populations, the controls, Majuro Ponape. The return to control values occured in 1956 and remained in 1957, 1958[5,6].

The experiments here reported show that the percentage of hatched eggs remains lower than the control non-irradiated populations even after the frequency of recessive lethal + semi-lethals have returned to the normal values[1].

The mean number of offspring produced by fertile single pairs, after a significant decrease recovered normal values five months after the normalization of lethal + semi-lethal frequencies[1].

The interesting results of genetical analyses, completed with allelism tests on the same populations, shows what might be an incorporation of newly induced lethals and probably a discharge of the 'wild' lethals.

Would these newly incorporated mutants be responsible for the persistance of the physiological effects observed?[7]

Viability Samples	Fertile Strains	Offspring	Mean %
6 R_1	86	2154	25.05 ± 2.13
2 EL-C-A	82	3412	41.61 ± 2.53
N 6 R_1	197	6315	32.06 ± 1.79
El-E_1	145	7739	53.37 ± 3.40
2 N 6 R_1	182	3746	20.58 ± 0.77
El-E_2	69	2542	36.84 ± 1.70
3 N 6 R_1	207	6716	32.14 ± 1.32
6 N 6 R_1	212	14788	69.76 ± 4.43
El-E_4	132	10552	79.94 ± 5.19

Zusammenfassung. Die Analyse einiger Adaptationskomponenten (Häufigkeit des Schlüpfens aus dem Ei, Viabilität und Sterilität) bei einer isolierten natürlichen Population von *Drosophila willistoni*, zeigte nach Bestrahlung mit Co 60 verminderte Adaptationswerte, während mehrerer Generationen nach Bestrahlung, mit progressiver Angleichung an das Kontrollniveau in den folgenden Generationen. Jedoch erreichte diese Population während 15 Generationen den Grad der Häufigkeit des Schlüpfens von unbehandelten Populationen nicht.

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Departamento de Genetica, ICN Universidade do Rio Grande do Sul, Pôrto Alegre (Brazil), January 30, 1961.

[7] Work developed with grants in aid of the Conselho Nacional de Pesquisas (CNPq) (Brazilian Nat. Council of Research) Comissão Nacional de Energia Nuclear (C.N.E.N.) and the Rockefeller Foundation. – We acknowledge the constant interest and criticism of Dr. A. R. Cordeiro in charge of the general planning of the radiation genetics project.

Chromosomal Polymorphism Decrease due to γ-Radiation on Natural Populations of *Drosophila willistoni*

Studies on genetics[1] and fitness[2] of isolated natural populations, irradiated for one year and compared with control populations of the same region, accompanied these cytological observations.

A short account is given of the most significant results obtained. Before irradiating the first sample from the chosen 'Capão A', the inversion frequencies of the chromosomes from the salivary glands were determined.

As mentioned in [1], a total of about 45 kr γ-radiation was delivered in one year throughout the successive releases of F_1 flies from three samples that received 10 kr followed by three samples that received 5 kr (about 70000 individuals in each sample). The population size determined experimentally was 3 to 10 times lower, according to the season. One month after each release the samples: N1R, N2R, N3R, N4R, N5R, and N6R were collected from Capão A simultaneously with the controls (see Tables I and II). The total cytological analysis includes about 3000 individuals. The samples N6R to 6N6R complete this analysis to 14 months after the last release: $6R_1$.

For the second chromosome inversions (Table I) and the III chromosome C inversion, the pooled values from the N1R to the N5R show significantly lower frequencies in comparison with Control A, obtained from the same wood before radiation. The III C was below the Control values until the 5N6R and the IIL: D, E, and F until the 6N6R.

The mean number of inversions per individual (only females were considered) after remaining almost unchanged for the long period of seven months, from N1R to N4R, decreased significantly afterwards from the N5R to the 6N6R sample (Table II).

Another result was the detection of two new inversions restricted to the irradiated wood. One is a long sub-distal inversion in the III chromosome, the other is subproximal, short, in the XL Chromosome, called respectively R E1 and I E1. The former (III R·E1) involves the inversion of the sections 92 to the middle of 100, and the latter

Tab. I. Significant differences among various samples of *D. willistoni* natural populations, irradiated and control (X^2 and P)

Chromosomes and inversion	N1R–N5R	N6R	3N6R	4N6R	5N6R	6N6R
II L-D	28.10	14.70	15.11	44.47	6.25	28.64
	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01
II L-E	28.24	6.91	6.27	37.42	16.37	15.72
	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
II L-F	30.38	5.77	4.63	1.75	6.54	15.29
	<0.01	<0.02	<0.05	<0.20	<0.02	<0.01
II L-H	12.73	7.95	–	6.99	–	–
	<0.05	<0.01	–	<0.01	–	–
III B	–	–	4.73	–	–	–
	–	–	<0.05	–	–	–
III C	14.06	12.43	9.43	5.30	8.49	–
	<0.05	<0.01	<0.01	<0.05	<0.01	–
III J	–	5.37	2.71	–	–	–
	–	<0.02	<0.10	–	–	–
Number of studied individuals						
Irradiated	568	188	106	199	162	244
Control	133	117	117	214		240

[1] H. Winge, M. Napp, C. M. P. Maciel, and E. K. Marques, Exper. 17, (1961).
[2] E. K. Marques and C. M. P. Maciel, Exper. 17, (1961).

Tab. II. Mean number of inversion per individual *D. willistoni* from natural irradiated and control populations.

Irradiated natural population			Control population
N1R + N2R	3.08 ± 0.15	=	Control A
N3R	2.67 ± 0.17	<	3.59 ± 0.15
N4R	3.03 ± 0.16	=	
N5R	2.79 ± 0.09	<	
N6R	2.61 ± 0.09	<	4.14 ± 0.17
3N6R	3.35 ± 0.17	<	
4N6R	2.17 ± 0.08	<	3.26 ± 0.09
5N6R	2.49 ± 0.10	<	3.26 ± 0.10
6N6R	2.53 ± 0.11	<	

(XLI·E1) inverts the block comprising the distal half of section 4 to the end of 6 in the reference map[3]. No other chromosomal aberrations were observed.

In experimental *D. melanogaster* irradiated populations, PAGET[4] observed some new inversions in high frequency. Nevertheless, SEECOF[5] detected no increase of new rearrangements in *D. ananassae* heavily irradiated natural populations.

The adaptive advantage of heterozygous for inversions in *Drosophila*, demonstrated by the valuable work of DOBZHANSKY and many others, would, in the *willistoni* irradiated natural populations here studied, represent a protection for lethals and semi-lethals accumulated[1].

The crossing over suppression effect of inversions will favour this 'incorporation'. These trapped and protected lethals or deleterious mutants may correspond to the interesting allelic affinities discovered in the same populations[1,6].

The decrease of inversions frequency in irradiated natural population might be due to their overload with deleterious mutants.

Zusammenfassung. In einer isolierten natürlichen Population von *Drosophila willistoni* wurden innert 7 Monaten viermal je 70000 γ-bestrahlte Fliegen freigelassen. Anschliessend wurde eine beträchtliche Abnahme der mittleren Inversionshäufigkeit pro Individuum festgestellt. Einige Inversionen im 2. Chromosom und IIIC, IIID, IIIE und IIIF waren sogar seltener als in der nicht bestrahlten natürlichen Kontrollpopulation, selbst 14 Monate (= 35 Generationen) nach dem letzten Freilassen. Doch wurden in der bestrahlten Population auch 2 für diese Art neue Inversionen gefunden (eine im X- und eine im 3. Chromosom).

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Genetic Effects of γ-Radiation on Natural Populations of *Drosophila willistoni*[1]

As radiation levels in our planet increase, the importance and urgency of knowing its effects on natural populations, becomes more evident. Several valuable experiments have been done with *Drosophila* population cages by WALLACE[2,3] and others, but only recently STONE et al.[4], STONE and WILSON[5,6], started comparative studies on natural populations of *D. ananassae* from Bikini and other less irradiated islands. Amongst *D. willistoni*'s advantages are: the possibility of obtaining homozygous strains (II and III chrom.) by a method similar to ClB using DOBZHANSKY's marked stocks[7], and consequently, of having exact data on the frequency and allelism of lethal, semi-lethal, sterility and visible mutants; the easy-growth in laboratory and abundance in wild environments; the low dispersion rate[8] that limits its populations to the isolated 'capões' (island of woods in the grassland regions of Rio Grande do Sul State) etc.

A short report is here presented showing the most significant results obtained after a three-year period (1957–1960) of studies on genetic effects of γ-radiation, exhibited by an isolated natural population of *D. willistoni* inhabiting a specially chosen 'capão A' and compared with a control natural population from another 'capão' in the same region[9,10].

To start the experiment 1200 *willistoni* individuals were collected from the 'capão A' and bred in laboratory by daily culture bottle transfers. During one year, six doses, three of approximately 10000 r and three of about 5000 r, were given to each alternating generation of about 15000 individuals each time. These were bred again to be released in the '*capão A*' (about 70000 flies) and to maintain a large laboratory stock. As IVES[11] demonstrated, γ-radiation produces an average increase of 2% lethal mutations per 1000 r in the dosage range of 300 r to 12500 r. The decrease of fecundity or fertility by high doses of Cobalt 60 γ-radiation seems to be less severe than the X-rays.

Each of these releases had about 10 to 3 times the experimentally determined number of adult flies living in the '*capão*'. The last laboratory irradiated 'generation': $6R_1$ was sampled before the release and genetically analysed. Four samples from 'capão A' were also analysed: the N6R, 3N6R, 4N6R, and 5N6R, respectively: 2, 6, 7, and 10 months after the last release of irradiated flies ($6R_1$).

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