Qualia

Why we need insects: Hard evidence of evolution

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Insects have an essential role in their ecosystems and scientists have quickly seen the consequences of removing them (Image: André Karwath aka Aka)

Because it often takes place on the time scale of thousands or millions of years, evolution is difficult to observe in action. Most real-time experiments on evolution involve bacteria in test tubes that can reproduce at an exponential rate, producing many generations in only days or weeks.

Now, scientists using a "living laboratory" have observed how insects can drive rapid evolutionary changes in plant populations. The five-year study provides real-time data demonstrating natural selection in action and underscoring the importance of ecology in shaping evolution. The research was published in the October 5, 2012 issue of *Science*.

The study began in 2007, when Anurag Agrawal of Cornell University and colleagues set up 16 plots of a native wildflower called evening primrose. For the next five years, the researchers treated half the plots with an insecticide and left the other half as controls. The scientists watched as in just three to four generations, the insecticide-treated plants lost defensive traits that helped protect them from herbivorous moths. These plants produced lower amounts of insect-deterring chemicals in their fruits and tended to flower earlier in the season. In the control plots, later-flowering plants were more successful because the number of plant-eating larvae peaks early in the growing season. The non-treated evening primrose plants were also better able to compete for space and other resources against dandelions, which thrived and out-competed many of the insecticide-treated evening primrose plants. These results show that the evening primroses quickly lost their anti-insect defenses when those defenses were no longer needed. In the absence of plant-eating insects, the plants ceased investing energy in their anti-insect defenses, and in just a few generations those defenses disappeared through natural selection.

Over the course of the five-year experiment, the number of evening primrose plants in the insecticide-treated plots decreased when compared with control plots. These results indicate that getting rid of insects (or breeding crops to be more resistant to insect pests) could trigger unexpected and unwelcome ecological consequences. In a Cornell University press release,

Agrawal said their study "indicates that various genetic tradeoffs may make it difficult or impossible to maintain certain desired traits in plants that are bred for pest resistance."

Studies such as this one are important for what they tell us about the unforeseen speed and complexities of evolution. The elimination of insect pests can have immediate consequences on the health of individual plants and the evolution of entire plant populations. Agrawal and his colleagues plan on maintaining the experimental plots as a long-term "living laboratory" to study the interplay between ecology and evolution.

Related Links:

- Insect Herbivores Drive Real-Time Ecological and Evolutionary Change in Plant Populations
- Interview with lead author Anurag Agrawal of Cornell University
- Marlene Zuk reads from 'Sex on Six Legs
- Why insects matter with Marlene Zuk