Drosophila melanogaster

Drosophila melanogaster, a family of fruit flies, order Diptera, also known as the vinegar fly, is one of the most frequently used model organisms in biology as well as genetics, physiology, microbiology (in the study of the pathogenicity of microbes) and evolution, because they reproduce quickly and lay a large number of eggs.

Content

Appearance

The natural type of Drosophila has red eyes and a tan color with black stripes across the belly. We observe **sexual dimorphism** in drosophils: males are smaller with a black belly. The size of Drosophila is approximately 2.5 mm.

Life cycle and reproduction


Drosophila melanogaster

The developmental period of Drosophila varies with temperature, as with many cold-blooded species. The shortest possible time from egg to adult is 7 days at 28 °C. At a higher temperature, this time is extended due to temperature stress. Females lay approximately **400 eggs**, about 5 at a time, in rotting fruit or other suitable material such as decaying mushrooms or sap. The eggs (about 0.5 mm long) hatch after 12-15 hours. During the next 4 days, the larvae molt twice, approximately 24 and 48 hours after hatching. During this time, they feed on micro-organisms that decompose the fruit and sugar from the fruit itself. Then the larvae pupate and undergo a four-day metamorphosis during which an adult individual emerges.

The female responds to courting males approximately 8-12 hours after hatching. The average time of a successful copulation is 30 minutes, during which the male deposits several hundred unusually long spermatozoa (1.76 mm) into the female. Females store sperm in special organs where sperm from several matings compete with each other for fertilization. The highest probability of fertilization of the eggs is from the last male (up to 80% of the eggs) by inactivating the sperm of previous males.

Model organism in genetics

Drosophila melanogaster is one of the most studied organisms in biological research, especially in the field of genetics and developmental biology, for several reasons:

- Complex equipment is not required for care and cultivation, and only **a small** space is used, even in the case of using large cultures, and the total costs are also low.
- Drosophila can grow very easily in **laboratory conditions** and its morphology is **easy to identify** in case of death (most often by ether, carbon dioxide, cooling...).
- They are characterized **by a short generation time** (about ten days at room temperature), so several generations can be studied after only a few weeks.
- Another advantageous feature is **high fecundity** (females lay more than 100 eggs a day and even 2000 throughout their lifetime).
- Males and females are **easily distinguished**, and unfertilized females can be easily isolated, facilitating genetic crossbreeding.

- In the salivary glands of an adult larva, there are large **chromosomes**, also called **polytene chromosomes**, with easily marked sites of transcription and thus gene activity.
- They consist of only **four pairs** of chromosomes: three autosomes and one pair of sex chromosomes.
- In the case of males, meiotic recombination does not occur, which facilitates genetic studies.
- The technique of genetic transformation has been available since 1987.
- The complete genome sequence was first published in 2000.

Gene markers

Gene markers are commonly used in Drosophila research, e.g. inside balanced chromosomes or P-inserted elements, and most phenotypes are very easily identifiable and visible with the naked eye or under a microscope.

List of the most frequently used markers:

- Cy1: wings turn away from body, possible deterioration of flight
- e1: black body and wings (heterozygotes are also visibly darker than wild type)
- Sb1: hairs are shorter and thinner
- w1: eyes lose pigmentation and appear white, possible visual impairment
- y1: body pigmentation and wings appear yellow

Drosophila genes are mostly named according to the phenotype in case of mutation. This system of nomenclature results in a wider range of gene names than in other organisms.

Genome

The Drosophila melanogaster genome consists of four pairs of chromosomes : one pair of sex chromosomes and three pairs of autosomes, designated as 2, 3, 4, the fourth of which is so thin that it is often ignored despite containing an important blind gene. The annotated genome sequence consists of 165 million base pairs and consists of approximately 13,767protein coding genes that make up 20% of the genome out of a total of 14,000 genes. More than 60% of the genome appears to be non-protein-coding DNA, but is involved in the control of gene expression. Sex determination in drosophila is possible due to the ratio of X chromosomes to autosomes, not due to the presence of a Y chromosome, as in the case of humans. Despite the fact that the Y chromosome is heterochromatic, it consists of at least 16 genes, many of which apparently have some connection with functions in the male organism.

Use in human medicine

Drosophila is used as a genetic model for many human diseases, including neurodegenerative diseases such as Parkinson's disease/PGS, Huntington's chorea, ischemic stroke, or Alzheimer's disease. It is also used to study the mechanism of aging and oxidative stress, the immune system, diabetes, cancer or drug addiction.

Links

related articles

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