The evolution of orchids

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Angraecum sesquipedale ('Comet Orchid').

(PhysOrg.com) -- Charles Darwin and many other scientists have long been puzzled by the evolution of orchids, the largest and most diverse family of flowering plants on Earth. Now genetic sequencing is giving scientists insights into how these plants could evolve so quickly.

There are over 25,000 species of orchids, but few fossilized specimens have been found. A specimen preserved in amber alongside a bee was discovered in 2007 and dated to 100 million years ago, which means orchids were present at the same time as dinosaurs.

Orchids are pollinated by a greater variety of pollinators than any other family of plants. Petals of the fly orchid found in Britain resemble a

female bee so strongly that males attempt to mate with the petal, pollinating the plant as they do so. An amazing orchid studied by Darwin, the Catasetum, actually fires "arrows" covered with pollen at insects brushing past the flower.

Another orchid studied by Darwin was the comet orchid of Madagasca, which had an elongated nectar tube. Darwin predicted its pollinator would be a moth with a tongue the same length as the tube. It was not until the BBC's *The Private Life of Plants* in the 1990s that the moth was found.

Even stranger is the fact that Madagascan comet orchids also exist on Reunion Island, some 480 km (300 miles) away, but the moth is not present on the island. Instead, these orchids are pollinated by the white-eye, a nocturnal bird. A closely related orchid was found by student Claire Micheneau of the Royal Botanic Gardens in Kew, London, to be the first example of a flower being pollinated by a cricket.

Researchers at Kew Gardens are trying to unravel the mystery of why and how orchids became so diverse. They have discovered that the plants have fused female and male parts, and they also have a special petal that is governed by different genes to those controlling the remaining petals. This genetic difference enables it to evolve differently to the remainder of the flower, producing structures such as the petal resembling the female bee.

The rapid evolution of so many species of orchids and other flowering plants may also lie in the fact that flowering plants exhibit allopolyploidy or genetic redundancy, in which there is more than one gene to do a particular job. Professor Chase, the new Keeper at Jodrell Laboratory in Kew, explains that allopolyploidy means a gene can mutate and the duplicate will still be able to do the job. If the mutation is useful, the plant can evolve into a new species faster than other organisms could.

Professor Chase and his team have been studying the genetics of plants since the 1980s, spending the first 10 years gathering samples of the same gene in a collection of 500 different species, and analyzing the differences and similarities. Later on, as genetic sequencing techniques became easier, scientists were able to study a range of genes in plants, rather than just one.

Professor Chase's work on allopolyploids is concentrating on wild tobacco (Nicotiana) native to North and South America, and marsh and spotted orchids (Dactylorhiza) many of which are native to the UK.