Fruit flies and beer brewers alike have strong preferences when it comes to yeast aromas.

Better smelling beer, thanks to fruit flies

By David Shultz (/author/david-shultz) | 9 October 2014 12:15 pm | 0 Comments (/biology/2014/10/better-smelling-beer-thanks-fruit-flies#disqus_thread)

The next time you see a fruit fly hovering around your pint of beer, don’t swat it—appreciate it. You’re witnessing a unique relationship between yeast and insect. A new study reveals that the single-celled organisms have evolved to secrete a fruity scent that attracts fruit flies, which they hitch a ride on for greener pastures. The findings may also explain the sweet aroma of some craft beers.

Like many scientific discoveries, the new work was the product of a happy accident. Kevin Verstrepen, a geneticist at KU Leuven in Belgium, was working with two types of yeast: a normal strain and another with a
mutation in a gene called ATF1 that causes the cells to produce fewer odors during fermentation. “Nobody really knew what was happening until I was lazy enough to leave the lab on a Friday with these yeast left out on the bench,” he says. By coincidence, a group of fruit flies (Drosophila melanogaster) chose that weekend to escape from a neighboring genetics lab. When Verstrepen returned to work on Monday, he discovered that the insects had found their way into the smelly yeast culture but had ignored the mutant colony.

To probe further, Verstrepen and colleagues set up an enclosed “arena” and pumped ATF1 aromas, which are either fruity, flowery, or solventlike, into one corner. Another corner received a dose of odors from the ATF1-deficient yeast. The remaining two corners emitted odorless streams of air to serve as controls. As expected, the flies congregated almost exclusively in the corner emitting the fragrant odors of yeast with intact ATF1 genes. Analyses of the insects’ brains revealed that the neurons in flies exposed to smelly yeast responded in an entirely different way from those exposed to odorless air or the scent of ATF1-deficient yeast strain, the researchers report online today in Cell Reports (http://www.cell.com/cell-reports/abstract/S2211-1247(14)00777-3).

It makes sense that the fruit flies would evolve to be attracted to yeast odors, Verstrepen says. After all, these odors smell like the insects’ favorite food: rotting fruit. But what’s in it for the yeast?

Verstrepen thinks he has the answer. Additional experiments by his group revealed that yeast cells were capable of sticking to the tiny hairs on the fruit flies’ appendages. Every time a fly found a new fruit, it brought the yeast along with it. Moreover, the scientists discovered that the yeast were more likely to emit their fly-attracting odors when their populations were growing rapidly, suggesting that the aromas were an evolutionary adaptation that prevents a yeast colony from becoming overcrowded. “When [yeast is] feeding on a piece of banana the population is growing exponentially. So maybe it makes sense for a few of them to go somewhere else,” Verstrepen says. The yeast may also be tricking the flies into playing matchmaker for them. As the insects move from one rotting fruit to another, they transport members of one yeast colony to the next, helping the microbes breed and reproduce with distant, genetically different strains.

 “[The study] has added proof to the idea that the yeast produce these [aromatic molecules] to attract insects—the compounds are not just waste products,” says Paul Becher, a chemical ecologist at the Swedish University of Agricultural Sciences, Alnarp, who was not involved in the study. Verstrepen expects that an improved understanding of yeast-insect
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communication could lead to several new applications including safer fly traps and improved pesticides. In the midst of the honey bee decline (http://news.sciencemag.org/sifter/2014/04/a-bee-pocalypse-in-europe), there’s also the question of pollination. “Could these perhaps help to attract pollinators?” he wonders. But the primary application will likely be the one that Verstrepen jokingly says is “most urgent for humanity”: “to generate superior industrial yeasts that produce better beers and wines.”

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