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The production of diploid gametes by female D. melanogaster.

In a series of experiments designed to identify male meiotic mutants, evidence has been found for the occurrence of diploid, or unreduced, gametes from females. In the tests, males with structurally normal second chromosomes were crossed to C(2L);C(2R) females. Only two classes of offspring were expected; those resulting from a diplo-2 sperm fertilizing a nullo-2 egg, and those resulting from a nullo-2 sperm fertilizing a diplo-2 [C(2L): C(2R)] egg. However, in addition to these two diploid classes, two unexpected classes of offspring were recovered. These were triploid females and intersexes. Three types of crosses were made (see footnote, Table 1), and exceptional progeny were recovered from all crosses. In the first set of crosses, the triploids and intersexes were phenotypically Bar-eyed. In cross #2, the triploids were y^2 B and the intersexes were B. In cross #3, the triploids were B and the intersexes were y B.

Table 1

Cross 1 number	Number ♀ tested	3N ♀	Ix	Σ	Frequency
1	8161	148	92	240	0.029
2	708	12	5	17	0.024
3	956	6	10	16	0.017

Cross #1: X X B^SY;C(2L)RM4, dp;C(2R)RM4, px ♀ X cn;e^s ♂
Cross #2: C(1)RM, y/B^SY;C(2L)RM, +;C(2R)RM, + ♀ X $Y^SX{\cdot}Y^L$, y^2 su(w^a)w^a/y^+ Y ♂
Cross #3: C(1)RM, y/B^SY;C(2L)RM4, dp;C(2R)RM, + ♀ X cn ♂

From crosses 2 and 3, it is clear that these progeny received both a compound-X and B^SY from their mother. The exceptional offspring also received the compound autosomes, since in crosses 1 and 3 they are phenotypically cn^+. This means that in a diploid oocyte, all four of these elements would have segregated to the same pole at the first meiotic division, a highly infrequent event. This also requires nondisjunction of the third chromosomes in one of the two parents. Because of the relative frequent recovery of these two classes (there were approximately three times as many triploids and intersexes as there were diploid exceptions), the explanation that these are the result of nondisjunction in a diploid cell seems highly unlikely. Alternatively, these two classes could be the result of a normal haploid sperm fertilizing a diploid, or unreduced, egg. An X bearing sperm would give rise to a triploid female and a Y bearing sperm would give rise to an intersex.

Such diploid eggs could be the result of either a failure of the first meiotic division, or a failure of a pre-meiotic mitotic division which would result in tetraploid gonial cells. In the latter, one would predict clusters of triploid and intersex progeny, whereas in the former, no large clusters would be expected. In cross #1, a total of 1313 crosses were made. Of these, 1112 produced no triploid or intersex progeny, 168 crosses gave one exception, 26 crosses produced two exceptions, six produced clusters of three, and one cross yielded four exceptional offspring. The lack of any large clusters suggests that the diploid eggs are most likely the result of a failure of the first meiotic division.

Crosses of compound autosome males to structurally normal females have not yielded any triploid or intersex progeny, indicating that males do not produce diploid gametes, or if they do, they are produced at a much lower frequency. Approximately 600 males have been tested in this type of a cross. Diploid gametes from a male in these crosses would yield intersex progeny, and any diploid gametes from the females would produce either haplo-2 or tetra-2 offspring, and thus would not be recovered.

Presumably, the production of diploid gametes is a characteristic of female meiosis, and would explain the occurrence of rare triploid females and intersexes in structurally normal Drosophila stocks. Since the effect has been found with two unrelated stocks of compound autosomes, it is felt that the effect is not due to any meiotic mutant induced when the compound stocks were constructed. It is, however, possible that the production of these diploid gametes could be due, in some way, to the structural rearrangements involved in these stocks.