

Study Aphids, See the World

To gardeners, aphids are disease-carrying pests that can suck the life out of plants. The tiny, soft, green insects, known as “plant lice,” brought France’s legendary industry to near collapse in the Great French Wine Blight of the mid-1800s.

To evolutionary scientists, however, aphids are a fascinating oddity that have played an “outsized role” in the history of biology, says David Stern, an HHMI investigator at Princeton University. And they were his ticket to see the world.

Stern describes aphids’ unique characteristics: “With the same genome, they can make different phenotypes, depending on the environment.” For example, they can reproduce with or without the help of a mate and can spawn offspring with wings or without them. Certain aphids provoke trees into forming galls—bizarre, sometimes beautiful, hollow growths that serve as aphid hideaways. Some aphid species breed castes of “soldiers”—fierce (but sterile) warriors. Some variants poison their predators and some stab them with sharp horns, wrote Stern in an admiring essay, while others “squeeze their enemies into submission with their fat hind legs.”

To Stern, an avid gardener since age six, aphids were merely a nuisance until, during his graduate studies, he took a five-year sojourn in Japan, Malaysia, Indonesia, and Taiwan to study aphids in the field.

The discovery of the sterile caste of aphid soldiers in the 1970s by a Japanese taxonomist had raised interesting questions about the evolution of social behavior. Intrigued, Stern packed his bags for Japan in 1989 and spent several years collecting aphids and sequencing their DNA—a time-consuming process in those days. He then used DNA evidence to determine how many times the soldiers had emerged in aphids’ evolutionary history.

The fieldwork for his Ph.D. “was not as romantic as it sounds,” Stern admits. The sapsuckers were most abundant on roadside plants. “So I would walk along the road, flipping over leaves.” He also attached clippers to long poles to cut off branches where soldier-


producing species had formed galls, so he could bag the aphids inside their domiciles.

The lone scientist based himself in rented apartments in cities like Kuala Lumpur, and sampled many indigenous foods. “I remember eating the most outstanding homemade noodles and chicken soup in a roadside stall,” Stern recalls, “and a vegetarian restaurant where everything was supposedly made from bean curd but looked identical to, and tasted strongly of, every imaginable body part. I remain skeptical to this day.”

After completing his doctorate, Stern continued to study evolution and development in aphids, but his interests shifted. He began to study the fruit fly and devised powerful methods for hunting genes that he plans to use in

probing the control of quantitative traits, such as body size, life span, reproductive rate, and—Stern’s current enthusiasm—behavior. Aphids haven’t disappeared from his radar screen, however. Back in 2001, he pushed hard for funding to sequence the aphid genome, a project that is now nearing completion.

And the lifelong gardener says that on his mile-and-a-half walk to his Princeton lab, he checks daily progress on several trees that are forming galls. “I must admit I still harbor some crazy plans to attack the problem of gall development,” he confesses. “But I’m putting it off—at least for a couple of years.” —*Richard Saltus*

 **WEB EXTRA:** Visit the *Bulletin* online to see photos from Stern’s aphid-collecting travels and more.



As a graduate student, David Stern traveled to far-flung lands to study the evolutionary history of a sterile caste of plant-sucking aphids.