

INSECTS AS FRUIT POLLENATORS.

by

W. A. BOYS.

INSECTS AS FRUIT POLLENATORS.

There has perhaps been an idea quite prevalent among the majority of people for ages past that color, fragrance and all that is pleasing in flowers to the senses of man were created for his enjoyment. Christian Conrad Sprengel seems to have been the first to take a different view of the subject. In 1787 he discovered that in most flowers that contain nectar it is so located that insects may have easy access to it and that at the same time it is protected from destruction by rain, and he concluded "that the nectar of these flowers is secreted for the sake of insects and is protected from rain in order that the insects may get it pure and unspoiled." He also observed that there were certain markings near the nectaries which he concluded were pathfinders or honey guides. This led to the conception that if these markings were to lead the insect to nectaries then the color of the flowers was first to attract the insect to the flower.

Although his conclusions as to the importance of cross-fertilization in plants were rather meager, as later investigations has revealed, he was the means of starting observations which were carried on by others in later years that have given more established facts.

There has been much study on the relation of insects to flowers in cross-pollenization since the time of Sprengel. As it has

been demonstrated that there is a decided benefit to plants in cross-pollenization it seems that nature has provided for such through the process of natural selection in which flowers have become adapted to visits of insects.

In this thesis will be given the results of some original observation as to the kinds of insects which mostly frequent flowers and as to the relation of fragrance, color and structure to insect visits. Only insects belonging to the family andrenidae and apidae were especially observed.

Plum. (Prunus Species).

On April 6th these trees were practically all in full bloom. The flowers are white and nectar quite easily accessible. The stamens are numerous and of about equal length symmetrically arranged about the pistil. The pollen seemed to be matured, also the stigmas, as grains of pollen were seen adhering to the stigmas. The flowers are very fragrant.

Insects collected: Family Andrenidae, Genera Halictus, Colletes, Andrena, Angochlora. These insects were present in comparatively small numbers but honey bees were present in great numbers. The next day a rain fell after which the fragrance seemed to be greatly reduced and also the number of insects greatly diminished.

Apricot (Prunus Armeniaca).

On April 6th the apricot trees were in full bloom. The flowers are of a light pink color and nectar easily accessible. The stamens are numerous and symmetrically arranged about the pistil and are of equal length. The flowers are not quite so fragrant as that of the plum tree.

Insects collected: Genera, Halictus, Andrena.

There were about as many honey bees present as on the plum trees but

the smaller bees were not so numerous.

Cherry. (Prunus Cerasus).

The cherry trees were in full bloom on April 30th. The pollen and stigmas were mostly matured. The flowers are white and have but little fragrance. They contain a small receptacle and about its mouth are numerous stamens, the inner ones protruding inwardly and somewhat obstructing the entrance of insects, making it more difficult for them to obtain the nectar. There were comparatively few insects present most of which were the hony bees, although they were standing near plum trees which were at the time visited by numerous insects. Insects collected: Genera, Halictus, Andrena.

Honeysuckle. (Lonicera Species).

These flowers were visited on May 6th. The flowers were both yellow and white in color and very fragrant. They are tubular in shape and the pistil is shorter than the stamens and in most cases leans directly over the petal on which the insect rests while drawing nectar from the flower. Being thus located the pollen from a previously visited flower will come in contact with the pistil while the pollen from this flower is dusted upon the insects head and thorax ready for the next flower, thus increasing the chance for cross-pollenization. The flowers contain five stamens so placed about the pistil that the insect cannot draw the nectar from the flower without becoming dusted with pollen.

Insects collected: Genera - Augchlora, Colletes, Halictus. The number of honey bees present was greatly in excess of the other kinds.

Red Haw. (Crataegus).

The flowers of this tree are white similar in form to apple blossoms though some smaller. Some are very fragrant while others

seem to have rather an offensive odor. The pistil is five branched and the stamens bend inwardly in such a manner that the insect cannot obtain nectar without touching them and at the same time come in contact with the stigma. Honey bees visited these flowers in moderate numbers and one bumble bee was noticed.

Silver Bell. (*Halesia tetraptera*).

The flowers of this shrub are white and are bell shaped possessing very little fragrance. The stamens are numerous and symmetrically placed about the pistil and in such a position that the insect cannot enter the flower without touching them. The pistil is about twice as long as the stamens so that in most cases the insect touches the stigma on entering the flower though I observed in a number of cases that it extended so far beyond the mouth of the flower that the insect did not touch it on entering the flower. There were but few insects present, all of which I noted were honey bees.

Caragana Arborescens.

The blossoms of this shrub are yellow and the form and structure similar to the pea blossom. There were but two kinds of bees that were noticed to visit these flowers, viz., honey and bumble bees. The flowers seem to be normally closed and the weight of the insect on one side is required to open them sufficiently to obtain the nectar.

Lilac. (*Syringa Vulgaris*).

These flowers are purple and are arranged in pyramidal panicles and are quite fragrant. The flowers are small and tubular in form, about one-half inch in length. There are two stamens attached to the tube of the corolla. Only Lepidoptera were observed to visit these flowers, this is probably because the structure of the mouth parts of any other insect is such that they could not obtain the nectar.

Spiraea.(White).

The flowers of these bushes are arranged in small clusters thickly placed along the drooping branches giving the appearance of nearly a solid mass of white. The flowers possess but little fragrance. The stamens are numerous and symmetrically placed about the pistils which are fine, mostly, in number. The pollen and stigmas mature at the same time. A large number of insects and of various kinds visit these flowers.

Insects collected: Genera - *Augochlora*, *Halictus*, *Andrena*, *Colletes*, *Prosopsis*. The honey bee was in predominance here also.

Horse Chestnut. (*Aesculus Hippocostanum*).

The flowers of this shrub are arranged in panicles and are of a yellowish green color. There are seven stamens in most cases and the pistil is somewhat longer than the stamens, is curved at the end and covered all along the surface with hair-like projections so that pollen will adhere to it anywhere along the sides which the insect can scarcely avoid touching on entering the flower. The honey and bumble bees were the insects observed visiting these flowers, the former in considerable numbers. In a number of instances honey bees were seen to draw nectar from beneath the calyx while resting on the outside of the flower. Also a number of flowers were noticed where incisions had been made through the base of the corolla so that the nectar might be drawn from the outside. By this means they did not come in contact with the pistil which of course would be of no benefit to the flower.

Exochorda. (Pearl Bush).

The flower of this shrub is about the size of an apple blossom. It is white and possesses no fragrance. They are quite numer-

ous making the shrub quite conspicuous. There was scarcely an insect observed to visit them. The pistils are five in number and the stamens are of about the same length and are arranged symmetrically in threes about the pistils. The flowers are very open and easily accessible.

Barberry.

The flowers of this bush are small and yellow in color, bowl shaped with a large pistil surrounded by the stamens. The nectar is easily obtainable. The flowers are arranged in racemes and are quite fragrant. The stamens are borne in pairs there being six pairs. Mostly honey bees visit these flowers, there were a few smaller bees.

Conclusions drawn from the foregoing observations:

One of the characters influencing the visits of insects is their conspicuousness. In the case of the white spiraea and barberry there is a very wide difference in the conspicuity of the two and likewise in the number and various kinds of insects visiting them. The barberry being quite inconspicuous in comparison with the white spiraea and but few insects visiting it save the honey bee and a limited number of those; while the spiraea being very conspicuous is visited by great numbers of honey bees and various other bees and beetles. Plants may gain by the great number of insect visits as their chance of cross-pollenization is increased, but at the same time there will be many insects, such as the beetles, present that only devour pollen and do not carry any on the surface of their bodies.

Another important factor is that of fragrance. The blossoms of the plum trees were the most fragrant of any that were studied and they were also visited by the greatest number of insects; bees in particular. This would seem to be a more important character influencing insect visits than conspicuousness since fragrance may be detected by

the insect farther than the color of flowers. Then too it is presumable that fragrance would be more attractive to insects than color since it would be a better indication of the presence of desired food. In comparison with the plum flowers, Exochorda (Pearl Bush) might be mentioned. The flowers are quite conspicuous but have no fragrance and are scarcely visited by insects at all. Cherry blossoms were also equally conspicuous but not so fragrant as those of the plum, and although they were near each other the cherry flowers were visited by but few insects compared with those visiting the plum blossoms. No doubt the greatest attraction flowers have for insects is the food supply they contain, for if they possessed ever so great an amount of fragrance and color or conspicuousness, the insects would not be likely to repeat their visits did they not receive some substantial benefit. But a substantial benefit is found in the nectar and pollen contained in the flowers. The nectar is manufactured into honey and the pollen is used by the bees to make bee bread on which the larva feed.

Considerable difference in the structure of flowers was noticed which restricts insect visits to only a few kinds of insects.

The flowers of *Caragana Arborescens* are of the pea-flower type and seem to be normally closed, but when the insect alights its weight opens the flowers, and by a little exertion on the part of the insect the nectar is quite readily obtained. This operation seems to require a considerable degree of intelligence which seems to be possessed by but few, as the honey and bumble bees were all that were observed to visit these flowers. The benefit of this to the plant is that of keeping out those insects that devour pollen and steal nectar without assisting in cross-pollenization. By this means great numbers of insects are excluded so that those which do visit the flowers will be more sure to find a supply of nectar awaiting them. This

will induce more frequent visits from these few insects and in this way the plant will gain a great benefit. The lilac is another instance in which many insects are excluded, in fact only Lepidoptera visit these on account of the small tubular form of the flowers preventing any but those having long proboscides from obtaining the nectar.

It was observed that the colors were brightest and the fragrance strongest at the time of maturity of stigmas and pollen thus securing greater certainty of cross-pollenization, since that will be the time the insects will visit the flowers most. Also if much rain falls during this period the fragrance is almost entirely destroyed and the number of insect visits very much decreased so that we might conclude that if a cool, rainy season happens during most of the blossom period, chances for cross-pollenization are greatly reduced.

It was found that the most beneficial insects in cross-pollenization are the bees and most of them belong to the family Andrenidae. These are well adapted in the structure of their bodies for carrying pollen as they are more or less covered with hair-like projections over their bodies and appendages. But of all these the honey bee is the most beneficial. In every plant in blossom observed the honey bee was there on special business even in instances where no others were present and in all cases in considerable greater numbers than any other insects. In the case of blackberries and strawberries the honey bees were practically the only insects seen visiting them and they were in greater numbers on the former than on the latter.

As the nectar in the blossom of all fruit trees or plants, large and small, is quite easily obtained by the honey bee it seems that the great economic importance of this busy little insect to the fruit grower cannot be too greatly emphasized.