Common artificial sweetener likely a safe, effective birth control and pesticide

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Credit: Drexel University

Because of its quick lethality to freshly hatched flies and the ability to halt egg production, the artificial sweetener behind Truvia could be a potent but safe pesticide, according to a new study by Drexel University

researchers.

The polyol (sugar alcohol) that was tested, Erythritol, eliminated the larvae of flies in the study within three days, long before they could have reached adulthood. On top of that, as long as flies were feeding off of the sugar substitute, they were barely producing eggs, if any at all.

"Erythritol has potential to be deployed in a wider array of settings, targeting adults, egg production, active feeding larvae, or all of the above," said Sean O'Donnell, PhD, professor in Drexel's College of Arts and Sciences and one of the researchers on the study. "Many insect control programs focus on knocking back insect reproduction, rather than—or in addition to—killing the adults. In part this is because reproductive suppression or disruption has a very strong effect of reducing pest population growth rate and limiting maximum pest population size."

The work on erythritol was actually inspired by a science project undertaken by the son of another researcher on the study, Daniel Marenda, PhD, associate professor in the College of Arts and Sciences. Marenda's son initially tested the lethality of sweeteners on adult fruit flies, known as Drosophila melanogaster. Subsequent studies by Marenda, O'Donnell and Kaitlin Baudier, a graduate student in the college, tested multiple polyols and found that erythritol was the deadliest for adult fruit flies that ingested it.

While lethal, Erythritol was found in that study to take three days or so to kill adult flies. That could be three days of egg-laying time.

So, O'Donnell, Marenda, Baudier and graduate student Katherine Fiocca tested erythritol specifically on its effect in reproduction and the flies' freshly hatched larvae.

"Many times, the larvae of insects can be more destructive than the adult," Marenda explained. "The larvae are also less mobile most of the time, and, therefore, are more sensitive to these sorts of interventions."

As it turned out, erythritol had a pretty significant—and deadly—effect.

First, the flies' young that fed on erythritol never progressed past their larval stage. These larvae lived an average of just a day and a half. In fact, just one out of 38 test larvae lived the third day of the study. For perspective, it usually takes five or six days for larvae to reach the pupa stage—a whole stage before adulthood.

What's more, it's not as if the larvae exposed to the erythritol-laced food simply starved. Special blue dye in the food that was visible through the larvae's skin showed that they were in fact consuming the food.

And by comparison, 90 percent of the larvae being fed regular food—devoid of erythritol—lived to the pupa stage.

But the erythritol might not just be effective when it comes to eliminating fruit fly larvae. Results from the study showed that it could actually be an effective form of fly birth control.

Egg-laying by adult flies was significantly reduced on the day they were fed erythritol. After that day, the adult flies were fed regular food. The day after being fed erythritol, flies egg-laying began to recover, and by the second day of normal food, they were laying eggs at the same rate as flies who'd never been fed erythritol.

"Even though adults can live through eating erythritol for some time, their reproduction is impaired," O'Donnell said. "They will make little or no contribution to population growth before dying, and this effect is relatively rapid: It was apparent on Day One."

While the study was limited to fruit flies, it definitely shows promise for reducing the populations of other pest insects, too.

"Our results on other species are promising, and other lab have published follow-up work on different insects suggesting our results apply to a wide array of pest insect species," O'Donnell explained.

"One recent paper showed that erythritol can be sprayed in a solution over blueberries and kill spotted wing Drosophila larvae, which are a significant pest for blueberry farmers," Marenda added. "We have only tested the use for erythritol in bait situations, but these other laboratories are now starting to expand the repertoire in which erythritol can be used to control pests."

More information: "Erythritol ingestion impairs adult reproduction and causes larval mortality in Drosophila melanogaster fruit flies (Diptera: Drosophilidae)," DOI: 10.1111/jen.12409

Provided by Drexel University

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