

A HISTORY OF ORCHIDS. A HISTORY OF DISCOVERY, LUST AND WEALTH

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Abstract

Orchidaceae is the second largest families of flowering plants. There are approximately 900 orchid genera comprising between 28,000-32,000 species of orchids. The relationship between orchids and mankind is complex. The history of orchids' discovery goes hand in hand with the history of humanity, encompassing discovery and adventure, witchcraft and magic, symbolism and occultism, addiction and sacrifice, lust and wealth. Historically, the Chinese were the first to cultivate orchids as medicinal plants, more than 4000 years ago. Gradually, records about orchids spread, reaching the Middle East and Europe. Around 300 B.C., Theophrastus named them for the first time orkhis. In 1737, Carl Linnaeus first used the word Orchidaceae to designate plants with similar features. The family name, Orchidaceae was fully established in 1789, by Antoine Laurent de Jussieu. In 1862, Charles Darwin published the first edition of his book, Fertilisation of Orchids. Darwin considered the adaptations of orchid flowers to their animal pollinators as being among the best examples of his idea of evolution through natural selection. Orchidology was on its way. During the 18th and the 19th centuries, orchids generated the notorious Orchid Fever where orchid-hunters turned the search for orchids into a frantic and obsessive hunt. Ever since, orchids have conquered the world, becoming a much-desired, multibillion-dollar commodity.

Key words: orchids, history, cultivation, medicinal, micropropagation.

INTRODUCTION

EXOTIC, BIZARRE, MYSTERIOUS BLOSSOMS IN ROMANTIC FARAWAY PLACES. ORCHIDS

Since ancient times they have exerted a fascination and power of seduction which has increased over the centuries, sparking a range of emotions from wonder and curiosity to admiration and passion. Orchids or daydream flowers as they sometimes have been known, are a symbol of magnificence in the world of flowering plants. By the incredible luxuriousness of their forms, the splendour, variety and harmony of their colours and the diversity and refinement of the traps they display to attract pollinating insects, orchids can be singled out as having attained a peak of beauty and perfection unrivalled in the Plant Kingdom. The combination of their mysterious beauty, amazing colours, strange growth habits, intricate shapes and hypnotic perfumes has ensured a long-lasting obsession for orchids (Hawkins-Tillerson, 2007). The strange

tuberous forms of the roots of the terrestrial species and the unusual ways of life and features of the exotic species have led various cultures and civilisations to award orchids sacred and magical virtues. The relationship between orchids and mankind is complex. The history of orchids encompasses discovery and adventure, witchcraft and magic, symbolism and occultism, addiction and sacrifice, lust and wealth. In their quest for world domination, after colonising all the six continents and almost every habitat on Earth, orchids decided to shadow the history of human kind throughout the millennia, from antiquity to modern times.

ANTIC CIVILISATIONS

For thousands of years human civilisations have regarded the art of healing as having been sent from the divine. The remedies of traditional medicine were passed on and practised by knowledgeable lay people and by trained practitioners such as wise women, shamans or priests. As soon as writing was

developed and culture had progressed sufficiently, numerous records of religious and magical writings accompanied by lists of herbs were inscribed onto thousands of clay tablets and rolls of papyrus, these documents becoming the first Herbals (Budge Wallis, 1927). In ancient Egypt, Mesopotamia, China, India and Europe, herbals were among the first literature produced, containing the medical wisdom of the day accumulated by herbalists, apothecaries and physicians. Herbals were collections of names, descriptions and illustration of plants that included their medicinal, culinary, toxic, hallucinatory, aromatic and magical properties as well as the legends associated with them. It would be foolish to deny the fact that in ancient times medicine and magic were almost inextricably linked, yet despite the use of magic, the compilers of the oldest herbals had a very real knowledge of primitive traditional medicine.

MESOPOTAMIAN CIVILISATION

Although human settlements had probably existed for millennia, traditional medicine developed between the Tigris and Euphrates rivers during the period of the great Mesopotamian civilisations, beginning with the Sumerian (c. 5200-2000 B.C.), followed by the Akkadian, Assyrian, Babylonian and Persian Empires (Retief & Cilliers, 2007). The first written mention of the use of orchids comes from two clay tablets of recipes found in the Royal Library of the King of Assyria, Ashurbanipal (668-626 B.C.), in the ancient city of Nineveh (Price, 2001). The recipes were elaborate and often called for rare ingredients. Various grains and vegetables were used, and there were lists of dates, apples, figs, pomegranates, grapes, apricots, mulberries and melons as well as 'saffron and orchid root, truffles and mushrooms [which] were harvested for the table' (Budge Wallis, 1927). The orchid roots are likely to have been species of the tuberous *Orchis* genera, as well some of the edible species of the *Disa*, *Habenaria* and *Eulophia* genera, all of which were widely spread across Northern Africa and Central Asia (Pant, 2013). These recipes reveal the fact that orchids were familiar to the ancient Sumerians, at least as food. Since we know that a drink flavoured with saffron has been made from the

tubers of various kinds of *Orchis* and *Eulophia* orchids for over four millennia, it is quite possible that the Sumerians may have also used them for this purpose. Today this drink is known as Salep, the Middle Eastern beverage (Sezic, 2002). Also, in ancient Mesopotamia, young mothers used for the first time, various orchid species to stimulate lactation (Jacquet, 1994).

ANTIC CHINA

Historically speaking, the Chinese were the first to fully document and leave written certification of their use of orchids as medicinal plants, starting almost 4000 years ago (Yang L., 2008; Teoh, 2016). Their interest in orchids started with the legendary Shennong, an emperor and scholar who lived between 4000-2500 years ago and who is considered to be the father of Traditional Chinese Medicine (Yang S., 2005). The 'Shen Nong Ben Cao Jing' (The Divine Husbandman's Classic of Materia Medica) is a Chinese book on ancient medicinal plants attributed to the scholar, probably written around 2700 B.C. (Yang, 2005). This is considered to be the earliest Chinese Pharmacopoeia, and includes 365 medicines derived from minerals, plants and animals. Species such as *Bletilla striata* (pai-chi), *Dendrobium nobile* (shih-hu) and *Gastrodia elata* (chih-chien) were mentioned for the first time as being utilised in Chinese medicine (Bulpitt et al., 2007). The Chinese word for orchids, 'lan' or 'fragrant', has appeared in Chinese herbal medicine for centuries, although in many ancient writings, 'lan' was used as a general reference to all fragrant plants rather than an exclusive reference to orchids (Bulpitt, 2005). Orchids were first collected from the wild and cultivated in the private gardens of nobles during the Wei (220-265 C.E.) and Chin Dynasties (265-317 A.D.). In Chinese manuscripts dated 290-370 C.E., there are some direct referrals to orchids, the most common species being *Cymbidium ensifolium*, *Dendrobium moniliforme* and *Vanda tessellata*. Wang Kuei Hsueh wrote 'Wang Shi Lan Pu' (Wang's Treatise on Orchids) in 1247, and described the cultivation of 37 new species including some *Cymbidium* species (Hew, 2001). Although orchid cultivation was

common during the Song Dynasty, it became very popular during the Ming (1368-1644 C.E.) and Ching (1644-1911 C.E.) Dynasties. In the royal palaces and parks, the Chinese gardeners used to cultivate *Cymbidium*, *Vanda* and *Aerides* species suspended in baskets. During his travels in China in 1613, a Jesuit missionary, Álvaro de Semedo (c. 1585-1658), saw these hanging orchids and referred to them as 'diao hua' or 'hanging plants', saying that they possessed the peculiar property of 'growing suspended in the air' (Arditti, 1992).

INDIA'S ANCIENT AYURVEDIC MEDICINE

Along with China, India has had a long tradition in herbal medicine dating back several thousand years, having its roots in magical and occult practices. This led to a system of health care known as Ayurvedic medicine, which comes from the Sanskrit word Ayurveda meaning the 'knowledge of life'. The oldest known Ayurvedic texts are the Suśrutha Saṃhitā and the Charaka Saṃhitā, which contain 700 descriptions of medicinal plants and their usage. They were appendices of the Hindu texts the Rig Veda and the Atharva Veda, where several orchids, *Dendrobium*, *Eulophia*, *Habenaria*, *Orchis* and *Vanda*, were mentioned to be used as medicinal plants (Panda & Mandal, 2014).

ANTIC GREECE

In Greece, the early compilers of herbals based much of their knowledge on the translations of the ancient Egyptian and Mesopotamian medical and medicinal writings (Jacquet, 1994; Bulpitt, 2005). The Greek physician Hippocrates (460-377 B.C.) is often called the Father of Medicine. He infrequently used herbal remedies, preferring to treat with diet, physical therapy and rest, he did use species of Mediterranean orchids in some of his cures, which have been identified as being from the *Orchis* genus. Written references to Mediterranean orchids were also made by the Greek philosopher Theophrastus (371-287 B.C.). Two of his works, 'Historia Plantarum' (Enquiry Into Plants) and 'Causis Plantarum' (On the Causes of Plants), are in existence today, having been translated into Latin in the middle of the 15th century. In the 9th book,

which dealt specifically with medicinal herbs and their uses, Theophrastus described a plant with two little ovoid tubers, which he referred to as *orkhis*, the ancient Greek word for the mammalian testicle (Bulpitt, 2005). He used this word to denominate some of the terrestrial Mediterranean orchid species that had similar root characteristics. The name of the family *Orchidaceae* has origins in the same word, and to this day, the species Theophrastus described are known by the same genus name, such as *Orchis maculata*, *Orchis mascula* and *Orchis simia*. Pedanius Dioscorides (40-90 C.E.), a Greek physician, pharmacologist and surgeon with the Roman army, compiled the information about the many useful plants he had found on his travels into 'De Materia Medica' (On Medical Materials), a 5-volume encyclopaedia, written between 60-70 C.E. The book contained approximately 600 species of medicinal plants, two of which were species of orchids, *Orchis mascula* and *Orchis militaris*. Interestingly, the text also recorded the Dacian and Thracian names for about 60 species of medicinal plants. Dacians were the ancient inhabitants of the present-day countries of Romania and Moldova, which are located in and around the Carpathian Mountains and to the west of the Black Sea.

In 77 C.E., Gaius Plinius Secundus or Pliny the Elder (23-79 C.E.), the Roman naturalist and philosopher, described numerous species of orchids and indicated their medicinal qualities in his treatise 'Naturalis Historia' (Natural History), a synthesis of the information contained in about 2000 scrolls and it includes myths and folklore, written between 77-79 C.E.

ARABIC TRADITIONAL MEDICINE

Arabic traditional medicine originally developed from a combination of the magic-based medicine of the Bedouins with the medical traditions of the major ancient civilisations. One of the most famous 11th Century Arabic medical treatises was 'The Canon of Medicine' (1025 C.E.) by Persian philosopher and medic Ibn Sīnā (980-1037 C.E.). Ibn Sīnā was most commonly known in the West by his Latinised name, Avicenna. The book described the use of several exotic orchids in herbal cures. One of the most widely used beverages of the Middle East around that time

was Sahlab or 'sahlep', the name of which derived from 'th-thaeleb' or 'hasyu al-tha'lab', which in Arabic means 'fox testicle'. This ancient, highly nutritious and healing drink, also mentioned in the Persian medicinal works, was made from the tubers of various *Orchis* species, particularly from those of *Orchis mascula* and *Orchis militaris* that grew in abundance across the Middle East and Asia (Subedi et al., 2013; Bulpitt, 2005).

THE GOTHIC ERA AND THE MIDDLE AGES – SUPERSTITIONS AND WITCHCRAFT

Astrology, astronomy, medical knowledge, alchemy and magic from the ancient philosophers of the great scholarly cities of the Middle East, Greece and Rome were circulated throughout society. The Swiss-German physician, astrologer and philosopher Philippus Aureolus Theophrastus Von Hohenheim, later known as Paracelsus (1493-1541), developed the 'Doctrine of Signatures' further in his treatise 'Liber de Imaginibus' (Eternal Imagination), by describing the properties of all animals, plants and minerals and assuming associations between their shapes, colours, forms and curative properties. Perhaps due to this long-standing belief that the larger tubers of orchids had stimulatory, generative and curative benefits for the male genitalia, some of the philosophers of the Middle Ages imagined that these plants grew from the drops of semen which fell to earth in places where animals or birds came together to breed. Medieval medicine and healing practices were reverting to their roots in pagan rituals and traditional herbal folk medicine. Witches were thought to use orchid tubers in their philtres or love potions, the fresh, firmer tuber being given to promote true love, and the withered one to reduce passion, perpetuating the belief in the aphrodisiac properties of orchids. They added magical elements to the prescriptions for the treatment of diseases, much of the knowledge about plants being usually recorded in legends. In Western Europe the first witch hunts, in which large numbers of people were tried and convicted of witchcraft, were held in France and Germany in the 15th century. In the 16th century witch mania spread to England and Scotland. Eventually the more educated people

gradually stopped believing in witches and during the 18th century it finally became fashionable to regard witchcraft as a superstition.

RENAISSANCE - THE 'EARLY MODERN' IDEAS

During the 16th century, new publications dealing with orchids became increasingly common in Europe. In 1539, Hieronymus Bock (1498-1554), a German botanist and Lutheran minister, firmly reiterated the belief in the spontaneous generation of orchids from animal semen in 'Das Kräuterbuch' (Book of Herbs). In 1542, the German physician and botanist Leonhart Fuchs (1501-1566), mentioned over 400 plants in 'De Historia Stirpium Commentarii Insignes' (Notable Commentaries on the History of Plants), and also described various *Dactylorhiza* species.

William Turner (1508-1568), the father of English botany, was an early English herbalist who studied medicine in Italy. His three-part 'A New Herbal' (1551) described over 200 species native to England, among which are mentioned species of the *Orchis* genera and their uses in the treatment of alcoholic gastritis. In 1597, the English naturalist John Gerard (1545-1612) published the 'General Historie of Plantes', which became known as 'Gerard's Herbal'. Gerard mentioned several types of *Orchis*, calling them *Satyrium femina* or 'Fox-Stones'. His approach had an extensive impact on medicine in early North American colonies, the early English settlers taking the 'Herbal' to North America. Many species that Gerard had described were also introduced into the New World from England, including the Lady's Slipper Orchid *Cypripedium calceolus* (Cribb, 2014; Higgins & Alrich, 2016). In 1640, the English botanist John Parkinson (1567-1650) published 'Theatricum Botanicum' (Theater of Plants - An Herbal of Large Extent), which was a compendium of about 3800 plants and the largest herbal ever produced in the English language. In this he described a wide range of orchids, putting them into several different classes and separating those with oval tubers from those with palmate tubers. He also noted that orchids produce dust-like seed after the flowers fade and are therefore unlikely to be spontaneously generated from the semen of

animals or birds. In the 17th century, the English botanist, herbalist, physician and astrologer Nicholas Culpeper (1616-1654) took the 'Doctrine of Signatures' theory as common knowledge in his book the 'Complete Herbal' (1652-1653), and maintained a common belief in the magical and medicinal powers of orchids. He wrote that the many *Orchis* species could be separated into two main groups, those with two round tubers and those with a hand-shaped or palmate tuber - such as the *Dactylorhiza* species, perpetuating the idea of the 'lustful power' of orchids.

THE FIRST CONTACTS WITH THE NEW WORLD

After the first contact with the Bahamas by Christopher Columbus (1451-1506) in 1492, the numerous successive expeditions taken to what later became known as the New World focused the interest and actions of the Europeans towards the colonisation and exploitation of this new continent. 'The Libellus de Medicinalibus Indorum Herbis' (Little Book of the Medicinal Herbs of the Indians), was written in Mexico, in 1552, and described the medicinal properties of 250 medicinal herbs used by the Aztecs (Safford, 1912). It was translated from Aztec Nahuatl into Latin by the Aztec Indian Juan Badianus (1484-1552), who offered the translation as a present to Charles I the King of Spain (1500-1558). This became known as the 'Badianus Manuscript'. One of the most well-known orchids, *Vanilla planifolia*, was described in great detail and its nutritional properties indicated. During the 1600s Europeans also began to be introduced to the flora of distant new lands discovered in Africa, the Far East and Australasia. In 1688 the very first specimen of the distinctive red *Disa uniflora* was brought from South Africa. John Ray (1627-1705) described this flower as 'the loveliest orchid from Africa' in his work 'Plantarum History' (History of Plants). The earliest Western books specifically on orchids did not appear until the 'Herbarium Amboinense' was written by the blind Georg Eberhard Rumphius (1627-1702). 'Herbarium Amboinense', a catalogue of the plants of the island of Amboina in modern-day Indonesia, was published posthumously in

1741, 39 years after his death, after a series of disasters (Veldkamp, 2011; Kull, 2002).

CARL LINNAEUS AND THE BINOMIAL NOMENCLATURE

The avalanche of new species of plants coming into Europe without the assistance of a unique classification and notation system created a lot of confusion, with each botanist using a system different from the others. Towards the middle of the 18th century, the need for a unique system to classify plants became imperative. The Father of Modern Ecology and Taxonomy was Carl Linnaeus (1707-1778), a Swedish botanist, physician and zoologist, also known as Carl von Linné after his ennoblement in 1761. Linnaeus wrote three major works, all of which were regularly revised and updated. These were 'Systema Naturae', 'Genera Plantarum' and 'Species Plantarum'. In 1737, in 'Genera Plantarum' (The Genera of Plants), Linnaeus first used the word Orchidaceae to designate the entire orchid family. At that time, he described only eight orchid genera, one of which was *Orchis*, the name that had been coined by Theophrastus almost 2000 years before. 'Genera Plantarum' was the first step towards a universal standardized biological nomenclature. By 1753, Carl Linnaeus had published 'Species Plantarum' (The Species of Plants), the work that is now internationally accepted as the beginning of the modern botanical nomenclature known as Binomial Nomenclature, this being the first coherent identification of plants by a genus name followed by a specific name (Jarvis & Cribb, 2009). By the time the 10th edition of 'Systema Naturae' had been brought out in 1758, Linnaeus had classified 4400 species of animals and 7700 species of plants, among which a hundred different species of *Epidendrum* were mentioned, a name which was loosely given to all of the tropical orchids known at that time (Müller-Wille & Reeds, 2007). The Orchidaceae family name became fully established when the French botanist Antoine Laurent de Jussieu (1748-1836) published his own work in 1789, also called 'Genera Plantarum'. De Jussieu continued to use the term 'Orchidaceae', gathering together under this name all the plants with similar morphological features that had been described

up to that date. Towards the end of the 18th century, research on orchids had progressed well. The classification of orchids had passed through numerous revisions, and the number of genera they had been divided into, had increased.

THE ORCHID-HUNTERS AND THE GREAT EXPLORATIONS OF THE NEW WORLDS

The search for new lands and the study and collection of new species of flora and fauna attracted many noted botanists and adventurers. Great travelers such as the French admiral Comte Louis Antoine Bougainville (1729-1811), the British explorer and cartographer James Cook (1728-1779) and the experienced French navy officer Jean François de Galaup, Comte de La Pérouse (1741-1788) discovered and explored Australasia, New Guinea, Polynesia and the Easter Islands. After his first voyage to South America and Australasia (1768-1771), Captain James Cook made a presentation on preserving the health of his crew to the Royal Society in London (Biskup, 1987). During the 18th century, the most common fatalities on long sea voyages were due to scurvy, a debilitating illness caused by lack of Vitamin C in the diet. In addition to scrupulous cleanliness, fumigation and a selection of other measures, which included fresh vegetables and meat, he had used Salep, a nutritious ancient drink made from the ground dried roots of several types of orchid including *Orchis militaris*, *Orchis (Anacamptis) morio*, *Orchis mascula* and *Orchis simia* as part of the diet on his ship (Cook, 2010). By the end of the 18th century, many new species of exotic orchids have been introduced to Europe, not only from Australasia and the Pacific but also from China, the Antilles and the Americas. Unfortunately, very few orchids survived the conditions in which the sailing ships navigated. Improper storage conditions in dark and unaired stowage, predation by rats, and lack of the fresh water that was critical to the survival of these plants would all have taken their toll. Despite this, the stories of the sailors and explorers, as well as the specimens of unusual plants they brought back, heightened the interest in orchids and fired the imagination of the Europeans. A passion developed for these

exotic plants (André, 1995). Explorers and gentlemen of fortune travelled to the tropics to search for orchids which had never been seen before, as well as to collect specimens of those that had become popular back home and would fetch the highest prices. They penetrated deep into the heart of these new lands and the search for orchids turned into a frantic and obsessive hunt (Orlean, 2000). Neither the presence of pirates or cannibals nor the danger of earthquakes and hurricanes deterred the orchid-hunters of the 18th and the 19th centuries. They were confronted with excessive moisture and heat, the constant threat of tropical diseases, insect bites, venomous reptiles, the poisoned arrows of the native people and the weapons of their European competitors. Thus, many of them paid for their desire to become rich and famous with their lives. Once the rarest species were found, whole areas were often stripped. Specimens that could not be loaded onto the ships due to lack of space and those that could not be transported from the regions where they had been discovered were destroyed in vast quantities, either in order to avoid falling into the hands of competitors, or to further enhance the value of those being shipped back. Once the plants arrived home, they were sold at exorbitant prices, enriching the most important European botanical collections and gardens. The orchid hunt also had catastrophic consequences for the existence of some of the species. Many habitats were seriously damaged or destroyed during this time, causing numerous species to become endangered or driven to extinction. This obsession with orchids became known as the Orchid Fever (Hansen, 2001). Numerous naturalists, horticulturalists, physicians and adventurers over the centuries have been commemorated by having orchids named after them. For example, the genus *Goodyera* was named after the 17th century English botanist John Goodyer (1592-1664). Goodyer translated and revised many important works including 'Dioscorides' 'De Materia Medica' and 'Gerard's Herbal'. He was so well thought of that a stained-glass window in his local church even now bears a commemorative inscription about him and his family coat of arms. An important figure of the 18th and 19th centuries was the English botanist, orchidologist and taxonomist John Lindley

(1799-1865). In a later work, 'The Genera and Species of Orchidaceous Plants' (1840), Lindley described thousands of species and hundreds of new genera, many of which are still in accepted use today. Lindley was particularly fascinated by orchids and on his death left an unfinished book, 'Folia Orchidaceae', which is considered a classic on the Botany and Taxonomy. Lindley is considered the Father of Orchidology. In 1818, Sir William Cattley (1788-1835), a merchant and horticulturalist, was unpacking a shipment of plants that he had received from Brazil when he found some half-dead tendrils. Under his attention, these grew into a beautiful orchid, which was given the name *Cattleya labiata* in 1824, in honour of its rescuer. One of the foremost German orchidologists of the 19th century, Heinrich Gustav Reichenbach (1823-1889), described thousands of species of orchids and has many orchids named after him using the species epithet *reichenbachii*. A German taxonomist, Friedrich Richard Rudolf Schlechter (1872-1925) was responsible for the first systematic classification of orchids, used up until a few decades ago. His volume 'Die Orchidaceen von Deutsch Neu Guinea' (The Orchids of the German New Guinea) described around 1400 species of orchids from Papua New Guinea, 1102 of which were new to science. In South America, the Brazilian botanist João Barbosa Rodrigues (1842-1909) was recognised as an important scientist and artist. He published 'New Varieties and Species of Orchids' (1877-1881) on the orchids found in the Amazon basin area. His magnificent orchid watercolours and illustrations of 700 species of rare Brazilian orchids have since been published in 'Iconographie des Orchidées du Brésil' (1996).

ROBERT BROWN & CHARLES DARWIN - THE GIANTS OF MODERN BIOLOGY

During the 18th and 19th centuries a dichotomy developed between the practitioners of herbal medicine and regular physicians. This was an essential and pivotal point in the expansion of scientific knowledge, since it opened the way for the rigours of objective scientific enquiry lead by proof.

In 1833, the Scottish botanist Robert Brown published a pamphlet called 'Observations on

the Organs and Mode of Fecundation in Orchideae and Asclepiadaceae'. The article contained the observation that the pollen of orchids, when placed on the stigma, emitted long tubes which could be traced down into the ovary. Having closely observed the leaves of *Cypripedium* orchids under the microscope, Brown also noted the existence of a peculiar dark, circular structure within the cells, like a single circular areola, which he called the 'nucleus'. It was the first time that the word 'nucleus' had been used for this intercellular organelle in cell biology. Some years earlier, Brown had observed under the microscope the irregular motion of tiny particles of orchid pollen grains in water. This phenomenon became known as Brownian Movement (1827). Although earlier botanists had described the structure of orchid flowers and observed visits by insects, the nature and variations of pollination mechanisms in orchids were first fully appreciated by the English naturalist, explorer and geologist Charles Darwin (1809-1882). In 1862, Darwin published the first edition of his book named 'Fertilisation of Orchids, with the subtitle On the Various Contrivances by Which British and Foreign Orchids Are Fertilised by Insects and on the Good Effects of Intercrossing'. This was his first essential contribution to the understanding of the strategies used by orchids to ensure propagation by cross-fertilisation (Cameron, 2011). Darwin also explained how complex ecological relationships could result in the co-evolution of orchids and insects. He considered the adaptations of orchid flowers to their animal pollinators as being among the best examples of his idea of evolution through natural selection, considering their floral structures '*as perfect as the most beautiful adaptations in the Animal Kingdom*' (Yam, 2009).

ORCHID CULTIVATION AND THE MYSTERIES OF SEED GERMINATION

The dust-like seeds of orchids were first observed and drawn by the Swiss naturalist Konrad Gessner (1516-1565), sometime between 1540 and his death in 1565. The earliest published description of a cultivated orchid in Europe can be traced to the herbal of Rembert Dodoens (1568), which illustrated a Slipper Orchid that had been drawn by Joannes

Vreccomtus, who had grown the plant in his garden in Brussels (Mathé, 2016). In England the first published record of an orchid in garden cultivation was made in 1597 by the author of 'Gerard's Herbal', John Gerard, this also being the Lady's Slipper Orchid *Cypripedium calceolus* (Cribb, 2014). An English botanist of Scottish descent, Philip Miller (1691-1771) mentioned several orchids in his first edition of the 'Gardeners Dictionary' (1731), including three species of European *Cypripedium*, which he had cultivated in the Chelsea Physic Garden while he was Curator.

Towards the end of the century, he described twenty species of *Orchis* native to the British Isles in the 8th version of 'The Gardeners Dictionary' (1768). He explained that transplanting orchids from the wild frequently failed because each species needed a particular habitat to survive. During the 19th century, many orchidologists had achieved some success by planting seeds in the soils the plants had been transported in from their places of origin. Gradually horticulturists began to concern themselves with the conservation and cultivation of these orchids, using greenhouses to reproduce tropical climatic conditions. Recorded horticultural attempts to germinate orchid seeds date to the mid-1800s (Jacquet, 1994). Sir Joseph Paxton (1803-1865) was the first grower to build and use different greenhouses with improved conditions of sunlight, ventilation, watering and humidity for cultivating species of orchids that came from different habitats. The first reported germination of orchid seeds was *Prescottia plantaginea*, from the Horticultural Society Garden in Chiswick, England, around 1830, but it was not until 1849 that the first detailed and substantiated paper on seed germination was published, this by David Moore (1807-1879), Director of the Glasnevin Botanic Gardens in Ireland. In 1820, there were just 130 species of exotic orchids grown in England, but by 1830 their number had exceeded 400. Orchidology was on its way. But despite the intense interest and much experimentation, the secrets of orchid seed germination through mycorrhizal fungi continued to remain a mystery.

NOËL BERNARD (1874-1911) - 'THE GREATEST HOPE OF FRENCH BOTANY'

During his short but productive career, Noël Bernard shed much light on the nature of the endophytic fungi found in orchids and their importance in the survival of these plants. His major discovery was the symbiotic germination of orchid seeds. This is where a soil fungus provides water, mineral nutrients and carbon to the seedling, compensating for the lack of seed reserves typical of the Orchidaceae. In 1899 Bernard was 25 years old, still studying for his doctorate and also doing his National Service in Melun when he discovered the dead inflorescence of the achlorophyllous orchid *Neottia nidus-avis* while walking in the nearby forest of Fontainebleau. In a letter to a friend about his find, he wrote that the *Neottia nidus-avis* flower was 'accidentally buried in the soil, under a layer of dead leaves. In the spring, the seeds, still inside the fruit, had not been released, but started to germinate'. Under the microscope, Bernard saw subterranean orchid seedlings and protocorms that 'no botanist's eye had seen before'. He also observed the fungal mycelial filaments associated with them, and became convinced that the fungus was providing nutrition. It was common knowledge at that time that orchids were generally infected by mycorrhizal fungi, but Bernard's work was to establish once and for all that the relationship was necessary for the survival of the plants. On January 26th, 1911, very weak but fully conscious until his last hours, Noël Bernard lost his long battle with tuberculosis. He was only 37 years old. In a note published after his death, Bernard reported on the fungicidal capacity of orchids. He wrote: 'even a relatively limited infection of the orchid *Himantoglossum hircinum* is sufficient for the orchid's tubers to acquire fungicidal capacity'. Bernard suggested that the orchid killed the fungus in a controlled manner, allowing it to survive in the soil during the winter and to re-colonise the plant the following spring. Antifungal compounds from orchids, such as hircinol, loroglossol and orchinol, were later discovered because of these observations (Selosse et al., 2011).

FROM GERMINATION TO INDUSTRIAL CLONING

Working in parallel with Bernard, in 1904 German botanist Hans Burgeff (1883-1976) germinated orchid seed in agar inoculated with the right species of mycorrhizal fungus. Although Noël Bernard had not formed a practical and reliable method for asymbiotic germination in 1904, the direction of his research had allowed others to do so (Arditti, 1979). In 1922, the American biologist Lewis Knudson (1884-1958) used an improved culture medium to reproduce germination in the absence of fungi. This he called the asymbiotic method. The Knudson Method and Knudson culture medium were named after the American (Arditti, 2010). In 1932, Burgeff, and independently, Carlos Cappelletti in 1935, cultured different fungi in association with various genera of orchid seeds. In 1949, Professor Gavino Rotor (1917-2005) at Cornell University made the first real attempt at propagating an orchid from *Phalaenopsis* genus by tissue culture methods. This was based on vegetative or meristematic propagation. Using Rotor's culture method, an orchid nursery owner Hans Thomale was the first to culture stem-tip explants of *Dactylorhiza maculata* in Germany in 1956. When the new plantlets formed and started to develop, he stated: '*This is a form of vegetative multiplication whose potential cannot be overlooked*'. Meristematic cloning methods were later used industrially by hundreds of horticultural companies and research laboratories worldwide (Arditti, 1984; 2000).

ORCHID HYBRIDS - AN INCOMMENSURABLE TREASURE

John Dominy (1816-1891), a British horticulturist working for James Veitch, achieved the first artificially bred intraspecific orchid hybrid: *Calanthe* × *dominyi* (*Calanthe sylvatica* × *Calanthe triplicata*), which flowered in 1856. Then in 1861, Dominy hybridised two different genera, *Goodyera* (*Ludisia*) *discolour* × *Dossinia marmorata*, which generated *Goodyera* × *Dominii* (Veitch, 1906). This was the first ever intergeneric orchid hybrid, or as Charles Darwin once called them: '*strange crosses between distinct genera*'. Over his lifetime, Dominy raised only 25 hybrids. In

1892, it was created the first tri-generic hybrid, *Sophrolaeliocattleya veitchiana*. Just one year later, in 1893, one of the most popular natural orchid hybrid in the world, *Vanda* 'Miss Joaquim' var. Agnes, was disclosed to the orchid community in Singapore by its discoverer, Miss Agnes Joaquim (1854-1899) (Arditti, 1984; Ridley, 1893). At the 1899 Singapore Flower Show, the orchid hybrid *Vanda* 'Miss Joaquim' var. Agnes was the main highlight. Ms. Agnes had lived just long enough to see her orchid win first prize and be publicly recognised for her achievement. Suffering from cancer, she died less than three months later. For its resilience and year-round blooming quality, *Vanda* 'Miss Joaquim' var. Agnes was chosen on the 15th of April 1981 to become Singapore's National Flower (Johnson & Wright, 2008).

THE 20TH CENTURY SURRENDERS!

At the beginning of the 1900s, the scientific interest in describing new species continued, and plants were still collected in large numbers in order to be sent to Europe, mostly to botanical gardens and wealthy amateurs. The requirements of botanical gardens as well as the considerable earnings from the trade of orchids generated a proliferation of horticultural companies in England, the Netherlands, Belgium, Denmark, Germany, France and the United States. Orchids became a social symbol of luxury and wealth in the West much as they had been in the Far East centuries before. Orchids that had once been reserved for the wealthy elite could at last be afforded by the masses. Orchid sales became gigantic business. The topmost orchid cultivator in the world is currently the United States, particularly California, where hundreds of thousands of plants are sold every year. In Europe, the most important orchid cultivation areas are in the Netherlands, Germany and France, which together produce hundreds of thousands of specimens a year. There is fierce competition from Southeast Asian countries like Thailand and Singapore where the trade in orchids triggers annual sales of tens of millions of dollars.

“Orchidelirium is beyond addiction and beyond hope”, revealed in 2006, William

Langley, journalist with The Telegraph newspaper.

Avid orchid collectors worldwide have a craving for new specimens that just cannot be satisfied. Today, there is a massive market for illicit plants and it seems the rarer and more valuable the find the better. Many of these collectors rely on buying specimens from people who have smuggled the orchids across borders without a permit and have obtained them directly or indirectly from the wild. Often the fact that a plant has been secretly brought into the country under wraps adds greatly to the appeal. Of course, this means that the collected plants are even more sought-after and expensive. Carlo Blistery, legal counsel to the American Orchid Society, says: *'There are people who are kind of romanced by the idea that a plant has been smuggled in. It adds to the attraction and they want to have it, no matter what'*. It cannot really be known how many illegally collected orchids are traded every year on the black market, although it has been estimated at over £6 billion (Langley, 2006). The supply routes criss-cross the world and in many ways the market resembles the international trade in drugs and arms. Eric Hansen, the author of *'Orchid Fever'*, recalls a conversation with an otherwise down-to-earth neighbourhood flower grower who told him: *'You can get off alcohol, drugs, women, food and cars, but once you're hooked on orchids you're finished. You never get off orchids. Never'* (Langley, 2006). Nevertheless, there is currently a longstanding debate about whether collection from the wild is always harmful. The argument is that world class facilities such as the Royal Botanic Gardens at Kew and numerous private horticulturalists may in fact be doing the world a service by propagating and preserving plants that are threatened by habitat destruction, so using the trade as a conservation tool. It is a Catch-22 situation.

But paradoxically, orchid smuggling led to new orchid discoveries in more recent years.

In 2002, American orchid dealer and entrepreneur Michael Kovach bought three magnificent, large flowered pink and purple slipper orchids from a roadside flower seller in Peru. Kovach smuggled one of the plants into the United States in his suitcase to Marie Selby Botanical Gardens in Sarasota to get the orchid

identified. The stunned experts confirmed that this was a species of the genus *Phragmipedium* previously unknown to science. They published the first scientific description of the flower within 8 days, calling it *Phragmipedium kovachii* to the honour of its discoverer. Following an investigation Kovach was arrested and fined for breaking the international CITES treaty prohibiting the movement of wild orchids across borders. He was fined and put on probation, narrowly avoiding a prison sentence. Federal officials charged the Marie Selby Gardens and one of its employees with illegally possessing the plant. On returning to Peru, Kovach found to his dismay that all of the wild plants, some 500 or so specimens, had already been dug up and removed from the area by plant poachers. Meanwhile, wild specimens were reportedly being sold to collectors for up to \$10,000 each. Despite the illegality of the actions, the intrepid back-stage story and many calls for his name to be removed, Kovach's surname currently remains as the species epithet for this orchid (Yoon, 2002). *Phragmipedium kovachii* is considered to be the most important orchid species to have been found in the Neotropic Ecozone in the last 100 years. Orchid specialists say the newcomer is a multimillion-dollar commodity that will enable breeders to produce a novel array of Slipper Orchid hybrids, which beauty will defy imagination (Shapira, 2002).

In 2004, an established pharmacist and head of a pharmaceutical company, Sian Tiong Lim (1974-2014), had a permit to bring certain orchids into Britain from Malaysia, but attempted to bring some rare orchids into the country hidden among the others. He was discovered with several wild-collected orchids in his luggage on his arrival at Heathrow airport in England. Among the 126 specimens found in the consignment, there were several species threatened with extinction in the wild. Experts from the Royal Botanic Gardens at Kew who were called in to identify the plants. They were so rare, that one orchid expert at Kew had never ever seen them before. Lim was imprisoned for 4 months, which, it was said, nearly destroyed his life. He was also struck off from practising pharmacy for bringing the profession into disrepute. The scientist sadly passed away in 2014 aged 40, killed in a

cycling accident in Richmond Park, London (Morgan, 2014).

Orchidelirium is clearly alive and well!

As fashions change sometimes certain species go out of favour for a while, but for their beauty, fragrance and endless variety, orchids have been delightful companions not only for orchid lovers worldwide, but for mankind throughout history. There is little doubt that this most beautiful and intriguing member of the Plant Kingdom will remain a firm favourite, now and in the future (Guérin, 2004). The only question is, will we still have wild orchids growing in their natural habitats, or will the only orchids we have left be growing under artificial conditions? Perhaps only time will tell.

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