Watada, Masayoshi,[1] **Sumie Shigeoka**[1]*, **and Yutaka Inoue.**[2] [1]Department of Biology, Faculty of Science, Ehime University, Matsuyama, Ehime 790. [2]Osaka University of Foreign Study, Minoo, Osaka 562, Japan. *Present address: Kameoka-Syuzo and Co., Ltd., Ikazaki, kita-gun, Ehime 795-03. Inversion lethal and female sterile mutants of X chromosome from a natural population of *Drosophila melanogaster* in Japan.

In laboratory experiments, spontaneous mutations of lethal and fertile genes were well studied using X chromosomes of *Drosophila melanogaster* (Ashburner, 1989). Typically, spontaneous sex-linked lethal frequencies in normal stocks of *D. melanogaster* are on the order of 0.08-0.30%, which corresponds to specific locus mutation rates of between 0.1×10^{-5} and 0.3×10^{-5}. The frequency of recessive sterile mutations in *D. melanogaster* is considerably less than that of lethals. Frequencies of recessive male and female sterile mutants are about 10-15% of that of recessive lethals.

On the other hand, lethal and sterile mutations in natural populations of *D. melanogaster* have been studied usually using second and third chromosomes (Mukai, 1978). The frequenciy of recessive lethal and sterile mutants in natural populations is high because of covering by the dominant wild alleles. However, lethal and sterile mutations on the X chromosome have rarely been reported from the natural populations of *D. melanogaster*. These mutants are thought to be easily selected out from the natural populations.

In this paper, we report the result of a preliminary survey of lethal or strile mutations of genes on the X chromosome of a natural population of *D. melanogaster* in Japan.

Materials and Methods: From a natural population of Ozu in Ehime prefecture, 251 inseminated females of *Drosophila melanogaster* were collected using banana bait traps. Females were put into a separate vial. Virgin female progeny of these flies were crossed to FM7a males. Figure 1 shows a mating scheme for screening recessive lethal and sterile mutants of X chromosomes. A lethal mutant was checked by the absence of F3 wild-type males. Male sterility was surveyed by the progenies from the cross between Canton-S females and F3 wild-type males. Female sterility was examined using homozygous females of a wild type from the stock lines. For a lethal mutant of X chromosome, a recombination experiment was performed using a strain marked with *y cv v f*. The salivary chromosome with a lethal gene was also examined using progeny of the cross between lethal heterozygous females and Canton-S males.

Results and Discussion: Out of 251 strains examined, no male sterile mutant of X chromosome was found in this study as expected. However, one lethal and three female sterile mutants in the X chromosomes were found from the Ozu population. The frequencies of the lethal and female sterile mutants in Ozu population are 0.4 and 1.2%, respectively. These frequencies appear to be higher than that of spontaneous mutation of the X chromosomes, although only one strain has been found as a lethal mutant in this study.

The lethal mutant was mapped using a chromosome marked with *y cv v f*. A map position of the lethal mutant was estimated to be near the *v*. However, the recombination values were 6.6% between *y* and *cv*, 9.2% between *cv* and *v*, and 13.2% between *v* and *f*. These recombination values were very low, compared with the standard distances between the marker genes. This result suggests a suppression of recombination by the lethal chromosome. Therefore, the polytene chromo-

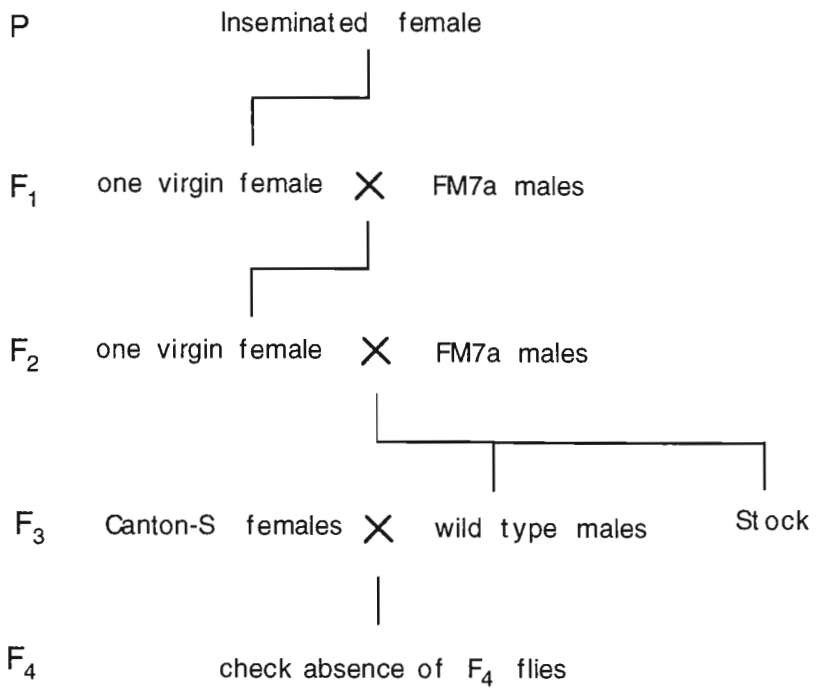

Figure 1. A mating scheme for screening recessive lethal and sterile mutants of X chromosomes.

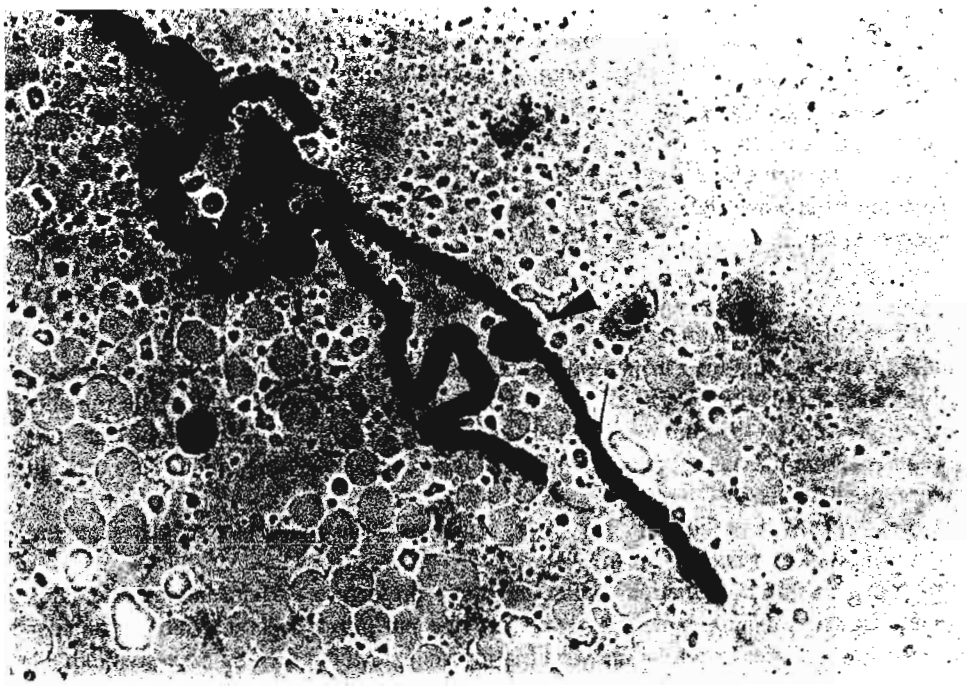

Figure 2. Salivary chromosome of a heterozygote of *In(1)OZ* and Canton-S. An arrow indicates an inverted region.

some of the lethal strain was studied using third instar larvae produced by the cross between lethal heterozygous female and Canton-S males. Observation of salivary chromosome of the lethal showed that this chromosome had an inversion at the breakpoint of 8F and 11A/B (Figure 2). We named this X chromosome inversion with a recessive lethal as *In(1)OZ*.

Many inversions have been described in the previous papers (Lindsley and Zimm, 1992). Among the described inversions, X chromosome inversions of *D. melanogaster* from natural populations were relatively rare compared with those of the second and third chromosomes of *D. melanogaster* (Lemeunier *et al.,* 1986). Ozu population of *D. melanogaster* was well studied with respect to chromosome inversions. Inoue and Watanabe (1979) reported 4 unique endemic inversion from Ozu population among 17 total endemic inversions unique to Japan. Thus, the Ozu population carries more unique endemic inversion than any other populations in Japan. It has been suggested that some extent of dysgenesis may have contributed to the inversion mutations in Ozu population. However, we have, at present, no molecular data that these mutations may have occurred by transposons.

The allelism of three female sterile mutants was examined by complementation tests. The result shows that two mutations are allelic, indicating the transmission of the sterility gene between generations in Ozu population. The frequency of female sterile mutations of X chromosome seems to be higher than that of lethals. Some female sterile mutation on autosomes have male sterility or low viability as homozygotes (Ashburner, 1989; Watanabe and Oshima, 1973). However, Lindsley and Lifschytz (1972) reported that about 8% of the major autosomes from nature carried female steriles, presumably because they are covered by dominant genes. Female sterile genes on X chromosome may be also transmitted in a manner similar to autosome sterile genes if they have no negative effect on the fertility and viability of female heterozygotes and male hemizygotes.

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