Resistance is not futile: it shapes insecticide discovery

Recent news around the world has focused on the dangers of antibiotic resistance. Antibiotic resistance occurs when a bacteria, or fungus, adapts so it can survive in the presence of an antibiotic (a drug that slows bacterial growth, or kills the bacteria). Superbugs are multi-drug resistant bacteria, meaning they are able to survive in the presence of several types of antibiotics, and they are becoming increasingly common all over the world. The US Centres for Disease Control and Prevention estimates indicate that over two-million illnesses and 23,000 deaths have occurred in 2013 as a result of antibiotic resistance in bacteria and fungus.

Antibiotic resistance is not the only form of resistance we should be worrying about. What of another type of resistance that is resistance to insecticides which can also have a huge impact on the population?

The concept of "resistance" also applies to another set of chemistry that we use to protect ourselves, our food supply, and our environment: insecticides. Older insecticides were broad-spectrum, persistent chemicals that would kill other living things along with insects. Due to concerns about danger to people, pets, and the environment, new insecticides are subject to rigorous safety testing.

Insecticides are now tested for safety against humans, fishes, honeybees and livestock, as well as for possible contamination in groundwater and environments.

New research program is focused on discovering and characterizing novel insecticides. an orally-active insecticidal peptide (OAIP) from the venom of a native Australian tarantula or the first bioinsecticide from spider venom was approved by the United States Environmental Protection Agency (EPA).

A naturally-occurring peptide isolated from spiders, which has been approved for use on a wide variety of crops and has shown no toxicity to fish, birds, or mammals (including humans).Spider venoms are a complex chemical cocktail made up of hundreds of different compounds. Spider venoms appear to be excellent insect killers, since that's what they are designed to do in nature.

Individual spider venom components are small proteins, called peptides that have the pharmacological properties of stability and efficacy that are needed for new insecticides. Once these compounds of interest are isolated, we can use recombinant technology to incorporate them into bacterial or yeast expression systems so that the venom is no longer needed. By using hundreds of millions of years of evolution as a starting point, we can use chemistry to adapt the molecular scaffolding of these peptides to be more effective, more selective, and safer to use. New insecticides are designed to be very specific in what they target, namely, insects.

Source: Hardy MC. 2014. Resistance is not futile: it shapes insecticide discovery. *Insects 5*(1): 227-242; doi:10.3390/insects5010227