THE ORCHIS FAMILY.

The peculiar manner in which fecundation takes place in the flowers of the plants belonging to the orchis family has always attracted the attention of naturalists, and when Darwin, a few years ago, published the results of a series of experiments and observations, made with a view to throw additional light on the mode in which mutual fecundation is effected between individuals of the same as well as different species and genera, the work was received with much interest by the entire scientific world.

Generally only one, rarely two, stamens are developed in plants of this family. The stamen is considerably longer than, but entirely coherent and confluent with, the style on which the two-celled anther is situated. The latter consists of a slender stem or caudicle, to which are attached two club-shaped arms. The glands of the stigma, to which the stalks of the pollen masses cohere, are contained in a common sac formed by a fold in the lower portion of the stigma.

The pollen grains of the orchidaceæ vary in shape as well as in structure and appearance. The pollen is sometimes pulverulent, and in isolated grains, as in some species of neottiæ, but more frequently cohering in waxy masses or clusters. To effect fecundation the pollen must, by reason of its position relative to the stigma, be forced by some mechanical means from the pouches in which it is contained, the anther being moved toward the extremity of the stigma, which, like the base of the anther, is covered at maturity with a viscid mass.

The perianth may be divided into two portions: the outer, consisting of the three sepals, and the inner, formed by three petals. Both sepals and petals are of the same texture and appearance. The upper or posterior petal appears generally, on account of the twisting of the stalk and ovary, to be the lower or anterior one, and is called the lip. To this is attached the nectary in form of a spur. The nectar contained in it serves solely to attract insects, the intermediation of which is, in the majority of the orchidaceæ, indispensable for fecundation. As soon as an insect inserts its trunk into the nectary, the anther moves forward, the pollen is forced from the pouch, and attaches, by means of the waxy mass by which it is held together, to the trunk and head of the insect. Frequently butterflies, bees, etc., are found, the trunks, heads, and fore legs of which are covered with pollen. The insects rarely effect the fecundation of a flower by its own pollen. In the majority of cases the pollen is deposited on the stigma of a flower visited afterwards, to which it adheres by means of the viscid mass covering the stigma. It happens frequently that the pollen is perfectly developed, while the female organs of reproduction are not yet ready to receive it, and it seems as if the large majority of orchidaceæ were almost entirely dependent upon the services of insects for the procreation of offspring. This may explain the great variety of species occurring, as well as the differences frequently observed between individuals of apparently the same species. This peculiar mode of fecundation led Darwin to conclude "that, according to the laws of nature, mutual fecundation must take place between individuals belonging either to the same or different species of living organisms, and that hermaphrodites are unable to fecundate themselves for an indefinite period."

As stated above, the male and female organs of generation arrive at maturity at different periods. In some the stamen arrives at maturity before the stigma; these are called protandria, while those in which the contrary takes place are called protogynia. The orchidaceæ were, together with a few plants belonging to other families, but showing similar peculiarities, formerly placed apart from the phanerogamous as well as cryptogamous plants, under the name of dichogamæ (twice married), but this classification has, of late years, been abandoned.

The non-maturity of one organ at the period of full maturity of the other naturally renders both indifferent to each other, and nature has in its wisdom remedied this evil by the intermediation of animal agents.

This has been proved beyond doubt by innumerable experiments. Hildebrand and Scott, who are among the closest and most diligent observers in this respect, found it impossible to fecundate a flower with its own pollen, but they were most successful when they fecundated flowers with pollen derived from other individuals, even when derived from different species. J. Müller states that the pollen of a species of oncidium acted like poison on the flowers of the individual that had produced it and killed them.

From this general rule there are few exceptions, of which we may mention the vanilla. Darwin admits the probability that the other members also of the order *Malaxideæ* fecundate themselves. To demonstrate this fact, plants were grown, and throughout their life completely cut off from any communication with other plants or from insects. They nevertheless produced normal seeds. Moggridge, another authority with respect to the orchid family, has observed the same in the case of *Orchis intacta*. In all those species, however, in which the aid of an insect is not required for fecundation, the pollen is not found in waxy, adhesive agglomerations, but as a fine powder, the particles of which do not cohere and easily separate and fall into the opening of the stigma.

Some orchidaceæ are devoid of the beautiful green color of other plants, and on account of this they have by some been believed to be parasites. Closer investigations, however, have shown this idea to be erroneous.

The orchidaceæ vary greatly with respect to the form of all their vital parts. While some bear tubers similar to those of colchicum, others possess a spindle or bulb shaped root, and others again rise from amidst a network of fine fibrous rhizomas. Those that, like the vanilla, climb up on trees or rocks, send out numerous aerial roots, which, even when not reaching the soil, contribute much toward the maintenance of the plant. In our greenhouses orchidaceæ are frequently met with; the rich, glossy, silvery strains of aerial roots attract general attention. Instances are not uncommon in which the connection between the plant and the soil have been gradually broken, until the plant remained suspended in the air from a wire, without any other means of support than the gases and vapors inhaled by the pores of the aerial roots. These, and especially the epidermis, are in this case altered in structure to suit the circumstances. The pores are found to be larger in number as well as in size. The epidermis becomes thicker, and the aerial roots generally become in a superior degree fitted to discharge the duties which formerly devolved on the subterraneous roots.

The leaves vary greatly in form and size. In some genera, as Vanda, Agrœcum, Phajus, they are very large and fleshy, while in others they remain quite small. Orchidaceæ of tropical climates especially are distinguished by their thick, fleshy leaves, the epidermis of which is very thick, and tough. They are very succulent, and serve as cisterns for storing water, which enables the plant to survive the heated term. Frequently the leaves are transformed into bulbs, which, apparently dead during the hot season, nevertheless send forth numerous young shoots as soon as the first rainfalls supply the necessary moisture. Of plants the flowers of which surpass in elegance and beauty of colors anything else the vegetable kingdom produces, we might naturally expect the leaves to be more or less devoid of ornamental beauty in color or shape, yet Blume met with some most beautiful species on the Malayan Islands, the leaves of which were lined on one side with a velvet-like tissue of silvery hue, while the other reflected in great brilliancy all the colors of the rainbow.

While the orchidaceæ indigenous in the temperate zones are generally annual or biennial herbs of from six inches to eighteen inches in height, the tropical zones possess a great many which are perennial; in these the stem is of a ligneous texture, and they generally climb upon trees or rocks. Their flowers emit fragrant odors, and excel all others in the variety and brilliancy of their colors as well as in shape. Some species of Sobralia, for instance, attain a length of from twenty to thirty feet; Aerides and Vanda reach a height of four to six feet. On the Fiji Islands some species are found the stalks of which are hard enough to be worked into canes and whip sockets of great durability.

A true representation of this class of orchidaceæ is the vanilla plant, which is also in fact the only one from which a product of commercial value is obtained.

The culture of indigenous as well as exotic orchidaceæ in gardens and nurseries has become both a science and an art. Large volumes have been written on the best modes of raising and propagating them.

Species indigenous in tropical zones must be kept in hothouses at a temperature corresponding to that under which they live in natural conditions. Due attention must be also

THE ORCHIS FAMILY.

paid to a proper regulation of the moisture of the atmosphere. In many cases exposure to direct sunlight must be avoided, as in the dense forests of America and Africa, or the jungles of India. direct light does not reach these plants, but they only receive it as reflected from and transmitted through the foliage of the trees.

Many orchidaceæ require also a very rich humus soil. That of the forests and swamps is very rich in decaying vegetable matter, and the nearer the soil in which they are to be raised approaches to that naturally selected by them the better they will develop. In France very good results have been obtained by planting the seeds or tubers in a stratum of half decomposed moss, species belonging to the genus Sphagnum being generally preferred on account of the large quantity of water which they are able to retain. This artificial soil must be well fertilized by guano, as it contains in itself little nourishment.

The duration of flowering, as well as the time at which it begins, varies greatly with the different species, and this circumstance is one of the principal reasons for the favor with which orchids are generally regarded. Odontoglossum, Aerides, Agrœcum, Vanda, Zygopetalum, Saccolabium, and others flower for periods extending from a few days to several weeks. On the other hand there are others that flower only for a single day.

The irregularity existing in this respect permits the artificial prolongation of the period of flowering of some species by the aid of another. Instances are related in which plants, which generally flower from one to two days only, were kept in bloom for some time by being fecundated with the pollen of another species flowering through a longer time. New varieties of great beauty have also been obtained in this manner.

The geographical distribution of the orchidaceæ is very extensive, hardly any portion of the globe being entirely devoid of them. They abound, however, principally in the hot zones, especially in America. During the past few years quite a number of interesting species have been discovered in Australia and on the islands of the Malayan Archipelago.

One of the most common orchids found throughout the temperate zone, on both hemispheres, the vanilla, belongs to the group Arethusea, the members of which belong exclusively to the tropical zones. Epidendrea are of American origin, it being questionable whether the few species found in Asia are indigenous there. All the other genera have members indigenous in all continents.

Excepting the pods of the vanilla plants the articles of commerce derived from the orchid family are of little importance. The tubers of Orchis Morio, Militaris, Mascula, Maculata, and other species, contain large quantities of mucilage and starch, and they were formerly largely used as an article of food. Dioscorides mentions this fact, stating that by drying the tubers lose their peculiar bitter taste. This is done to some extent at the present day, especially in Egypt, Nubia, and Abyssinia.

The tubers of orchids have, under the name of *salep*, been admitted into the reciparium of medicine, and are highly valued, in the form of mucilage, as an emollient and demulcent in inflammatory diseases of the stomach and bowels.

The root of cypripedium, or lady's slipper, is also officinal, and is used as a popular household remedy in nervous and epileptic affections, but it is probably inferior to valerian. *Ophrys nidus-avis* was formerly used as a vermifuge, but seems to be of little value. A decoction of *Neottia ovata* forms a good dressing for wounds, but has been replaced by other agents of more modern origin. Many other orchids are here and there used for gout, and other diseases, but with the exception of *Spiranthes diuretica*, which seems to be a good diuretic, none of them appear to be of special value.—*T. Poisson in La Nature.*

THE NEW YORK ACADEMY OF SCIENCES.

At a meeting of the Biological Section of the New York Academy of Sciences, on Monday evening, April 28th, the President, Dr. J. S. Newberry, occupied the evening with some interesting notes on the various

"DEVICES EMPLOYED IN NATURE FOR THE DISTRIBUTION OF SEEDS OF PLANTS."

The speaker remarked, in substance, that we find among plants a host of adaptations to enable them to overcome the many obstacles that they meet with on every side in their struggle for existence. In tropical countries, where plants are most highly favored, we find their vegetative parts highly developed; but as we ascend northward and approach the arctic regions, we find the energies of the plants more and more directed toward a greater increase of the reproductive parts; so in such latitudes arboreal vegetation becomes reduced to mere shrub-like plants, yet completely loaded down with a mass of flowers and fruit. The struggle for existence in this case is aided by redundancy of fruit, for at least 99 per cent of all the seeds produced by the flora of such regions must, through the nature of the surroundings, either perish or fail to germinate.

Plants being immovably fixed to the spot where they grow, must necessarily be provided with some way of distributing their seeds, in order to insure the perpetuation and extension of their species. As a large proportion of all the seeds that are produced must, through many causes, fail to germinate, many plants make provision against such an accident by yielding these in immense quantities. The tobacco plant, for instance, produces at least 350,000 seeds in each of its capsules, and thus. by this very redundancy, is enabled to overcome a thousand obstacles in the way of its propagation.

But coming directly to the subject to be especially considered, there is a class of devices employed by plants to effect the dispersion of their species over a wide extent of country, which are mechanical; and such devices are various and confined to no particular group of the vegetable kingdom.

The first method to be considered, and the one that is most conspicuous, is that of distribution by the wind, and we see the effort constantly being made by nature to spread seeds broadcast in this way. A large number of plants depend on this method for their wide dispersion, and their seeds are so constructed as to enable them to take every advantage of it. The extensive order of plants, the *Compositæ*, depends largely but not entirely on this means. In many of the genera of this order, the one-seeded capsules remaining on the disk after flowering are surmounted by a tuft of fine hairs called the "pappus," which is really the hair-like calyx of the florets. This being persistent and increasing in size as the fruit goes on maturing, forms a feathery sail to carry the seed far away through the air. The pappus varies in different genera, both in form and size; sometimes it consists of hairs, sometimes of feathers, and sometimes it is mounted on a stipe, so that it resembles a parachute. Familiar examples of this may be seen in the dandelion, thistle, etc.; and it is by such a means that is distributed the *Erechtites*, a composite plant, which, from its habit of springing up suddenly on recently burned-over timber lands, where it was before unknown, has acquired the name of "fire weed." This device is not confined to composite plants; we find examples of it likewise in the asclepiads or milkweeds, whose seeds are provided with long silken comose appendages, by means of which they are wafted to great distances by the wind. The fruit of the virgin's bower, too, is furnifhed with long plumose tails, like downy tufts, which serve a like purpose in the economy of the plant. Other familiar examples may be seen in the seeds of the cotton plant, dog's bane, etc.

Another mode of wind distribution is by means of what maybe called the "balloon." In many plants the seed vessels, during the progress of maturing their seeds, become greatly inflated and balloon-like; and when detached from the parent plant are readily carried through the air or rolled along the ground by the winds to considerable distances. We have familiar illustrations of this in our balloon-vine or *Cardiospermum*, which is very remarkable for its large, inflated membranous seed capsules; in the common "bladder-nut" of our woods; and in the "ground cherry" and Bougainvillea. The varieties of this sort of fruit found in nature are very numerous.

The dispersion of the seeds of still another great group of plants is effected through the aid of "wings." Appendages of this kind, both to seeds and seed capsules, are various. One of the more familiar forms is that known as the "samara," characteristic of such trees as the elm, maple, and ash. By means of their membranous, wing-like expansions (entire and circular in the elm, or two diverging "keys" in the maple) this form of fruit is enabled, when ripe, to go fluttering away through the air like bits of paper. A like device is found in the fruit of the conifers, nearly all the species of which are provided with seeds having their membranous wings.

A very large number of plants are distributed through the involuntary acts of man and the lower animals. To effect this, seeds and fruits have been provided with various kinds of appendages, and one of the commonest of these is "hooks." Familiar examples are to be seen in the involucres of the burdock, the outer surface of which is covered with scales terminating in hooks; in the "beggar's ticks" (*Bidens*), the achenia of which are two horned and adhere to every passer-by; in the clotweed, the burr of which is covered with stiff hooked prickles; and in the "hound's tongue" (*Cynoglossum*), the seeds of which are armed with hooked prickles. In the leguminous plant, *Desmodium*, the seed pod or loment is not only covered with minute prickles, making it adhesive, but it also breaks up at the constricted joints, so that the seeds have a greater chance of being still more widely scattered.

Another method of seed dispersion is by what may be termed "explosion." This, too, is exhibited under a good many different forms. One of the most curious of these had lately come under the speaker's observation, and suggested to him the subject of his present remarks. Some time ago a student had brought him from Cuba a specimen of the fruit of one of the *Euphorbiaceæ*, the "sand box" or *Hura crepitans*. This fruit is a hard and woody capsule, discoid in shape, something like a muskmelon, but very deeply ribbed, and about three inches in diameter. He laid the specimen on his writing table, and while reading the other evening he was suddenly startled by an explosion as loud as the report of a rifle, fragments of some material at the same time flying through the air to every part of the room. On examining these he found them to be the seeds and broken pieces of the sand box fruit. A study of one of these capsules shows it to be a marvel of ingenuity in the arrangement of its parts to accomplish seed dispersion. The rib-like processes are seen to consist of carpels placed parallel to a common central axis, and these on becoming dry open very suddenly with a loud detonation, the force being exerted by two strong woody springs, between which the lenticular seed is inclosed.

Other illustrations of seed expulsion by "explosion" are found in such plants as the balsams (*Impatiens*), the pods of which at a mere touch throw back their valves and eject the seeds with great violence; in the Mexican *Astragalus*, the vesicular pods of which explode when mature; in the g[illegible]an; in the common lupine, and in many other plants. In some of the cucurbits, too, we find force of this kind exerted in the expulsion of the seed, particularly in the squirting cucumber, the fruit of which when fully ripe throws out its juice and seeds with considerable force through an opening at its base. Many examples of this method of expelling their reproductive bodies are found also among cryptogams. In the liverwort (*Marchantia*) the minute spores are contained in globular capsules, and intermixed with spiral threads or *elaters*, by the untwisting of which they are ejected to some distance. In the "horse tails" (*Equiseta*) we find something analogous: the capsules of the plants are filled with minute spores, to each of which is attached (and wound spirally around it when moist) four club-shaped elastic appendages. These filaments are hygrometrical, and rapidly uncoil when they become dry and cause the spore to move about, and are admirably adapted to aid in the dissemination of the plants.

Many kinds of plants are distributed in still another way. Certain hard and indigestible seeds often accompany delicious and succulent fruits. The latter being eaten by man or the lower animals, the seeds pass through the alimentary canal unchanged and unharmed. By this means very many hard seeds, such as those of the dogwood (*Cornus*), etc., swallowed by birds, are often carried by them and deposited at a great distance from the place where they were produced.

Another method of seed distribution is by means of the "waves." A large number of tropical plants, whose seeds are so protected as to be unaffected by the action of water, are floated off to immense distances and deposited on the shores of foreign countries, where, if the conditions for it are favorable, they germinate. By this means the cocoanut has been transported from one country to another; and in this way the coral islands (which are of comparatively modern formation) have been stocked with this as well as with other tropical fruits. The well known sea beans, which grow on the river banks of Central America, are carried by the rivers to the ocean, and, transported by the waves of the latter, are often thrown on the coast of Norway.

Dr. Newberry then mentioned a method of seed dispersion common to one of our native trees, and which he stated he had never seen noticed in print. Our button-ball tree or scyamore (*Platanus*), although found in elevated places in the Eastern States, prefers the moist alluvial soil of bottom lands, and in such situations in the West grows luxuriantly and attains an immense size, the trunk sometimes reaching 10 to 12 feet in diameter. The seeds of this tree are produced in a "capitulum" or globular head attached to the branch by a stiff stem 4 or 5 inches long. In our common species these balls are solitary, but in a California species—the *Platanus racemosus*—three or four balls are borne on the same stem. These globular balls of seeds are persistent and hang upon the tree, on their long woody pedicels, throughout the winter. By the action of frost, and through the effect of alternate freezing and thawing, the woody pedicels become ultimately reduced to mere thin fibers, strong but exceedingly flexible. By the action of the winds of early spring the balls are beaten violently against the branches, and the seeds are thus detached and fall into the waters beneath. Now it so happens that all this takes place just at the season when freshets have caused the rivers to be at their highest, and as the waters afterward gradually subside the seeds are distributed far and wide over a large extent of country.

In conclusion, Dr. Newberry described and illustrated by a drawing on the blackboard the curious pods of a Western plant, the *Martynia proboscidea*, or devil's pod. This plant has large showy flowers, and its fruit consists of an oval fleshy pod terminating in a long rostrum or beak. The pods when mature are woody, and when ready to discharge their seeds the beak splits into two very rigid incurved horns abruptly bent at the ends into a very sharp grappling hook. This device is frequently utilized by the plant to effect its distribution, and the mule is made to act as the agent to accomplish it. When the animal steps on one of the pods (a matter of frequent occurrence) the pod opens, and the two rigid hooks clasp around his fetlock, and there remain until noticed by some person, for it is impossible for the mule to remove the pod by any effort of his own. In this way the devil's pod is often transported to great distances.

The speaker suggested that the devices employed by plants for the preservation of their seeds from injury would form an interesting topic for discussion, and hoped some one would bring the matter before the Academy in the form of a paper.

Wheeling as a Manufacturing City.

In a recent conversation reported in the *Tribune* of this city, Governor Matthews, of West Virginia, spoke of Wheeling as one of the chief iron making cities in the country. It turns out yearly more than one-third of all the nails made in the United States, and fully one-fifth of the annual production of the entire world.

Wheeling is also heavily interested in the manufacture of glass, which it ships everywhere —even to London. Brazil and Australia are among the best markets for its glass.

One feature of this industry is rather singular. Wheeling manufacturers make the beautiful glass chandeliers which have become so fashionable of late, but they import the cut-glass pendants from Switzerland, where the peasants make them by hand cheaper than they can be made by machinery in this country. Many of these chandeliers are sent to London, so the pendants make two voyages across the ocean.