

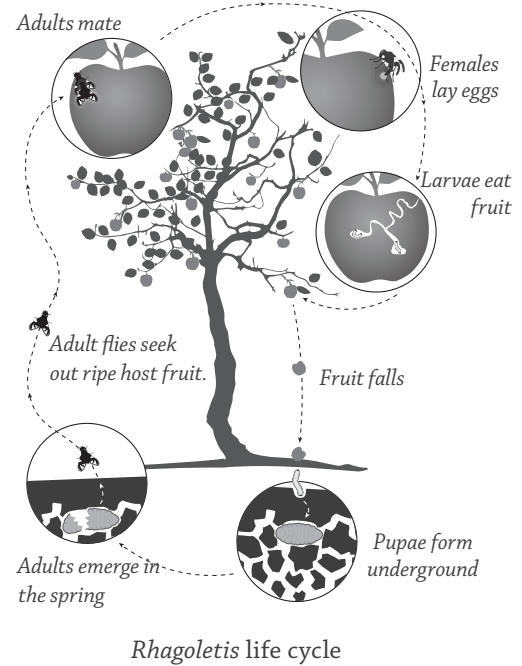
New Host, New Species? Host Fruit Preference

Guiding Question

Apples were brought to North America about 400 years ago. Sometime around 1850, some *Rhagoletis* flies moved from living on their native hawthorn fruit to living on apples. Is the population of hawthorn flies living on the apples becoming a new species?

Background

Adult *Rhagoletis* flies go to ripe fruit to find a mate and lay eggs. The offspring overwinter directly underneath the host tree they hatched in, and then emerge from the ground in the spring—and the cycle repeats.



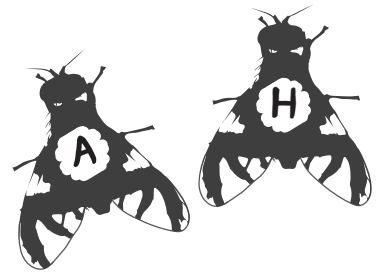
Experiment 1

Research question: When flies come out of the ground as adults, do they go back to the host fruit they hatched from, or instead randomly fly to either apples or hawthorns?

If the offspring from apple and hawthorn fly populations go back only to the same type of fruit they hatched from to mate and lay eggs, then the populations will be reproductively isolated.

Procedure

1. Catch adult flies as they emerge out of the ground under apple or hawthorn trees.
2. Mark each fly to show which host it came from. Release.
3. After a few days, re-capture flies from ripe fruit and count them.



Results (data based on Feder et al, 1994)

Host fruit that flies grew up in	Total re-captured	Host fruit where flies went to mate	
		Same fruit	Different fruit
Hawthorn fruit	45	43	2
Apple fruit	71	66	5

Question

1. In one sentence, summarize the results.

Experiment 2

Different types of host fruit have different odors. Odors from fruit are important signals that flies use to find a place to mate and lay eggs.

Research question: Is fruit odor preference a reproductive barrier?

Using dogwood flies as a control (they are known to be a separate species), researchers compared fruit odor preferences among dogwood, apple, and hawthorn flies.



apple fruit



hawthorn fruit

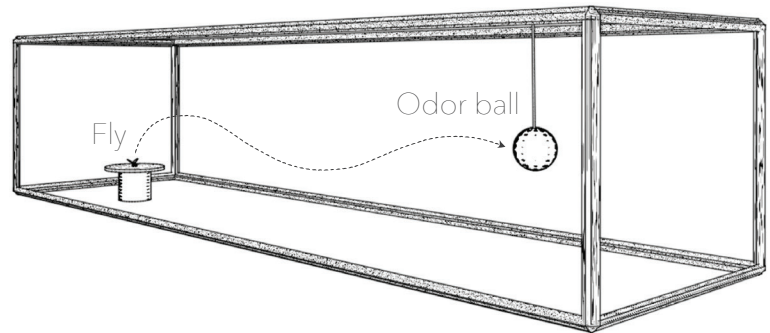
dogwood fruit



Procedure

1. In the fall, collect fruit with fly larvae living inside of them.
2. Take the fruit back to the lab and store each type of fly separately.
3. When flies emerge as adults in the spring, test them in a flight tunnel.

- a. To mimic ripe fruit, paint synthetic apple odors onto a red rubber ball.
- b. Place a fly onto a stand in the tunnel.
- c. Record whether the fly lands on the ball.



- d. Using a new fly each time, repeat until you have tested 100-200 flies. Repeat for hawthorn and dogwood odors. **Test each fly only once using only one of the three possible odors.**

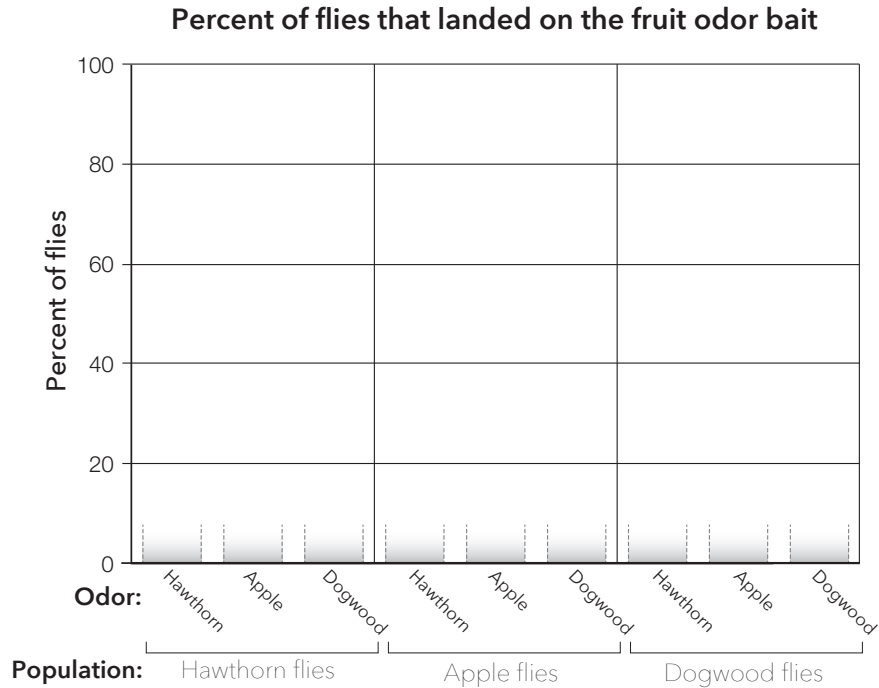
Results (data based on Dambroski, 2004)

Population	Percent of flies that landed on the fruit bait		
	Hawthorn Odor	Apple Odor	Dogwood Odor
Hawthorn Flies	77	21	15
Apple Flies	15	79	11
Dogwood Flies*	21	13	82

* Dogwood flies are known to be a separate *Rhagoletis* species.
 Note: No flies landed on a plain, odorless ball.

Questions

2. On the next page, plot the data from the table onto the bar graph. For each fly population, fill in 3 bars, one for each odor.



3. In one sentence, summarize the results.

Experiment 3:

According to one definition, two populations are considered to belong to the same species if they can produce fertile offspring together.

When researchers put hawthorn and apple flies together in the lab, they found that they could produce offspring together. These are referred to as hybrid offspring.

Research question: Which fruit odors are the hybrid offspring attracted to?

To find out, researchers tested the hybrid offspring in the same flight tunnel that they had used for experiment 2. For each odor, they tested over 100 flies.

Results (data based on Lin et al, 2004)

Population	Percent of flies that landed on bait	
	Hawthorn Odor	Apple Odor
Apple x Hawthorn hybrid	0	< 1

Questions

4. In one sentence, summarize the results.

NAME _____ DATE _____

5. Compare and contrast the odor preferences of the hybrid offspring to those of the parent populations (from experiment 2).

6. Do you think that fruit preference is a reproductive barrier for the apple and hawthorn fly populations? Make a claim, and support it with evidence and reasoning from experiments 1 and 2.

7. Flies mate and lay their eggs on host fruit. In the wild, do you think hybrid offspring between apple and hawthorn flies are healthy, plentiful, and able to reproduce? Make a claim, and support it with evidence and reasoning from experiment 3.

8. Attraction to fruit odor is a heritable trait influenced by genes. Do you think that differences in fruit odor attraction are being acted on by natural selection differently in apple vs. hawthorn flies? Make a claim, and support it with evidence and reasoning.

References:

- Dambroski, H. R. (2004). The role of diapause and host fruit odor preference in sympatric race formation of *Rhagoletis pomonella* (Doctoral dissertation). Retrieved from CurateND.
- Lin, C.E., Dambroski, H.R., Feder, J.L., Berlocher, S.H., Nojima, S. & Roelofs, W.L. (2004). Postzygotic isolating factor in sympatric speciation in *Rhagoletis* flies: reduced response of hybrids to parental host-fruit odors. *Proceedings of the National Academy of Sciences of the United States of America*, 101(51), 17753-17758. doi: 10.1073/pnas.0408255101