

Group Number from Canvas

Max Group Members = 6

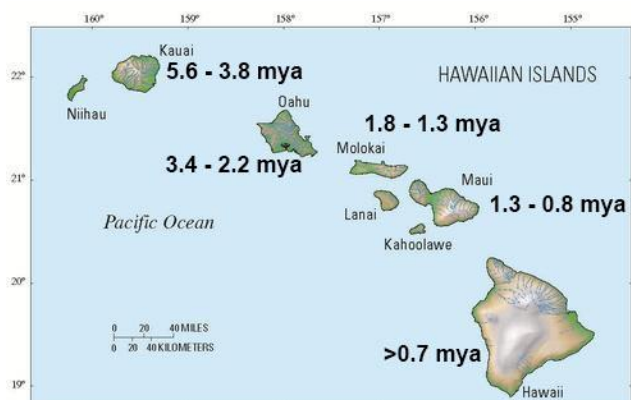
Name	Student Number
1)	
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Background on *Drosophila* from Hawai'i

The Hawaiian archipelago is a chain of volcanic islands in the Pacific ocean. Picture-winged fruit flies are common on the islands and look similar to the fruit flies you studied in genetics. The showy picture-winged fly lives on the island of Hawai'i, the drab picture winged fly lives on the island of Maui (see map below).

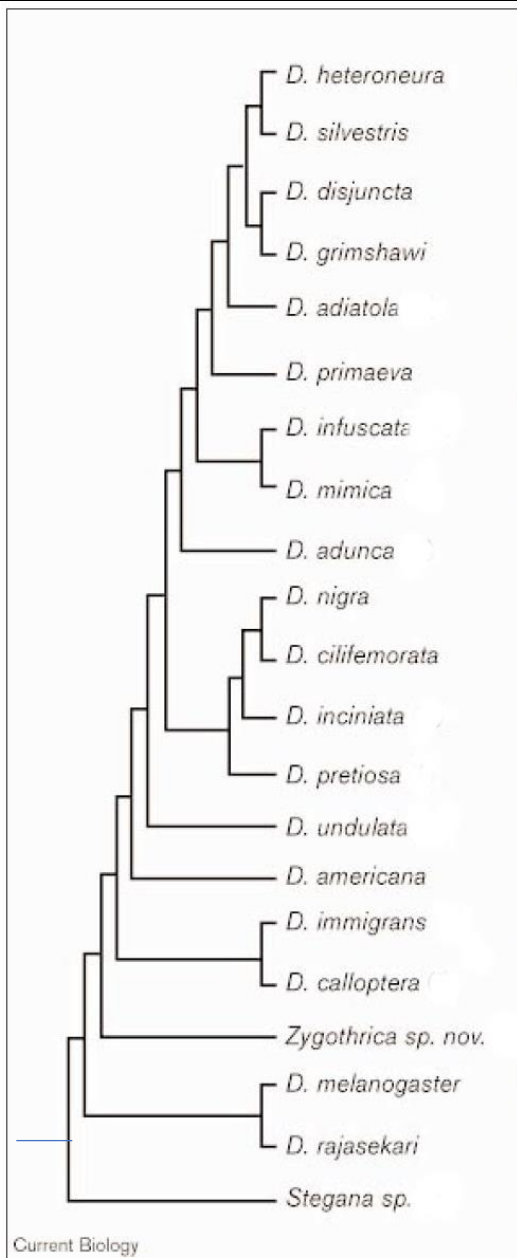
The islands of the Hawaiian archipelago are volcanic and formed at different times. The ages of the Hawaiian Islands in millions of years are as follows: Kauai, 5.6 - 3.8; Oahu, 3.4 - 2.2; Molokai, 1.8 - 1.3; Maui, 1.3 - 0.8; and Hawaii, less than 0.7 (see map below). The islands of Maui and Hawai'i are separated by 40 km of ocean. *Drosophila* generally can't fly more than a few kilometers but can occasionally be transported longer distances by storms or rafting on material floating in the water.

The showy fly from Hawai'i has a larger head, stalked eyes and a larger body than the drab fly from Maui. Hybridization can occur in the lab and hybrids have been observed in nature.



Map modified from Hawaiian Islands <https://www.usgs.gov/media/images/hawaiian-islands> (Public Domain)

1) The phylogeny below shows the relationship among species of *Drosophila* from Hawai'i.



a) What is/are the closest relative(s) of *D. pretiosa*? (1 mark)

b) Is *Stegnata* sp. the ancestor of the *Drosophila* species that occur in Hawai'i? Briefly explain your reasoning. (2 marks)

c) Based on the phylogeny, should the name of *Zygothrica* sp. nov. be changed to *Drosophila* sp. nov.? Briefly explain your reasoning. (2 marks)

d) Is *D. heteroneura* the most highly evolved species of *Drosophila* on the islands of Hawai'i? Briefly explain your reasoning. (2 marks)

BIOL 121-123 2021 – Group Midterm & Individual Midterm Prep

- 2) Consider a situation where *showy* flies from Hawai'i have been transported to Maui due to human activities (e.g. movement of produce and people by boat from Hawai'i to Maui) resulting in the establishment of a small population of showy flies in Hawai'i.
- a) You are investigating the differences between the populations of *showy* flies on Hawai'i and Maui and are looking at genetic markers that are known to be variable within the population but don't influence fitness. Fill in the table below with the missing allele frequencies and genotype frequencies. Show your calculations below the table. **(5 marks)**

	Hawai'i Population (Number of Individuals Observed)	Hawai'i Population (Observed Frequency)	Hawai'i Population (Expected Frequency)		Maui Population (Number of Individuals Observed)	Maui Population (Observed Frequency)	Maui Population (Expected Frequency)
A ₁ A ₁	473	.335			838	0.631	0.632
A ₁ A ₂	689	.488			433	0.326	0.326
A ₂ A ₂	251	.177			56	0.042	0.042
A1 Frequency					0.795		
A2 Frequency					0.205		

- b) Is the population from Hawai'i in Hardy Weinberg equilibrium? Briefly explain your reasoning. **(2 marks)**

- c) The expectation for the A1 and A2 alleles is that they are **not** under selection. Does it appear that these alleles are under selection in either the population from Hawai'i or Maui? Briefly explain your reasoning (1-2 sentences). (**2 marks**)
- d) What evolutionary mechanism would likely be responsible for the differences in allele frequencies between the Hawai'i and Maui populations? Briefly explain your reasoning (1-2 sentences) (**2 marks**)
- e) For another genetic marker locus "B", there are three alleles (B_1, B_2, B_3) in the population from Maui there are only two alleles (B_1, B_3) in the population from Hawai'i.
- What is the most likely explanation for the presence of the B2 allele in the population from Maui? Briefly explain your reasoning (one sentence). (**2 marks**)
 - After several years you identify the B2 allele in the population from Hawai'i. What is the most likely explanation for the presence of the B2 allele in the population from Maui? Briefly explain your reasoning (one sentence). (**2 marks**)

- f) Hybridization between *showy* and *drab* flies has been observed in the lab and hybrids are occasionally found in nature. Hybrids produced in the lab do not produce viable offspring when mated with other hybrids, *showy* flies or *drab* flies. Would the *showy* and *drab* flies be considered separate biological species? Briefly explain your reasoning. **(2 marks)**
- g) In nature, mating between a *showy* and *drab* individuals occurs on Maui in areas where the ranges overlap. How would mating between *showy* and *drab* individuals affect the fitness of these individuals? Briefly explain your reasoning. **(2 marks)**
- h) There is heritable variation in *showy* males for the size of wing spots. Spots range from large to small. *Drab* males only have small spots. In mating tests in the lab, you determine that there is heritable variation in *showy* females for mate preference. Some females preferentially mate with males that have large wing spots; other females prefer males with small spots. In regions of Hawai'i where both *showy* and *drab* flies occur, would you expect the frequency of large spot males to change? Explain your reasoning. **(5 marks)**