Effects of Elevated Temperatures on the Photodegradation of Pyrethroid Insecticides on Vegetable Leaves

Yang, Yixiao (School: The Experimental High School Attached to Beijing Normal University)

The effect of climate warming on the fate of pollutants has aroused attention around the world. Photodegradation is an important transformation process at the plant leaf surface for pesticides, which is affected by the photosensitive groups in the leaf wax. It was reported that elevated temperatures may change the compositions of leaf wax. Thus, I hypothesized that increased cultivated temperatures will change the compositions of leaf wax, further influencing its photosensitizing properties and reactive oxygen species generation, and then the photodegradation of pyrethroids on the plant leaf surface. To test this hypothesis, the effect of elevated temperatures on four pyrethroid photodegradation on spinach leaves under simulated sunlight was studied. The results showed that the photodegradation temperature had minor effects on pyrethroid photodegradation. However, the photodegradation rates of pyrethroids decreased with elevated spinach cultivated temperature. For example, the photodegradation rate of cypermethrin on spinach cultivated at 15 °C was 1.8 times that at 21 °C. This was because the elevation of cultivated temperature affected the spinach growth and leaf wax composition, and then might affect reactive oxygen species generation. Hydroxyl radicals (•OH) was detected in leaf wax with electron spin resonance and it played a dominant role in the photodegradation of pyrethroids. The results of elemental analyses and Fourier transform infrared spectra showed that the polarity index and ether content of the leaf wax decreased with elevated spinach cultivated temperature, which might reduce the •OH generation and its contact probability with pyrethroids, leading to a lower photodegradation rate of pyrethroids at a higher spinach cultivated temperature.

Awards Won:
Fourth Award of $500