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The Wonders of Orchid Pollination

Reproduction in orchids is one of the most complex and fascinating chapters in nature. The forms, colors and scents of their flowers play a key role in this process, as they attract pollinators through many deceits. To know about these tricks, Inkaterra interviewed Carlos Martel, MBA student at the Institute of Experimental Ecology in the University of Ulm (Germany). He is Peruvian and is researching pollination ecology in the genus Telipogon, with special interest in floral scents.

According to Charles Darwin, the ways in which orchids attract their pollinators transcend human imagination. What did he mean?

Plants have amazing and varied mechanisms to achieve their reproduction. When we see their flowers, we are astonished by their beauty. But we do not imagine why flowers have such attractive colors, shapes and scents. In case of orchids, the beauty of their flowers is used for enticement. The flowers of some orchids, like in many common plants, produce nectar and other rewards to attract pollinators. But many other orchids charm them through much more complex strategies, in which they imitate elements of

interest for potential pollinators. Let's remember an orchid that Darwin observed, *Angreacum sesquipedale*. Their flowers present a 30cm spur, with nectar on the base. Darwin was able to find the plant, but not the pollinator. He stated the existence of an insect with a proboscis so long (more than 30cm) to be able to feed from the nectar and pollinate the flower. This statement was not accepted at that time, as an insect with a proboscis that long was considered improbable. Nonetheless, 40 years later, that insect was discovered: a moth with a 35cm proboscis, which was the specific pollinator of the orchid he observed.

What differences can be found between the reproduction of orchids and of other plants?

The principle is the same, pollen must fecundate ovules and to achieve this pollen must be transported down to the flower's stigma. What differences orchids from other plants, is that they have developed varied strategies so pollen arrives from one flower to another flower from the same species. Many orchid species are pollinated just by one of very few insect species (known as specialist species); this differs from other groups of plants where flowers from one species are visited by bees, flies, wasps, butterflies, etc., which represent a larger spectrum of pollinators (generalist species).

Orchids have hermaphrodite flowers. How do these contribute to pollination?

Hermaphrodite flowers present male (androecium) and female (gynoecium) sex organs. There are species in which flowers are unisexual. The problem with hermaphrodite flowers is that these can be pollinated by the pollen from its own flower. Of course, this way there are more chances of being pollinated and achieving reproduction; but on the other hand it reduces crossing-over. Therefore, if auto pollination predominates, genetic variability is reduced in long term. This explains why orchids with hermaphrodite flowers have mechanisms to avoid auto pollination and let pollen be transported to a different flower.

Which are the main pollinating agents?

The most common pollinating agents in plants are bees, flies, beetles, butterflies, moths, wasps, birds and bats. Bees are the most important and efficient. All the agents named before have also been registered as orchid pollinators, except for bats. In relation to Neotropical orchids, in diverse genera predominates the pollination by dipterous insects (*Pleurotharis,*

Lepanthes, Madevallia), bees (*Oncidium, Maxillaria*) and butterflies or moths (*Epidendrum*).

Which methods of deceit are used by orchids to entice their pollinators?
Though other plants use methods alike, orchid flowers are the masters of deceit. Around 30% of orchid species attract their pollinators through deceit. There are many kinds of trickery: food, places for oviparity, shelter, sexual deceit, etc. For instance, many species of *Epidendrum* do not have nectar in their flowers, but they imitate other flowers from the same genus or group that have nectar. Butterflies and hummingbirds attracted by these flowers realize the deceit when they don't find nectar inside the flower. Others, like *Dracula* and *Masdevallia*, imitate fly oviparity, and female flies are appealed by their scents and shapes. When arriving to the flower, flies pollinate and even lay their eggs in it. Fly larvae will not survive as there is no feeding source inside the flower. The most extreme and fascinating method is sexual deceit, as flowers imitate the female's shape and color to attract male pollinators. They even produce pheromones. Males in search of a mating couple are attracted to flowers with such imitating skills that in some cases pseudo copulation occur, as the male tries to mate with the flower. Genera such as *Chiloglottis*, *Lepanthes*, *Ophyrs* and *Telipogon* have developed a sexual deceit as a pollination system.

Do orchids offer any reward for the work done by pollinators?
Around two thirds of orchids offer rewards such as nectar, oils, resins or perfumes. Nectar is the most common of these, while oils and resins occur in some genera such as *Oncidium* and *Maxillaria*. The reward via perfumes is arguably the most appealing among them. Genera like *Gongora* and *Catasetum* produce scents which are collected by male bees or euglossine bees, which store the perfume in their modified legs. These perfumes are later used to attract females, as some sort of aphrodisiac. Contrary to most plants, orchids do not offer pollen as a reward, as it is packed in pollinia. Though in some taxa, such as *Maxillaria*, flowers offer some grains that are similar to pollen and which contain reserved substances, known as pseudo pollen.

In your opinion, what is the most fascinating facet in orchids?
I am thrilled by its flowers, as these can be of such diverse forms. Anyone would believe to be observing an insect or a mushroom, instead of a flower.