Sun Orchids, Successful and Immoral

Drs Peter Bernhardt and Retha Meier, St Louis University Missouri, USA

Above: *Thelymitra macrophylla*
Left: Hybrid *T. macrophylla* x *T. crinita.*
Photos: Dr Retha Meier, St Louis University

Dozens of species of sun orchids (*Thelymitra*) call Western Australia home, flowering from winter through mid-spring. Some produce large and brilliantly colored flowers while others have tiny, subdued blooms. Some have rich, rosewater-like scents while others appear odorless to the human nose. One feature shared in common is that sun orchid species frequently hybridize with each other producing a generation of offspring intermediate in size, color patterns and fragrance. According to State Botanist, Andrew Brown, 80 kinds of sun orchid hybrid combinations are documented in Western Australia alone. When English author and gardener, Vita Sackville West, commented on how often she observed natural hybrids produced between columbines and granny bonnets (*Aquilegia*), "Their morals leave much to be desired," she might have been writing about our sun orchids. Why are WA wildflowers so…promiscuous?

In the Spring of 2009, National Geographic (America) funded Peter Bernhardt and Retha Meier, from St. Louis University (Missouri) to come to Perth and study the problem in the field and in the science laboratories of the Kings Park and Botanical Gardens. They selected three of the most common species for study. The lemon orchid (*T. antennifera*) crosses with the scented sun orchid (*T. macrophyllum*) and produces an apricot-reddish offspring. When the scented sun orchid "mates" with the blue lady (*T. crinita*) the hybrid keeps its blue petals but the hood in the center of the flower is intermediate in fine sculptures between the smooth-hooded scented orchid and the dramatically bumpy blue lady.

native bees are very confused by sun orchids,

Top left: *Thelymitra macrophylla* plant on left; *Thelymitra crinita* plant on right
Top: *Hybrid T. macrophylla* x *T. antennifera*
Above: Pollinator of *T. macrophylla* with pollinia attached to abdomen.
Left: *Thelymitra crinita.*
Photos: Dr Retha Meier, St Louis University

Flower color and sculptures aren't the only things that change in the hybrid offspring. Dr. Retha Meier collected odors from the blue lady, scented sun and their hybrid thanks to a living collection of all three in the KPBG glasshouse. She sent them to Dr. Robert Raguso at Cornell University (New York) as he is a specialist in the chemistry of flowers. His initial results suggest that scented sun orchids smell like old-fashioned garden roses because they produce two molecules that are also found in rose scents. Blue ladies appear odorless because they make molecules the human nose isn't built to pick up. The hybrid has a faint smell because it inherited some genes from the scented parent but fails to make the molecules associated with blue ladies.

Drs. Bernhardt and Meier are back in St. Louis and are still analyzing their results but it looks like hybrids occur between sun orchid species because… well, they can. Despite different sizes and colors the flowers of different

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sun orchid species fail to recognize "alien pollen" if hybridized by hand. Pollen grains sprout on the receptive surface (stigma) of the female organ (pistil) and their sperm-filled tubes unite with the unfertilized seeds in the ovary within less than a week. Dr. Bernhardt says that, "So far we can't see an obvious difference between pollen tube growth and seed fertilization in blue lady pistils pollinated with blue lady pollen vs. blue lady pistils pollinated with scented orchid pollen and vice versa.

People aren't pollinating sun orchids in the field, are they? Well, you never can be certain but Drs. Bernhardt and Meier insist that most hybrids occur naturally because native bees are very confused by sun orchids, especially when they have big colorful flowers. Sun orchids don't make nectar and they don't offer edible pollen. The small black and larger banded native bees are usually "unwed mothers" gathering pollen and nectar to provision offspring protected in earthen burrows or dead wood. Dr. Bernhardt has identified pollen taken from the hind legs of bees caught on sun orchids. It's quite a mixed bag of grains from trigger plants, pea blossoms, honey myrtles, native lilies and other species that offer edible rewards at the same time the pretty but stingy sun orchids flower.

Drs Bernhardt and Meier have witnessed the process. The bee lands on the sun orchid flower expecting a drink of nectar and some pollen to take home to the kids. She grabs the hood and shakes it mistaking it for a cluster of pollen-filled anthers. Too late, she's wrapped her bum around the hood and it touched a sticky gland called the rostellum. When she flies off in confusion (hopefully to visit another orchid) she doesn't know she's carrying a fat, white wad of pollen at the tip of her abdomen. "We never saw the process in the lemon orchid but we certainly saw it several times in the scented sun and the blue lady. It's identical," Dr. Bernhardt said, "And we caught the bees to prove it. Both orchid species deposit their pollen wads on the same spot on the bee's abdomen just above her stinger. If the bee visits a scented orchid flower after she visits a blue lady we are probably on the way to the next odd generation of hybrids."

"Go out and watch for yourself," the two American scientists urge. Nothing happens for hours and hours then everything happens at once, especially on a warm, sunny, October day when the sky is clear of clouds. Remember, most sun orchids refuse to open their petals until nine or ten AM and then they start closing by two or three in the afternoon (banker's hours?). Sun orchids enjoy the most leisurely work schedules because hardworking bees are so dependable… and gullible.