

### The Cross-pollination of Plants.

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In order to understand anything about the cross-fertilization of plants, we must first learn the structure of the blossoms. If we examine an apple blossom, we find underneath green leaves, called sepals; above these are five petals, the most conspicuous part of the flower, while in the center rise the pistils, which are surrounded by a whorl of stamens.

The sepals are persistent, protecting the blossom bud before it opens; in the apple they form the five tiny appendages round the eye of the fruit. The petals fall soon after the flower has been fertilized, their mission being to attract the insects. The stamens are modified leaves, consisting of anther and filament, corresponding to leaf stalk and blade of ordinary leaves. The anthers are divided into four chambers, in which are produced the pollen grains, or fertilizing dust. [Ganong, in "The Teaching Botanist, page 147, says: "Another common error is that of attempting to homologize the parts of the stamen and of the carpel with the parts of the green leaf."—J. D.]

The stamens and pistils, although generally the most inconspicuous parts, are really the most essential. The pistil is also a modified leaf, though it is difficult to realize this; it is composed of three parts, ovary, style, and stigma.

The ovary is a partitioned cell, in which grow the ovules, or rudimentary seeds; in different plants it varies in shape and size. The ovules are attached to the ovary wall by a tiny stalk, and they eventually become the seeds when fertilized.

The style is not present in all flowers, but its use is to elevate the stigma, and to secure pollination.

On top of the style grows the stigma, or pollen receptacle; it has a corrugated surface, which serves to retain the pollen; it also secretes a sweet, sticky substance, which causes the pollen to adhere, but its chief use is to nourish the grains, and to enable them to grow down the style, until they reach the ovules. Such growths are called pollen tubes; the sweet secretion does not appear until the stigma is ripe enough to be pollinated.

Pollination begins to take place when the pollen grain is deposited on the stigma; if all the conditions are right, it begins its downward course, forming the cylindrical pollen tube, which threads its way between the tissues of the style, absorbing its nourishment from the food which the stigma has prepared for it.

Nature has arranged many devices to secure cross-pollination. Some flowers cannot be naturally fertilized by their own pollen. Many flowers are necessarily crossed; willows bear one sex only on each tree, while the cucumber family bear two sexes on one plant, yet in different flowers. Nature employs many agents to bring about a cross; perhaps the most effectual one is the wind, which pollinates grasses, sedges, and pines.

It is noticeable that wind-fertilized flowers are inconspicuous, mostly blooming in the springtime, when winds are prevalent. They produce an abundance of pollen, which is blown hither and thither, almost every blossom being fertilized, although much of the pollen is wasted; this waste being provided for by the production of a large amount of pollen in such plants. Water is less common in aiding cross-fertilization, yet many of the water flowers are pollinated through this agency; one of the most interesting methods occurs in Vallisneria. The plants produce staminate and pistillate flowers; the staminate opening below the water, while the pistillate rise to the surface and expand; meanwhile the staminate are preparing to set free pollen, which also rises to the surface, and floats until it comes in contact with the stigma; then the pistillate flower is drawn down to the bottom by the coiling of the long stalk, and the seeds mature in safety.

[The staminate flowers do not open below the water. They break off, come up to the surface, and then shed their pollen around the pistillate flowers.—J. D.]

Many flowers are adapted to cross-fertilization by insects; indeed, some flowers depend wholly upon them for their pollination. Only certain kinds of insects are useful in aiding cross-fertilization; these are those with hairy backs, bees, moths, flies, butterflies, and some kinds of beetles come in this class; insects like ants, smooth-backed beetles, bugs and the like, are of no use in pollination, especially crawling ones, which the plant discourages, and even checks their visits to the flower. [Some observers say that Scrophularia's pollen is carried or transferred by ants.—J. D.]

Insects are attracted by brightly-colored petals, the shape and perfume of the flower. The most important of these are the bees; they do everything systematically; if they are visiting foxgloves, they always begin at the base of the spike, thus transferring pollen from the ripest flowers to the ones above. Not only does the bee do everything systematically, but thoroughly, rising long before the majority of insects have stirred, and never tiring until the sun is setting. If a bee is visiting a raspberry patch, it continues to do so until the whole patch is finished. If it went from raspberries to blackberries, and then to roses and other flowers, it would be a mutual loss, for the flowers would fail to be fertilized, and the quality and color of the honey would be inferior. [As a rule, nectar-seeking insects do not go from one to another kind of flower at haphazard.—J. D.]

Too much cannot be said of the importance of bees in orchards; few people realize how much work they do, or how necessary they are in aiding the setting of fruit.

Many trees cannot set fruit at all, unless they are cross-fertilized; this is evident in peach and melon culture under glass; each blossom must be pollinated by transferring pollen on a brush from flower to flower in the case of the peach, but in the melon house a staminate flower is inserted in a pistillate one. Some varieties of apple are self fertile; that is, they are able to set fruit with their own pollen; such varieties are the Baldwin and Greening, but it is quite possible that even they would be better for a cross. Often the best varieties are self sterile; that is, they cannot set fruit unless insects deposit foreign pollen on their stigmas; the Bishop, Pippin, Gravenstein, Red Astrachan, Primate and others belong to this class, therefore it is better to mix varieties in an orchard. ["Cross fertilized" is not the appropriate word. Some trees do not self fertilize, because either (1) they do not produce virile pollen, or (2) they need assistance from insects, etc., to convey it.—J. D.]

All the pruning, grafting, fertilizers and tillage count as nothing towards the production of fruit, unless the blossoms are pollinated, and this cannot be accomplished except by the presence of insects.

While the bees are rendering this service, the flowers spread for them a feast of nectar, which the insects carry home and manufacture into honey, wax, and with pollen, bee bread; thus the bee depends upon the flower for existence, just as truly as the flower depends upon the bee.

While everything is done to encourage the bees, just as many plans are devised to keep off their relations, the ants. Like the bees, the ant family is a hard-working set, but they seem to lack application, and have the misfortune to be of little use to the flowers; most of them crawl, and as this is a more laborious method of reaching flowers than flying, they crawl up the first stalk they come to, regardless of the family of plants—that is, if they can ascend it. As ants have shiny backs, they do not retain the pollen; if they did, they would probably waste it on other plants of different orders, and as it is produced at great expense to the plants, they cannot afford to waste it; so downward pointing hairs are grown on the stalk, which prevent the robbers' ascent; endless other devices are arranged—the bowls formed by two leaves growing together in honeysuckles and teasels, which hold the rain water, and drown all climbing adventurers. Exceptions occur, when the flowers encourage ants as a protection against browsing quadrupeds; even then they are never allowed inside the flower, sweets being secreted on the outside for their benefit. [One seldom finds water held by amplexical leaves for any length of time.—J. D.]

Flies, unlike bees, are not attracted by sweet perfumes; generally the most vile-smelling flower is a fly's delight. The calla family is characterized by its evil odors; it is supposed to lure flies by an odor like that of decaying meat. In the calla we find two rows of flowers, the lower pistillate, and the upper staminate at the base of the white trumpet, which is ordinarily called the flower; above these whorls is a row of downward pointing hairs, forming a trap at the bottom and guarding the floral chamber. Flies are attracted by the odor, and proceed down the spathe to investigate, only to find that when they have passed the barrier of hairs they are prisoners. In vain they fly upwards. In so doing, they jar the pollen on the pistillate flowers, which is just what the plant trapped them for; when they have worked at this for three days the hairs wither and release them. [I have read of this treatment of insects by a species of aristolochia; perhaps it is also true of calla.—J. D.]

The evening primrose, honeysuckle and many others are nocturnal flowers, for the same reason that others are diurnal, to secure cross-pollination. It is noticeable that evening flowers have long necks, or corolla tubes, down which no bee could get its prolegs, and they often remain closed during the day, opening only at the approach of night. Nocturnal flowers are white, yellow, or some light color, which stands out in the gathering gloom, when others, by reason of their colors, have faded from view. This is only another device to ensure cross-fertilization—by moths. These insects are attracted from long distances by the sweet perfume of evening flowers, which is often more powerful after the twilight has deepened; it is a noiseless call to the night workers to come on duty when everything is silent. The moths uncoil their spiral tongues, and suck the nectar from the base of the deepest flowers, at the same time brushing the anthers and stigmas with their hairy, almost feathery little bodies.

All these contrivances show how beautifully nature has arranged plans for cross-fertilization. The aim of all plants is to perpetuate the species. A plant must grow where the seed falls—it has no choice of site—consequently must adapt itself to its surroundings; it is only those that possess the greatest adaptive power that can survive—not necessarily the largest or strongest. Plants which have this power most developed are those that have been cross-fertilized; crossing strengthening the type, while inbreeding weakens it. Crossing plants has long been practiced by man. The progenitors of the apple of to-day were once crabs, sour as vinegar, perhaps no larger than a bullet, and almost as hard, but centuries of patient selection and waiting have brought the apple to its present-day perfection. Enormous strides have been taken during the last fifty years in its culture and improvement, and this is but a single instance of what has been accomplished in the amelioration of our fruits, largely through the agency of cross-fertilization. At most every other fruit known to man would give as striking examples. In view of all this, is it too much to say

that no other single factor has wielded so potent an influence in the plant world as has cross-fertilization? [Selection rather than cross-pollination. Both go together, but usually the first is of greater importance in respect to improvement of varieties.]

Oats and some other plants are fertilized before the flower opens. Chlorophyll-digestion is a factor vastly more important than cross-fertilization.—J. D.]

### Fireside Philosophy.

When everyone else plunges, stand pat.

Labor is valuable nowadays. Are you wasting any this winter?

Theory is a matter of principle; practice a matter of detail.

How about the manure heap? Fermentation loses us nitrogen; leaching loses us nitrogen, potash, and more or less phosphoric acid. Leaving the manure in the barnyard mortgages our time next spring. Can we afford these leaks?

Sow barley on the old root or fodder-corn patch near the barn, and seed it down to clover this spring. Convenience is not an adequate reason for growing roots year after year on the one spot. These old root patches are sink-holes which annually swallow up many tons of manure badly needed in other fields, while the same fields are almost certainly in need of a cultivated crop. "It is time for a change."

The essence of the principle justifying a law to exempt woodlands from taxation is that any legislation is warranted which helps to bring the interest of the individual into line with the interest of the public.

When dissatisfaction begins to brew there is nothing like bringing things to a head. The recent discussion on the hog question, culminating in the conference at Toronto, undoubtedly did much to clear the air, and the hog business is on a better basis because of it. If packers can now be persuaded to discriminate in price against the thick, fat hog, there will remain no reasonable ground for complaint.

### Approves of Exemption.

To the Editor "The Farmer's Advocate":

You are certainly in order in drawing attention to the condition of our remaining portions of forest, and to the need for energetic action, if they are not to be completely cleared off. That in many sections very little timber remains is well known to all. In the country surrounding London there are not nearly so many trees per acre as in the city itself, and the city trees are much the most thrifty. Something seems to be out of joint when more growthy forest in its natural condition can be seen in Springbank Park than for miles around. Probably the most feasible plan to create an interest in the preservation of wood-lots would be as you suggest—for the Legislature to pass an Act permitting municipalities to exempt from taxation, say ten acres, on every hundred-acre farm, on condition that it was reserved strictly for the growth of timber, all stock being rigidly kept out. By this means some inducement would be given to farmers to co-operate with the Government in forest preservation, and attention would be drawn to the possibility of keeping up on the wood-lot a healthy and continuous growth of timber. Many farmers do not believe that there is such a possibility. The idea has prevailed that, not only does it pay to cut down the woods and buy coal for fuel, but that it is impossible to save them, anyhow; they are doomed. The first notion is not so firmly held as it once was, the rise in the price of lumber—barrel timber, for instance—being such as to stagger people; but the belief that it is now too late to do anything is common. Government action, especially if along the line of bonus by tax exemption, would do much to dispel this error, and people would soon learn that a wood-lot can be kept thrifty and productive simply by keeping stock out. The one objection to the suggested system of paying people to do what, in the public interest, they ought to do of themselves. But as it is clearly in the public interest to have the country dotted with clumps of forest, the objection loses most of its force.

Middlesex Co., Ont.

### Always Welcome.

Received my premiums Saturday evening. We are all highly pleased with them. They exceed our highest expectations. "The Farmer's Advocate" is always a welcome guest at our home. I always enjoy "the news of the day." Wishing your paper every success, and again thanking you for the premiums, I am,

HENRY TOCHER.