Rolling out the red carpet...for insects

Pitcher plants are carnivorous plants that lure insects towards their fluid-filled pitcher - the walls of which are very slippery, preventing the insect from escaping. The insects then drown and are slowly catabolized either by secreted plant enzymes or by special bacteria.

What signals do the Pitcher plants use to lure in the insects? A new paper by Schaefer and Ruxton suggests that in addition to olfactory-based and nectar-based signals, plant coloration also plays a major role. The real importance of this paper is that it provides experimental evidence supporting their hypothesis.

Many carnivorous plants use combinations of UV reflection and absorbance to attract the attention of insects, most of which are able to see into the ultraviolet range. However, it has been noted that some pitcher plant species seem to use a range of colors - from red to green - to attract the attention of insects, and either use very little UV reflection or none at all. Why these plants would use red coloration when insects are generally not able to see very well into that part of the spectrum has not been well understood. It has been suggested that the red coloration is due to stress, as the pigment for red (anthocyanin) has been linked with plant stress in previous studies (plants deprived of prey for certain periods of time produce more quantities of anthocyanin). Perhaps the red coloration has nothing at all to do with attracting prey; that is, it may be non-adaptive.

Using twenty specimens of the pitcher plant species Nepenthes ventricosa (pictured above) which differed in their ranges of red-green coloration, Schaefer and Ruxton proceeded to split them into groups depending on the number of pitchers they had (group one had one or two pitchers, while the second group had three to five pitchers per plant). In order to minimize any kind of competing olfactory signals, they randomly assigned plants from group
one and two into two further groups - an experimental group, which they painted red, and a control group, which they painted green. The end result of all this work is that each group - the experimental group and the control group - effectively had the same number of pitchers per plant.

The team used a complicated method of counting prey in order to achieve more conservative results: at the start of the experiment they looked inside the pitchers without removing the caps and found a bunch of springtails in each one. After seven days, they again inspected the pitchers, this time removing the caps in order to get a more accurate count of the organisms inside - just in case they missed some during the original count. Eight days after this (on the 15th and final day of the experiment), they again counted up the number of prey in each plant and found a total of 133 prey organisms.

After subtracting the numbers recorded on the seventh day from the total count after 15 days, the team found that the red/experimental plants had trapped a significantly higher number of prey than had the green/control plants. This supports the hypothesis that red coloration is an adaptive trait in pitcher plants - especially when the prey are flies, which made up 58% of the prey.

One problem with the study (noted by the authors) is that the reflectance of the paints used in the two groups (red and green) differ from the natural reflectance of the colors used by *N. ventricosa* (as shown in figure one, below). How exactly this difference might have affected the prey response is not conclusive; however, it is suggested that regardless of this flaw, the reflection of red by carnivorous plants causes them to stand out amongst the green background, “rolling out the red carpet” to attract prey.
Keep in mind that I'm just a lowly first-year biology student (who happens to have a great love for biology and science in general), so of course I could be wrong about this - but I'll toss out my thoughts anyways; This is an interesting paper, but the whole discussion of the non-adaptive versus adaptive role of red coloration in plants reminds me of the problem of Panglossianism in biology that is so frequently talked about by those who agree with Gould and Lewontin. It is assumed *a priori* that a feature or function must be adaptive in some way, and then researchers set out to figure out what it must be. Perhaps red coloration arose as an adaptive trait in carnivorous plants, perhaps it arose for some other reason that has nothing to do with adaptation. As the paper shows, it most likely has some sort of adaptive use at the current time, but assuming that it originated as an adaptive trait is possibly a mistaken view.

At times, evolutionary theory seems to be so nuanced that I get completely confused by it; but it is fascinating nevertheless.