How do you successfully breed Orchids?

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Part 1: Introduction

I used to take care of reptiles such as geckos and frogs as a hobby. As I started designing and building more naturalistic and larger tanks for them, I developed an interest in tropical botany. This lead me to keeping orchids. Most people think that orchids are extremely difficult to keep alive, let alone attempting to breed them. I have found that most of the failure in orchid keeping comes from lack of knowledge and lack of patience with the plant. The most common misconception i've heard is, once the flowers have dropped then the plant is dead. This is not true, the orchid is simply done trying to reproduce of that season. I currently have over 20 species of orchids, including unique hybrids. I wanted to take my hobby further and look at it more scientifically, so I have decided to hybridize my own orchid. If the two orchids I cross-pollinate have never been bred together before, then I will have created a new hybrid, that I could even patent. This paper will be a guide through my orchid research and breeding process. Successfully breeding orchids requires healthy blooming parent plants, careful pollination that mimics that natural process and specialized care for seedlings.

Part 2: Historical Context

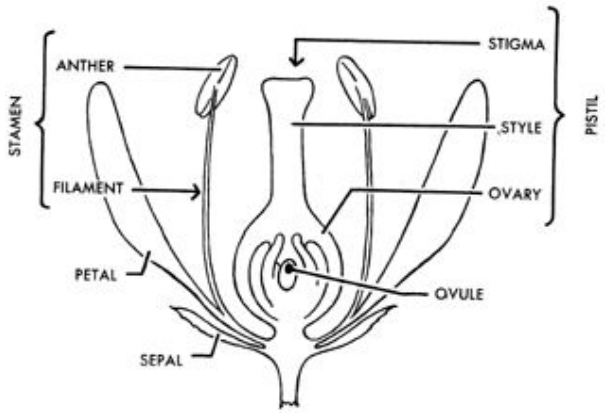
Another common misconception about orchids is that there is only one type of orchid. Most people are unaware that there are thousands of species of orchids. “Orchids are members of the family Orchidaceae, one of the largest families of flowering plants. There are an estimated 20,000 to 25,000 orchid species, which occupy wide ranges of ecological habitats and exhibit highly specialized morphological, structural, and physiological characteristics” (Pansarin, et al 1). As you can see there are

thousands of species of orchids that have very specialized growth habits. Most orchids are epiphytic, meaning they get their nutrients from air, and grow on other plants. These epiphytic orchids are in a symbiotic relationship with the plant that the are growing off of. They can grow off of rocks, bark, moss, but require no soil, which can suffocate the roots. Some are terrestrial and do need light, mossy soil. Because there is so much variety in orchid species, they are native to almost every continent, however my research focuses on tropical and sub-tropical species. The Phalaenopsis and Bulbophyllum, Dendrobium and Oncidium are some of the genuses that I plan on breeding.

Orchids are hermaphrodites meaning their flowers contain both male and female reproductive organs, this makes pollination and reproduction possible with only one flower. “The reproductive organs of the flower are the stamen and pistil (Fig. 1). A part of the stamen called the anther produces pollen grains, which contain male germ cells. At the base of the pistil is the ovary; it produces ovules, which contain the female germ cells. When the ovules are fertilized by the male germ cells, they develop into seeds in the ovary” (Butler 1). This information tells us that orchids can reproduce with a single flower, meaning they are a perfect flower. A perfect and imperfect flower are the 2 types the article talks about. A perfect flower contains both male and female organs, these are more common, orchids are a perfect flower. In a normal flower, like a hibiscus, the anther attaches the pollen to the flower. The pollen is the male part of the flower, the sperm basically. A insect would gather pollen on them and then transfer it to the stigma (the female part of the flower) that is sticky, and usually is center and different than the

pollen anthers. The pollen goes down the style to the ovaries where fertilization and seed development occurs. The pollen on the stigma gets pushed down the stem to where seed development occurs.

a. Figure 1



Part 3: Research and Analysis

Section 1: Healthy Blooming Parent Orchids

One of the most important aspects of breeding is to ensure you have healthy blooming parent orchids. The orchids that you are breeding must be healthy and creating full sized healthy not damaged flowers. Having healthy parents will promote success in young plants. Same with animals, if sick or diseased animals reproduce there is a higher chance of the offsprings having these same issues. Without proper care requirements orchids will not bloom, if they do not bloom, pollen has not been developed and can not be extracted to breed. Having healthy parent plants is also crucial in ensuring that breeding takes place without complication. “Plants inherit

characteristics from their parents in the same way that animals do. The laws of heredity explain why different traits are inherited by offspring of the same parents. Moreover, these laws make it possible to predict the number of offspring that will inherit a certain trait. A knowledge of the laws of heredity is essential for effective plant breeding" (Butler 1). Not all offspring will have the exact same genetic characteristics when breeding, even though they come from the same parent plants.

There are several ways to ensure healthy blooming parent plants. Attentiveness to each individual orchid and the amount of water and sunlight they need keeps orchids thriving. Giving your orchids more water will cause the plant to put out more growths. Allowing most orchids to dry out mostly between waterings will encourage them to bloom. Blooming depends on the species of orchid. For example, some Colorado orchids only bloom in the spring. The platystele I have will bloom year-round if given the right care.

Section 2: Pollination that mimics natural processes

In order to breed orchids, you have to cross-pollinate two different flowers. So you have to take pollen from one flower and put it in the other. To do this, you remove the anther cap to reveal the pollen, the pollen sticks to the cap, so you will have to remove the cap with the pollen stuck to it. Relocate this pollen to the stigma of the other plant, where it will fertilize and begin seed development. Without knowing the plant reproductive anatomy it would not be possible to do this process. In pollinating the plant, I will have to mimic the path of the natural pollinators to get the pollen from the anther and then to the stigma. "In some species, the lip is moved by the wind, and some

authors have suggested that this lip movement is an important mechanism by which fly-pollinated flowers attract insects (quick lip movements would mimic flies shaking their wings and would attract other insects (Teixeira et. al. 1).” Considering these orchids developed a way of attracting natural pollinators and how important that is to breeding, It should be fairly easy to reenact that process successfully.

Another aspect of breeding is specialized seedling care, which is important to the success of growing these orchids. Each different species of plant has different care requirements and if those requirements are not met the plant will die. Because most orchids are epiphytic, the care that goes into raising the seeds is going to be different from your typical flower seeds. So more specific care will be required in order for them to develop into a mature flowering plant.

Part 4: Conclusions

Each element of part three has to do with the breeding process, start to finish. Beginning with successful blooming of both parent plants, proper pollination and then leading to seed development and finishing with growing seeds into a healthy hybrid. The order of what is discussed in Section 3 is extremely important as well because without starting out with two healthy parent orchids you won't be able to get to the following steps.

The process for pollinating your own orchid seems very intricate, but is actually quite a simple process. You start with a fully blooming orchid of your choice, all orchids basically have the same column structure (reproductive organ). This means the pollination process is going to be the same for every species, even though they may

appear extremely different. Because orchids are hermaphrodites only one flower is needed in order to reproduce. However, cross pollination from different flowers is recommended and you will have a greater chance of success in doing so. The second step in pollination is to start by locating the column in the center of the flower. The column is where both the anther and stigma are located. The anther is where the pollinia (pollen sacs) are kept. The pollen is protected by a small cap that covers the tip of the column called the anther cap. At the bottom of the anther cap there is a small, sticky tab that can be easily removed with a toothpick to reveal the pollinia. Removing the anther cap will pull the pollinia out with it. Both the anther cap and pollinia should stay stuck to the tool used for removal. Peel the anther cap off of the polinia and discard it for it will not be needed. Once you have your isolated pollinia you rub it against the stigmatic surface and it should stick to it. Ensure that the pollinia is making solid contact with the stigmatic surface. Once you have taken these steps you have completed the process for pollination and should have a fertilized orchid.

One area for more research is whether there are certain species that can not be breed together. I think that all orchids can be bred together because they all have the similar reproductive anatomy and are all of the Orchidaceae family. Another question I thought of during my research was orchids have such high reproductive success naturally so, It makes me wonder if orchids could hybridize with plants outside their species in a controlled environment.

For my project and as additional orchid breeding research, I will be breeding my

own hybrid orchid. This will involve taking my research and applying it to my hobby and starting my own science experiment. It seems quite simple to successfully breed orchids, every video I have seen makes it seem easy. My research was intended to gain a deeper scientific understanding of breeding orchids. I think that I will be able to breed my orchid on the first try.

Successfully breeding orchids requires healthy blooming parent plants, careful pollination that mimics that natural process, and specialized care for seedlings.

Bibliography

J. D. BUTLER. “Plant Breeding as a Hobby.” *University of Illinois Urbana-Champaign-School of Horticulture*. Web. 25 Jan. 2018.

Pansarin, Emerson R, and Artur A Maciel. “Evolution of Pollination Systems Involving Edible Trichomes in Orchids | AoB PLANTS | Oxford Academic.” *OUP Academic*, Oxford University Press, 20 July 2017. Web. 25 Jan. 2018

TEIXEIRA, SIMONE DE PÁDUA, EDUARDO LEITE BORBA, and JOÃO SEMIR. “Lip Anatomy and Its Implications for the Pollination Mechanisms of *Bulbophyllum* Species (Orchidaceae).” *Annals of Botany* 93.5 (2004): 499–505. *PMC*. Web. 25 Jan. 2018.