Texas A&M Entomologist Hot on the Trail to Stop Global Locust Devastation

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COLLEGE STATION – From time immemorial, man has suffered from the devastation wrought by locust swarms of biblical proportions often visited on those least able to weather the plagues.

But now a Texas A&M University entomologist at College Station with a passion for helping humanity is hot on the trail of pinpointing the cause that triggers the insects' swarming behavior and defusing it to stop the destruction.

Dr. Hojun Song's work was published in the June 30 edition of Research Features. According to their website, the online publication strives to make complex, basic applied research accessible to a global audience. View the paper at http://researchfeatures.com/2017/06/30/locust-swarms-powerful-force-nature/.

"Locust swarms are a severe threat to agriculture and food security," Song said. "Our research focuses on understanding how and why locust swarms occur, which is crucial if we are to develop effective control methods."

Central American locusts on the move.
(Texas A&M University photo by Dr. Hojun Song)

Desert locusts, Schistocerca gregaria, found in Africa and the Middle East are among the major culprits to widespread famine in their native lands due to the speed in which they can mobilize and travel great distances and because of their sheer numbers while doing so. These swarms can literally block the sun, according to the article.

To put things in perspective, Song said a large locust plague can have 150 million insects in an area less than an acre. A third of that number can weigh a metric ton, or about 2,204.6 pounds. That many locusts can eat as much as 10 elephants or 2,500 people in a single day. A large locust swarm can contain up to several billion insects**.**

It is estimated 20 percent of the world is visited upon by desert locusts**,** according to the article. But they are not the only locusts that wreak havoc. Song said there are more than a dozen species with one or more affecting every continent. Song's team of Texas A&M students is dedicated to fully understanding the genetics and environmental conditions that trigger and sustain swarming so they can come up with ways to stop it.

All locusts are grasshoppers, but not all grasshoppers, which typically are somewhat sedentary creatures, are locusts. When desert locust populations increase for example, the insects can change their physical appearance and behavior, a phenomenon called locust phase polyphenism. Bad things start to happen rather quickly when that occurs, he said.

“When populations are low, desert locusts are bright green and are repelled by each other; but when populations increase, at a certain point they become attracted to each other and form large mobile units or swarms. The individuals start to grow, and their metabolic rate increases all the while developing conspicuous coloration.”

Song noted desert locusts and the non-swarming, sedentary grasshopper types belong to the same genus Schistocerca and to some extent share various traits. In laboratory rearing experiments involving a number of species in both isolation and crowded studies, Song and his students made some observations as the various species numbers grew and populations became crowded.

“Two of the non-swarming species native to Florida exhibited the physical and behavioral changes very similar to that of the desert locust and two of the sedentary species developed the black patterns when crowded, but their behavior didn’t change,” he said. “And another sedentary Texas type didn’t change color or behavior when crowded, so there is quite an interesting array of differences.”

Song said the desert locust is the only Schistocerca species found in Africa while the rest of the genus, about 50 of them, are found elsewhere in the world.

“Ancestors of the locusts in this genus were probably very similar to the present-day desert locust,” Song said. “Most of the species share their ancient ability to change color when crowded, but the sedentary types don’t show the behavioral changes or plasticity in their natural environment, because it is not adaptive for them to do so.”

Song said those like the desert locust that do swarm, start the process through positive feedback including a combination of sight and smell or even through touch alone. And while much is known about the desert locust through years of research, it’s not clear if that research can be directly applied to other swarming locust species. So Song and his team developed another model system to understand the locust phase polyphenism on a molecular level on another serious locust pest species.

To accomplish that, he and his team visited Yucatan, Mexico in 2015 to collect the Central American locust S. piceifrons, one of the most damaging insect pests in Mexico and Central America. And even though it swarms almost annually, not much is known about its behavior.

Through his studies of captive populations of the Central American locust, Song and his team of students learned that many genes important for metabolism, the immune system and cellular processes associated with the phase change appear to be very different in the Central American locust in comparison with their closely related non-swarming brethren.

“Hopefully, in the next few years we will be able to understand what makes locusts different from their sedentary grasshopper kin from a molecular perspective, so we can develop better, more environmentally friendly ways to control their destructive swarms.

“Pesticides are the go-to method for controlling swarms now, but chemical controls on the level needed to stop huge swarms can cause great harm to the environment, being highly toxic to non-dangerous species, honeybees for instance,” Song said.

“A safer, more environmentally friendly means would be to inhibit swarm formation by manipulating specific molecular pathways, for example, inhibiting serotonin receptors or by knocking out the genes responsible for phase polyphenism. That’s the direction we are going with our research, though much more research is needed before this technique can be commercialized.”

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