

# The Attraction of *Drosophila melanogaster* to Wine, Vinegar, and Soda

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**Abstract:** *Drosophila melanogaster* is a species of fly in the order Diptera and the family Drosophilidae. It is also known as the fruit fly and it is primarily attracted to fermenting fruit. It is a common pest that many people and places have to deal with. If one were to create a trap to reduce the amount of *D. melanogaster* in an area that was infested, it would be important to know what would work best as bait. This experiment tested and compared the ability of three different substances to attract *D. melanogaster*. The three substances were red wine, vinegar, and soda. The traps were made from plastic water bottles. The experiment was conducted in a wooded backyard where the traps were placed and stayed there over the course of two days. Results showed that red wine attracted the most *D. melanogaster* by far. Vinegar came in at second, and the soda proved to be least effective. All three of the traps also caught organisms that were not originally intended to be caught. Red wine was concluded to be the best substance out of the three to use in a homemade fly trap.

**Keywords:** *Drosophila melanogaster*, wine, vinegar, soda, trap

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*Drosophila melanogaster*, or more commonly known as the fruit fly, is a type of fly specifically “attracted to ripened or fermenting fruits and vegetables” (Potter). Every year, they contaminate and “take a heavy toll of fruits and vegetables in many regions of the world” (Christenson & Foote 1960). It is safe to say that fruit flies are considered pests. People who have a pest problem with fruit flies may want to find a way to trap them and reduce the infestation.

Given that *D. melanogaster* are attracted to fermenting fruit, red wine would be a good substance to test their attraction

because wine is made from fermented grape juice (Jackson 2008). Vinegar was also used as bait in this experiment because it “involves a first fermentation where simple sugars in raw material are converted to alcohol by yeasts” and “fruit juices are the primary starting materials used for vinegar production” (Budak et al. 2014). Soda was the third substance being tested because it has been proven that “fruit flies detect and are attracted to the taste of carbonated water” (NIH 2007). These are the reasons why wine, vinegar, and soda were chosen as substances to compare *D. melanogaster* attraction.

There are plenty of studies testing *D. melanogaster* attraction to wine or vinegar, but there are not many testing their possible attraction to soda. Furthermore, there are even less studies, if any, comparing these three substances in one experiment. Between wine, vinegar, and soda, this experiment tested which of those three work best for *D. melanogaster* fly traps.

## Materials and Methods

This experiment was conducted in a wooded backyard in Fort Worth, Texas. It lasted over the course of two days and two nights. The temperature outside on the day the experiment started was 73°F. On the day it ended, it was 57°F.

There were three liquids tested. Cabernet sauvignon red wine (Imagery Estate Winery, Glen Ellen, CA), distilled white vinegar (Albertsons Companies, Boise, ID), and soda, specifically Dr. Pepper (Dr. Pepper Snapple Group, Plano, TX).

Three empty plastic water bottles (Albertsons Companies) were collected and the caps were removed. The top three inches of each water bottle were cut off and kept for later. Each bottle was filled with  $\frac{2}{3}$  a cup of one of the liquids. One bottle had the red wine, one had the vinegar, and one had the soda. A teaspoon of unscented dish soap (Seventh Generation, Burlington, VT) was added to each bottle and mixed around. The soap served as a way to keep the *D. melanogaster* from flying away by breaking the surface tension of the liquids. The top half of each bottle that was cut off earlier was placed back on the bottles, but upside down so that the mouth end was on the inside. It created a funnel effect. The funnels were

taped to the bottle so they would not fall off, but there was still a central opening for the *D. melanogaster* to get in.

The traps were placed about 1 foot away from each other in the wooded backyard mentioned previously. The traps stayed out there for a total of approximately 48 hours. Occasionally, they were checked on, but it was not easy to see what had been caught due to the translucence of the dish soap. The red wine and soda were especially difficult to examine because they are dark liquids.

In order to extract what was caught, the liquids were poured onto paper plates (Albertsons Companies). This allowed for more transparency in seeing what each trap caught. Cotton swabs (Q-tips, Jefferson City, MO) were used to extract each individual *D. melanogaster* and place it on a paper towel (Albertsons companies).

## Results

The wine solution was by far the most effective in *D. melanogaster* attraction, but there were also some bugs caught in the other two solutions that were not originally intended to be caught.

The wine solution caught 36 insects in total (Figure 1). Thirty three of them were *D. melanogaster*, one of them was *Musca domestica* (house fly), and the last two were unidentified beetles of some sort.

The vinegar solution trapped 4 insects in total (Figure 2). Two of them were *D. melanogaster*, one of them was *Culex quinquefasciatus* (Southern House Mosquito), and one was *Euborellia annulipes* (Ring-legged earwig).

The soda solution trapped 3 organisms in total, and actually none of them were *D. melanogaster* (Figure 3). One was *Valenzuela flavidus* (Lizard barklice) and the other two were *Parasteatoda tepidariorum* (Common house spider).



**Figure 1.** The wine trap caught 33 *D. melanogaster* (left), 1 *Musca domestica* (middle), and 2 unidentified beetles (right).



**Figure 2.** The vinegar caught 1 *E. annulipes* (top), 2 *D. melanogaster* (middle), and 1 *Culex quinquefasciatus* (bottom).



**Figure 3.** The soda caught 2 *P. tepidariorum* (top) and 1 *V. flavidus* (bottom).

## Discussion

When creating a fly trap, it's important to remember that different substances will attract different types of flies. It is also essential to take into account all possible factors that have affected the results. This includes temperature, time of year, location, how long the traps were out, and of course what is being used to trap them.

Contrary to what was expected, the soda attracted zero *D. melanogaster*. Soda is made up of “energy-containing sweeteners such as high-fructose corn syrup and sucrose” (Hu et al. 2014). In addition, it was mentioned earlier that fruit flies are attracted to carbonated water. However, in regards to sugar, *D. melanogaster* are primarily attracted to trehalose, which is found in yeast (Ebbs & Amrein 2007). The fruit flies were not trapped by the soda because they are, for the most part, attracted to a different type of sugar. Furthermore, the same NIH study referenced earlier stated that “a fruit fly's attraction for the taste of carbon dioxide is on a much smaller scale than for sugar” (NIH 2007). It is safe to say that soda is not the best bait to use when trying to trap *D. melanogaster*. Even though the soda did not catch the intended organism, it did trap *P. tepidariorum*, which is interesting because that is not even an insect, it is an arachnid. There is no evidence to suggest that this type of spider is attracted to sugar. However, *P. tepidariorum* “is widespread throughout the world. For example, juveniles and adults are found upon their webs in the corners of building surfaces” (Oda & Akiyama-Oda 2020). This experiment was done in a wooded backyard, and it is commonly known that spiders eat insects, such as flies. Given

this information, it would make sense to have found them in the trap. Not necessarily because they were attracted to it, but because they live near that area. The other organism found in the soda trap was *V. flavidus*. This insect is a species of bark louse found in Europe and North America (de Moya 2021). There is not a lot of research on *V. flavidus* and there is no evidence to suggest that they are attracted to soda.

It is recommended that when attempting to trap *D. melanogaster*, you use vinegar and/or wine because they are the most successful (Landolt et al. 2011). This study by Landolt showed that “numbers trapped with vinegar alone were numerically higher, but not significantly greater, compared with traps baited with wine alone” (Landolt et al. 2011). His results differed from those of this experiment because in this one, vinegar only trapped two *D. melanogaster*, which was a lot less than what the wine caught. In his experiment, Landolt used apple cider vinegar, but this experiment used distilled white vinegar. Although the percentage of acidity was the same for both vinegars (5%), the fact that they are different types could be the reason why the results were different. It is possible that the fruit flies in Landolt's experiment were more attracted to apple cider vinegar because it is sweeter. If this experiment were to be done again, perhaps apple cider vinegar should be used instead of distilled white vinegar.

The results of the wine solution are reasonable because it was established earlier that *D. melanogaster* are attracted to fermenting fruit, which is what wine is made out of. It is interesting that the amount of *D. melanogaster* was significantly higher than

the results of the other two solutions combined. In the past, it has been proven that wine is effective because “other baits including yeast, alcohol and wine have been tested successfully” (Basoalto et al. 2013). This same study by Basoalto has shown that “flies were attracted to dark colours ranging from red to black” (Basoalto et al. 2013). This evidence could possibly be another reason why a significant amount of *D. melanogaster* chose wine over vinegar. Based on this experiment and past ones, it can be concluded that red wine is the best, or at least among the best, type of bait to attract *D. melanogaster*.

Aside from the actual substances, temperature and weather possibly had an effect on the results. It is known that “*D. melanogaster* achieves large population numbers early in the summer” (Parsons 1975). These flies are more abundant in the summer months, and this experiment was conducted in November. The temperature ranged from 54-73°F. Although there were many *D. melanogaster* caught in the wine trap, it is possible that there could have been more caught in all three if this experiment was conducted during the summer.

In summary, these results prove that *D. melanogaster* is most attracted to red wine between the three substances tested. If one were to make a fly trap for this species, soda would most likely not work, perhaps vinegar might, but neither would be as effective as red wine.

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