Chromosomal analysis of this stock was made by squashing 100 larvae randomly taken from culture bottles by lacto-aceto-orcein method. The observed and expected (via Hardy- Weinberg proportion) numbers of 2L, 3L, and 3R karyotypes are given in Table 1. The data on the frequencies of different gene arrangements in 2L, 3L, and 3R were obtained along with the level of heterozygosity (Table 2). The frequency of AL inversion is nearly 86 percent, while the chromosomes with delta and eta inversions are less frequent than those with the standard sequence. The mean number of heterozygous inversions per individual is 1.2. Hardy-Weinberg equilibrium was tested, and Chi-square values were calculated. The difference between observed and expected numbers of different karyotypes in 3L is statistically significant and insignificant for 2L and 3R. This shows that the population is polymorphic chromosomally, and there is a significant deviation from Hardy- Weinberg equilibrium as the difference between observed and expected numbers of different karyotypes in 3L is statistically significant ($p< 0.05$). This is due to a significant excess of inversion heterozygotes.

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References: Da Cunha, A.B., 1960, Ann. Rev. Entomol. 5: 85-110; Dobzhansky, Th., 1970, *Genetics of Evolutionary Process*, Columbia University Press, New York; Singh, B.N., 1996, Genetica 97: 321-329; Singh, B.N., 1998a, J. Expt. Zool. Ind. 1: 3-13; Singh, B.N., 1998b, Ind. J. Exp. Biol. 36: 739-748; Singh, P., and B.N. Singh 2007, Dros. Inf. Serv. 90: 49-54; Singh, P., and B.N. Singh 2008, Genet. Res. 90: 409-419; Sperlich, D., and P. Pfriem 1986, In: *The Genetics and Biology of Drosophila*. (Ashburner, M., H.L. Carson, and J.N. Thompson jr., eds.), Academic Press, New York, 3e: 257-309.

Colored light norms of genotypes of parental strains and hybrids in *D. melanogaster*.

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The object of the present experiment was to study the norms of genotypes in *D. melanogaster* iso-female lines and in hybrids, using the three colored lights as an environment and the average weight as a phenotypic trait.

Materials and Methods

Four iso-female strains (genotypes) were used for the present study. The F_1's and F_2's were made for each strain. The parental, F_1's, and F_2's were tested under three different colored lights: Blue: 25W; White: 25W; and Red: 25W. The males and females were counted and the average weight per male and per female was calculated for each of the parental, F_1's and F_2's.

Results and Discussion

Genetic variation: Table 1a and 1b and the graphic representation, Figure 1a and 1b, show the variation in an average weight from one genotype to another when tested under a given colored

Table 1a and 1b. Average weight in microgram (µg) ± 1 for parental, F_1's and F_2's of each of the four genotypes of *D. melanogaster* tested under three different colored lights: red; blue; and white.

Table 1a: Males

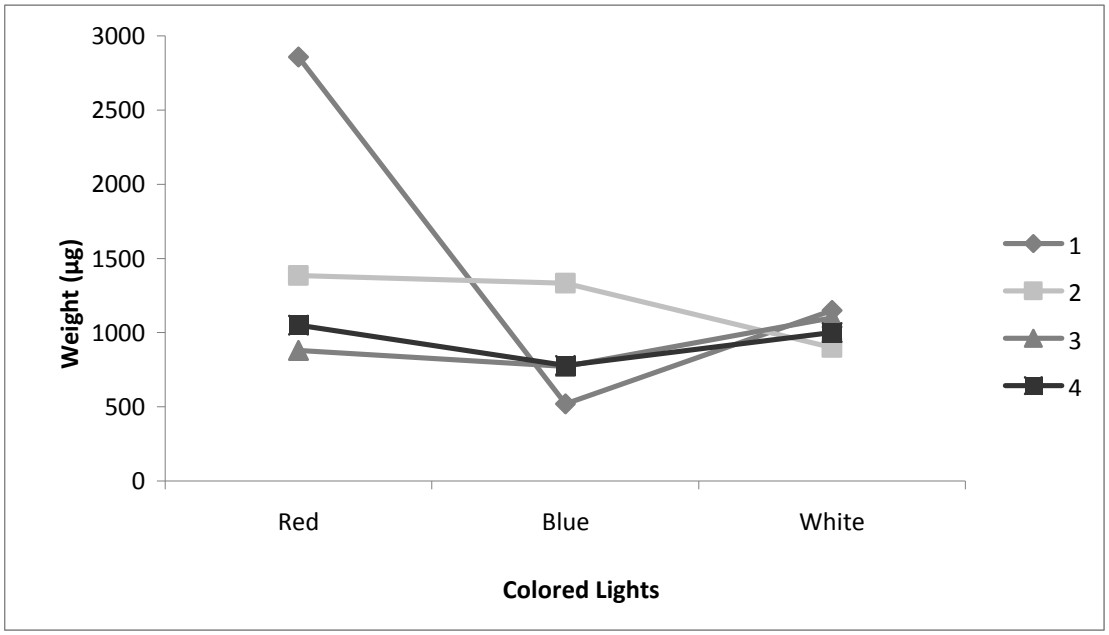
Genotype	Red (19°–20°C)	Blue (20°–21°C)	White (20°–21°C)
1			
Parental	2857.00	520.00	1150.00
F1	1900.00	1750.00	1900.00
F2	1100.00	1500.00	860.00
2			
Parental	1385.00	1333.00	900.00
F1	1800.00	1850.00	1800.00
F2	900.00	1700.00	2500.00
3			
Parental	880.00	772.00	1100.00
F1	2000.00	1800.00	1950.00
F2	900.00	1700.00	1700.00
4			
Parental	1050.00	779.00	1000.00
F1	1750.00	1417.00	1300.00
F2	1000.00	1700.00	1700.00
Average			
Parental	1543.00	851.00	1037.50
F1	1862.50	1704.25	1737.50
F2	975.00	1650.00	1690.00

Table 1b: Females

Genotype	Red (19°–20°C)	Blue (20°–21°C)	White (20°–21°C)
1			
Parental	3714.00	666.00	1450.00
F1	2000.00	2150.00	2150.00
F2	1600.00	1800.00	500.00
2			
Parental	520.00	1185.00	1350.00
F1	2250.00	2150.00	2200.00
F2	1600.00	1900.00	2000.00
3			
Parental	2341.00	397.00	1400.00
F1	2350.00	2250.00	2400.00
F2	1500.00	2100.00	1300.00
4			
Parental	520.00	1000.00	1300.00
F1	1700.00	1626.00	1650.00
F2	1200.00	2000.00	800.00
Average			
Parental	1773.75	812.00	1375.00
F1	2075.00	2044.00	2100.00
F2	1475.00	1950.00	1150.00

light for parental, F_1's, and F_2's. For example, in ***males*** (Table 1a and Figure 1a): i) under ***red*** light for parental class from 880.00 to 2857.00 µg; F_1's from 1750.00 to 2000.00 µg; and F_2's from 900.00 to 1100.00 µg. ii) under ***blue*** light for parental from 520.00 to 1333.00; F_1's from 1417.00 to 1850.00 µg; and F_2's from 1500.00 to 1700.00 µg; iii) under ***white*** light for parental class from 900.00 to 1150.00 µg; F_1's from 1300.00 to 1950.00 µg; and F_2's from 860.00 to 2500.00 µg. In ***females*** (Table 1b and Figure 1b): i): under ***red*** light for parental class from 520.00 to 3714.00 µg

(with the exception of genotypes 2 and 4 having the same weight, Figure 1b); F_1's from 1700.00 to 2350.00 µg; and F_2's from 1200.00 to 1600.00 µg. ii) under ***blue*** light for parental class from 397.00 to 1185.00; F_1's from 1626.00 to 2250.00 µg; and F_2's from 1800.00 to 2100.00 µg; iii) under ***white*** light for parental class from 1300.00 to 1450.00 µg; F_1's from 1650.00 to 2400.00 µg; and F_2's from 500.00 to 2000.00 µg. The data support the hypothesis that the variation among genotypes is *mainly genetic*.



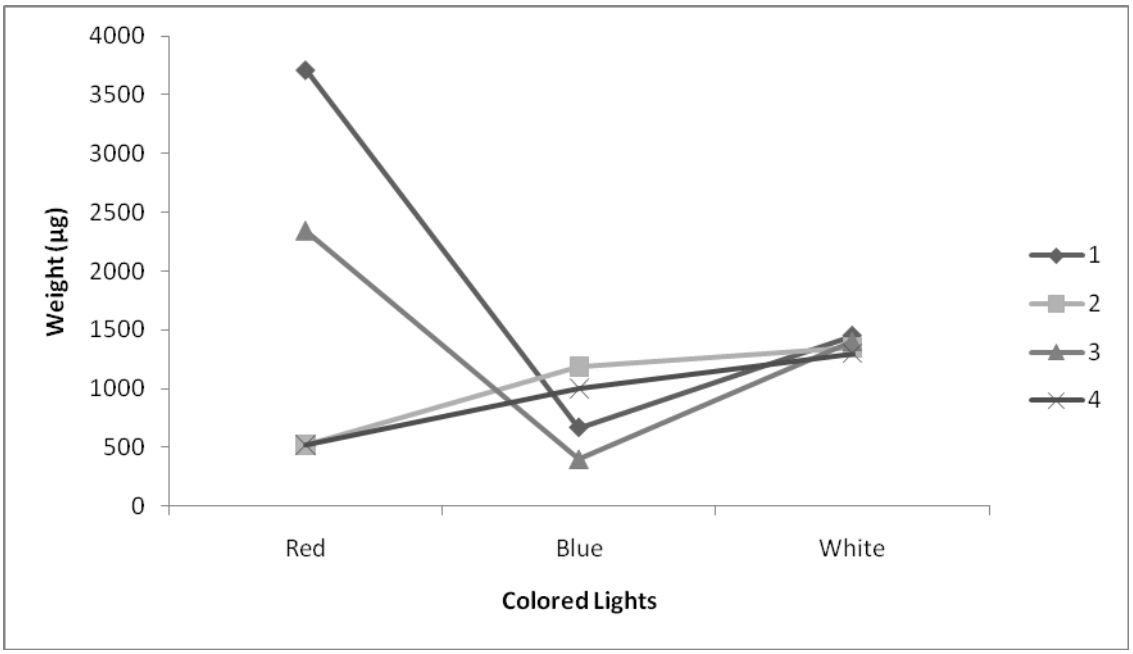


Figure 1a (top) and 1b (bottom): Average male and female weight in microgram ± 1 for four genotypes of *D. melanogaster* tested under three different colored lights.

Environmental variation: The data in Table 1a and Figure 1a demonstrate that the **male** weight varied from one colored light to another, for example, for parental genotype 1 (2857.00 µg for ***red*** light; 520.00 µg for ***blue*** light; and 1150.00 µg for ***white*** light); in case of F_1's (1900.00 µg for ***red*** light; 1750.00 µg for ***blue*** light; and 1900.00 µg for ***white*** light); and while for F_2's (1100.00 µg for ***red*** light; 1500.00 µg for ***blue*** light; and 860.00 µg for ***white*** light). Similar results, in general, were observed for the other three genotypes, F_1's and F_2's (Table 1a and Figure 1a). In case of females (Table 1b and Figure 1b), the **female** weight varied from one colored light to another, for example, for parental genotype 2 (520.00 µg for ***red*** light; 1185.00 µg for ***blue*** light; and 1350.00 µg for ***white*** light); in case of F_1's (2250.00 µg for ***red*** light; 2150.00 µg for ***blue*** light; and 2200.00 µg for ***white*** light); and while for F_2's (1600.00 µg for ***red*** light; 1900.00 µg for ***blue*** light; and 2000.00 µg for ***white*** light). Similar results, in general, were observed for the other three genotypes, F_1's and F_2's (Table 1b). These results provide the experimental evidence that the male and the female weight variation from one colored light to another for the same genotype are *mainly* environmental. (It should be noted that the graphic representation for F_1's and F_2's is not presented here but can be done from the data available from Table 1a for F_1 and F_2 males and from Table 1b for F_1 and F_2 females, to analyze the genetic and environmental variation.)

Statistical analysis: The average male and female weight of four genotypes for parents, F_1's, and F_2's are given in Table 1a and 1b. The 1-sided student paired 't' test was performed to analyze the significant difference in means between: 'red and blue'; 'red and white'; and 'blue and white' lights. It was done for parental males, parental females, F_1 males, F_1 females, F_2 males, and F_2 females separately (calculated values not detailed here but available from A. Gupta* upon request). The 1-sided 't' table value for 3 degrees of freedom is 5.841 at a probability of 0.99 (0.005 percent level of significance), and that is higher than the 't' observed value in parental males and females; F_1 males and F_1 females; and F_2 males and F_2 females, implying the means calculated and tested for the difference between red and blue'; 'red and white'; and 'blue and white' lights were significantly different. The statistical analysis provides the evidence of the effect of colored light on weight in parental males and parental females; F_1 males and F_1 females; and F_2 males and F_2 females.

Genotype and colored light interaction: The genotype × colored light interaction phenomenon is observed for two genotypes (1 and 2) between red and blue light, between blue and white light in case of males (Figure 1a), and in case of females (Figure 1b). The wavelength for *red* light is less than 650nm; and for *blue* light about 450 – 400 nm. The wavelength for white light is an unfiltered incandescent bulb. [However, the wave length (not measured) at which such an interaction is observed differs from males to females.]

Canalization: It is a measure of the ability of a population to produce the same phenotype regardless of variability of its environment or genotype. In the present experiment, genotypes 3 and 4 show the formation of canalization originating from blue light (point of canalization) towards red as well as towards the white light (Figure 1a). This means that the two genotypes becomes phenotypically cryptic under canalizing conditions but uncovered under particular decanalizing environmental or genetic conditions. ["The canalization therefore may, at least temporarily, constrain phenotypic evolution, Flatt (2005)"].

Evolutionary aspect: These data suggest that genetic variation in the four genotypes may allow different levels of successful adaptation to different colored light environments. Thus, over a longer period of time in such environments, the *Drosophila* populations may evolve to favor the most successful genotypes.

Finally, the present experimental data show the effect of colored light due to the difference in *light wavelength* on the development of a phenotypic trait from a genotype. The results are in accordance with those in *Drosophila* by Dobzhansky and Spassky (1944), Gupta and Lewontin (1982), in plants by Clausen *et al*. (1948), in human-beings by De Lorenzo *et al.* (1999), and Van't Veer and Bernards (2008). The present data confirm the results reported by Berry-Wingfield *et al*. (2010) using different colored light and analyzing *only* the *data on parental* iso-female lines of *D. melanogaster*, and *not* the hybrids (F_1's and F_2's). The data suggest that further research should be carried out on an individual genotype basis for the development of a phenotypic trait.

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References: Berry-Wingfield, A.P. Gupta, and T.D. Champion 2010, Dros. Inf. Serv. 93: 58-61; Clausen, J., D.D. Keck, and W.M. Hiesey 1948, Carnegie Inst. of Washington Publ. 581: 1-129; Dobzhansky, Th., and B. Spassky 1944, Genetics 29: 270-290; Gupta, A.P., and R.C. Lewontin 1982, Evol. 36(5): 934-948; De Lorenzo, Cecilia, B.M. Mechler, and P.J. Bryant 1999, Cancer and Metastasis Reviews 18: 295-311; Flatt, T., 2005, Q. Rev. Biol. 80(3): 287-316; Van't Veer, and Rene Bernards 2008, Nature 452: 564-570.

Evaluation of ethidium bromide effects in the life cycle and reproductive behavior of *Drosophila melanogaster*.

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Abstract

Ethidium bromide (EB) is an intercalating agent of nucleic acids. For this reason it is generally used in molecular biology and in structural studies of DNA and chromatin. Many scientists have demonstrated that this chemical can have mutagenic properties in some living organisms, including *Drosophila melanogaster*. However, most of them used concentrations up to a thousand times higher than those used used in methods of molecular biology for nucleic acid staining after electrophoresis. In the present work we verified the effect of Ethidium Bromide in all phases of development (egg, larva, pupa, and adult) of ten generations of *Drosophila melanogaster* exposed to the chemical treatment (F1, F3, F6, and F10). Moreover, we analyzed the time spent for pre-copulation and copulation. The results show that ethidium bromide interferes in the viability of eggs, larvae, pupae, and adults of *Drosophila melanogaster*. On the other hand, the behavior related to reproduction showed significant differences between the groups exposed to 30 μM EB and 1μ M EMS (ethylmethanesulfonate) and the control group in terms of the time spent in copulation. So, the data suggest on one side that ethidium bromide interfered in developmental genes, causing in some individuals inviability to reach the adult phase, and on the other side that it can interfere in the fruit fly behavior, acting as a neurotoxic agent.