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All Life Comes from Life:

The Role of Sanitation in Small Fly Population Reduction

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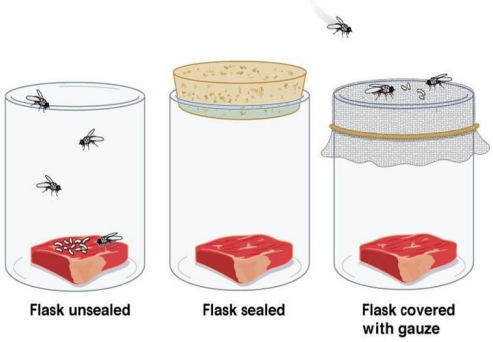
Where Did all these Small Flies Come from?

It's a question we have all muttered under our breath at various times. Sometimes in a restaurant, sometimes in a grocery store, sometimes in our very own home. What was once a vacant and unoccupied space appears to turn into a disease-vectoring meeting spot within days. Up until the 1600s, people believed the flies just appeared. It's a theory called Spontaneous Generation, and people of the time figured that the flies just all of a sudden burst into being. Rotting meat tended to be associated with the fly populations, so people believed that maggots, the juvenile stage of flies, just spontaneous arose from rotting meat. After all, the flies weren't in their kitchens the day before and no one saw the flies enter, but the meat was spoiled. It followed that the maggots (and in turn, adult flies) were coming from the rotten meat. So small flies weren't considered to be so much as a pest of rotting meat, but a red flag that the meat was no longer edible. When maggots were crawling on your meat, it was about time to throw that meat out, and the maggots would go with it.

All Life Comes from Life

One particularly enlightened Enlightenment Era entomologist, Dr. Francesco Redi of Italy, thought there might be more to the sudden appearance of flies and in 1668, he published his findings in a book entitled Experiments on the Generation of Insects (English translation). In his experiments, he put meat in jars in various states of closure: open without a lid, closed with a cork lid, and closed with a gauze lid. He found that maggots were only on the meat in the jar that was open; the meat in the jars with cork and gauze lids were maggotless. However there were maggots on top of the jar covered in gauze (though those maggots did not survive). In addition, he found that when he put dead flies in sealed jars with meat, no maggots appeared on the meat. But if he put live flies in sealed jars with meat, maggots appeared. He therefore proved that maggots and small flies do not spontaneously generate, but instead, as he put it: "omne vivum ex vivo" which means "all life comes from life."



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Breeding Sites

For something to be a good home for maggots, and therefore attractive to small flies, it needs to be organic matter and have a high level of moisture.

So if these flies are not spontaneously generating, where are they coming from? As we learned from Dr. Redi, live flies in a sealed jar with meat led to maggots, so the maggots are coming from the eggs of other flies. Indeed, that's a primary life goal of an adult small fly. She must find a suitable place to lay her eggs so that the hatched maggots can feed and continue their metamorphosis into adult flies. In Dr. Redi's laboratory (and in his neighbors' kitchens), that suitable place was rotting meat. Small flies, as a group, need two important ingredients to feed their maggots: organic matter (decomposing food) and moisture. A female fly looking for a place to lay her eggs is attracted to rotting meat, but not if that meat is inaccessible and in a sealed container. She's unable to get her eggs into the food itself, so will keep looking until she finds a more accessible substrate. That substrate will vary based on the environment. Sometimes there may be rotting meat to grow maggots on, but other times it's a forgotten tomato that has rolled under a shelf, or a dirty drain with months of debris hugging the wet pipes. For something to be a good home for maggots, and therefore attractive to small flies, it needs to be organic matter and have a high level of moisture.

Organic matter is simply the remains of living or dead organisms, such as plants and animals, and their waste products. Typically, small flies will find these breeding sites inside. Although small flies can come from the outside, as well, it's more common for them to come from the inside of a building.

But still, even armed with this knowledge, the question often remains. Where did they come from? There isn't a rotting piece of meat on the table. All of the produce is fresh and stored properly. The sink is sparkling. The counters are clean. So why do we have flies? Small flies need time on rotting organic matter. They need time for the maggots to hatch out of the eggs and grow and grow until they pupate and become adults. So, the adult females are going to prefer to lay their eggs in undisturbed areas where the eggs can continue their development without interruption. That cursory glance around your kitchen or grocery deli counter or restaurant prep area is rarely going to yield any of the hot spots that small flies are developing on. Those preferred areas are going to be tucked away, seen only occasionally and even more rarely cleaned.

Not all small flies prefer the same habitat to raise their maggot offspring on. Species will prefer varying substrates at different levels of fermentation. Some species, such as the Red-Eye Fruit Fly (also known as the Small Fruit Fly) like food when it is just starting to go bad. Other species, such as the Dark-Eyed Fruit Fly and the Drain Fly (also known as the Moth Fly) prefer food so rotten that it doesn't even look like food anymore. Knowing which species is inhabiting your home or facility is the first step to figuring out where their breeding spot is. The next step is to narrow down those places with some moisture. Sometimes, these places can be readily identified with a flashlight and a little bit of effort, such as a hard-to-reach drain that had been overlooked during cleaning, or a fountain drink station with sugary liquid gunk in the drip tray or nozzles.

Sanitation as Control

While finding that breeding spot may take a little bit of time and effort, it's worth it, because it's there. If there are small flies flying in your kitchen or restaurant or grocery store (or wherever you're seeing them), then somewhere in that same approximate area are maggots. These maggots will continue to grow into adult flies that will lay their eggs on another suitable habitat. Fortunately, unlike spontaneous generation, small fly development is typically something we have a bit of control over and can often be eliminated by thorough sanitation programs and a reputable pest control operator. By eliminating the hospitable areas for small fly breeding, we eliminate places for females to lay their eggs. As Dr. Redi showed us, females aren't going to lay their eggs on cork-sealed jars – they know that's not a hospitable environment for their offspring because the maggots won't have access to food and moisture. The key to making an entire area or facility an inhospitable environment for small fly offspring is to increase sanitation and find those hard to reach moist areas that accumulate debris. By cleaning and drying the area, we're eliminating the attractiveness of it, effectively bottling the whole area up in a cork-lidded jar.

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About the Author

Anna Berry is training manager at McCloud Services. She is a board-certified entomologist, ServSafe certified and instructor and proctor for the National Restaurant Association and is certified in HACCP. Berry holds a bachelor's degree in biology from the University of Oregon and a master's degree in grain science from Kansas State University.