

Lecture :

4



زانكۆی سه‌لاحه‌دین - هه‌ولێر
Salahaddin University-Erbil

Practical

GENETICS

Drosophila

Subject :

melanogaster

Department: Animal Resources

Stage : 2

Done By :

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Introduction

Drosophila melanogaster is a species of fly. The species is known generally as the **common fruit fly**. *D. melanogaster* is a small, common fly found near spoiled fruit. It has been in use for over a century to study genetics. Starting with Charles W. Woodworth's proposal of the use of this species as a model organism, *D. melanogaster* continues to be widely used for biological research in genetics, physiology, and microbial pathogenesis.

Scientific classification

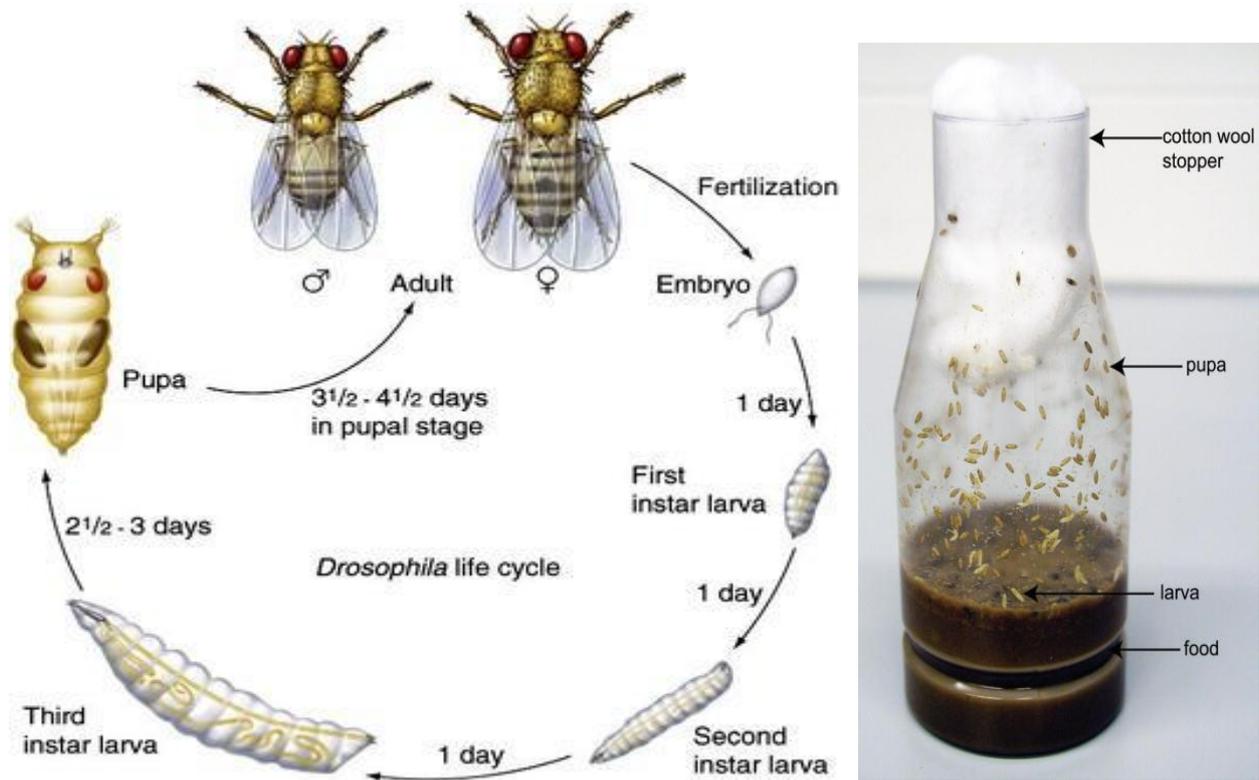
Kingdom:	Animalia
Phylum:	Arthropoda
Class:	Insecta
Order:	Diptera
Family:	Drosophilidae
Genus:	<i>Drosophila</i>
Subgenus:	<i>Sophophora</i>
<i>Species group:</i>	<i>Drosophila melanogaster</i> group
<i>Species subgroup:</i>	<i>Drosophila melanogaster</i> subgroup
<i>Species complex:</i>	<i>Drosophila melanogaster</i> complex
Species:	<i>D. melanogaster</i>

Why is *Drosophila* called Cinderella of genetics?

1. They are small and easily controlled.
2. They can be easily anesthetized with unsophisticated equipment.
3. They are sexually dimorphic (males and females are different), making it is quite easy to differentiate the sexes.
4. Flies have a short (lifespan) generation time (10-12 days) and do well at room temperature.
5. The care and culture of fruit flies requires little equipment, is low in cost and uses little space even for large cultures.

Life cycle of *Drosophila melanogaster*

Drosophila melanogaster exhibits complete metamorphism, meaning the life cycle includes an egg, larval (worm-like) form, pupa and finally emergence (Ecdysis) as a flying adult. The larval stage has three instars.



- Day 0: Female lays eggs: Eggs are small, and have two filaments at one end.
- Day 1: Eggs hatch
- Day 2: First instar (one day in length)
- Day 3: Second instar (one day in length)
- Day 4 - 5: Third and final instar (two days in length) (2nd, 3rd, 4th and 5th days called larva)
- Day 7: Larvae begin roaming stage. Pauperization (pupal formation) occurs 120 hours after egg laying: A pupa undergoes four days of metamorphosis. They form a hard and dark pupal case.
- Day 11-12: Ecdysis (adults emerge from the pupa case). : Adult flies have a head, thorax, abdomen, six legs, and two wings. They live a month or more and then die.

- Females become sexually mature 8-10 hours after eclosion.
- The generation time of *Drosophila melanogaster* varies with temperature. The above cycle is for a temperature of about 22°C. Flies raised at lower temperature (to 18°C) will take about twice as long to develop.
- Females can lay up to 100 eggs/day.
- Virgin females are able to lay eggs; however, they will be sterile and few in numbers. **But still virgin female flies are very important?**

Anesthetizing flies

The problem with fruit flies is that they fly! Therefore, a variety of methods have been developed to anesthetize flies. The least harmful to the flies is either carbon dioxide or cooling anesthetizing. Of these two choices, cooling is the simplest, requiring only a freezer, ice and petri dishes until the flies are not moving, generally 8-12 minutes.

Transferring flies from one vial to another.

Flies should be transferred every 10 to 14 days. There are two basic ways to transfer flies when forming new cultures. One requires no anesthetizing but quick hands.

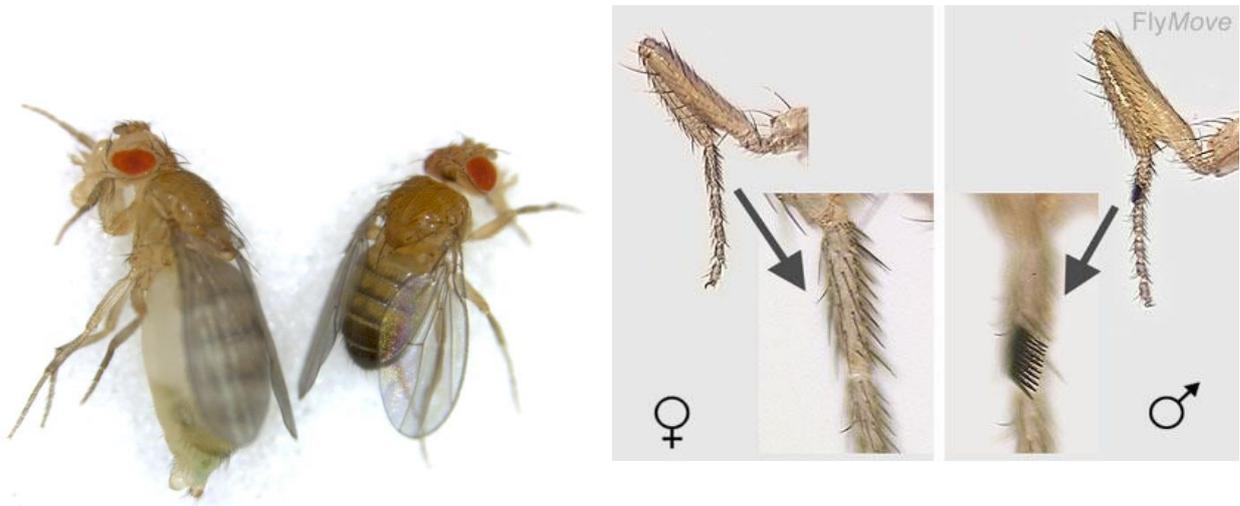
A) Place a funnel in a fresh culture vial. In the old vial gently tap the flies down. The flies will fall to the bottom then plug off the vial, invert it into the funnel.

B) Put the flies in the freezer. This will cause the flies to fall into a state of stupor. After placing a funnel on the new vial, invert the vial into the funnel.

How to distinguish male from female drosophila?

1. **Size of adult:** The male is smaller than the female, due to the shorted abdomens in comparison to females. It is mainly due to the short and blunt abdomen of the male
2. **Pigmentation (Markings on the abdomen):** Alternating dark and light bands can be seen on the entire rear portion of the female; the 5th and 6th abdominal segments of the male are fused.

3. **Appearance of sex comb:** male-specific structures consisting of a specialized row of 10- 12 densely packed, curved, and blunted/thickened on the foreleg.



Drosophila melanogaster Genome

The genome of *D. melanogaster* sequenced in 2000, contains four pairs of chromosomes: an X/Y pair, and three autosomes labeled 2, 3, and 4. special type of chromosome called Giant chromosome (polytene chromosome) those chromosomes found in salivary gland of larva. The *D. melanogaster* sequenced genome of 139.5 million base pairs and contains approximately 15,682 genes.

Polytene chromosomes

- They are commonly found in the salivary glands of drosophila. Hence it is also called salivary gland chromosome. It is larger in size. Hence it is a giant chromosome.
- The larger size of the chromosome is due to the presence of many longitudinal strands called chromonemata. Hence named as polytene chromosomes.
- The many strands of the giant chromosome are due to repeated division of the chromosome without the cytoplasmic division.
- The polytene chromosome contains two types of bands: dark and inters bands.
- The dark bands are darkly stained and the inter bands are lightly stained.
- The dark bands contain more DNA and less RNA. The inter bands contain more RNA and less DNA.