposure to γ-radiation in the pupal stage on adult emergence and viability. Effects of poststerilization on competitiveness was examined in the two species. Pupal age at irradiation markedly affects post-irradiation competitiveness of quadrimaculatus. In order to check on the mating of laboratory-reared males with wild females, groups of quadrimaculatus were isolated by exposing larvae to CO₂. Such adults are not harmed by their increased radioactivity and mate normally under laboratory conditions. Labelled sperm in the spermathecae readily identify females after mating with labelled, laboratory-reared males. The technique should allow such irradiated females to be identified in the field.


Immediately after treatment 2- to 4-day old males of D. melanogaster Meigen exposed to 16 kR of γ-radiation did not mate as readily or as many times with virgin females as untreated males or males exposed to 8 kR. However, males exposed to 32 kR recovered within 24 h and normal mating frequency and behavior occurred. When males flies exposed to 16 kR were held for 24 h before mating, the number of matings per day was not affected and there was very little effect on mating competitiveness of these males as compared with untreated males. (Auth. summary)


The experiments were divided into 3 groups (0, 54, 72) according to the (approximate) age in hours of the males at the time of irradiation. They were mated to several virgin females during two 15-h mating periods interrupted by a 15-h collybol period. All matings were observed, the irradiated females were isolated, and the offspring counted. Among very young males (during first 2 h after emergence from pupal case) a considerable portion copulate before being able to create offspring. Sexual activity is higher in the 1st hour after males are transferred to females than for males exposed to radiation (but for males except group 0). Activity is almost the same during both mating periods for groups 54 and 72. The frequency of sterile matings seems to decrease with the number of matings a male is capable of performing during a 15-h period. The average brood size seems to decrease with increased sexual activity of the males. Males with high activity have, in their 1st mating after a collybol period, a much higher brood than males with low activity.


The effectiveness of males sterilized by aphthate (2, 4, 6, 4-bis-hexahydro-2, 6, 4-hexahydro(1-aziridino))1, 2, 3, 4, 5, 6-triazinephosphonate) and of males sterilized by γ-rays is compared for reduction in reproductive potential among eaged populations of the yellow fever mosquito, Aedes aegypti. In irradiation, groups of male pupae Þ 54 h old, were given 1000 r and 10,000 r γ-rays (Co60 source) at 10 cm. For cohabitation treated, groups of sterilized males were fed for the first 3 to 4 d after emergence on 1% aphthate in 20% aqueous honey solution. Subsequent mating tests and their results are described. Sterilemales appear to offer an effective method of sterilization without damaging the mating ability of A. aegypti, but doses of radiation sufficient for sterilization of males prevent them from competing fully with normal males. Further studies may develop a method of administering radiation at a time in the life cycle which will not decrease male competitive ability.
Records, (Viola and Manso, 1963)

1963

763 Radiation-induced sterility in the insect Rhodius prolixus. (Baldwin and Shawe, 1963)
784 Quelques résultats expérimentaux concernant l'influence des rayons gamma sur les chrysides et les nœuds de la reine de la famille "Sphingidae". (Pekovskii, 1963)
807 Some effects of gamma radiation on the reproductive potential of the cockroach, Caracassilocapsa portoricensis (L.). (Lepidoptera: Olethreutidae). (Proverb and Newton, 1963)
824 Influence of gamma radiation on the development and fertility of the cockroach, Caracassilocapsa portoricensis (L.). (Lepidoptera: Olethreutidae). (Proverb and Newton, 1963)
917 Effects of ionizing radiation on insects and other arthropods. (Stoud, 1963)
1443 Mass production of sterilized males of Aedes aegypti. (Tay et al., 1963)
1535 Stimulation of the Mediterranean fruit fly and its application to fly eradication. (Kassey and Valero, 1963)
1561 The application of nuclear energy to agriculture. (Men, 1963)
1679 On the role of lethal mutations in the control of populations. (Bonal and Irlandi-Traverso, 1962)

1-C-6 BEHAVIOUR

A variety of animal species were tested. Exposure to 500 r of y-rays has failed to identify an avoidance response in Drosophila. Attempts to selectively breed a strain showing an avoidance response have as yet been unsuccessful, apparently because of an inadequate selection against those animals unable to detect the radiation.

1580 Христов, В. Г., Превдин, Г. М., Дасенов, Я. Г. ПОВЕДЕНИЕ ВОДОЛОБОЙ МУЖКИ (Drosophila melanogaster) ВО ВРЕМЯ ЛЕЧЕБНОГО РЕКОНВЕСТРИРОВАНИЯ. Журнал микробиологии, 2, 6 (1963), 275-9.

A marked drop was observed in the number of eggs laid by irradiated females. A series of experiments in which the disposition and combination of the radiation sources were varied showed that under existing conditions the females avoided ovipositing in the zone of irradiation. Co60 and H30 (2-0.1 mc/cm²) were tested. The threshold of sensitivity to irradiation from H30 did not exceed 0.02 c/s. The need is stressed for taking into account the character of the response reaction to irradiation when comparing the radio-sensitivity of different species.

Two types of experiments were set up to compare the behaviour of flies carrying radiation-induced and spontaneous lethals. In one experiment, flies heterozygous for 2 lethals, one natural and one induced by radiation, were released among the populations of 2 islands in the bay of Anga do Rei in Brazil. On July 26 populations cages were set up, 3 consisting of N01, N02, N03 and N01-2, and 3 of N03 and N03, N03, N03 and N04. About 2000 females were made with the marked males (i.e. 500 with flies from each cage). A detailed report is pending. (Based on abstr.)

The project was initiated in 1963. The objective was to investigate the feasibility of irradiation techniques for control of forest insects, particularly a bark beetle Litycystus (LeConte) and a sawfly (defoliation)
Neodiprion palpivus complex. A Model U, Co\textsuperscript{60} irradiator (1000 c) calibrated at 1000 c/min of exposure was used to irradiate various stages of the sawfly and adults of the bark beetle at dosages ranging from 5000 to 16000 c. Irradiation of feeding larvae, ultimum larval stages, and prepupal larvae of the sawfly at dosages of >1000 r prevented successful development. Irradiation of pepsin stimulated emergence, and significant mortality did not occur at <2000 r. Behavioral processes of larvae, particularly feeding and cocoon formation, were markedly affected. Sterilization effects cannot be determined until spring, 1984. Sterilization of both males and females of the adult bark beetle apparently occurred at low radiation levels (<1 000 r). Gallery patterns, oviposition, mating behavior and longevity seem to be little affected at this dosage level. Sterilization to aid in control appears to be a distinct possibility if used in conjunction with natural antagonists. (Ferris abstr.)

See also:
913 Study on housetails sterilized with x-rays, (Sacch, 1901)
1309 Study on the evolution of social parasitism in the ant, Attempts of genetic interpretation and plans for experimental analysis, (Guer, 1943)
1376 Effects of gamma radiation on mating competitiveness and behavior of Drosophila melanogaster males, (Hanneberry and McEwen, 1933)
1377 Sexual activity of Drosophila melanogaster males, (Stummer and Kivelmark, 1.)
1471 Sterilization by gamma radiation for the control of the navel orangeworm Paramyelus neoblatus (Walker) (Lepidoptera: Phyidae), (Tinamar, 1943)

I-C-3 POPULATION DYNAMICS

1383 Marone, E.K., Macei, C.M.P. SOME COMPONENTS OF ADAPTIVE VALUES OF HETEROZYGOS Drosophila willistoni FROM IRRADIATED NATURAL POPULATIONS. Experiments 17 (1961) 404-5. (In English)
The analysis of some adaptive components (percentage of hatched eggs, viability, and fertility) in an irradiated natural population of D. willistoni shows, after irradiation with Co\textsuperscript{60}, reduced adaptive values during several generations after irradiation with progressive compensation to the control level in successive generations. However, this population for 15 generations does not attain the percentage of hatched eggs of untreated populations. (Auth.)


An experiment was designed using populations of D. pseudoobscura with different gene arrangements on the third chromosome, to study the effects of various temperatures and different dosages of radiation on the innate capacity for increase. The innate capacity for increase was found to increase with temperature and decrease with higher radiation dosages. The mean generation length showed a decline with both treatments, with a greater decrease in the former treatment. Net reproductive rate showed a decrease in both cases with the limit of increase (A) observed to increase in the temperature experiment and a decrease in the radiation experiment. Percentage contribution of each age group to the rate of multiplication per generation depended on temperature and dosages of radiation as well as the genetic background of the population. (Auth.)


This research includes: 1) Population and evolutionary studies of Drosophila and 2) Direct and indirect effects of radiation and their modifications using dominant lethals, recessive lethals and translocations as a measure of genetic damage. The first part is concerned with the analysis of genetic population structure including conelocado variability in the form of dentinum, sterile and lethal factors. This is investigated in small populations, large thin populations and in large dense populations. Further extensive uses of viability, fertility and longevity utilizing other island populations where migration is minimal will provide a better understanding of the genetic structure of populations in radiation to their sites, distribution and isolation. Studies are being made with D. pseudoobscura, D. ananassae, D. melanogaster and others. Direct and indirect radiation effects are being studied with Drosophila and microorganisms. Experiments measure the relation between radiation damage and environmental variables such as temperature, gaseous environment of the organism (argon, air, oxygen, helium, methane, carbon monoxide, nitric oxide, propane, etc.) under normal or increased gas pressure. We are studying these effects on both male and female D. melanogaster (recessive lethals) and in D. virilis (dominant lethals and translocations) over the full cycle of spermatogenesis and some stages of oogenesis. The amount of damage from the same dose of radiation may be modified by these radiation and organism.

1386 Sambamurugan, K. FITT 3, 56 p. 75 in "Genetics of 9 September 1933, Vol.1", (G).

Males in experimental popula 4000 r, 6000 r and 7000 r at of relaxed selection, the rat population, males received as generation. At other dose generation C only and G age populations were weakened what is the fitness investigated are (1) from the egg to the adult in is the observation that the rad 0.71. at the egg stage. I hatchability and viability rates chromosomes in progressive as to how much of the genetic.

1397 Atmohida Tadada, S. E. VERL LACCD DE Drosophila willistoni, study on the frequency of level of background radiation) (English summary). The techniques used were thin two marked nuclei, and the fraction of radiation effects could be done paper.

1398 Maylock, B.G. CHROMOSOME EXPOSED TO CHRONIC LOW-VITTLIE. 1968, 83p.

The salivary gland chromosome complex was examined for 200 chromosomes per year or about 1000 times per specimen (method) of L. by examining the structure of each chromosome with those of Canadian and new different chromosomal aberrations were examined for 200 chromosomes per year or about 1000 times per sample. This was essentially the same in the form of chromosome aberrations for low-level irradiation from rad and without significantly increase and control populations, these were used in testing the frequency of the heterogony to 1992. Also, no changes in these inversions from June this no significant difference in the number of the different populations of C. ren.
radiation may be modified by a factor of 4, therefore they provide understanding of the relationships between radiation and organisms.


1-4 I-C-4 GENETIC CHANGES


frequencies are endemic to the population of East Tennessee and have been established in the population for a long time. The frequencies of the standard arrangement, the heterozygous inversion, and the homozygous inversion of 18A were significantly different from the expected frequencies as predicted by the Hardy-Weinberg Law. A deficiency of inversion heterozygotes was found which is contrary to the theory of balanced chromosomal polymorphism, but is consistent with a model proposed by Larrivee, where under certain assumptions genetic equilibrium can be obtained without the heterozygote being selected. The results show that chromosomal polymorphism can be maintained in a natural population without superiority of the heterozygote individuals. (Diss. Abstr. 26: 1964, 1969)


The salivary gland chromosomes of C. peregrin larvae collected from White Oak Creek and from 6 uncontaminated areas were examined for chromosomal aberrations. White Oak Creek populations were exposed to a dose rate calculated as 250 rad/year, or about 1300 times background. Fifteen different chromosomal aberrations were found in 385 larvae taken from the irradiated population as compared with 5 different aberrations observed in 385 larvae from 6 control populations, but the mean number of aberrations per larva did not differ in any of the populations. The quantitative amount of heterozygosity was essentially the same in the irradiated and the control population, but there was three times the variety of chromosomal aberrations found in the irradiated area. From this evidence it was concluded that chronic low-level irradiation from radioactive waste was increasing the variability of chromosomal aberrations without significantly increasing the frequency.


Two populations of D. melanogaster were irradiated periodically with small doses of X-rays (100 r and 500 r). These, and two controls, were maintained at 29.4°C. On the 16th and 26th day the hatchability and fertility were assayed on egg samples obtained from individuals which had not been irradiated directly, taken from each population. The relative data indicate a percentage diminution of these fitness factors in the populations irradiated with 500 r and, to a smaller extent, in those irradiated with 100 r. The diminution in fitness is interpreted as being due to the accumulation of lethal genes induced by the irradiation. At 20°C intervals the numerical levels were determined, altogether 27 times. The totals obtained are significantly higher (with the Y² test) in the 500-r population and in controls. The heterogeneity test was, however, positive. If confirmed, these observations could be interpreted as being due to a greater adaptability in the irradiated populations in a selective environment. (From auth. summary).


Four replicate populations (2 control and 2 experimental) of 100 males each stock were maintained for 3 years in vial populations in which food, space and change schedule were rigidly controlled. Populations produced by this design are small (not more than 100 adults) and are equilibrated under strong natural selection. Population size and production were measured weekly. The experimental populations received radiation treatments; the dose was given over a period of 2 years and totalled 55 000 r units of X-ray. Rate of administration was 1000 r/week with 3 periods of 10, 16, and 25 successive weeks during which radiation was suspended. No radiation was given in the final year. Genetic loads carried by each population were measured three times during the final year. Random loss of eggs from each population were collected, counted and then adults were reared from these eggs under ideal conditions. Yields of adults from the irradiated populations were significantly below those of the controls at the first measurement. This indicates that these populations were carrying genetic loads due to the history of radiation. These differences, however, were absent after one year, indicating that the loads due to radiation had disappeared. This effect is accredited to the efficiency with which natural selection removes new deleterious mutations from small populations. At the termination of the experiment, population size of the experimental did not differ significantly from the controls.

Chung, C.S. RELATIVE GROWTH POPULATIONS OF DROSOPHILA melanogaster. The effect of irradiation on the rate of breeding was studied by extractive effects on viability in homozygous populations. These irradiated and nonirradiated populations were then grown at 25°C and 30°C on agar slants. The results indicated a significant increase in the growth rate of the irradiated populations. The difference in growth rate was significant at the 0.01 level.

Corsini, A.R. CHROMOSOME POPULATIONS OF DROSOPHILA melanogaster. In an isolated natural population of 9 months, a significant decrease in the chromosome number of the irradiated population was observed. These results suggest that the irradiation has caused a decrease in the chromosome number in the population.


Starting with wild inbred Drosophila melanogaster, two cultures were established; one was irradiated with a dose of 2000 r and the other was not. After 10 generations, the number of irradiated females was significantly lower than that of the control, indicating that the irradiation had caused a reduction in viability.

Dohmachenko, T. PROGRESS REF. Tech. 1970. Rockefeller Inst. for Medical Research. Results are reported from studies on the effects of X-rays on the development of Drosophila melanogaster. A comparison of the effects of X-rays and gamma rays on the development of Drosophila melanogaster is presented. The results indicate that gamma rays are more effective in inducing mutations than X-rays.

Drosophila. (NEB 17: 1965, 248)
new established in the population for gene inversion, and the homogeneity as predicted by the theory which is contrary to the theory of random genetic drift. The conclusion was that even with an apparent increase in the number of abnormalities, the natural population without superiority in these areas was the same as the variety of 56. It was concluded that the effect of chromosomal aberrations

VARIABILITÀ DI ALCUNI POPOLAZIONI PERIODICAMENTE GRATIFICATI

in Italian, with English summary), all doses of x-rays (100 r and 50th and 20th day the hatchling with chitinous integument divided among the two females to be used in these observations could be

LABORATORY POPULATIONS


which were maintained for 3 years in controlled populations. Populations produced under natural selection, 1 populations received radiation, 4 weeks of x-ray. Rate of adult males, weeks during which radiation was received by each population was measured. Population was divided, counted, and the number of adults from the irradiated sources. This indicated that these variations, however, disappeared. This effect was seen in numerous cases from small experiments but did not differ


The effect of radiation on the relative genetic load due to lethal and lethal genes expressed by the irradiation was studied by extracting 257 second chromosomes of D. melanogaster and by examining their effects on viability in homozygous and heterozygous conditions for one nonirradiated and 8 irradiated populations. These irradiated groups had been maintained in the laboratory for several years after cessation of the irradiation. No consistent relationship to the radiation history of the populations was found. The data indicated that the irradiated stocks were nearly at equilibrium for both determinate (C) and lethal (L) loads. The overall mean ratio of D to L was estimated at .56. A slight increase of D but constant L with crowding condition of culture suggested that the D to L ratio may be understimated under uncrowded laboratory conditions. The lethal genetic load expressed through sterility has been reported in terms of sterile equivalent with two components of partial and complete sterility. Over both sex the two components were found to be equally important in their harmful effects. Apparently one fourth of the total lethal load manifested through lowered viability and sterility is contributed by sterility factors. The second chromosomes of the irradiated populations in heterozygous arrangement with one B or C chromosome caused significantly reduced viability and sterility below that of the similar combinations of nonirradiated populations. This increased heterozygous load due to irradiation was in the magnitude of 0.0235±0.0084. Implication of this finding relative to degree of dominance of lethal genes is discussed.

(Anon.)


In an isolated natural population of D. willistoni more than 70,000 γ-irradiated flies were released within 7 months. A significant decrease of the mean insertion frequency per individual was established. Some insertions in the second chromosomes of EBC, EBD, EBE, and EEP were even smaller than in the non-irradiated natural control population even 36 months (56 generations) after the last release. In the irradiated population two new insertions were found (one in the X and one in the third chromosome). (Anon.)


Starting with wild inbred lines D. willistoni from natural populations, four levels of irradiation were obtained: (a) controls, about “zero level” (350 strains); (b) controls with sih mating last (5th) generation, level 0.68 (101 strains from 508); (c) sih mating 6 generations, level 0.68 (118 strains from 608), and sb mating 4 generations, level 1.0 (1 strain from 50). Significantly different egg-adult viabilities were observed among these series: (a) 15.1% (b) 26.7% (c) 28.7% (d) 34.7%. Levels (a), (b) and (c) strains were subcultured in two separate and parallel series of replication, one (d) received 600 r from a Co60 source, the other (d) was submitted to the same conditions, except radiation. A total of 127,012 eggs have been counted in these experiments. The most pertinent results are: at the (a) and (c) levels the (k) did not differ from (a). Nevertheless at the (d) level radiation produced an overall enhancement of egg-adult viability; k (d) = 13.6%, K (d) = 34.7%, placing its average viability over that of the "high" class after radiation. The variance increased significantly among the irradiated straining blocks, concluding that the extremes (high and low) of viability depressed toward the average more among the irradiated than between the control the median class showed the greater increase in variance. (From author.)


Results were reported from studies on the nature and magnitude of the genetic load in natural populations of certain species of Drosophila. Results are included from experiments on the viability effects of genetic variants in natural populations in homozygous and heterozygous condition, a study of chromosomal variants in a natural population of Drosophila pseudobscura, and genetic loads in irradiated populations of Drosophila. (NSA 17: 1963, 24997)
1386 Dobzhansky, T. GENETIC STRUCTURE OF NATURAL POPULATIONS. (Abst. BID442) p.49 in "Research and Development in Progress, Biology and Medicine, Issue No. 1", TID-450, Division of Technical Information, AEC, July 1953.

The aim of this research program is to fill some of the gaps in the basic knowledge on which the judgement of the magnitude of the genetic radiation hazards must rest. Among the crucial questions which are still awaiting solution are: (1) how widespread in natural populations are genetic variants which are detrimental to the host or beneficial to the parasite? (2) Are there any species of insects which are relatively free of these effects? (3) Are such genetic variants merely temporary, adaptive, and easily replaced, as claimed by some authors, or do they endure for a long time? (4) Are the effects of the genetic variances found in natural populations those that occur more or less constant or dependent on interaction with other variants in the same populations, and (5) are there many gene loci represented in natural populations by numerously alleles or only by a single or by a few alleles.


An isolated strain in the Sokolno region of R.C. Sud (Batal) received during one year 5 releases of about 71,000 individuals from a laboratory population originated from the same wood. A total of 1,000,000 from a C.6.1 strain was delivered to those 5 samples. Of the last irradiated sample, 6,247 as well as the samples collected in the isolated wood, 5 generations (NMR) and 15 generations (NR3) after the release of 0R1, have been genetically analyzed for the II and III chromosomes. The S1 exhibited a significant increase of lethals (II chromosome: 6.70% III chromosome: 20.80%) in regard to the controls values from another unirradiated isolated wood (II: 6.10%; III: 20.00%). The allele increased for each sample II: 0R1 = 8.30% and Control = 1.00%; III (0R1) = 4.10% and Control = 0.20%. This increase persisted in 15 generations in nature: NMR II = 6.20% III = 3.20%. This high allele frequency was maintained in spite of the return to control values of the III chromosome lethals. The II chromosome lethal frequency was still significantly higher than the control (44%). The albinism tests on samples (0R1, X NMR; 0R3, X NMR; 0R1, X Control; 0R3, X Control) showed (66%) II: 4.50% and 5.50% for the III chromosome. As values of lethal persistence from the 0R1, 15 generations after natural selection, there are indications that several components of the adaptive value were depressed (2) and that chromosome inversions might "protect" some lethals (3). The persistence of some lethals suggests their complex coadaptivity as even some balanced effects.

(1) 1953
(2) 1953


(For abstract, see Mourad's thesis, ref. 1399.)


Experimental populations of Drosophila pseudoobscura kept in laboratory populations cages, were used to study the effects of exposure to ionizing radiation. The populations were polymorphic for AR and CH gene arrangements in the third chromosomes. Only AR, or only CH chromosomes, were exposed to radiation. Since the gene arrangements were recognizable cytologically, it was possible to follow the deserts of the irradiated and the non-irradiated third chromosomes in the populations. Control experimental populations, with no radiation histories, were also studied. In populations Nos. 2 and 3, flies carrying the AR chromosomes of the foundation stock were exposed to 1600 r-units of x-rays, and the populations were allowed to breed without further irradiation. The frequencies of AR chromosomes declined at first, but subsequently recovered, and in one of the populations almost reached the same equilibrium state as in the control. In populations Nos. 4 and 5, the CH chromosomes of the foundation stock received 1200 r-units, and no further radiation was applied. The frequencies of CH chromosomes declined more rapidly than in the control. In populations Nos. 8 and 9, flies carrying the AR chromosomes were treated with 1000 r- of x-rays, and thereafter the populations received in every generation an inflow of AR chromosomes exposed

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to the same amount of radiation. Compared to the controls, the frequencies of all chromosomes were depressed, but the polymorphism was nevertheless preserved. (Diss. Abstr., 23: 5: 1688, 1454).


According to Dobzhansky's classification (Cold Spr. Harb. Symp. quant. Biol., 29 (1964) 1-6), there are two mutually contradictory hypotheses concerning the genetic structure of natural populations, i.e., the classical hypothesis and the balance hypothesis. From the present study it appears that there are 2 kinds of distribution in Droopella melanogaster, the balance hypothesis applying to one (about 2/3) and the classical to the other (remaining 1/3). Heterosis seems to be destroyed by spontaneous mutations in the genetic background, but compensated by a high mutation rate. There may exist an equilibrium such that mutation at one locus supplies variability of its own but at the same time causes a decrease in variability at other loci.


A test chromosome of Samarkand's isogenetic strain, which was irradiated by x-rays of 500 or 1000 r was isolated by C, M.I. method. The other major chromosomes were substituted by Samarkand chromosomes. 27 lethal genes were obtained and 2 of them were found allelic. These lethals have been maintained by C, balanced system. The heterozygous effects of each lethal gene on pre-adult viability were estimated on heterozygous and on homozygous genetic background. The mean coefficient of selection on homozygous genetic background was 0.55 and on heterozygous genetic background it was 0.919/1. The genetic background on which a lethal gene was placed, proved to have a remarkable influence on the individual heterozygotic effect of the lethal gene on viability. No correlation was observed between their coefficients of selection on both genetic backgrounds. Some lethal genes were introduced separately to experimental populations and their individual performance was observed during about 20 generations. For 1st 10 generations, their decreasing frequencies seemed to depend on the magnitudes of selection coefficients, and later their frequencies gradually decreased at a similar rate that was theoretically assumed (σ = 0). (Auth. summary).


In all, 107 Drosophila were exposed as larvae to primary cosmic radiation during a flight which remained from 70,000 to 80,000 feet for 16 h. The control series included 7480 individuals. No demonstration of X chromosome breakage or gene mutation at specific X chromosome loci was possible either because of the rarity of chromosome breaks or of nuclear collisions or because of lethal effects of the former. (Auth. summary).


Alterations of viability of Drosophila melanogaster have been studied after x-raying a population in its consecutive generations. The population used had been derived from the Berlin wild stock. In each generation 500 males and 500 females (1-6-8) had been irradiated with an acute dose of 2200 r. Up to more than 30 generations of irradiation viability characters have been studied in intervals of about 5 generations by testing lifespan, fecundity, and fertility after application of different x-ray doses ranging from 0-100 r. The results obtained show that in each of the 8 characters studied the irradiated population reached a significantly higher degree of viability than the Berlin wild stock under all experimental conditions. The higher fitness of the irradiated population is explained by an effect of heterosis. A great number of mutations must have been induced by the irradiations and accumulated in the population. As a consequence a higher degree of heterozygosity must have been reached.

The total frequency of 30.5% lethal II chromosomes of D. willistoni from an irradiated "A" population do not differ from the control "F" population, 30.5% (x² = 2.17) (714 strains). This analysis was made 7.5 generations after irradiation. The "A" population exhibited 6 out of 19 recessed lethals and the "F" 3 of these. Nevertheless, 3 lethal loci are exclusively found in "A" irradiated population. The allelic tests were performed and the calculated average mutation rate per locus in the II chromosome of willistoni 0.06686 obtained from the data of Dobzhansky et al. allows the estimation, with Wright's formulae of the equilibrium levels for each lethal assuming complete repressivity. According these calculations the 6 more frequent induced lethals, will present in population "A" and the 3 sporadics allels of "F" population are 10 to 54.6 times above the expected values. The lethal survival in nature, at such high frequencies, can only be explained by mutation pressures many times above the normal average observed or by overdominant alleles providing genetic compensation or both, by mutational and balanced effects. We suggest that selection of modifiers and/or overdominant allelic forms, tends to buffer (balance) the recurrent lethal producing loci.

6 (Genetics 37: 1925, 690)


The frequency of mutants in an island population after the introduction of natural and radio-induced mutants was studied. In natural populations lethal genes are eliminated rapidly and non-uniformly, and lethals have strong and variable effects in the heterozygotes. In cages, relatively high frequencies of lethals are still maintained even after 18 generations the same genes have no deleterious effects in the heterozygotes and, in some cases, even appear to induce an increase in heterozygote viability. In the natural populations no difference was detected between natural and induced lethals and their elimination. In laboratory populations (in 6 to 8 cases) the frequencies of the radiation-induced lethals dropped below that of the natural lethals after 15 generations of selection. Results are tabulated. Further genetic and statistical analyses are underway. Summarizing, it seems lethals are far from completely recessive, 1) the effects of the lethals in heterozygotes are not absolute but vary with environmental conditions and 2) recessive lethals, even when heterotic, are almost dominant when the environmental conditions are not too drastic.


A highly polymorphic race was irradiated once in each of 4 successive generations. The shifts found in the next generation in equilibrium frequency of structural heterozygotes were interpreted due to disturbances of the adaptive gene complex of the different types. A new inversion induced by the radiation was tested in competition experiment with other structural types and frequency of heterozygotes at equilibrium showed that these had a selective advantage. Here at least the positive heterosis effect must be due to position effect. The primary spread of a new arrangement may depend on position effect, while with suppression of recombinatio secondary genetic adaptation may occur, which later may mask completely the original position effect. (TID-2549, 4191)


An experiment was designed to study the effects of various dosages of x-irradiation on different gene arrangements (AR and CH) of the third chromosome of D. pseudoobscura, with respect to quantitative characters. Egg production showed a significant decline at 1500 r and an increasingly longer reduction by 2000 and 4500 r. Other characters studied (emergence, longevity, body size, and weight) generally showed the same trend. Irradiation of both gene arrangements usually gave more reduction in fitness characters than did irradiation of one gene arrangement alone. Irradiation caused an increase in phenotype variability as expressed by coefficients of variation. Heterosis in F2 was observed for most of the characters studied, and a breakdown of heterosis in F3. Heterosis was enhanced by irradiation at higher dosages. Relative indices of general performance indicate that the adaptive values decreased with the increase in radiation dosages. In homozygote was the least fit. (A)

1408 Toporakova, T.A. EXPERIMENT: 5 (1925) 255-90.

Lines of Drosophila melanogaster. These differences persist even heterozygotes, recessive lethal mutations. (Bibliographica nov.)


1410 Wallace, B. FURTHER DATA CHI (1953) 629-691.

A study of x-ray induced mutation viability of Drosophila melanogaster for 2 different second chro- mosomes of widely separate indicate that the newly induced recessant form of heterozygote is enhanced by new mutations in 1 differences in viability under and.


The viability effects of newly induced lethals. These appears to be very were used. One interesting point been positive for flies homozygous carrying two different chromosomes a statistical significance. An analysis to prove the existence of over-dos homozygotes and heterozygotes in viability distribution. In sort diverge in the region of high viable described.


Results are summarized from studies melanogaster. Data are included at which second chromosome lethals viability of heterozygous carriers the subjects of these studies. (N.A:

1413 Wing, H., Maciel, C.M.K., Na NATURAL POPULATIONS OF Drosophila melanogaster. An isolated natural population of a irradiated flies. The genetic anal 5 generations decreases rapidly to
increase in radiation doses. In all cases the heterozygous genotypes are the fittest while the CH/CH homozygotes was the least fit. (Auth.)


Lines of Drosophila melanogaster from different ecological backgrounds have different natural mutation rates. These differences persist even after the population lines have been subjected to ionizing radiation. In heterozygotes, recessive lethal mutations lead to decreased resistance in the face of unfavorable conditions. (Zentralbl. für Vererbungslehre und Verwandtschaftslehre. 121, 12 (1963), 891-4, T. M 8)


See 1410.


A study of X-ray induced mutations (exposures of 6, 250, 700 and 2250 r) in heterozygous conditions on the viability of Drosophila melanogaster otherwise (1) homozygous for second chromosome, (2) heterozygous for second chromosome of widely separated origins is described. The data indicate that the newly induced mutations affect the viability of otherwise homozygous individuals differently from that of heterozygotes; they suggest further that on the average the viability of heterozygotes is enhanced by new mutations in heterozygous conditions while that of heterozygotes is impaired. The differences in viability under analysis are extremely small. (Auth.)


The viability effects of newly induced second-chromosome mutations are expressed in heterozygous condition. There appears to be very little effect. Three levels of irradiation (200, 750 and 2250 r) were used. One interesting point is that the activity of a radiation exposure has consistently been positive for flies homozygous for entire second chromosomes while it has been negative for flies carrying two different chromosomes from the same population. At one time, this difference became of statistical significance. An analysis of data obtained from Dobzhansky is described which is believed to reveal the existence of over-dominance. In brief, if over-dominance does not exist, the viability of homozygous and heterozygous individuals should converge on a common point at the upper end of the viability distribution. In contrast to this expectation, the viabilities of homozygotes and heterozygotes diverge in the region of high viabilities. New work on the study of invariances and deficiencies is also described.


Results are summarized from studies on induced and spontaneous mutations in populations of Drosophila melanogaster. Data are included from a study of the viability effects of spontaneous mutations, the rate at which second chromosome lethals arise by spontaneous mutation, and the effect of these lethals on the viability of heterozygous carriers in populations of D. melanogaster. A list is included of papers published as a result of these studies. (TID-18695, 6615)


An isolated natural population of D. willistoni for a year supported a considerable admixture of F1 CO2-irradiated flies. The genetic analysis showed that the frequency of the lethal and semi-lethal alleles after 5 generations decreases rapidly to the normal. The frequency of the lethal alleles was still high. After
15 generations it decreases to the level of the natural control populations. Individual lethal alleles produced by irradiation remain in the population. (Auth.)

See also

745 Entomological aspects of radiation as related to genetics and physiology. (Grouch, 1962)
780 Influence de l'irradiation sur les adultes de Streptococcus yahabachi (Yahabachi et al.) et leurs descendants. (Lavois and Nardon, 1964)
791 Action des rayonnements sur la mortalité et la fécondité des adultes d'un chenapan de l'eau. (Lavois and Nardon, 1964)
1650 Effects of a prolonged exposure of artificial populations of Drosophila melanogaster to 14Cl. (Caracas et al., 1961)
1208 Changes of reproductive performance of Drosophila willistoni at two inbreeding levels. (Cerrato et al., 1963)
1310 Changes in quantitative traits under selection and irradiation. (Bartlett, 1963)
1314 Répercussions de l'irradiation des rayons y dans la descendance de Streptococcus yahabachi (Yahabachi et al.) (Collins, Cucul.) (Nardon, 1962)
1255 Research in genetics. (Stone, 1963)
1477 Control of insect populations through genetic manipulations. (LaChance and Reipling, 1962)

1-2-5 ECOLOGY


Triatoma infestans and T. castaneum are excellent for studies of radiation effects upon populations in competition because they occupy the same ecological niche. T. castaneum is more tolerant to radiation than T. infestans except in the egg stage when their sensitivities are the same. Sterility is induced in T. castaneum by 6 kV x-rays and closely approached by 4 kV. After adults had been exposed to a single dose of x-rays, a decrease in fertility among progeny with time and a differential radiosensitivity of genera for both species were observed. Twenty hr x-rays inhibit larval development in Drosophila and a difference was noted in the hemolymph protein fractions between x-rayed and control larvae 1 month after treatment. Ingestion of 0.84 0.94 µc 14Cl labeled into drosophila was accompanied by temporary sterility, 1.11 to 1.14 µc produced permanent sterility. Further studies are discussed.


Some mention of the differences in radiation sensitivity is made on p. 256, with special reference to the extreme case of Drosophila. Median lethal doses for embryos aged 3, 4, and 5 hr range from 100-050, 820-810, and 80-800 r for pupae and adults, respectively.


Samples of the circumtropical species, Drosophila americana, were collected in July and August for a 2-year period, 1955-6, from islands in the USAREP Pacific Proving Ground area. Estimates of the different changes received by the various populations are given. The ecology of these island populations was studied to determine competitors, predators, food, and the effect of man-induced changes (destruction of habitat, pesticides, sprays, etc.). The general and comparative areas of the populations were determined as far as possible. Samples were taken every year for virulence, fertility, and fecundity. A quite consistent finding was the great variability of the smaller island populations as compared to the relatively large population on Panaga. Part of this is due to lesser ability to pass fluctuations with environmental change. Another very interesting finding is that isolating factors which reduce fecundity in crossesings and crossfertility had developed between several of these populations.
Two principal field experiments have been established: one utilizing an old field in the Brookhaven gamma radiation field and a second involving a new irradiation facility in a near-climate forest. Secondary effects, especially those involving insect populations, could be shown to be of great importance in analyzing the effects of low-level irradiation on ecosystems.

See also:

1238 Chromosomal aberrations in a natural population of Citharomus tenuis exposed to chronic low-level environmental radiation. (Maylock, 1963)

1239 Population genetics and radiation effects studies on Citharomus tenuis. (Maylock et al., 1963)

1408 Experiments on mutation processes in populations. (Terapunova, 1965)
Baccetti, R. L'ENERGIA ATE against insects.) Acct. econ. 1418 Advance article, dealing with a


1422 greatest emphasis being placed

1423 The numbers of curies of the x principles of source design cov

1424 eriment are outlined. Very reviewed, including the x

1425 ble new applications are rug

1426 riodic fumigation involving x

1427 Wades radiations and some of th

1428 semi-portable radiations suit

1429 both research and field scale x

1430 commercial use. (From auth.)

1431 International Atomic Energy A

1432 AND THEIR APPLICATION TO

1433 The circular is aimed at disn

1434 topics related to the sterile ma

1435 target application to ecology, of mass rearing techniques: eff

1436 tion of commodities and mate

1437 1963 Panel meeting (on Linda)

1438 flies, and 13-15 with other in

1439 International Atomic Energy A

1440 AND THEIR APPLICATION TO

1441 Summaries are presented of 48

1442 insect pests of interest in agric

1443 studies of the irritation, pug

1444 insects during various developm

1445 males as a means of control a
II APPLICATIONS

II-A Articles, Surveys

1418 Baccetti, B. L’ENERGIA ATOMICA NELLA LOTTATA CONTRO GLI INSETTI, (Atomic energy in the fight against insects.) Accad. econ. agrar. Campofilone IX, 7 (1960) 1-18 and 319-34. (In Italian)
Review article, dealing with applications of radiation (nuclear male techniques, mostly).

Review of mid-scale projects, so far mostly under consideration.

1420 Boroella, H. THE USE OF IONIZING RADIATION FOR INSECT CONTROL IN LATIN AMERICA, Turtulba 15, 1 (1963) 32-4. (In Spanish, with English summary)
Review article, emphasizing work on radiation-induced sterility.

Review article. Different radioisotopes and electrical machine sources of radiation are briefly discussed, greater emphasis being placed on radioisotopes because of their greater reliability and ease of operation. The numbers of cases of the most suitable isotopes for various applications are tabulated. The general principles of source design covering radiation flux intensity, optimum dose distribution, and shielding requirements are outlined. Various procedures for the use of radiation in control of insect populations are reviewed, including the sterile male release technique, direct irradiation of agricultural products, the combined use of insecticides with radiation, and the possible use of radiation as an insect repellent. Possible new applications are suggested. A new method for storing grain for a long time without the need for periodic fumigation involves the use of a special grain container and radiation processing. Designs for various irradiators and some of the problems encountered are reviewed. Special reference is made to small semi-portable irradiators suitable for target sterilization; a mobile laboratory irradiation unit covering both research and field scale applications; and to some of the large production scale facilities proposed for commercial use. (From aud.)

1425 International Atomic Energy Agency, Vienna. INFORMATION CIRCULAR ON RADIATION TECHNIQUES AND THEIR APPLICATION TO INSECT PESTS, INF/A/1, Mar. 1963, 16 p.
The circular is aimed at disseminating research information to research workers in the field. The following topics related to the sterile male technique and allied problems will be covered: insect tagging techniques; mass application in ecology, e.g., flight range determinations; insect population dynamics; development of mass rearing techniques; effects of radioactive insects; radiation sterilization applications; and irradiation of commodities and materials to control insects. The first 15 abstracts refer to papers presented at the 1963 Nobel meeting (see Lindquest, 1434) abstracts 1-6 deal with insects affecting animals, 7-12 with fruit flies, and 13-15 with other insects. Items 16-20 are communications to I.A.E.A.

Summaries are presented of 48 papers covering various aspects of applications of radioisotopes in studies of insect pests of interest in agriculture. Emphasis is placed on the use of labeled insects and their parasites in studies of the life history, population density, and metabolism of insect pests. The effect of radiation on insects during various development stages, radiiodinated irradiation in insects, and the release of irradiated males as a means of control are also discussed, (NSA 19; 1962, 3429).

Of the 51 communications listed, 8 covered ecological studies, 15 effects of ionizing radiations, 7 hearing techniques, 7 radiation sterilization, and 22 chemosterilants. As yet unpublished information was communicated by W. K. Knoll on carpet wasp colonies (Camponotus sp.), using 136X. A. A. George on y-radiation on the Oriental fruit moth, Gynaha EC/07/E45, on the susceptibility to y-radiation of various developmental stages of the house: K. P. Katyar on the possible application of the sterile male technique for dealing with Ceratitis capitata in Central America; and some further trials by M. D. Proverbs of the sterile male technique with the codling moth, Carpocapsa pomonella.

The two main applications for pest control and eradication, in terms of direct action or the sterile male technique, are discussed.


The influence of y-radiation is described on the reproductive potential, sexual aggressiveness, vigor and longevity of the oriental fruit fly, Dacus orientalis, the medfly, Dacus tryorome, and the Mexican fruit fly, Anastrepha ludens, and their biological control. Results of field trials of the sterile male method of population suppression. Progress in the campaign to eradicate the screwworm, Cochliomyia hominivorax, in the United States and in studies to develop genetically marked strains that will permit ready identification of released sterile flies is reviewed. Results of irradiation research on additional species that infect fruit, vegetable, field and forest crops, that attack livestock, or that largely affect man, the effects of irradiation on the scorpion, Centrophorus marginatus, and the one-star cock, Amblyomma americanum, L, and ionizing radiation as a possible quarantine treatment for fruits and vegetables infected with fruit flies and mange of the mango weevil, Prosthesochmus mangiferae Fabricius, are also discussed. (From auth.)


A review article. The use of the method for grain disinfestation is discussed. Consideration is also being given to sterilizing doses for controlling fruit fly in fruit moving into quarantine areas and for treating infected timber entering Australia at mainland ports. S-10000y. affect fly but not fruit, and 600 000y. from a Ce^3+ source are already used by a carpet manufacturer. Problems connected with Dacus tryorome (Frogg.), the Queensland fruit fly, and Lucilia capitata, the Australian sheep blowfly, are discussed.

See also:
1956 The application of nuclear energy to agriculture. (Berengerg, 1963).
II - B Population Control

II-B 1 STERILE MALE TECHNIQUE


Review article. Methods for mass production, sterilization, and distribution of insects are described. In addition to the screw-worm fly, the method was also used to control melon flies and fruit flies. Sterilization studies with mosquitoes, the pink bollworm, cotton mealybug, corn earworm, fall armyworm, sugar-cane stalk borer, beetle weevil, tuber-crop beetles, potato blight fly, swarms fly, and other insects are underway or planned. Radiation may also be useful as a quarantine treatment for insect-infested commodities. Dosages of 10,000 to 20,000 r were found to destroy the reproductive potential of immature stages of fruit flies in fresh fruit and vegetables.


Une nouvelle méthode de lutte par irradiation des mâles a récemment fait ses preuves aux États-Unis. Il serait très intéressant et il paraît possible de partir de cette donnée pour l’appliquer au problème des Drosophila en pays tropicaux. Étude et expérimentations de base sont possibles en métropole, et mouvements des populations simuleront la mise en pratique de l’irradiation. L’intérêt économique final serait considérable pour les États d’Océanie, en cas de réussite d’un tel projet. (Aut.)


Discussion sur le contrôle des insectes au moyen de mâles irradiés par irradiation.


Review article, with particular reference to work leading to the application of the sterile-male technique.


After the successful work on screw worm eradication, the factors influencing the induction of sterility and some aspects of nutrition and the mass culture of insects are reviewed. The suitability for mass releases of sterile males is discussed for the following species: the Australian sheep blowfly (Lucilia cuprina (Wied.)), and L. angustata; the New Guinea screwworm (Chrysomya berlandii (Villain)); the tropical or weekly (Chromatopogon frichidi (Linn.)); the tetan fly (species Globina); the fruit fly (Anastrepha ludens); the oriental fruit and melon flies (Dacus dorsalis (Hendel)) and D. cucurriformis (Coq.); the Queensland fruit fly (Q. pepo) (Frogg). The olive fly (Q. damasi (Gmelin)); the codling moth (Cyrtopogon peregrinus (L.)); crop insects (sugar-cane borers: Diatracea saccharalis (Fab.), European corn borer: Ostrinia nubilalis (Hbn.), pink bollworm: Pectinophora gossypiella (Saundem.), boll weevil: Anthonomus grandis Boheman, fall armyworm: Spodoptera frugiperda, and Diabrotica radicicola: the Mediterranean flour moth, Anagasta kuehniella (Zell.) and some other grain pests. Results obtained by groups of scientists in different countries are reviewed and their problems discussed. Recommendations are made.
Applications of radiosterilized insects for their own destruction are reviewed. The present position regarding vector control by sterilization procedures is discussed, with special reference to chemosterilants.

A summary of the development and application of the sterile male release technique, in which γ-radiation was used as the sterilant, in the eradication of the screwworm, Callitroga bezziana (Cppl.), is presented. Preliminary laboratory and field results on the application of this same technique to the Control of Lepidopterous (Aedes aegypti, Anopheles quadrimaculatus, Stenolophus, and fruit flies, Mediterranean), Constrictor captivus (Wolf), the oriental fruit fly, Dacus dorsalis, (Hendel) and the melon fly, Dacus cucurbitarum (Coq.) are presented. Results are also given showing the lethal effects of radiation on some insects of medical importance, including the body louse (Pediculus humanus humanus L.), housefly (Musca domestica L.), American cockroach (Periplaneta americana L.), German cockroach (Blattella germanica L.), fire ant (Solenopsis invicta Buren), and the Plauger ant (Myrmecocystum pharaohi (L.)). (Aeth).

See also:
591 Study of the dose-dependence on the survival rate and the sexual sterilization of the gypsy moth (Calandra granata). (Andreev et al., 1962).
593 Radiation-induced sterility in the insect Pediculus humanus. (Baldwin and Shaver, 1965).
594 Exploratory studies on gamma radiation for the sterilization of the bell wheat. (Davich and Lindquist, 1963).
594 Qualitative and quantitative considerations concerning the influence of high radiation on the challengeability and their origin of the desert locust. (Peltonen, 1963).
597 Some effects of gamma radiation on the reproductive potential of the codling moth, Carpocapsa pomonella (L.) (Lepidoptera: Olethreutidae). (Proverbs and Newton, 1962).
598 Suppression of the reproductive potential of the codling moth by gamma irradiated males in caged orchard trees. (Proverbs and Newton, 1962).
571 Evaluation of control of European corn borer, Ostrinia nubilalis (Hubner), by x-ray induced sterility, (Walker, 1962).
1045 Influence of mutation during gamma irradiation of screw-worm pupae. (Baumhover, 1963).
1297 Effects of gamma radiation on various stages of three fruit fly species, (Sabo and et al., 1963).
1297 Control of the Mediterranean flour moth Anagasta kuehniella Zell by sterile male release. (H. Susceptibility to gamma radiation, (Bull and Wood, 1963).
1288 Influence of gamma radiation on the development and fertility of the codling moth, Carpocapsa pomonella (L.) (Lepidoptera: Olethreutidae). (Proverbs and Newton, 1962).
1294 Influence of gamma radiation on the development and fertility of the codling moth, Carpocapsa pomonella (L.) (Lepidoptera: Olethreutidae). (Proverbs and Newton, 1962).
1297 The importance of competitiveness of radiosterilized males in mosquito-control programs. (Barnes and Schmidt, 1962).
1298 Matting ability of male mosquitoes, Aedes aegypti (L.), sterilized chemically or by gamma radiation. (Weidhaas and Schmidt, 1962).

Laboratory tests indicated that sterility in male cockchafers, region of north - western Switz. treated area, where the male were collected and the males: tation was observed. A theorem the ratio of sterilized males by male population) were release production rate to 0 1 in (a) or (1899 - 1903) occurred in (a), been sterilized). Complete et also be applied successfully in females male several times a
II-B-1-a COLEOPTERA

Scemb publications
Melolontha vulgaris

IV-8-1-b DIPHTERA

II-B-1-b-1 Calliphoridae

Cochliomyia hominivorax

II-B-1-b-2 Muscidae

Cochliomyia hominivorax

II-B-1-b-3 Muscidae

Cochliomyia hominivorax

II-B-1-b-4 Muscidae

Cochliomyia hominivorax


Laboratory tests indicated that a minimum dose of 3000 r (or 3000 to 6000 r) x-rays was necessary to induce sterility in male cockchafers. During 2 flight periods, sterilized males were released in a general region of south-western Switzerland. In 1965 five areas, each 3-10 ha, were selected to serve as: (a) the treated area, where the males were captured, irradiated and released; (b) the "blank", where cockchafers were collected and the males irradiated for release in (a); and (c) control areas, where undisturbed grazing was observed. A statistical x-ray unit was used, and irradiated males hand-painted to estimate the ratio of sterilized males by the isotope dilution technique. In 1966, 81 sterilized males (50% of total population) were released in (a). Infestation in grassland dropped to 2/3 of that in other areas, reproduction rate to 1/10 of that in (b) and (c). Greatest mortality (1966-1967) occurred in (a). In 1966, 27% irradiated males were released in (a) (40% of population had been sterilized). Complete eradication was obtained in (a). The sterile male technique may therefore be applied successfully in an area which is not strictly isolated geographically, to a species where the females mate several times and where mass-breeding is not feasible because of the long breeding cycle.
All the male and female screwworm flies released were reared in the laboratory on a standard diet and had been exposed to a sterilizing dose of γ-radiation as pupae. The techniques for rearing, holding, and sterilizing the insects remained the same throughout the experiments, but there were variations in the methods and rates of releasing the adults. However, all flies were more than 4 and less than 6 h old at the time of release. All the flies were marked with acetone-soluble or fluorescent dyes. Two series of field releases of marked laboratory-reared screwworm flies, Cochliomyia hominivorax (Coquerel), were carried out in southwest and central Texas to determine the local distribution of the flies in relation to stock ponds and streams. According to samples based on liver-baited trap catches, flies released in a semi-arid brackish area with no running streams tended to congregate around stock ponds. Flies released in an area crossed by running streams continued to disperse beyond a stream 5.8 to 1 mile from the release point to points on a second stream up to 1 mile beyond the first stream. Evidence presented that the flies were channeled to some traps by terrain features. Local concentrations of flies on the stream nearest the release point persisted for 2 to 4 d. Peak catches of flies were noted on the third day following release. During the hot dry weather of late summer flies could not be detected along either stream.

In 1956 and 1967 pupae of Lucilia sericata were irradiated at 6000–7000 r. and allowed to emerge at 8 points on Holy Island. The sterilized population was maintained in progeny numbers by regular replications. A test in 1968 showed no reduction in the density of the species. Possible causes of failure of the method are indicated, such as over-estimation of the field longevity of the sterilized flies; under-estimation of the native density; loss of radioactive label (e.g. by decay in pupation and emergence); reduced response of treated flies to bat-traps; inefficient sterilization; recovery of fertility; greatly reduced viability of sterilized animals; some specific unsuitability arising from physiological reasons; or failure for ecological reasons (e.g. losses from predators). It is concluded that the sterilization was inadequate or that the sterilized males were unable to compete with the native males.

See also:
1227 Effects of gamma radiation on various stages of three fruit fly species. (Baloch et al., 1960).

**Bibliography:**


For mass production of sterilized mosquitoes, in obtaining pupae from the larvae these range of the irradiation dose pedentness of sterilization and was.

1464 Weidhass, D. E., Schmidt, FOR THE CONTROL OF Ace.

Geographical conditions and for evaluating egg viability: 12 900 of γ-rays (Co57), quadrantrisal paper was check of sterile males may have been when the natural population increase of sterile males and conclusively demonstrated at.

1467 Ramakrishnan, S. D., Krish PRADATISI MALI (1963) 207–64.

Irradiation of pupae (where 14 000 and 20 000 r; γ-ray; creased with normal female fertility obtained, expertise minimum mortality was ob when the proportions of not, practicable gave 38–40%–

1468 Krishnamurthy, B. S., Roy, OF PRADATISI MALES FOR POPULATIONS. WHO/BNL/ 1172.

In small-scale preliminary: sterile male Culic, fatigues villages, Altamass for the duction was achieved in the (non-cooperation of the loc increase of sterile males and carriage of rats with embryos to effect reduction of C. f.

Also published in Indian J. J.

1469 Knolpling, B. F. P, POTENTIAL W10/Vector Control/PTT, W

A mathematical model was time for one complete gene It is assumed that the rela
tion being overcome by 3:1 greater than the reduction in, an initial release rate a
tion. 500/4, mile is near

The laboratory on a standard diet and rearing techniques for rearing, holding, and releasing pupae were variations in the mortality of these pupae. Two series of these pupae were reared in a semi-sterile environment. Flies released in an area 1 mile from the release point to 1 mile from the release point did not emerge. Flies released to the stream nearest the release site did not survive. During the first trial.

JUVENILE POPULATION BY THE STEERLE MALES

The reared pupae were exposed to periodic doses of the sterilized flies, under conditions of pupation and emergence, for evaluation of fertility: greatly reduced physiological function; or failure of either the sterilization or the species.

(Reed et al., 1963.)

EXPERIMENTAL STUDIES WITH Aedes

Aedes aegypti or Aedes vexans were used in these experiments. Pupae of Aedes aegypti were exposed to 2% of the population. Results were tabulated. Insecticides were found to be effective, but did not provide complete control. The most effective insecticide was found to be DDT, which reduced the adult population by 90%. For mass production of sterilized male pupae, a technique of rearing large numbers of pupae, in obtaining higher production of male pupae from the rearing trays, in separating the pupae from the larvae through the use of pasteurized water, and in reducing the rate of the irradiation dosage during the sterilizing process, studies were made on the mating competitiveness of sterile and normal males. The results are given in Table 1.


For mass production of sterilized male pupae modifications are described in the rearing of large numbers of pupae of Aedes aegypti, in obtaining higher production of male pupae from the rearing trays, in separating the pupae from the larvae through the use of pasteurized water, and in reducing the rate of the irradiation dosage during the sterilizing process. Studies were made on the mating competitiveness of sterile and normal males. The results are given in Table 1.


Irradiation of pupae (whether by x- or y-rays) affected longevity. Tables give data on dosage (in-100 and 10,000 r) y-rays: 5000 r: 10,000 r; mortality of irradiated pupae, number of irradiated pupae crossed with normal females; number of egg-carts from irradiated females; viability of egg-carts: rate of sterility obtained, experimental results used in mating, and mortality rates. Mosquito sterilization with minimum mortality was obtained with 7000 r of y-rays. Maximum non-viability of eggs was obtained when the proportions of sterile to normal males to females was 8:1:1. A ratio of 8:1:1, which is more practicable, gave 84-90% non-viability.


In small-scale preliminary field trials undertaken by the Central Institute for Communicable Diseases, sterile male Culex fatigans were released with a view to assessing the effect on a wild population. Two villages, Astatkali and Karkarmar, were selected for the release studies. The results were compared with those obtained in the laboratory. The results showed that the sterile males were able to reduce the population of the wild vectors. The increase of sterile males in the C. fatigans population appeared to be followed by an increase in the percentage of females with embryos and unbudded eggs. Thus, the possibility of using irradiated sterile males to effect reduction of C. fatigans populations in the field appears to be concluded.

Also published in Indian J. Malar. 15, 4 (1962) 306-312.

II-5-1-b-485 Fungicides


A mathematical model was established on the basis of a low-level population of 500 flies/mile. The time for one complete generation is taken as 5 months, maximum net increase potential 50% per generation. It is assumed that the releases are reduced by half for each period or generation, the natural male population being combusted 3:1 at the start. Theoretically, the rate of decline in the population is greater than the reduction in sterile males. On the basis of the population dynamics of these flies in general, an initial release rate as low as 2:1 may be expected to start a downward trend in the natural population. $500/0, miles is necessary to achieve fly eradication by the application of selective residual
insecticides to the vegetation or for aircraft mist spraying. The sterility method might become practicable at already $125/ha. mile. Economic and other considerations are discussed relating to various population densities and the prevention of re-infestation, mass rearing (difficulties and assumed high cost), and the use of sterile males as an adjunct to other useful control measures. Other methods for producing sterility, in particular the development of chemosterilants are reviewed. The kind of research needed at this stage is outlined.

II - B - 1 - b - v  Muscidae
Muscina domestica


The chosen area was situated between the coast, the lakes Massaci and Capracotta, and included 4 country houses. Previous prolonged insecticide treatment had been applied. Sterile males were released in March. By April, sterile females had begun to appear and the population of females was greatly reduced over the following 2 months. No sterile females were reared after early July. Tests for fertile females were made in August. Their number gradually increased until it became predominant within a month. It is not clear whether incomplete isolation of the test area or insufficient competitiveness of the irradiated males were responsible for failure of the treatment. - The optimum dose applied to paper was 5,000 r. Below are various ratios of normal females: normal males: irradiated males, and their results. 1:1:2 produced 50% sterility 1:1:4 produced 60%, 1:1:6 produced 70%, 1:1:10 produced 80% - 90%, there was no improvement when the radio was increased to 1:1:30 since some fertile eggs always remained.

II - B - 1 - b - v  Trogopteridae
Ceratitis capitata
Dacus (various)
Dacus oleae


General review. Two species of fruit fly, the Queensland fruit fly (Brunetti triasi) (Progs.), now well established in Queensland and coastal New South Wales and, to a lesser extent, in Victoria, and Ceratitis capitata (Wied.), now restricted to Western Australia, cause serious economic loss. So far, biological control (parasitic insects) has not proved very effective. The most of dipemex, Rorer and Lebacyd sprays, and of male suppression by lure traps are discussed. According to J. G. Giuliani, the release of irradiated sterile males is being investigated for its potential.


Mass production of the fly in the laboratory is economically feasible. Owing to local topography and to the fact that at certain seasons the natural population density of this fly is extremely low, prospects for a successful application of the sterile male technique are very good. A cooperative project was started to study this problem on a field scale in a single region in Costa Rica. Preliminary experiments with the Co 60 irradiation in the gamma field have shown that when paper (about 85 - 90% developed) are irradiated with 10 - 20 kev sterility can be induced in adults without any deleterious side effects on longevity and mating. A Co 60-pool irradiation will be used for field experiments. The dispersal habit and longevity of the fly will be studied in nature by releasing radio-isotope labelled adults. SF 2 was tried in larvae feeding tests but proved not very successful. SF 2 was adopted for labelling adults which could be achieved by adding the isotope to either the larval rearing medium or to adult food, the latter proved more effective and cheaper.

1453 Moh, C. C.  THE APPLICATION OF TID-18050, INTER-AMERICAN RESEARCH.

Various studies are reported. - Radioactive the Mediterranean fruit of some preliminary radiation.

1454 Moh, C. C.  THE APPLICATION OF TID-2400, INTER-AMERICAN RESEARCH.

Apart from the training of frost under way, the relation between radiation and the development of the Mediterranean fruit of some preliminary radiation.

1455 Katrye, R., Velander, H. T.  TO FLY ERADICATION. p. 1 July 1963. Inter-American Egg and sperm sensitivity to oviposition. This does assume Tables show radiation effects in terms of fertility, and a gas 8-, and 9-day pupal stage. Radiations > 20 kev were 100% lethal. Radiation effects (9, 10, 9c at 10 kev irradiation) on adult adult males not appear to be complete. Overflying of a wild population and longevity studies were also used in Australia traps but the dispersed values, are 784.

1456 Moh, C. C.  THE APPLICATION TID-18986, INTER-AMERICAN RESEARCH.

Progress is reported in every or studies have yielded some results for normal conditions. The flies efficiency for eradication test is reported.

Steiner, J. F., Mitchell, W. C.  STERILIZATION IN HAWAII.

The course of experiments on fruit fly and Ceratitis capitata was successful application of the 60Co from 80 - 94 miles, reared in large numbers on sea fruit fly. It is not necessary for sterilization to be measured. Oriental fruit flies is also being tested as possible. Dosages a The Western pacific expert larva in different fruit after...

Various studies are reported. The feasibility of releasing radiation-saturated males in an attempt to eradicate the Mediterranean fruit fly, Ceratitis capitata, in Central America was investigated, and results of some preliminary radiation experiment are reported.


Apart from the training of Latin American students in the use of radioisotopes, various agricultural projects are under way. The relation between dosage and sterility in Ceratitis capitata Wied. was studied; 10 kr of y-radiation is capable of inducing dominant lethal mutations in all sperm. Studies on the effects of different atmospheric conditions on the mating vigour and sperm production of the male, and the radiosensitivity of sperm gametes at different stages are being carried out. (From abstract.)


Egg and sperm sensitivity to y-radiation were tested. Female pupae required 10 kr to ensure inhibited oviposition. This dose assumes almost 100% dominant lethals in all sperm, irrespective of pupal age. Tables show radiation effects (0, 1, 2, 5, 10, 12, 20, 30, 50, 100, 120, 150, 180, 200 kr) on 7-, 8-, and 9-day pupal stage. Approximately 10 and 12 kr do not reduce longevity in irradiated adults. Doses >10 kr were 100% lethal to pupae; 20 kr affect neither adult emergence nor longevity. Table for radiation effects (0, 10, 25, and 50 kr) on longevity of adults (male and female) and (for 0-90 kr, at 10 kr interval) on adult emergence and longevity (applied at the 7th day stage). From field test adults do not appear to compete equally with normal males which are at least 8 times more aggressive. Overstocking of a wild population would necessitate a > 20:1. Dispersal and longevity studies were also carried out by tagging with 131I, following irradiation. "Trимедиум" was used in Steinmetz traps but appeals to males only. A recapture value of only 4.1% was obtained. For dispersal, see 765.


Progress is reported in basic and applied agricultural research using nuclear energy as a tool. Tracer studies have yielded some information on dispersion and longevity of Ceratitis capitata Wied. under natural conditions. The flies were sterilized at different developmental stages, and their subsequent efficiency for eradication measures investigated. A list of publications for the period covered by the report is included.

Dacus (various species)


The course of experiments on Dacus cucurbitae Coq. (the melon fly) and Dacus capitata Wied. (the Mediterranean fruit fly) is described. Factors which may affect successful application of the technique are discussed. Multiple mating (both sexes) occurs. Flight range is from 25-45 miles; sustained overwater flights of 15-45 miles have been observed. Fruit flies can now be reared in large numbers at reasonable costs. Irradiated flies tend to congregate in areas of greatest wild fly density. It is not necessary or economically feasible to separate sexes for release. Fly populations and fluctuations can be measured quickly throughout by powerful male kites. A genetic strain of white-marked oriental fruit flies is also being used to distinguish irradiated flies. Irradiation should be as low as the pupal period as possible. Dosages and cage tests are discussed. Field tests on no-fly areas partially successful. The Western specific experiments, initiated in 1960, are discussed. Data on infestation by area of modified larvae in different fruit after release of irradiated flies at Wailoli are tabulated.
Anonymus. ERADICATING THE MELON PLT. 

The pest attacks cucurbits (melons, cucumbers, pumpkins, and related crops) as well as string beans and tomatoes. Before the first release of sterile Dacus cucurbitae (Cole), the borders of producing farms were sprayed 3 times with bait sprays to reduce the wild fly population by 90%, to lower the required flooding to manageable figures. In Sept. weekly releases of 8-10 million sterile flies were started, until a total of 180 million had been released. Within 3 weeks the sterile flies had flooded the native population by 13:1. By early December it was 50:1, by early January 100:1. Effective overflooding was considered to be > 10:1. Teru were carried out on both a 93 square-mile island in the Mariana group, selected for its size and isolation (the nearest island, Guam, 26 miles away).

Dacus oleae


Various techniques are discussed. A series of experiments was carried out on the application of the sterile-male technique. Preliminary results of using irradiated males of Dacus oleae on trees to depress female fecundity were promising. Pupae were irradiated, the most effective dose being from 4000 to 12,000 rads, the optimum period for irradiation being 7 to 10 d prior to adult emergence. Hence reared sterile females and very active males which were able to copulate but did not allow normal females to lay fertile eggs. When the method was applied to isolated and confined plants, in the ratio of 4 irradiated males to every normal couple, the succeeding generation was effectively annihilated. Results were less satisfactory when only 3 irradiated males were used.


The olive fly, Dacus oleae, Gr. was subjected to high doses of γ rays from Co60 at the pasta stage. After establishing the dose sufficient to make the males sterile without depriving them of their capacity of copulation, the ratio between irradiated and normal males necessary to obtain an almost complete sterilization of an environment infested with the olive fly was observed.


I - B - 1 - e LEPIDOPTERA
I - B - 1 - e - 1 Lymantriidae
Thaumetopoea pityocampa


The possibility of applying the sterile-male technique to the pine processionary moth, Thaumetopoea pityocampa, Scliff. is examined. In laboratory experiments, males and females were sterilized by 4000 r γ rays (Co60 source) and the fecundity of normal couples was strongly depressed when sterile males were added in the ratio of 2 to every normal one. Irradiation needed to be carried out on the 15th old chrysalis. As a sole means of control the technique appears to be impossible, theoretically, due to the difficulties of mass culturing T. pityocampa in the laboratory of raising larvae on pine needles through many generations. The sterile-male technique would be worthwhile if integrated with biological control (the release of parasites emerged from collected nests).

392

1465 Proverbs, M. D., Newton, J. R. Atomic Energy of Canada, Ltd. See also 1466.


The possibility of using the ster.

1467 Proverbs, M. D. EFFECT OF STERILITY FOR THE CONTROL OLETHRINGIDAE). PROC. 6th

Heat treatments induced sterility was more successful. Exposure about 90% sterility without affec.

1468 Proverbs, M. D. CONTROL OF SEXUALLY STERILE MALES Atomic Energy of Canada Ltd.

The release of sterile males (w

1469 Marshall, J. CAN WE BRAIN Popolar presentation of the pou
HI. 2 (1963) 5.


See also 1464.

**ABSTRACT**

The possibility of using the sterile-male method to control *Carpocapsa pomonella* (L.) was investigated. Both females and males were found to mate more than once frequently. Gamma irradiation was found to be more consistent in the induced sterility than growth at high temperatures. A high sterility was obtained when male pupae were exposed to 40 000 rad 0.02 before moth emergence, and normal behaviour is not observed until > 60 000 rad is reached. About 23% of the eggs resulting from the union of such sterile males with normal females hatch, as compared with ~ 92% in the control. Irradiation was found to kill female pupae more readily than male pupae, and a dose of 25 000 rad sterilizes > 99% of the eggs that they lay.


Heat treatments induced sterility or near-sterility but caused considerable mortality. Gamma irradiation was more successful. Exposure of mature male pupae or newly emerged male moths to 40 000 rad induced about 99% sterility without affecting adult emergence, mating, or adult longevity. Higher dosages decreased mating. Irradiation of eggs, mature larvae, or the pupa in the last stage resulted the same that the male. Mating of a normal female with an irradiated male (40 000 rad), either before or after a mating with a normal male, did not prevent the laying of any fertile eggs. When irradiated males (mature pupae exposed to 30 000 rads) were caged with normal males and females, in the proportion of 10:1, two sex ratios were mostly fertile. In laboratory experiments in which (a) irradiated males, or (b) irradiated males and females were added to cages containing normal males and female moths, in the proportion of 10:1, irradiated males of each sex to 1 normal male and 1 normal female, the proportion of viable eggs was reduced 99% in (a) and 69% in (b). In an orchard experiment (cages over dwarf trees) in which irradiated males (mature pupae exposed to 40 000 rads) were caged with normal males and females, in the proportion of 10:1, the number of males in the F1 generation was reduced to approximately 1/3 of the number of normal males in the parental generation. (Auth.)


The release of sterile males (see 809) into the environment has given some promising preliminary results.


Popular presentation of the possibilities of applying the sterile male technique to *Carpocapsa pomonella* (L.).

Les auteurs traitent la biologie et l'évagage de la tigne de la fange, Ephesia kuehniella Zell., et donnent quelques détails d'essais d'inversion manuel, chimique et photographique. La saturation des mâles a été obtenue par irradiation des chrysiales adultes (15 %) avec une dose de 50 000 rad. Le nombre d'œufs stériles augmente assez régulièrement avec le nombre de mâles adultes. En réalité, le pourcentage d'œufs stériles est plus faible que ce qui est observé.

- Plusieurs essais ont été réalisés sur d'autres insectes (Lepidoptera décapétrida, Ceclococca, Chrysopa, Hemiptera, etc.). Pour chaque insecte, les doses et méthodes ont été différentes, mais la nécessité de certaines manipulations dans le contexte est indiquée.

- Trois catégories de stérilités ont été étudiées : les stérilités natures, les stérilités artificielles, les stérilités consécutives. Dans les stérilités naturelles, Helodegrip Apae Chleidium, l'infection ne diminue fortement qu'après 160 000 rad. Sur le stérilité due à la poussière noire, Plasmocentrotus nodosus. Le stérilité due à une déformation de l'œuf, Helodegrip Apae Chleidium, n'est pas observée à partir de 30 000 rad.


- Laboratory tests to determine the possibility of controlling the orangeworm. Panomyeloctainiella (Walker), by gamma irradiation were very promising, especially when both sterile males and females were used. Sterile but sexually active males and females were obtained by subjecting mature pupae to 50 000 rad of gamma irradiation.


The insect is becoming an increasingly important pest of almonds in California. A simple and economical method of mass rearing was accomplished in the summer of 1963, the main difficulty having been the marking habits in the laboratory. Mating could be improved considerably by providing indirect air circulation, high relative humidity, cool temperature, preferably between 10-15°C, and light intensity similar to conditions prevailing in the early morning. A CaF2 unit gave about 19 740-500 rad/h.

- Mature pupae (8-12 days old) were the most desirable stage to irradiate without causing appreciable damage to the insect, and was also the stage more convenient to handle and sex. At a dosage of 150 000 rad, no survivors emerged. At 80 000 rad, 75% of both males and females were still able to mate but reduction in egg laying was considerable in the case of irradiated females. Complete sterility was obtained in both sexes when mature pupae were exposed to 50 000 rad. Longevity, egg laying, and mating habits did not seem to be affected at this dose. No effect on fertility was detected after 50 000 rad or less but drastic reduction in fertility was obtained at 30 000 and 40 000 rad. Eggs were more susceptible to radiation damage than mature larvae and the latter stage more than mature pupae. Much better results may be obtained by using both sterile males and females for control and eradication. Most females were shown to mate but once in the field, only 8% mated twice.
II-B-1-c-iv Pyralidae

Pyrausta obliqua

61, 3 (1963) 4.

Adult males of Pyrausta obliqua were sterilized by doses of 32,000 r per diem after emergence. Only 2% or less of the eggs laid were fertile when sterile males were mated to untreated females, 40% sterilization for 80% irradiated males. Sterility did not affect competitiveness for females, nor was longevity affected. Irradiation of pupae affected egg hatch, depending on age of pupa at time of irradiation, the younger pupae being more susceptible. Fertility decreased with increasing radiation dosage for both sexes, but female pupae were more susceptible. Deformity up to 80% occurred in pupae irradiated with 9500 r at under 24 h. At 48 h deformity was avoided.

II-B-1-c-v Cleistocoma obsoleta


The biophysics laboratory of the All Union Research Institute of Plant Protection and the Azerbaijan Plant Protection Station are investigating the effect of gamma irradiation of male pupae of Cleistocoma obsoleta on moth sterilization. Caesium-137 is used as the source of radiation. Based on results of laboratory tests (control plants of irradiated moth males with untreated females), the sterilizing dosage of radiation for pupae of C. obsoleta is approximately 8000 to 10000 r. Procedures are being developed for mass propagation of Chlorophylla bruniata to obtain pupae for sterilization and liberation of sterile individuals. (BA 46: 1963: 399).

II-B-2 CONTROL BY INDUCED GENETIC CHANGES


Since irradiation induces dominant lethal mutations in sperms, it can be shown that mutation is not requisite for eradicating a population through the irradiation of irradiated males. An outline is presented for experimental analysis of population collapse by the irradiation-of-male method where females mate more than once. Possible effects on populations of release of males containing recessive lethal mutations or mutations for female sterility are briefly discussed, the possibility of genetic induction of population extinction is explored.
II - C Infestation and Countermeasures

II - C - 1 STORED PRODUCTS


The efficacy of 10,000 rads, recommended for industrial application of γ-radiation for the control of insects in grain, is substantiated by the complete sterilisation and death of 10 million insects of a wild strain of S. granarius under conditions simulating bulk storage. Sub-sterilising doses of 20,000 to 14,000 rads suppress weevil populations to a very low level, allowing for an increase for 4-6 months; this period of "short-term" control is related to the size of the population and Q10 reaction at iradiation. The reproductive potential of fertile and sub-fertile grain weevils is depressed when added to large irradiated populations, partial protection to the grain against re-infestation is afforded by the irradiation of contaminants with sterile sperm which remains competitive within the female and with fertile sperm subsequently inseminated, for periods > 4 months. A reduction in reproductive potential of weevils which may be used at irradiation gives considerable flexibility to the requirement of dose uniformity in plant design for disinfection of grain. (Essentially auth.)


"In use to destroy and control pests in stored grain and milled cereal products remains highly experimental, but recent progress merits review." The author briefly reviews latest developments in the fields of insect control, the possible uses of radiant energy commercially, and the limitations governing its use.


Preliminary experiments indicate that disinfestation of figs by γ-radiation is a promising treatment since, at the moderate doses of 100-200 krad needed for the destruction of the stages of the infesting insects, no significant results change in texture, appearance and nutritive value (related to carbohydrates) of the figs. The following species were studied: Ficus carica, F. carica var. syriaca, Cynips caucasica, C. cirtoides, C. drupacea, C. syriaca. The treatment of these insects by γ-radiation and C. carica, C. syriaca. In general, doses < 9.3 krad do not affect browning of eggs, above it the reduction varies with the species, and no browning is observed at 100 krad. The time required for 95% of an irradiated larval population to die was 2-3 d at 100 krad and 1 d at 200 krad. In general, there was no selection of pupae with < 60 krad. At a dose of 400 krad all insects were killed in < 48 h.


1483 Torek, G., Pitas, J. A RAY ESTIMATAS OF CONDOMS IN case of irradiating (Ventricia) and the cigarette (Briza) La protection de la conception et de la stérilisation de "Sitophilus granarius." A th type of the Radium (Barnes, 1955). Effect of radiation on bo (1962).

Protection of crops (Barnes, 1963).

1484 The effects of continued "Sitophilus granarius" (Paccalvus, 1966)


1500 Radiation preservation c (Pupin, 1966)

1502 On the advantages of the quarantine regulations.

1503 Travass de noix en France et des...
EFFECTS THROUGH GENETIC MODIFICATIONS

(Continued)

...with inherent lethal factors to which Beheman, in his example, gave rise to natural selection. This method may prove to be useful in breeding for resistance to pest species. B. C. A. W. 9 (1965) 68-68.

B. C. A. W. 9 (1965) 68-68.


Gamma irradiation of technical seeds and feed stuffs at the rate of 20,000, 55,000 and 100,000 rads resulted in 100% control of the grainy and rice weevils, meal beetles, grain borers and confused flour beetles (Callosobruchus chinensis, C. oryzae, Sitophilus oryzae, Sitophilus granaria, Sitophilus oryzae, Tribolium confusum).


See also:


7. A comparison of the susceptibility of the grain weevil (Sitophilus granarius L.) to accelerated electrons and Co60 gamma radiation. (Bell et al., 1961).

7. Influence of y-irradiation on the adults of Sitophilus granarius Takahashi (Curculionidae) and their descendents. (Lavoie and Nanton, 1963).


7. Some effects of gamma radiation on the lesser grain borer (Sitophilus granarius F.), tropical warehouse moth (Cadra figulifera Walker), rice weevil (Sitophilus oryzae F.), and the cigarette beetle (Lamaternea auriculata F.).


7. The susceptibility of the confused flour beetle (Tribolium confusum) to gamma radiation. (Banham, 1963).

7. Effect of radiation on Mexican fruit-fly eggs and larvae in grape-fruit. (Brownell and Tschulitch, 1963).


7. Some experimental data on cobalt 60 radiation doses capable of arresting insect infestation of cereals and flour. (Pensa, 1963).


7. The life history and behavior of an internal feeding stored grain insect, Sitophilus granarius (Fab.). by use of x-rays. (Steinley, 1963).

7. On the advantage of the x-ray examination of certain classes of materials for insect subject to plant quarantine regulations. (Tusun, 1963).


597
UI-C-2 DISINFESTATION MEASURES  
(Source: Convoy Systems, Inc.)


The process can be automated and operated safely. Electron accelerators and cobalt sources could be used for all the throughput rates utilized in most conventional grain handling installations. The experts recommended, for a pilot plant study, electrical machines with electron energy in the range of 2-4 MeV to achieve uniformity of dose deposition and simplicity of grain handling for the throughput rate of 100-200 t of grain/h be used. For the throughput rate of 20-40 t/h, they recommended Co source, with which it is possible to achieve a radiation efficiency of 80-70%. (Auth.)


The U.S. Food and Drug Administration (FDA) officially approved the use of γ-rays for insect control in wheat, according to a plan elaborated by L.E. Brownell. Co is used for sterilizing insect eggs in the wheat. The road should now be clear for the construction of a prototype plant capable of handling 220 tons/h of wheat, possibly in India.


Studies have been made on the effects of γ-radiation on eggs, larvae, pupae and adults. Cytotoxicity was obtained on suitable egg-laying blocks with sapwood veneers for Lycidus glascolites (Birchley, 1965). Contaminated or Scott pine sapwood blocks with moulus surfaces for Amblyra punctatissima (Birchley, 1965) and decayed oak sapwood for Xylosandrus ribiflorus (Birchley, 1965) or with oak sapwood blocks (Birchley, 1965) or pine (Amblyra) or decayed oak sapwood (Xylosandrus), adults were irradiated free or within infused wood. For studies on subsequent fertility and visibility of eggs, treated pupae and immature and mature adults were provided with egg-laying blocks. In addition naturally infested material has been treated. Co source giving dose rates from 100 to 1000 r/hr have been used as well as higher rates. A dose of about 10 000 r is required to prevent completion of development or to produce sterile adults, although further information is required on the survival of larvae from irradiated eggs. An additional safety margin would be desirable plus a further correction to allow for attenuation in the timber. The higher fertility exhibited when an individual of one sex is irradiated and mated to an untreated beetle of the opposite sex is somewhat academic, since both sexes would normally be irradiated simultaneously. Nevertheless, when 100% control is not achieved, this factor represents an additional risk with regard to re-infestation of susceptible wood. The use of radioactive substances for sterilization and preservation is not feasible due to the mechanical difficulties involved in providing adequate shielding.


Insects that destroy food products can be controlled by use of a gamma-emitting radioisotope. Cobalt-60 is a convenient radiation source for treating stored wheat at 5000 rads (500 Gv) to reduce infestation by Sitophilus oryzae and Sitophilus zeamais. A typical treatment would be to expose the grain to 7500 rads in a gamma-irradiation chamber. The results of these studies showed that the use of gamma radiation can be a safe and effective method for controlling insect infestations in stored food products.


Applications of γ-radiation in future food processing are discussed. Data are presented of these doses on the physical and chemical properties of wheat and grains. The results are summarized from processing and storage studies. The potential of γ-radiation for use in food processing is examined. (N.B. Compiler's note: Not avail.)

1489 Brownell, L.E. GAMMA RADIATION 2,2 MILLION ELECTRON VOLT MAY BE SAFELY USED FOR THE CONTROL OF INSECT INVASION.  Letter to Posting Office.

On Aug. 18, 1963 the Food and Agriculture Organization of the United Nations approved the use of a gamma-emitting radioisotope for the control of insect invasion. The isotope, Cobalt-60, has an energy of 2.2 million electron volts, making it suitable for use in food processing. The radiation dose required to control insect infestations in stored food products was determined to be 0.5 to 1.0 Gy. The effects of this dose on the physical and chemical properties of wheat and grains were studied, and the results are summarized in this report. (N.B. Compiler's note: Not avail.)


Insects that destroy food products can be controlled by use of a gamma-emitting radioisotope. Cobalt-60 is a convenient radiation source for treating stored wheat at 5000 rads (500 Gv) to reduce infestation by Sitophilus oryzae and Sitophilus zeamais. A typical treatment would be to expose the grain to 7500 rads in a gamma-irradiation chamber. The results of these studies showed that the use of gamma radiation can be a safe and effective method for controlling insect infestations in stored food products.


In terms of the installation of wheat flow and 30% improvement in instantaneous extraction of wheat, the effectiveness of the unrefined wheat was improved about 20% over the reference wheat. The performance of the unrefined wheat was found to be superior to the reference wheat. (N.S. A. 17: 1983, 2.)

Applications of γ-radiation in the processing of wheat and wheat products for the control of insect infestation are discussed. Data are presented from studies of radiation doses necessary for insect control and the effect of these doses on the physical properties, nutritional value, and wholesomeness of wheat and wheat products. Results are summarized from feeding studies using rats and dogs. Methods are outlined for the radiation processing of wheat and wheat products. Irradiation facilities are described, and an estimate on cost factors is included. 36 references. [AIA 18: 1964, 19446].

Bowness, L.E., GAMMA RADIATION FROM SOURCES WITH MAXIMUM ENERGY NOT TO EXCEED 2.5 MILLION ELECTRON VOLTS, TO PROVIDE AN ABSORBED DOSE FROM 20,000 TO 50,000 RAD MAY BE SAFELY USED FOR THE IRRADIATION OF WHEAT AND WHEAT PRODUCTS FOR CONTROL OF WHEAT INSECT INFESTATION. Federal Register, 21 Aug. 1963, 23 FR page 20095. Washington, D.C., Government Printing Office.


On Aug. 15, 1963 the Food and Drug Administration approved the use of γ-radiation to process wheat and wheat products for the control of insect infestation. Exhaustive tests to check the wholesomeness of irradiated wheat and wheat products were carried out at the University of Michigan. A dose of 20,000 rad was used on a mixture of white wheat and winter durum, exposed to a Co-60 source with a γ-flux of 100,000 rep/hr, after storage at room temperature for 1.5 months. Adverse storage conditions (90-95°F for 6 months) on the nutritional values of irradiated wheat were also tested. Groups of 12 male and 20 female Holtsman-strain albino rats were used. Irradiated wheat fed to rats for 9 months or more had no effect on growth, reproduction or pathology. Lower and upper dosage limits for irradiating wheat commercially were specified as 20,000 rad (for breaking the reproductive cycle of the infesting insect) and 50,000 rad. No detrimental effects of the upper dose have been observed on nutritional value, wholesomeness and quality. Costs of preparing and operating a gamma sterilizer are estimated. For a single treatment the use of γ-radiation will be more expensive than the use of fumigants. If more than 2 fumigations are required during storage the irradiation could be the more economical, as a single irradiation will suffice if the treated grain is protected against reinfestation (insect-proof containers, bags with specially treated surfaces, etc.) Co-60 will probably be more economical than Ca-45 as a γ-source if the period of amortization is 5 years. The geometry of the source is an important consideration in obtaining efficient use of the radiation source and in keeping the dosage range between 50,000 and 80,000 rad. The gravity feed irradiator, with a matrix of 11 x 24, may be used in numbers sufficient to meet the demand. Mobile irradiation would consist of 150 elements at 6000 Ci, each capable of treating 9-10 000 tons of grain/week on 24 hour/120 bhp operation. Irradiators could be used on shipboard to treat grain on entry through a seaport. For continuous processing at fairly uniform rates, permanent irradiators would be preferred, possibly using the gravity flow design for loose grain and a bucket conveyor for bagged grain and packaged wheat products.


Irradiation of wheat flour and cereal products with doses of Co-60 γ-radiation between 25 and 150 kilorads resulted in destruction of insect pests in all stages of development. Exposure of flour to doses between 25 and 150 kilorads improved the holding quality of wheat flour, and doses of 500 to 1000 kilorads improved the storage life of unrefrigerated pre-baked or partially-baked packaged products. Results are reported from studies of the chemical effects of γ-radiation on the protein, enzymes, and other constituents of wheat flour. [AIA 17: 1963, 21980].

999
A major portion of the AEC food irradiation program is devoted to the development of a family of radiation facilities. First, research irradiation capable of supporting food irradiation studies were designed and constructed. Current emphasis is on proto-commercial facilities either under design or construction, or planned for construction as the program develops. Proto-commercial facilities are intended to translate laboratory data to semi-production or pilot plant operation to prove laboratory data on a near commercial scale, and to aid in the determination of the economics involved. Included in this category are mobile units, a Marine Products Development Irradiator (MPDI), and a grain irradiator. Types of irradiation claimed as highly specialized, or applicable in unique situations, constitute another category. Detailed discussion is presented on a research irradiator, transportable units, the grain irradiator, control or implant irradiators such as the MPDI, on-board ship irradiators, the Hawaiian irradiator, and the U.S. Army Radiation Laboratory at Natick, Massachusetts. (NSA 14: 1964, 22001).
In the treatment of a family of radiation studies, was designed and conducted, with the goal of developing methods to control insects on a large scale. The research focused on the use of different radiation doses to control pests in various agricultural settings.

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The effectiveness of radiation treatment was assessed for various insect species, showing promising results in controlling beetles, ants, and other pests. The use of gamma radiations was found to be particularly effective in reducing the population of these pests.

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The study aimed to determine the minimum effective doses of gamma radiation required to arrest the development of several insect species, including beetles and flour weevils, in stored grain. The results showed that doses as low as 8000 rad were effective in controlling these pests.

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Investigations were conducted to determine the minimum effective doses of cobalt 60 radiation required to sterilize insect populations. The study concluded that doses as low as 20,000 rad were sufficient to sterilize several species of insects, making this technique a promising method for pest control.

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Preliminary results on the disinfection of dried figs showed no significant changes in sugar content and reducing up to doses of 60,000 rad. The color of the irradiated figs was unaffected by gamma radiation at these doses. The radiation resistance of certain species of insects which attack stored figs is reported under investigation.
are not necessarily reliable, i.e. pre-existing with the petti-
ning the blockage before one, maintenance the infected b
section and reporting of the original Pyrausta ventricosa (Newp.
young larvae of H. bajulus an

8th 1964, 8)

1504 Berryman, A.A., RADIOGRA
STUDIES OF FOREST INSECT
AN X-RAY STUDY OF CRYPTIC LIP
1506 Berryman, A.A., Stark, R.W
4 (1967) 466-66.

The use of radiography in the damage. Longwave or "soft"
insects infesting planer insect
38 kv, 10 ma and variable e
pine beetle larvae and papaw
les chausse (LaCoute) red to
lychnophora infesting various thick
infesting insects. Less surface
could be detected. (Auth.)

1506 Berryman, A.A., Stark, R.V
ie contours USING RADIO
Limitations and possible imp
satisfactory, providing penet
graph showing from insect 1
5 constant temperatures (15°,
ment occurred at 50° to 25°
progeny were produced at 50°
data on pinto mortality were
and a high mortality in puma
form slabs at the 30° C level

1507 Betchly, J.B., Baldwin, W.
(1902) 643-9.

After reviewing work in the i
techniques are discussed. In
obtaining clear photographs of
house longhorn beetle (Hylob
wood and to follow their dev
evaluation of wood preserv
are likely to have little effec
difficulties, e.g. detecting e
distribution of parasites of w
(Pestsalys) ventricosa an
structural timber in thin cou
thickness, the ratio of timber
and other factors would com
be overcome. It for


Details of a larval transfer method for with A. punctatum and H. bajulus are given. It is applicable to tar-oil, water-borne and organic solvent types of preservatives, though comparisons between these groups

II-C-3 ECONOMICS

1502 Cornell, P.R. INSECT CONTROL BY GAMMA IRRADIATION - A TECHNICALLY FEASIBLE PROCESS, BUT IS IT DESIRABLE AND CAN IT BE APPLIED? Food Ind. 1. 4 (1961) 49-111.

Some of the fundamental problems and applied problems in the use of irradiation for the control of insects in grain are examined, and a comparison is made with conventional methods. A detailed appraisal was published earlier in J. Sci. Food Agro, 11: 1960, 754 (Cornell and Bell, Insect control by gamma irradiation - an appraisal of the possibilities and problems involved). Three major factors which discourage commercial exploitation at present are (1) sources of 1-2 Mc C are required to accommodate the producer at 500 tons/year, the maximum handling rate demanded by the trade, (2) capital expenditure for these massive sources is prohibitive, and (3) operating costs are not competitive with conventional means of insect control. With the significant advances made during the last 2 years in the development of electronic machines, with considerably greater power outputs than the present accelerators, but with low beam energy, some of these factors should be resolved in the future.


1490 The potential value of gamma radiation in the wheat industry. (Brownell, 1963).


II-C-4 DETECTION


Details of a larval transfer method for with A. punctatum and H. bajulus are given. It is applicable to tar-oil, water-borne and organic solvent types of preservatives, though comparisons between these groups
...as are not necessarily reliable, and directions are given for selecting and preparing the wood blocks, impregnating them with the preservative, boring the holes into which the larvae are to be inserted, conditioning the blocks before use, maintaining the larvae before use and inserting them into the blocks, the maintenance of the infested blocks, their subsequent examination with or without x-rays, and the evaluation and reporting of the results. Appendices contain information on precautions against contamination by Phytophthora viticola (Neumo), which sometimes affects oaks with A. pustulata, the method of obtaining young larvae of H. bachi and the use of x-rays to detect living larvae within the blocks. (From RAE-A 55, 1964, 8)


As x-ray study of cryptic insects (including lps confusus (Le Conte)).


The use of radiography in the study of cryptic insects was investigated for several kinds of forest insect damage. Longwave or "soot" x-rays (8-22 KV) were found most suitable for the detection and study of insects infesting plant material. A portable industrial x-ray unit was used which had an output of up to 35 KV, 15 mA and variable exposure time. Excellent results were achieved in radiographies of western pine beetle larvae and pupae in ponderosa pine bark; adult gallery construction and larval development of lps confusus (Le Conte); red turpentine beetle in the sugar pine; hypsodema, cambia, psyllids, and lycids infesting various thistles and kinds of timber; weevils infesting lodgepole pine tips and wood-boring insects. Less satisfactory was the detection of insects in whole cones, although their galleries could be detected. (Auth.)


Limitations and possible improvements of the method are discussed. "Soft", low KV x-rays proved most satisfactory, providing penetration was adequate and the time exposure was short enough to minimize radiographs blurring from insect movement. The rate of adult gallery construction and wood development at 6 constant temperatures (15°C, 20°C, 25°C, 30°C and 35°C) was observed. Maximum rate of wood development occurred at 30°C to 35°C and a sharp reduction in activity occurred at 17°C. Greatest numbers of progeny were produced at 30°C and highest wood survival occurred at this temperature and at 25°C. The data on wood mortality were suggestive of high mortality in the egg stage and larval stages at all temperatures and a high mortality in pupal and adult stages at the lowest and 2 highest temperatures. Adults emerging from slabs at the 30°C level were significantly smaller than those reared at lower temperatures.


After reviewing work in the field to date, and the effects of radiation on wood-boring insects, modern techniques are discussed. Recent advances in equipment design have made it possible to use x-rays for obtaining clear photographs of insect larvae of the death-watch beetle (Nitidulidae microcerus), the house longhorn beetle (Hylasaphus bachi), and the common furniture beetle (Anobium punctatum) within wood and to follow their development without destructive examination of their environment. This facilitates evaluation of wood preservatives as well as biological research. Short exposures at low-voltage x-rays are likely to have little effect on the viability of insects within wood. Nevertheless, there are certain difficulties, e.g., detecting certain larvae depends on their age and mineral content. The presence and distribution of parasites of wood-boring insects may also be revealed by x-rays as for the parasites Pyrospora (Pseudococcidae) vesiculosa and Theoborus formiciformis. It is altogether doubtful if x-ray examination of structural timbers in situ could be relied on to determine whether or not attack was still active. In large timbers, the ratio of timber thickness to larval size would be too great to provide the necessary contrast, and other factors would complicate interpretation. Only in wood of small sectional thickness can these difficulties be overcome. It is unlikely that x-rays could be used economically in routine examinations for quarantine purposes.
1508

S. granarius were allowed to oviposit for 4 d on samples of sterilized wheat and then steamed off. 2 batches of the infected wheat were then treated with malathion dust at 2.0 ppm. All samples, incubated at 25°C and 90% R.H., were examined at intervals by the Hooke-Osley CO2 production test and by x-ray photography. Adults were removed from controls as they emerged, but not from the treated samples in which they died quickly. High CO2 figures were found throughout, but those in the treated samples (91.6%) were only 9% of those in the controls (4.5%). The presence of large numbers of immature stages was confirmed by x-ray. Sufficient larval development to cause heating therefore could take place in grain already attacked by S. granarius and subsequently treated by malathion. Malathion not only killed the adults on emergence but also reduced the population of immature stages.

1509

Estimates of the number of the western pine beetle, Dendroctonus brevicomis LeConte, in Plum ponderosa Lax. bark samples were made by radiographs of 25 bark samples and by dissection counts of the bark. High correlations (r = 0.9 between the 2 methods were found for (a) live larvae, (b) live plus dead larvae, (c) live of all stages combined, and (d) live plus dead of all stages combined. The bark dissection method took 24 hours and was 4 times as expensive as the radiographic interpretation method of estimating both beetle numbers. A Picker x-ray unit was used, and the samples classified by thickness (> 1/2 inch or < 1/2 inch). (Manuscript auth.)

1510
Demp, N. M., Docher, R. W. A METHOD AND MACHINE FOR DETECTING LIVING INTERNAL INSECT INFESTATION IN WHEAT. J. econ. Ent. 52, 2 (1952) 196-203.

Of the many methods developed for detecting hidden insect infestation in grain, only the x-ray-radiograph and the x-ray-grazing techniques have found any degree of acceptance. Technical difficulties involved, however, have led to the search for a simpler method. A promising chemical indicator technique uses the body fluids of the insects to produce a colour reaction with nitroblue-impregnated filter paper. The accuracy of the x-ray technique was found to be inferior for low-level infestation. A table is given comparing the relative performance of the x-ray and nitroblue techniques for wheat infestation. The unit described is a prototype. An improved unit has been built which will be field-tested against the x-ray method.

1511

The development of insect larvae was studied by x-ray photography. The entire post-embody development of A. laegvagatella takes place lengthwise inside the new shoots. It is quite impossible to detect infestation in the autumn by external inspection. By means of x-rays it is possible not only to discover infestation but also to observe the development and behaviour of the larvae. Pupation and eclosion can also be followed.

1512
Ednow, H. UNTERSUCHUNGEN ÜBER DIE ENTWICKLUNG VON PARASITEN BEI Coleophora lachellata Hs. MIT HILFE VON RÖNTGENPHOTOGRAFIE. (Study on the development of parasites in Coleophora lachellata Hs. by means of x-ray photography). Z. angew. Ent. 50, 1 (1965) 115-25. (in German, with English summary)

In late autumn the larvae of the parasites Spilampsis bobi Thoms. and Ctenothele picta Nees (Phylidae) attain full growth and kill their hosts, the larvae of Coleophora lachellata. They do not normally pupate until the following spring, but in the laboratory adults can be reared during winter. The developmental patterns of the parasites were constructed from observations during rearing experiments combined with repeated x-ray photography. Differences in development among the 2 species and sexes were found. No difference between x-ray treated and untreated animals was detected. For x-raying, model TEA-35 (Schottascher) was used. The tube is provided with a 35-mm window and produces very soft radiation. The object was placed at 20 cm distance, and optimum conditions for irradiation were a period of 15 sec at 14 kV and 10 mA. A Geiger connection with control manual.

1513
Gustafsson, A., Stenz, M. X "Proceedings of the 12th Congr 1962". Stockholm, Stockholm, Sweden. Data are summarized on x-ray methods used, x-rays have been used in diagnosis of old and species. The damaged seed is larvae. Each group in Sweden measures minute details for 5. (A list of two of the paper is concerned.

1514
Harlock, E. T., Armstrong, J. W. Agriculture, Fisheries and Food Dept. Tests were carried out on detection of organophosphates in cocoa beans using The latter proved to be much more presence of moulds.

1515
Harlock, E. T. DETECTION OF M Heritage, Jr. Food Manuf. 3

1516

1517
Johnson, N. E., Melotore, H. Canad. Ent. 50 (1961) 228-51. An improved method of rearing developed by using wax-coat a local hospital it was possible the bark of infested trees, for parent adults and their egg masses larvae. It thus appears except immature larvae. The development of bark borers.

1518
Johnson, N. E. CONE-SCALE CONE MIDES. For. Sci.

Premature cone-scale necrosis: cone scale, Conida roseana; Pseudoma roseana: wood, 1 coniferae; larvae, eggs, of Aedes containing from 1-3 larvae, of scales of infested cones. In e for gernination. Radiographic analysis and gernination test fix. The number of midges, etc., in cone scales, the number.

404
wheat and then staved off 2 batches. All samples, incubated at 25°C, were taken for x-ray photography, from the treated samples in which the leaf needles were dissected; we were able to take leaf samples from our field sites.

12.4 P. H. D. RESEARCH IN ESTIMATING INSECT MONITORING.

Insect live and dead larvae, (3) live plus dead larvae combined. The black selenium technique is used in this study for estimating density of insects and their stages. The result is shown in Figure 1.

12.5 P. H. D. RESEARCH IN ESTIMATING INSECT MONITORING.

The entire post-emergent period is long and critical. The larvae are susceptible to predation. The pupation and emergence of adult insects is observed. The effects of temperature and humidity on development are studied.

12.6 P. H. D. RESEARCH IN ESTIMATING INSECT MONITORING.

The use of x-ray techniques in detecting and monitoring insect populations is discussed. The x-ray photographs are used to determine the presence and density of insects in the field.

12.7 P. H. D. RESEARCH IN ESTIMATING INSECT MONITORING.

An improved method for monitoring insect populations is introduced. This method involves the use of x-rays to detect and monitor the presence of insects in various stages of development.

12.8 P. H. D. RESEARCH IN ESTIMATING INSECT MONITORING.


The number of cones per tree can be estimated using x-rays to detect and monitor the presence of insects in various stages of development. The x-ray technique is also used to detect and monitor the presence of insects in the field. The results are shown in Figure 2.
1554 Simak, M. BESTÄNDIGkeit AV INSEKTISKADON PÅ GRANFRÖ MEDELST SÖNTGENFOTOGRAFIERING. (Insect damage to seeds of Norway spruce determined by x-ray photography). Ekotsch Nordlands Skogs.
Växtforbunds Tidskrift. 8 (1962) 200-210. (In Swedish, with English summary)

The damaged seeds fall naturally into 2 groups: A (seeds containing larvae) and B (seeds without larvae). The gall-fly Pseudem Solda Sæther and Megastigmus abietis (group A) attack seed. Larvae of Pseudem Solda remain inside II for 2-3 years, also causing a reduction in seed size. Megastigmus does not alter the shape or colour of the seed. It has a life cycle of 1-2 years and becomes a dryfly in the seed. Insects of group B can only be penetrated by damage caused (e.g. punctures of the seed coat, presence of frass), and are usually found further north than those of group A. The degree of insect damage is easier to diminish with increasing altitude. Insects influence the site or the eggs of the attacked seeds, and the poisoning quality of the seeds. X-ray photography is in every respect superior to other methods of macroscopic examination. Secondary insect damage, especially reductions in seed quality, can be demonstrated exactly, and the method also gives wider scope for studies on evolution, occurrence, habits, and ecology etc. of the insects attacking the seeds.


A prime factor in seed production for reforestation is insect damage, which often is not visible externally. Proportions of empty and sound seeds and of deformed or diseased embryos can be rapidly estimated by x-ray examination. (Audubon.)

1556 Steenley, P.G. THE LIFE HISTORY AND BEHAVIOR OF AN INTERNAL FEEDING STORED GRAIN INSECT, Neospora Domoticus (FAB.) BY USE OF X-RAY. Dim. Annu. 9, 3 (1962) 1139.

The study was undertaken to determine life history, and habits of the insect inside wheat kernels. The rearing medium was Parnaw variety of hard red winter wheat, cleaned and adjusted to (0 ± 0.5) moisture; rearing was done at (83 ± 1) °F used to record the growth, development, and any changes in amino acid composition. The study was undertaken to determine life history, habits of the insect inside wheat kernels. The rearing medium was Parnaw variety of hard red winter wheat, cleaned and adjusted to (0 ± 0.5) moisture; rearing was done at (83 ± 1) °F used to record the growth, development, and any changes in amino acid composition.
The use of X-rays for checking


A special apparatus for x-raying seeds and a method for their entomological examination are described. The roentgenogram permits the stage of development of the pest to be established, as well as the extent of infestation, the efficacy of insecticides, and the presence of fungal and bacterial diseases. Roentgenograms are most important for the quarantine examination of imported cotton seeds, grains, and leguminous seeds. (See Ref. Zhur., Biol., 1959, 6264).


I. - D. Sericulture


Changes in the dynamic properties of γ-irradiated silk and raw silk fiber (produced from irradiated cocoons) in the presence of air and in vacuo (10^-8 mm) were investigated. A Coγ γ-ray source and 3 x 10^4 to 2 x 10^5 equivalent physical irradiation doses had been used. Dynamic tests in vacuo gave less statistically dispense results, because of the stabilizing influence of the vacuum. Compared to the tests in the presence of air, the same loads and deformation times, tests in vacuo show a sharp decrease of the absolute elongation of the fiber. The change in elongation is in vacuo proportional to the load (to 80 g), i.e., the plastic deformation for silk in vacuo is small and the plastic deformations predominates, while in presence of air the plastic deformation predominates. Irradiation of natural silk in vacuo (10^-4 mm) with doses up to 10^5 equivalent physical increases the strength of the fiber, i.e., a process of stretching of molecular chains predominates. Raw silk, in presence of air-irradiated cocoons (doses 3 x 10^4 to 2 x 10^5 equivalent physical, did not show a decrease of strength. (CA 55:1031, 3114).


Fibroin from hybrid cocoons of mulberry silkworms was irradiated with γ-rays (1800R) in doses of from 1 million to 50 million R. The acid hydrolysates of irradiated and unirradiated fibroin were studied for changes in amino acid composition (chromatographic method) and for N content. A spectroscopic study

407
was also made. In the beginning of radiation the content of total and amino N decreased rapidly. At doses over 26 million the rate of decrease dropped sharply. In the hydrolysate of unirradiated fibrin the content of alanine, phenylalanine, tyrosine, glycine + serine, glutamic acid + aspartic acid, valine, histidine + lysine, and arginine decreased with increase in the dose of radiation. The percentage of the relative decrease in the content of these amino acids increases in the sequence of their enumeration. At the same time, new unidentified amino acids were detected. Hydrolysates of irradiated and non-irradiated fibrin have identical absorption max. at 271 m.μ. From Ref. Zh., Khim. 1962, Abstr. No. 155532 (CA 67:1962, 20154b).

1532

Anerobic γ-ray irradiation (105 - 106) of silk, linen, flax, and silk fibre produced asymmetric ESR signals closely related to those of cytochrome and reduced glutathione. When irradiated silk fibres were examined for ESR by applying a perpendicular magnetic field, a doublet signal resembling that of glycyl-glycylglycine was observed, presumably owing to intrapeptide chain bonding with free radicals. Anerobic irradiation of the protein yielded a symmetric triplet (g = 2.002) signal, presumably of peroxido radicals. These signals of irradiated proteins were undetectable if irradiation was performed in the presence of H2O. The addition of irradiated protein or cytochrome to native albumin solution decreased the amount of diamagnetic SH groups. (CA 66, 1966, 16554 d).

See also:
870 Difference of radiation sensitivity between male and female upon the egg contour-sex-limited, in the silkworm. (Hirohot and Yasuda, 1961).
1067 Studies on the breeding method taking advantage of γ-rays in the silkworm. (Japan. Sericultural Experiment Station, Tokyo, 1963).
1209 Studies on the breeding method taking advantage of γ-rays in the silkworm. (Japan. Sericultural Experiment Station, Tokyo, 1963).

II E Biological Control

1539

1534


Certain species of entomopathogenic fungi are host-specific and are capable of bringing about epidermatomic spores among many harmful insects. Their cultivation is difficult. Field tests in application of entomopathogenic fungi were sometimes successful. Fungi imperfecti cause mycotic diseases. These fungi are cultivated on a large scale on steamed hay, grain residues, or on fallen leaves and other invertebratebase materials. A good yield of Beauveria bassiana was obtained on a mixture of corn and wheat extract with stimulants - methoxyl acetic acid, 5,4-D, DDT, and microelements (K2SO4 or CaSO4) in concentrations of 0.03 to 0.25%. The article describes experiments in colonization of the fungi at pest foci and the utilization of effect of the biological preparation with small additives of insecticides. The virulence of fungi can be increased by controlled orientation on a culture with chitin and in the presence of choline (DDT, HCH, petroleum products) and physical γ- and x-rays 400).

1535
Various processes were tested in experiments begun in 1957 for increasing the virulence of Bacillus bassiana and Aspergillus flavus, which give important control of insects. Virulent strains of the fungi were used and after treatment were tested in the laboratory on the notous Pananomid [Nasonia longicornis] and the apple Tsettid [Cydia pomonella (L.)]. In comparison with untreated fungi, ultra-sounds and ultraviolet rays applied to them had little constant effect, but exposure of B. bassiana to soft X-rays and γ-radiation from Co²⁹ gave positive results in the range 1000 - 40 000 r, and the former were effective even at 40 r. The effect depended not only on the species of fungus and the dose, but also on the stage of development of the fungi. The best results were obtained with young cultures in the mycelial and early sporating stage. Insect mortality from the treated strains was increased by 30 - 40%. There was no increase in the virulence of A. flavus subjected to such treatment. In B. bassiana, the effect persisted for 1 - 10 generations. (RAE-6 55: 1960, 788).

II - F Insect Diseases


Honey-comb and honey heavily contaminated with spores of Bacillus larvae were sterilized after exposure to a dose of 1.5 x 10⁴ to 5.0 x 10⁴ rad from Co²⁹. Sugar-tolerant yeasts were killed by 10⁴ rad and cysts of Nosema apis by 0.2 x 10⁴ rad. (CA 57:1982, 26384).

See also:
The principle of the method is viewed. The method is further synthesized in nitrous. (CA 65: H)

Brockman, E., Chevremont, LABORATORY. Bull. Inst. op

Branton, D. DRY, HIGH RES.
Micromorph sections of freshbacked by a foil pad. The next exposure, the sections are firm of 8-butanone and acetone. T processing, though the tissue contains with tissues containing 8 with standard liquid emulsion c

Faeh, G. L., King, R.C. RAD
THICKNESS. Rad. Res., 20, (1
Data are presented relating to efficiency compensators in part, polymeric methacrylate was as The improved autoradiographic subsequently coated with thin f

Herrmann, W., Herrmann, G.
AUFNAHMEN UND UNTESUC
TEN BETASTRAHLUNG (Teil)
dence on the energy of 8−radiation
The energy dependence of low 8−radiation. Close agreement described.

Herrmann, W., Herrmann, G.
AUFNAHMEN UND UNTESU
WENDEN BETASTRAHLUNG
its dependence on the energy of the experimental results are present power ranged from 3.3 μCi for 8 against energy, obtained from thus possible to assess the suitab in which a particular resolving

Jeffery, D. L. RADIOAUTOGR.
INSECT CONTROL. p. 1.4-16
Review article illustrating the problems, since it can provide. The technique places no restraint and 14C will register on the ma
A Autoradiography


The principle of the method is interpreted and applications in localisation of radioactive isotopes are reviewed. The method is particularly valuable in demonstrating the exact timing of deoxyribonucleic acid synthesis in mitosis. (CA 56: 1942, 2079 h).


Micrometre sections of freeze-dried, paraflin-embedded tissues are placed on pieces of thin sheet Teflon backed by a felt pad. The sections are then pressure-mounted on dry photographic emulsion. After suitable exposure, the sections are firmly cemented to the emulsion with 0.45% cellulose acetate in a 10:1 mixture of 2-butanone and acetone. This prevents the specimens from falling off or moving during photographic processing, though the tissue can be stained through the cellulose acetate binder. The method has been tested with tissues containing tritium-labelled DNA, and it produced resolution comparable to that obtained with standard liquid emulsion or stripping film techniques. (Auth.).


Data are presented relating radioautographic efficiency to section thickness which indicate that increased efficiency compensates in part for the decreasing radioactivity in increasingly thick sections. (In the tests, polyvinyl methylacrylate was used as a substitute for tissue, together with Eastman Kodak NTB2 emulsion). The improved autoradiographic resolution obtainable in most cases by means of thinner ( ~ 0.5 mm) sections subsequently coated with thin films of suitably diluted liquid nuclear emulsion is pointed out.


The energy dependence of local resolving power is discussed for microaautoradiographic exposures, using B-radiation. Close agreement is obtained between calculated values and those measured with the model described.

1541 Hermann, W., Hartmann, G., Buss, R. DAS AUFLÖSUNGSPRÄGÉN MICRAUTOAUTORADIOGRAPHISCHER AUFNAHMEN UND UNTERSUCHUNGEN ÜBER SEINE ABHÄNGIGKEIT VON DER ENERGIE DER VERWENDETEN BETASTRAHLUNG (Teil II). (The resolving power of microautoradiographic exposures and its dependence on the energy of B-radiation. II.). Atomphysik 8 (1962) 8-11. (In German)

Experimental results are presented for radiotopes 32P, 35S, 32P, Au197, 32P, and 35S. The resolving power ranged from 0.3 to 10 μm for 32P, 35S, and 32P. A graph shows three curves of resolving power plotted against energy, obtained from (1) calculated values, (2) the analog model, and (3) experiment. It is thus possible to assess the suitability of an isotope, under the experimental conditions used, for a problem in which a particular resolving power is essential.


Review article illustrating the applicability of autoradiographic techniques to many different types of problems, since it can provide information on actual sites of deposition in insects and even parts of cells. The technique places no restriction on the isotope used for labelling, since even the radiation from 32P and 32P will register on the nuclear emulsion. In fact, 32P and 32P(deuterium since nearly every invertebrate...
contains C and H) have the advantage of yielding high-resolution autoradiograms, and even long exposures present no difficulty. Staining can be done before or after application of the emulsion, depending on the stain. The recommended techniques and the simple, generally available laboratory equipment required are described.


When the electron emitted by the isotope in a doubly labelled compound or a mixture of labelled compounds has sufficient energy differences, resolution can be achieved by autoradiography with 2 sheets of x-ray film. Thus, C⁴⁺ or S⁴⁺ will affect only the close film while P⁴⁺ will affect both films. (CA 60:1962, 15105c).


This technique has permitted much information on DNA synthesis in chromosomes to be collected. It also lends itself to the study of the dynamics of chemical processes occurring within single chromosomes and single chromosome loci. Tritium autoradiography has furnished clear-cut evidence of the occurrence of metabolic DNA in the giant chromosomes of Diptera where disproportionate synthesis of DNA has been found at certain loci, and in the Tipula nuclei, where a specific positive body incorporates large amounts of tritiated thymidine. This body is formed by the sex chromosomes before meiosis and dismnogonates at diplotene. Work on the following tissues has been cited: Tipula ruficeps, Malacocebus demeestri, Drosophila melanogaster, Rhyzocheta, and Gypsonemusidae. (See p. 305-3, 308-9, 310-11, 313, and Figs. 8-15, 16 and 17).


A squashing method, an autoradiographic procedure, and a staining technique designed primarily for study of grasshopper neuroblast chromosomes are described. Tissue is treated with 1% sodium citrate for 4-6 min to swell cells and separate chromosomes, fixed in 50% acetic acid for 6-30 min, and then squashed between a slide coated with potassium-chromate skim milk and a No. 1 coverslip. After further treatment slides are dipped into melted (50-40°C) Kodak NTS or NTD-2 emulsion, dried vertically and stored with silica gel at 4°C in light-tight boxes for the necessary exposure time. Processing is carried out at 17-18°C, with developer and fixer pre-filtered 1 h before use. Full strength Kodak D-19 developer (4 min); distilled water rinse (15 sec), full strength Kodak acid fixer (3 min); running tap water (20 min). Slides are then stained (distilled water) and dried at room temperature. Squash preparations or autoradiograms are stained for 5-30 sec with 0.1% toluidine blue in citrate buffer at pH 8.0, dried in tertiary butyl alcohol (1-2 min) and air-dried. They are then mounted as described.

See also:


177 Incorporation of iron-59 into the carbon of different tissues of Chlorococcus phormis. (Olley and Owston, 1960).

386 A micromethod for labelling steroids and eyedyes with tritium. (Karsten et al., 1967).


When measurements are in factures must be taken into absorption and back-scattering for the applied isotope layer. Mention is made of the problem. All such complications are with contamination correction in the various experimenter as type used. In this case, L, and Galliformus epytula

See also:

1520 Determination of the 1980.


704 Pesticides residues, 1 meat from dairy cows

1547 Sieber, K., Junat, A. AI CONTENT IN CORDONIA DER.

See:

415 Radioactive tracer tech

421 Nucleotides and other

517 Drywood termites meta al., 1968)

The method is used in a v

1548 Castro, C. E., Schenull, R.A METHTON ACTIVATION... AND POTASSIUM RESIDUES.

An extremely fundamental set directly the total brain on the result of fumigation with amounts of Na, K, Mo and C
B Dosimetry


When measurements are made of emission from intact insects of radioisotopes present as traces, various factors must be taken into account. Technical and mathematical ways of determining the value of absorption and back-scattering for different insect tissues are described. The substitution of Al-filters for the excised tissue layers represents an indirect method of measuring absorption by the insect body. Mention is made of the problem of curcular excision of Pm, with subsequent changes in counting rates. All such complications are greatly reduced if "γ"-sources are used as traces, and the measurements made with scintillation counters. If the "γ" and "β"-radiations from the same insect are measured in close succession in the various experiments described, the size of the effects may be easily determined for the particular isotope used. (In this study experiments were carried out on Peromyscus maniculatus Bosh., Peromyscus leucopus L., and Calliphora erythrocephala Meig.)

See also:

498 Determination of the y-isotope in fast-chlorocyclohexane by tritium dilution (Aralik and Lomas, 1958).
500 Determination of β-chlorocyclohexane by the method of isotope dilution. (Kolikova et al., 1963.)
704 Pesticides residues. Use of radioactive tracer method to determine possible residues in milk and meat from dairy cows. (Crawford, 1960.)

C Isotope Dilution

Siebert, K., Jumaa, A. AN ISOTOPE DILUTION TECHNIQUE WAS USED TO DETERMINE THE γ-HCH CONTENT IN COMMERCIAL MIXTURES. Symposium über Schädlingsbekämpfung, Magdeburg, 1962. DUR.

D Labelled Pool Technique

See:

412 Radioactive tracer techniques in insect biochemistry. (Winteringham, 1963.)
496 Nucleotides and other phosphorus compounds of cockroach nerve. (Masol and Bay, 1964.)
517 Drywood termite metabolism of Villare fumigant as shown by labeled pool technique. (Mehlke et al., 1963.)

The method is used in a variety of studies. See also subject Index under Amino acids, and Sterol metabolism.

E Neutron Activation Analysis


An entirely instrumental method of neutron activation analysis has been successfully employed to analyze directly the total bromine residues in raw navel orange peel and juice. The inorganic bromine found was the result of fumigation with the nematicide, 1,2-dihydro-3-chloropropane. Simultaneously, the amount of Na, K, Mm and Cl were quantitatively determined from the same set of γ-ray spectra. No or-
gastric binders were detected in these fruit, all of which had been harvested from trees 6 months after nematocide application. As a method of residue analysis for Br, the procedure outlined is non-destructive, the sample preparation required is minimal, and the method is extremely rapid. The sensitivity and wide scope of the technique are striking. The authors intend to explore the biochemistry of plant-parasitic nematodes and their host relationships utilizing this technique.


Comprehensive review article. A section (p. 283–72) is devoted to neutron activation analysis (theory; typical neutron-activation procedure; instrumental neutron-activation analysis; and instruments required).


Very comprehensive review article, divided into sections on the theory of neutron activation, neutron activation procedure (sample preparation, irradiations, post-irradiation instrumental analysis, calculation of concentrations from y-ray spectra), sensitivities for thermal-neutron activation, applications of neutron activation analysis (general, and specific applications to pesticide residues), and instrumentation and sources. P. 293–90 treat applications to pesticide residues, and unpublished results by various authors are cited (p. 318–4). An attempt was made to correlate the total organic chloride content with chlorinated pesticide levels in milk butterfat. In 80% of the butterfat samples, the total organic chloride content was 0.8 times the chloride content determined for the pesticides DDT, DDE, BHC, and TDE by chromatographic techniques. The potentialities of neutron activation analysis in pesticide residue work is stressed, given its simplicity, the high sensitivities for such elements as Cl, Br, and I, multichannel quantitation from a single neutron irradiation, and the non-destructiveness of the analysis.

See also:

208 Neutron activation analysis for phosphorus in a study of development in a beetle wing. (Bock and Manney, 1962).


302 Rodenticide residues in wheat and milled wheat fractions fumigated with methyl bromide. (Lindsay et al., 1965).

1260 Cell differentiation and radiobiology in the wing of Tribolium confusum. (Bock, 1962).

1301 Effects of x-irradiation upon cell population and morphogenesis in the wing of Tribolium confusum. (Bock, 1962).

302 Effect of x-irradiation on cell differentiation and morphogenesis in a developing beetle wing. (Bock, 1962)

F Miscellaneous


HC-N was generated from HC-N, of specific activity 0.2 mc/mg, and stored in a reservoir. The technique and apparatus are described. From there a known amount of fumigant could be introduced into the fumigation chamber. The rate of uptake of HC-N is studied by incorporating end-window GM-counter and measuring the decrease in concentration of radioactive gas as it is absorbed by the insect.


The construction and procedure for use of such an apparatus for topical application of insecticide solutions to mites and insects of a mass of approx. 50 µg are described. The apparatus consists of a self-filling micro-pipette mounted and arranged in the field of view of a stereoscopic microscope. The insects delivered to individual insects ranged from 0.0005 µl to 0.0005 µl according to the size of the micro-pipette used. Experimental results have been obtained using this method of treatment. Calibrations are effected micropipettcally and checked radiometrically, using repeated doses of hematocrit solutions of 32P-labeled tripolyphosphate. The volume of liquid delivered was within 5% of the estimated volumes. A check on the variation

of Individual doses from the solution for doses applied to pape takes a minute or two.

1553 Lewis, C. T. DIFFUSION O

Measurements of the rate of a 3H-substituted oil film. (17-17 - the specific activity bel

with oil and of subsequent it

were established over the who calculated that a monolayer

with the oil deposit. The oil and this is discussed. Simila

1554 Lewis, C. T. RADISPACE

Quantitative data concerning

mean of radioactive oil sur

For a range of species ssrate of flow on to the cuticle.

Nevertheless, an appreciable nicle, to cover the entire bo

us and the oil film or it

achieved in "culturing imes

Carpocapsa dimidita larva take about 34 us to approach elsewhere.

1555 Lewis, C. T. SOME APPLI

INSPECTS BY INSECTICIDE S

of Agricultural Importance.

radical study was carried n

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for critical w on oil about solubile derivatives. The

diate C-12 was used in sol

with Tribolium castanum the rate of diffusion over the ini

period, dielzine is ab

tion varying with viscosity.

See also:

303 Radiometric assay of

450 An apparatus for am

(Chudakov, 1961).

500 A new biosy tech

700 The grasshopper neu
of individual doses from the same capillary tube was also made radioactively. The coefficient of variation for doses applied to paper was 5%, to moles 10% and to larvae 5%. The whole treatment of one insect takes a minute or less.


Measurements of the rate of uptake of oil by active flies (Phomia terranovar R-D) were made by using 14C-labelled oil films. The labelled oil was added to a refined mineral oil - Sesamol 17 - the specific activity being adjusted as 40 ng/ml. Estimates of the rates of contamination of the insects with oil and of subsequent time absorption of radioactivity were made. Autoradiographs confirmed that oil films were established over the whole of the integument within a very few minutes after initial exposure. It was calculated that a monomolecular film was established within 5-10 min of the first contact of the fly with the oil film. The oil film advanced only when the integument was part of a living, active insect, and this is discussed. Similar results were obtained with Drosophila larvae.


Quantitative data concerning the uptake of oil by insects walking over fine deposits have been obtained by means of radioactive oil samples prepared by the addition of 14C to traces of an unsaturated hydrocarbon. For a range of species walking over a mineral oil (Sesamol 17) deposit of 3 μl/cm² on filter paper, the initial rate of flow on to the cuticle is found to be extremely small, varying from 5.3 x 10⁻² to 3.2 x 10⁻¹ ml/min. Nevertheless, an appreciable fraction of the oil thus transferred to the test rapidly diffuses over the epidermis, covering the entire body surface with a fine film within a very few minutes, to which more oil accumulates at a steadily decreasing rate. The long-term approach to equilibrium between the oil on the substrate and the oil film on the insect has been studied. A near approach to such equilibrium is achieved in "crawling insects" by the use of radioactive techniques. For example, the film of oil taken up by Cephalopinae lesnus larvae rises to a maximum level in 5 h in contrast, Tribolium castaneum adults take about 24 h to approach equilibrium. (This work forms part of an investigation to be reported in detail elsewhere.)


Preliminary work was carried out using di-iodo-octadecane-14C as a tracer in solutions in oil. This substance proved useful for investigating the creep of oil films over insect epicuticle, but was unsatisfactory for critical work on oil absorption through the cuticle, being converted in the tissues to one more water-soluble derivative. Phomia terranovar R-D was used in this work. In subsequent investigations, diiodo-C14 was used in solution in oils labelled with trifluoro-hexadecane. In comparative experiments with Tribolium castaneum exposed to 3 solutions of different viscosities, appreciable differences in both the rates of diffusion over the insects and in absorption through the cuticle have been found. After an initial period, diiodo is absorbed relatively faster than solvent, the magnitude of the differential absorption varying with viscosity. (Essentially auth.)

See also:

500 A new label apparatus, with special reference to the specific biosyn of DDVP insecticide. (Sun and Johnson, 1963).
900 The grasshopper neuroblast culture technique and its value in radioautographical studies.

The smallest portable x-ray set obtainable may be used, with thin film. Infected blocks were scraped clean of surface growths and photographed in the laboratory, masked, and replaced to the sea. The whole course of attack could thus be followed in a series of experiments on infected blocks and information obtained on the times and preferred positions of settlement, on growth-rates, and growth habits. In order to interrupt the arrangement of the worm's stereoscopy was introduced. Boring habits could be followed from the moment of entry of the individual shipworm. Tendo sp., into the wood.


The structure and mode of action of the proventriculus are described. X-ray photographs have shown that as the crop empties the decrease in volume of the fluid is partially compensated for by swallowing of air. The effects of various factors upon the rate of crop-emptying have been studied using solutions of different osmotic pressures. Changes in viscosity, affected by the addition of methyl cellulose, produce only a minor reduction in crop-emptying. The frequency of opening of the proventricular valve is not proportional to the rate of crop-emptying over the whole range of concentrations used, and it is assumed that changes in other parameters must affect the process. (Auth. summary)


Very soft rays from an x-ray tube 12A-95 (Schönander) were used, at 25 cm from the object, and through Be-window. X-ray film and exposure times from 8-7 sec (14 KV, 10 mA) were used. No damaging effects from radiation were observed. Internal infestation of larval by Asymphila hortensis H. S. can be followed in its various stages of development, although the hosts themselves show outward signs of attack. Populations and emergence can be diagnosed, also whether a cocoon contains a live or dead insect. X-ray photographs are also shown of cocoons of Pseudephemer lutea Htg. and P. reticulata Htg., being attacked by a parasitizing wasp larva, and of a parasitically infested grasshopper. Grasshopper m. l., which, apart from the egg eggs, anatomical details are easily recognized. The possibilities of the technique are pointed out.


An x-ray technique (see Radiography 1956, p. 203) was used to study the passage of radiopaque foods through the intestine of the migratory locust, Locusta migratoria L. and P., and the desert locust, Schistocerca gregaria (Forst.), prior to an analysis into the absorption of stomach poisons. Differences in the form of the colot, particularly the S-bend, in fed and unfed insects and changes during defecation are described. The S-bend is present in both fed and unfed Locusta but is reduced in a hungry Schistocerca, the colon remaining almost straight. Its significance is discussed. In Locusta intestinal contents pass into both arms of the sac, at the anterior end of the midgut, in Schistocerca intestinal contents are only found in the posterior arm, the anterior arms remaining unfilled. A peristaltic membrane is found in the posterior arm.


When adult, starved flies are fed to repletion on sugar solutions, locomotor activity is immediately and markedly depressed. Upon subsequent deprivation, locomotor activity increases at a rate that is dependent upon the concentration of the sugar ingested. An x-ray technique was developed to measure the rate of crop emptying in individual flies after feeding to repletion. Activity experiments performed in conjunction with the x-ray studies showed that after feeding to repletion, locomotor activity remains at a low level until approximately 50% of the crop contents have been utilized. Thereafter, locomotor activity begins to increase. The shape of the activity curve upon deprivation is dependent upon fewer periods of complete locomotor inactivity as the deprivation period is extended, rather than on an increase in the speed of movement. An explanation is put forward of spontaneous locomotor activity on the basis of a neurochemical mechanism involving foregut receptors and neurosecretory cells in the protocerebrum and/or the corpus cardiacum.
In many applications of radiocarbon to ecological problems it is more important to assay large numbers of samples at frequent intervals than to obtain detailed measurements at any one time. It was found that certain scanning systems, originally designed for paper chromatographic work, can be adapted for such rapid large-scale scanning. Two systems are described. A system at Oxford was very successfully used in a study of population density of P. labelled ants. Long strips of ants from unspaced samples were attached to the eidoson belt that passed slowly in front of a shielded detector. The pen recorder, located below the detector automatically recorded which individuals were tagged. Although it was only necessary to identify which ants in the sample had been previously marked, the actual amount of tagged individuals could easily be determined by calibrating the setup to either of 2 ways: (1) by inserting in the strip an index holder containing a known amount of isotope, or (2) by setting and counting selected individuals which had already been scanned to determine pc amounts producing a given pulse height on the recorder. The 2nd system described involves only a simple modification of equipment commercially available in the U.S. A.
