Comments on a Useful Pesticide

Barry Rice • P.O. Box 72741 • Davis, CA 95617 • USA • barry@sarracenia.com

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I usually do not use pesticides in my horticultural practices—I find that pest problems for well-grown plants usually take care of themselves. This is particularly true for plants being grown out doors. However, terrarium plants are often very susceptible to bug infestations.

Last spring I returned several plants that had been wintering on my porch back into one of my 230 liter (60 gallon) terraria. I did not know it at the time, but one of the plants had contracted a few aphids. A few weeks later, I noticed the plant (and plants in two adjacent pots) were infested with the nasty little things. I manually removed the aphids as well as I could, but it was too late—within a month, aphids had spread to every one of the plants in my terraria, including various *Byblis*, *Dionaea*, *Drosera*, *Genlisea*, *Pinguicula*, *Sarracenia*, and *Utricularia*. Plants were producing grotesquely deformed leaves. I was in trouble!

Staff at the University of California Botanical Conservatory told me that an insecticide they use with success on carnivorous plants (i.e., it killed the pests and not the plants!) contained the active ingredient Imidacloprid. This systemic insecticide resides in the plants for a few weeks, and even translocates short distances within the plant, so you do not have to actually spray the pest itself for the compound to be effective. If the pests are on the underside of a leaf, and you spray the top surface, you can have reasonable expectation that the pests will be killed.

After prowling the aisles in a number of garden supply stores, I found a pesticide marketed by Bayer called "Rose and Flower Insect Killer (ready to use)" that contained 0.012% Imidacloprid and 0.003% Cyfluthrin. I was concerned about the presence of the Cyfluthrin—which I knew little about, and also the 99.985% "other ingredients" in the product which were trade secrets that I knew absolutely nothing about. However, it was an emergency situation! I took the risk, and over the next few months I used the product on all the plants in both of my terraria (including all the genera listed above, as well as on *Heliamphora* and *Cephalotus*). I removed the plants from the terrarium and sprayed them so the plants were completely wet. I let their leaves dry overnight before returning them to the terrarium. The results have been excellent. All the pests were killed, and no short-term or long-term damage to the plants was observed.

Several months have passed; the bugs are still gone and the plants are doing fine. However, I have observed three side effects. First, the aquatic bladderworts (*U. inflata*, *U. gibba*) that once thrived in the several centimeters of water in the bottom of my terraria have slowly perished. Furthermore, the tiny aquatic invertebrates (copepods, daphnia, etc.) that lived in the water also died, while the filamentary algae are growing more rapidly. I presume that the growth of the algae is due to the absence of microscopic herbivores. I have no proof that these effects are due to the insecticide applications, but I have my suspicions. Finally, John Brittnacher and I have both seen Imidacloprid-related damage to *Dionaea* plants (distorted leaves, some browning), however, the plants were not killed or set too far back (although one plant out of about 25 did indeed die). I will be cautious about using this insecticide on *Dionaea* in the future, but will probably apply it to plants newly arrived from other collections.

If you are interested in trying these insecticides on your plants, you can consider my results to be promising pilot work. The "Rose and Flower Insect Killer (ready to use)" has the EPA Registration Number 3125-504-72155. I also successfully used a similar product by Bayer called "Rose and Flower Insect Killer (ready to spray)," which has the EPA Registration Number 72155-7. The "ready to spray" formulation's bottle is designed to be fit onto a hose-end applicator; when used this way the product is applied via garden hose at the correct concentration. When I used this product, I manually diluted it with purified water: 1 part concentrate to 29 parts water, resulting in a mix with active ingredients in the concentrations of 0.012% Imidacloprid

and 0.012% Cyfluthrin. (If you are inexperienced with laboratory practices, you should probably stick with the "ready to use" formulations.) You can view the product labels for these products at:
http://www.bayeradvanced.com/pg/pg_gp.html (a general web page),
http://www.bayeradvanced.com/pg/PDFs/rfik_rtu.pdf (for the ready to use product),
http://www.bayeradvanced.com/pg/PDFs/pgRoseFlowerRTS.pdf (for the ready to spray product).

If you cannot find these products in your country, perhaps you can find a similar product with the same active ingredients. I cannot promise that other formulations of these insecticides will be as useful for pest control on carnivorous plants, but they might be a solution you are looking for.

I feel compelled to remind you of three caveats. First, tread carefully whenever using industrial compounds on your plants. Even if the "active ingredients" may be safe on your plants, the other mysterious "inert ingredients" might be harmful to them. Apparently for the products mentioned above, the formulations are not harmful to carnivorous plants (except, perhaps, to *Dionaea* and some aquatic *Utricularia*). Second, when using any compound such as these insecticides, make sure you follow all appropriate safety precautions as described on the product label. Third, use these compounds sparingly. Since the active ingredients may take more than a few weeks to degrade naturally, they may pollute the environment. If these chemicals start appearing in groundwater tests, it is likely they will become prohibited, as has happened to other pesticides that were overused.

Literature Reviews

Forterre Y., J.M. Skotheim, J. Dumais, and L. Makhadevan L. 2005. How the Venus Flytrap Snaps. Nature 433: 421-425.

The title of this paper should rather be "a mathematical model for the phenotype of venus flytrap closure". Here we finally have a geometrical definition of the comparatively obvious fact that the most wonderful phenomenon in the carnivorous plant world does not rely on the trap lobes folding upon each other along the midrib acting as a hinge (cf. the *Mimosa* pulvinus) but rather on the change of the conformation of the lobes from a convex to a concave state. The physiological processes in the lobe tissues inducing that change are most unfortunately still not elucidated by this piece, although the rather exaggerated publicity around it might have suggested such. The good news is even utterly descriptive work may (contrary to widespread belief) still be published in popular journals. (JS)