FRUITS OF ORCHIDS: HAVE YOU EVER NOTICED ?

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Orchids or Orchidaceaes are the members of family Orchidaceae which is one of the largest plant families of flowering plants in the world. Orchids got their name from Greek “Orchis” which means “testicle”. It was first stated by Theophrastus (372/371–287/286 B.C.), the father of botany and ecology in his “De historia plan tarun” (The natural history of plants). According to the latest updates published by Royal Botanical Gardens of Kew in collaboration with Missouri Botanical Garden (The Plant List, Version1.1), there are 925 genera of orchids within the family Orchidaceae containing around 20,000 species and countless hybrids. As published by S. S. Fernando and Paul Ormerod (2008), Sri Lanka owns 188 species belonging to 78 genera with one endemic genus and 55 endemic species. Orchids are cosmopolitan in distribution, occurring in every possible habitat except Antarctica and deserts. Even though these plants are famous as epiphytes or air plants which grow on trees (a), also they are subsisting in some other places as well (Fig. 1). Orchids that grow on rocks by clinging to the rock surface are called lithophytes (b). Those grown in mulch, often on the forest floor are called saprophytes (c) and in addition there are terrestrial orchids (d), which grow on soil or sand.

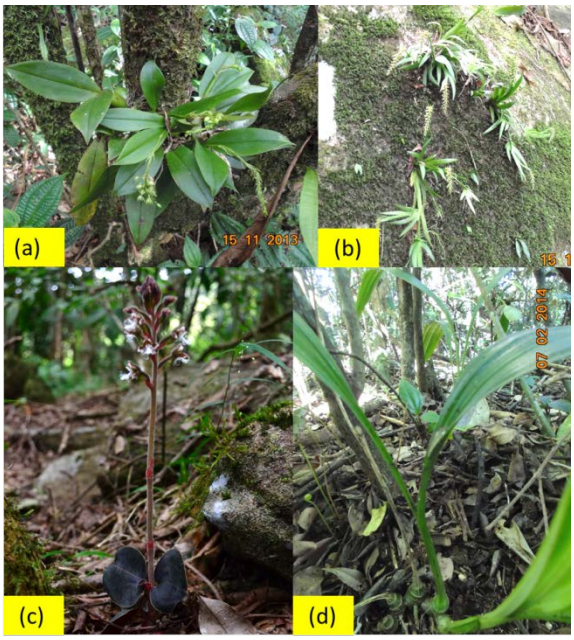

Figure 01: differant habitats of Orchids (a). An epiphytic orchid (b). A lithophytic Orchid (c). A saprophytic Orchid (d).A terrestrial Orchid

Members of this family are unique among other plants in the nature and show a vast diversity among the members within the family. They are classified as perennial herbs. Orchids occupy the top position of all flowering plants. Most of them are well known for their bright, characteristic blossoms which come with different shapes, colors, sizes and fragrant smells.

Figure 02: Pseudo-copulation (a). *Ophrys speculum*, the Mirror Bee Ochid (b). Pollination by a bee

A basic orchid flower composed of three sepals in the outer whorl, three petals in the inner whorl. However the middle petal has deviated from others by producing a labellum or a lip. This lip can be developed either in the same color as the flower or in a contrast color. These specializations in colors and structures have resulted in unique pollination mechanisms. One such mechanism is pseudo-copulation in which flower mimics a potential female mate visually but inducing factor is a chemical. The best example for this senerio is *Ophrys speculum*, the Mirror Bee Orchid. Some other pollination mechanisms are self pollination and cross pollination. Even though self pollination take place within the flower, for cross pollination orchids depends on pollinators. The pollinating agents may be insects (Lepidoptera, Diptera, and Hyrmenoptera), birds, and possibly bats.

At the end of a successful pollination and fertilization, fruits are developed. Size of the fruits or in other words capsules deviated from very few millimeters to some centimeters. It may depend on size of the flower (Figure 03). Some species contain large number of capsules in one spike while some others contain very few depending on the number of fertilized flowers. Each capsule consists small (microscopic), dusty and transparent seeds (Figure 04). Therefore investigation on these seeds can be carried out only with scanning electron microscope (SEM). For example, seeds of *Ophrys mammosa* are 0.557 µm in length and 0.138 µm in width. Its embryos are smaller than the seeds: 0.107 µm in length and 0.062 µm in width. These seeds can travel a great distance in the air due to their fusiform, aerodynamic features and above mentioned light weight properties (Aybeke, 2013).

Figure 03: Differant sizes of Orchid fruits/ capsules

Some epiphytic orchids of the tropical rain forest produce the world's smallest seeds weighing only one 35 millionths of an ounce (1/35,000,000) or 0.81 micrograms. These minute seeds dispersed in to the air like dust particles or single celled spores and eventually reach and rest in the upper canopy of the forest trees.

Figure 04: Seeds of a *Dendrobium*

Germination of Orchid seeds under natural circumstances require special conditions. Since they are so tiny, these seeds do not contain endosperm and undeveloped embryos, practically they have no food (Energy) reserves other than small lipid droplets and endogenous or exogenous supply of cytokinin that is essential for the lipid mobilization. Therefore in order to germinate they must establish a symbiotic relationship with a compatible mycorrhizal fungus.Most of them are classified in the form-genus *Rhizoctonia*. This group includes anamorphs of *Tulasnella*, *Ceratobasidium*, and *Thanatephorus.* At the begining of the germination the fungal patner of the symbiotic relationship provides critical nutrients to the orchid partner. Eventually the orchid may become fully independent, or it may retain its mycorrizal relationship throughout its life. However orchids utilize fungus to stimulates the seed germination and seedling development by allowing the fungal hyphae to enter in to seed via micropores. Then the fungal hyphae grow inside the inner embrayonis cells as little coils called peletons. The orchid simply digests these peletons . With the new supplements Orchids start to develop a shoot with roots and leaves (Figure 05). Peletons are sufficient for Orchid seedlings as a carbon source until the chlorophyll in the leaves have developed, this can take from months to an eternity as some orchids never produce chlorophyll (*Dipodium punctatum* and *Gastrodia sesamoides*). Dependency on the fungal partner could be annihilated once the orchid reaches maturity. Especially, while epiphytic orchids are known for losing the need for peletons, terrestrial orchids typically keep the relationship going until death does them part (Otero, 2002).

Figure 05: A seed of *Ochis mascula* in the soil with root hairs and hyphea

As the fields of Orchidology and seed biology develope, scientists were able to come up with alternatives for this essential symbiotic relationship between orchids and fungi. Development of Maceration technique using seeds of Barlia robertiana by Mehmet Aybeke (2013) from Turkiye and also by a Taiwan research team has established an efficient method of propagation via asymbiotic germination of seeds in vitro for medicinally important Orchid species called Dendrobium tosaense (Lo *et al*., 2004). An Indian research team also has developed an asymbiotic germination technique as a step for ex-situ conservation of endemic Orchids in India (Shibu *et al*., 2012). Royal Botanical Gardens of Peradeniya, Sri Lanka also propagates Orchids for industrial purpose using Murashige and Skoog medium and Knudson C medium. Using these specialized mediums seeds were given with all the nutrients required for the development of roots and leaves until the plant become stable and self sufficient.

However as a family with exceptional characteristics members of family orchidaceae were able to preserve their uniqueness even through the fruits and seeds.

Acknowledgment

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