ASGAP INDIGENOUS ORCHID STUDY GROUP

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FLOWER POWER : $130 Million Development Halted by Rumour of an Orchid's Presence

Innisfail is a small town in North Queensland situated in a delightful spot where the North and South Johnstone Rivers meet. It was established about 1875 as a sugar growing district and is still largely a rural service town. In recent years tourism has become an important money-earner, and now much of the lush lowland cane farming country is being sub-divided into expensive rural residential areas.

One of the more interesting of these developments is called Sea Haven. Plans are to connect a small creek which flows to Mourilyan Harbour with an artificial waterside marina-type enclave. The local newspaper, the *Innisfail Advocate*, ran a front page picture and story with the title of this article.

The article states : "A rare orchid has threatened to bring the $130 million Sea Haven waterfront development on Coquette Point Road to a halt before the first sod is turned. The project could be delayed several months while botanists comb the site for the rare Mangrove Orchid. The 179-lot subdivision encompasses 88 hectares of land adjacent to the Johnstone River and reaching to mangrove-lined Ninds Creek." Developers had carried out numerous ecological searches while planning the project and the orchid in question, *Dendrobium mirbelianum*, had not been discovered.

The *Advocate* reports that the Sea Haven development is a "controlled action" under the Environment Protection Act and as such the presence of a rare plant "has to be confirmed or not". The Director of the Australian Tropical Herbarium at James Cook University in Cairns (85 km north of Innisfail) said: "The Mangrove Orchid was very rare in Australia; it is accorded Endangered status in the EPBC Act. It is known from only four verified records – three from the Babinda area and one from the Daintree." The orchid also occurs in Papua New Guinea.

D mirbelianum's flowering period is from August to November. The developers are reported to have engaged a team of environmental scientists to comb the area during that period to confirm or deny the orchid's presence. If found, a management plan will be put in place.....

Some comments: Pauline and I live in a place called East Russell, on the lower reaches of the Russell River, about 11 km from Babinda and 45 km from Innisfail. Both the Johnstone Rivers and the Russell River arise from the mile-high Bartle Frere massif, and flow by a series of dramatic gorges and rapids to the coastal plain where they meander along to the sea. All three rivers are relatively short and carry massive amounts of flood waters during the torrential rains each year in February-March. Before much of the coastal plain was cleared for agriculture in the late 19th and early 20th centuries the ground between the rivers was covered by dense lowland tropical vine/rainforest associated with numerous small fast flowing streams which join the main rivers.

This area is (or was) home to a wide variety of plants for which the Daintree Rainforests (about 200km further north) have become famous. Primitive flowering plants indicate that these forests have been here for millions of years, and are a key to understanding the development of flowering plants. Such "dinosaur" plants as *Eupomatia laurina, Storckiella australiensis* and *Idiospermum australiense* can be found without difficulty not far from where we live.

(petals, sepals) emit pheromones which mimic those of female flower (thyninne) wasps. This attracts male wasps who have been patrolling their territory searching for new females. The males interpret the new location of the floral odour as new females and they follow the scent trail to the flowers. As they get close, the appearance of the flower (particularly the labellum area) provides visual stimulation by mimicking the appearance of the female wasp. The male attempts to mate with the labellum and is brought into contact with the pollinia, which sticks to his back and can then be transferred to the stigma of the next flower. A nifty little arrangement that allows us to carefully place a net over the flowers and capture the wasp for identification.

This technique can be very successful, given the right conditions (temp. of >18 and <30, sunny not too windy), with flowers being covered in wasps within the standard three minute exposure time. However, despite extensive baiting, some of our rare Spider Orchid species did not attract any interest anywhere from anything. Generally, the species with a dark, maroon-coloured labellum and calli are most visually attractive and best-suited to this method.

Caladenia hastata attracted only the very weakest of responses from wasps, with no physical contact with the flowers observed. This was a very disappointing result and we began to consider other possibilities, that perhaps the lighter colouring of the flowers was more attractive to another insect, maybe bees.

The following year was a busy one. We carried out more wasp-baiting for *C hastata*, again without success. As I went about my monitoring of the entire Point Danger population and looked at each individual flower, I couldn't help noticing the huge variation in the colouring and markings of the labellums. I began to wonder if some flowers were more visually attractive to pollinators than others. The labellums of all the flowers are white, but they are then marked by varying degrees with a dark magenta splash. This colouration may cover the entire apical third of the labellum, or it may be restricted to a small patch or only the calli. This variation is all considered normal within the species. I wanted to investigate further but the end of the flowering season prevented any further work for the year.

My final job for the season, monitoring the population for any natural pollination prior to undertaking hand pollination, was the source of a wonderful surprise – a single naturally pollinated pod on one of the ex-situ grown reintroduced plants. This was the first ever recorded natural pollination event and helped us to hope that the pollinator was, in fact, not extinct.

This year (2008) we set out more determined than ever to find and identify the pollinator. We also decided to test the labellum colour hypothesis and chose to use three flowers from each end of the spectrum (very dark labellums, very light labellums) as bait. We selected areas of high quality vegetation with nectar-producing plants the wasps feed on, which is standard procedure, but again were getting no interest. Whilst chatting with a Parks ranger who had arrived to observe the process, we became distracted and forgot to put away the flowers, which remained standing out. After approximately ten minutes of talking, we noticed a few wasps arriving and showing a very vague attraction to the flowers. We then decided, based on this observation, to extend the exposure time to between10 and 20 minutes. The very weak response from wasps continued. Considering we had not even had a sighting prior to this, we felt it was a development.

A week or so later (and fast running out of suitable days to bait), we decided to try at Point Danger. It was a very hot day (>30) with a strong northerly wind, not ideal conditions. We tried baiting near the natural pollination site - nothing. Colin Bower and I had baited extensively through Point Danger in 2006 with no interest from anything whatsoever, so we were not expecting anything. And that is what we were getting – nothing - although using our extended exposure time. I felt frustrated that we had been trying the same things for three years, yet expecting different results. Therefore, I decided it would be worthwhile baiting an area that we wouldn't normally try, highly modified, low diversity vegetation.

We laid out our bait, offering the distinct choice between the light and dark labellumed flowers. Ten minutes into the exposure, we both spotted a large wasp approaching. It flew straight onto the labellum of one of the 'dark' flowers. In my excitement and need to capture the specimen as the first to ever touch a flower, I didn't wait to observe any further interaction such as attempted copulation - I didn't want this one to get away. I don't need to tell you how excited we were. We caught a further seven wasps that day at Point Danger (all within the 10-20 minute exposure range), one of which attempted to mate with a labellum of a 'dark' flower and, as a result, got pollen attached to its back. This was the best result of all, as we were able to observe this entire process and confirm that this was indeed the pollinator and not just a visitor. A further, three plants were naturally pollinated this year, two with dark labellums, one with a medium.

So what did we learn from all of this? Well, the 'light' and 'dark' flowers both attracted the same number of wasps (four each) but the behaviour of those wasps was significantly different. Wasps that chose the 'light' flowers did not interact with the labellum. They displayed what is referred to as sepal-grappling (a kind of infatuation with the clubs where the wasps will hang onto and 'hug' the clubs on the end of the sepals/petals) for up to two minutes. Such prolonged grappling has not been seen before – it is possible that the wasp is visually mistaking the small black ovoid clubs of *C hastata* for a female.

Wasps that chose the 'dark' flowers interacted with the labellums, in one case removing pollinia. This suggests that they are being visually stimulated by and attracted to the dark colouring of the labellums. What all this means is that only the dark labellumed flowers are providing the appropriate visual stimulation to allow pollination to occur. However, these results are only preliminary and further research will be conducted next season for conclusions to be reached and verified.

I measured labellum colouration/marking for the first time this year in the entire flowering population at Point Danger. I found that 44% of flowers were 'light' and 31% were 'dark'. It is my opinion that 50% of the population ('light' and 'light-medium') are unlikely to be capable of attractingthe pollinator. The flowers considered to be 'medium' through to 'dark' (the other 50%) probably provide enough visual stimulation to enable pollination to occur.

We have also learnt that we need to be adaptive in our approach if things aren't working and not to assume anything. In this case, for some reason, it was necessary to lengthen the exposure time considerably. It was also necessary to test in a diverse range of habitats, rather than diverse habitat.

Also this species of wasp seemed to perform outside the normal meteorological conditions required. We have learnt that the morphological variation within a population can be a significant factor and should be incorporated into the monitoring program.

This case study is now raising some very serious ethical issues. It is possible that we have been artificially prolonging the natural lifespan of the 'light' coloured flowers through the intensive artificial breeding program of the last 20 years. We may have stepped in at a critical moment of the colour evolution of this species and interfered, actually decreasing its ability to attract its natural pollinator.

Further research is now required to determine labellum colour variation in the two other natural remnant populations and also to determine the genetics of the Point Danger population (which is highly inbred) and whether this influences flower colour. We will also be photographing flowers under UV to further investigate possible influences. At this early stage, the decision seems to be that we will continue to conserve diversity within the population in terms of flower colour. All plants being used for seed production now have their flower colour photographed and documented for future reference.

The wasp specimens are currently undergoing the identification process. At first it was thought they were a whole new genus, but they appear to loosely fit a description of a single wasp type specimen currently in a museum in Switzerland and only collected the single time from Australia. It is considered extremely rare at this stage as our specimens are the first to be collected since.

We still have many questions to answer....

Kate now organises what has started to be known as the National Orchid Conservation Conference, athough it is dominated by Victoria.. They had speakers from every state except Queensland (even the Northern Territory). "It was great as usual, very thought provoking, intellectually stimulating and great people, lots of fun." Kate holds out hopes that one day they will have a Queenslandd contingent present.

Do any of our Queensland members know of any orchid conservation work being done, either privately or Government sponsored? I can't even imagine active epephytic orchid conservation work, apart from the little we have attempted ourselves. I imagine that our terrestrials are locally abundant and found in places difficult to access. Is any particular ground orchid in danger of extinction, or already extinct? Can anyone see Kate's kind of work being replicated in Queensland? KATE WANTS ANSWERS.

It was very pleasing to see from our latest Queensland Region SGAP Bulletin that the Queensland Herbarium have changed the names of many orchids back to those with which we are familiar. I'm sure *Dendrobium Speciosum* feels so much better having all the family back together again for Christmas!

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