

## POLLINATION NOTES FROM THE CEDAR POINT REGION.

WM. BEMBOWER.

An extremely interesting phase of the study of Ecology in the vicinity of the Ohio State Lake Laboratory is that of pollination. There are various reasons for this: the plants range from purely Hydrophytic to quite Xerophytic, with numerous intermediate groups, and there are represented self-pollinated as well as all of the various classes of cross-pollinated plants.

Another interesting feature is that during the summer term only one specimen of the Honey Bee (*Apis mellifica*) was taken on Cedar Point. The supposition is that there are no colonies of the bees on the Point and that the occasional visitor came over from the mainland, three miles distant. A common pollinator is thus eliminated from the Cedar Point list.

Of the self-pollinated types of flowers, as found on Cedar Point, there are the cleistogamous flowers of the violet which are fertilized before the buds open, as well as the various types in which self-pollination is inevitable from the situation of the stigmatic surface below the discharging anthers.

In the cross-pollinated types we find most of the different general classes represented; as, wind, pollinated, insect-pollinated, bird-pollinated, snail-pollinated, and water-pollinated flowers.

The wind-pollinated flowers are easily recognized by their inconspicuousness; by the absence of any particular attraction for animals, such as odors, food, etc.; and by the abundance of pollen. The water-pollinated type is represented by the Eel Grass (*Valisneria spiralis*) in the coves on the south shore of the Point.

Of the bird-pollinated plants only a few observations were made. The Humming Bird was observed to visit the Pickerel Weed (*Pontederia cordata*) and the Buttonbush (*Cephalanthus occidentalis*) about the 20th of July, at about which time this bird is recorded to put in its appearance each year on the Point. This is presumably after the nesting season, after the young have flown from the nest, and as in the two plants mentioned seeds which were approaching maturity were observed previous to this date the conclusion is that the bird may aid in pollination but is not essential to it.

Turning now to the Entomophilus or insect-pollinated plants which comprise the largest class on the Point we find many adaptations between plants and insects. Many ingenious theories have been devised to explain why certain insects are attracted to certain flowers and considerable experimentation has been carried on in attempts to prove these theories. For the most complete work on this subject we have referred to a three-volume work by Knuth.<sup>1</sup> Quotations will be made from this work having ref-

<sup>1</sup>Knuth, Dr. Paul. Handbook of Flower Pollination. 3 vols. Translated by J. R. Ainsworth Davis. Oxford. 1906-1909.

erence to various structures of some of the Cedar Point plants upon which insect-visitors were collected. Most of the insects observed were members of the following orders, namely: Diptera, Lepidoptera, Coleoptera, and Hymenoptera.

We will now take up a consideration of some of the characteristics of a few of the summer-blooming plants of Cedar Point and note some of their insect-visitors. These studies were carried on under the direction of Mr. O. E. Jennings, Instructor in Ecology during the term of 1910.

#### **Nymphaeaceae** (Water Lily Family).

"The large floating flowers are protected from creeping animals by their aquatic habitat, and are only accessible to flying insects. The inner side of the sepals is colored like the petals, so that both whorls are conspicuous. A more or less distinct odor of honey also serves as a further attraction to insects."<sup>2</sup>

**Castalia tuberosa.** "The faintly odorous large white flowers which open in the morning and close towards evening are homogamous, according to observations. Kerner states that the stigmatic papillae are mature at the beginning of antithesis, remaining receptive for several days. The anthers dehisce a day—or rarely a few days—later. The filaments bend into the form of a sickle, so as to bring the anthers above the stigmas, which spread out into a plate-like surface so that self-pollination must result from the falling of pollen. Insect visitors may effect either cross- or self-pollination, but they are few in number."<sup>3</sup>

Visitors: *Diptera*; *Eristalis flavipes*.

**Nymphaea advena.** This water lily also may be self- or cross-pollinated. The visitors taken are as follows:

Visitors: *Diptera*; *Mesograpta marginata*; *Coleoptera*; *Donacia pusilla*.

**Nelumbo lutea.** Sprengel says: "The increased size and yellow color of the upper surface of the sepals have taken on the function of the corolla, and the under sides of the petals secrete honey" which serves to attract insects.

Visitors: *Diptera*; *Allograpta obliqua*, *Eristalis tenax*, *Mesograpta marginata*; *Coleoptera*; *Disonya pennsylvanica*, *Diabrotica 12-punctata*; *Hymenoptera*; *Microbembex monodonta*, *Agapostemon radiatus*.

#### **Malvaceae** (Mallow Family).

**Hibiscus moscheutos.** This plant is quite conspicuous on the edge of the marsh and with its pink or whitish color and its abundance of pollen proves attractive to certain insects. Insect visitors are essential to pollination since the stigma is slightly above

<sup>2</sup>Op. cit., II. 59.

<sup>3</sup>Op. cit., II. 59.

and to one side of the anthers. The stigmatic surface furnishes a convenient lighting place for insect visitors when they first arrive, thus affecting cross-pollination.

Visitors: *Diptera*; *Phthiria sulphurea*, *Lucilia caesar*; *Coleoptera*; *Disonycha pennsylvanica*; *Hymenoptera*; *Agapostemon splendens*, *Monarda maculata*. A *Bombus*, probably *B. americana*, was observed but not taken.

#### Rosaceae (Rose Family).

**Rosa carolina.** A not uncommon plant around the edge of the marsh or around ponds and swampy places.

Visitors: *Diptera*; *Eristalis americana*, *Eristalis tenax*, *Allograpta obliqua*; *Hymenoptera*; *Agapostemon radiatus*.

#### Cactaceae (Cactus Family).

**Opuntia rafinesquii.** This cactus, a true Xerophyte, has a yellow flower that attracts many insects which may effect either self- or cross-pollination. The filaments are sensitive to mechanical stimulation. They incline inwards on being touched by insects, or even spontaneously, and thickly cover the stigmas with pollen. Autogamy thus regularly takes place and is always effective.<sup>4</sup>

In observing the opening of a bud it was noted that within ten minutes after the petals began to separate a visitor (*Ceratina dupla*) appeared and began delving into the base of the stamens. Here, as well as among some of the other flowers observed, it was noted that while a given insect is visiting certain flowers they usually confine themselves to that species alone, this of course being advantageous in effecting cross-pollination.

Visitors: *Coleoptera*, *Trichius piger*, *Strigoderma arboricola*, *Centrinus scutellum-album*; *Hymenoptera*; *Microbembex monodonta*, *Agapostemon radiatus*, *Bombus americana*, *Vespa borealis*, *Ceratina dupla*.

#### Cornaceae (Dogwood Family).

**Cornus amomum.** "Here the flowers are homogamous with exposed nectar, secreted by a ring surrounding the style. The stamens and stigmas develop simultaneously. The anthers are introrse and at the same level as the stigma, though some distance from it. Larger insects will effect cross-pollination while small flies and beetles, owing to their erratic movements, will sometimes effect cross-, sometimes self-pollination."<sup>5</sup>

Visitors: *Diptera*; *Lucilia caesar*, *Polenia rudis*; *Coleoptera*; *Cyrtophorus verrucosus*, *Cryptorhopalum triste*; *Hymenoptera*; *Elis plumpies*, *Polistes pallipes*, *Xylocopa virginica*, *Microbembex monodonta*.

<sup>4</sup>See Op. cit., II. 458-459.

<sup>5</sup>Op. cit., II. 518-519.

**Rubiaceae** (Madder Family).

**Cephalanthus occidentalis** (Button Bush). This curious plant with flowers arranged in a spherical cluster offers nectar to several species, the only one taken being *Eristalis tenax*. The Humming Bird previously recorded was also a visitor.

**Compositae** (Composite Family).

**Cirsium arvense** (Canada Thistle). Numerous visitors were collected on this Composite, as follows:

Visitors: *Diptera*; *Odontomyia virgo*, *Lucilia sericata*, *Stratiomyia lativentris*, *Helophilus chrysostomus*, *Syrphus americanus*, *Muscina assimilis*, *Eristalis flavipes*, *Eristalis tenax*, *Stomoxys calcitrans*; *Lepidoptera*; *Chrysophanus thoe*, *Argynnis cybele*.

**Apocynaceae** Dogbane Family).

**Apocynum hypericifolium**. (Clasping-leaved Dogbane).

Visitors: *Diptera*; *Chrysopus moereus*, *Phormia regina*, *Eristalis dimidiatus*, *Stratiomyia lativentris*; *Lepidoptera*; *Argynnis cybele*, *Chrysophanus thoe*, *Harisina americana*, *Alypia octomaculata*; *Coleoptera*; *Donacia pusilla*; *Hymenoptera*; *Microbembex monodonta*.

**Asclepiadaceae** (Milkweed Family).

"In the sub-family Cynanchatae the five filaments are broadened, generally fused into a tube, and provided with external appendages, . . . pollen aggregated into pollinia, attached in pairs to the clip glands of the large capitate stigma. The clips grasp the legs of the insect-visitors when the nectar-secreting spots are on the same radii as the stamens (*Asclepias*), or the proboscis if these spots alternate with the stamens. . . . The clips are thus drawn out of their recesses by the legs or proboscis of visitors, and transferred to other flowers. (Pinch-trap Flowers). The extremely specialized flower mechanisms are adapted to insect visitors in a very perfect manner, so that a comparison may be made with orchids, though in this case there is nothing like the same variety."<sup>6</sup>

**Asclepias**. Pinchtrap Flowers.

Pollination is here effected by the legs of insects.

**Asclepias syriaca**. This plant bears flowers of a kind adapted to bees, the claws of which become entangled in the clips and carry off the pollinia to be introduced into the stigmatic chambers of other blossoms. An odor of honey is exhaled. The petaloid appendages of the anthers are in the form of fine fleshy nectar pockets, which alternate with the clips. From the bottom of each

<sup>6</sup>Op. cit., III. 90.

of the nectar pockets arises a curved horn-shaped process that bends inwards over the stigmatic disc.

"An insect searching for nectar slips about on the smooth flowers which make up the umbel until its feet get a firm hold in the lower part of a slit. When it wishes to go and draws up the leg the claws are guided upwards in the slit so that the clip becomes attached to the foot. During the subsequent movements the pollinia are introduced into one of the slits of another flower, and effect cross-pollination, while at the same time another clip affixes itself.

The development of the pollinia was investigated by Corry. He also found that flowers are infertile not only with their own pollen, but also with that from plants raised vegetatively from the same stock. Pollination is fully effective only when it takes place between flowers belonging to plants grown from the seeds of different stocks. Stadler worked out the histological details of the secretion of nectar and found that this is produced, not only in the petaloid cuculli, but also by internal nectaries on the inner wall of the stigmatic chamber. The approximated lower edges of the slits serve as nectar-covers for the latter.<sup>7</sup>

The fact of the plants being infertile to their own pollen as well as to pollen from plants raised vegetatively from the same stock probably explains the small number of fertile pods observed later in the season as compared with the large number of flowers originally observed.

Visitors: *Diptera*; *Pollenia rudis*, *Lucilla caesar*, *Chrysopus moereus*; *Lepidoptera*; *Harrisina americana*; *Hymenoptera*; *Microbembex monodonta*.

***Asclepias incarnata*** (Swamp Milkweed).

Visitors: *Diptera*; *Peleteria robusta*, *Midas calvatus*, *Phormia regina*, *Lucilia sericata*, *Phthiria sulphurea*; *Lepidoptera*; *Anosia plexippus*, *Satyrodes eurydice*, *Argynnis cybele*; *Coleoptera*; *Donacia pusilla* *Hymenoptera*; *Microbembex monodonta*.

***Asclepias tuberosa*** (Butterfly-weed).

Visitors: *Lepidoptera*; *Harrisina americana*, *Anosia plexippus*; *Hymenoptera*; *Microbembex monodonta*, *Xylocopa virginica*.

**Bignoniaceae** (Bignonia Family).

***Tecoma radicans***. In making collections on this plant it was found that most of the visitors had little to do with pollination but were busy collecting some material from the calyx. The nectar, which is secreted at the base of the long corolla-tube is available to certain insects only. The arrangement of the stamens

<sup>7</sup>Op. cit., III. 93-94.

and pistil is interesting as they were found in every case to be on the upper side of the fused corolla-tube so that an insect of similar proportions to a *Bombus* would be effectual in cross-pollination.

Visitors: *Diptera*; *Mesogramma geminata*; *Coleoptera*; *Strigoderma arboricola*; *Hymenoptera*; *Polistes pallipes*, *Microbembex monodonta*, *Chorion caeruleum*, *Spharophthalma ferruginata*, *Agapostemon radiatus*.

Family **Labiatae** (Mint Family).

**Monarda fistulosa.** (Wild Bergamot).

Visitors: *Lepidoptera*; *Hemaris diffinis*; *Hymenoptera*; *Bombus separatus*, *Agapostemon splendens*, *Apathus citrans*, *Cetraria dupla*.

**Nepeta cataria.** (Catnip).

Visitors: *Diptera*; *Eristalis tenax*, *Mesograpta marginata*; *Lepidoptera*; *Pieris rapae*, *Chrysophanus hypophlaeas*; *Coleoptera*; *Trichius piger*; *Hymenoptera*; *Ceratina dupla*, *Elis plumipes*, *Microbembex monodonta*, *Coelioxys 8-dentata*, *Megachile prunina*, and *Megachile sp.*

**Pontederiaceae** (Pickerelweed Family).

**Pontederia cordata.** Here we have an example of a tri-morphous flower. Apparently no observations had been made on this plant, as Knuth made no record of such. On this account special care was taken in collecting and labeling the various visitors. During the collecting it was noted that a bee-fly (*Eristalis flavipes*) visited about sixty individual flowers, on several spikes, during a one-minute period.

Visitors: *Diptera*; *Helophilus chrysostomus*, *Eristalis flavipes*; *Lepidoptera*; *Hemaris thisba*, *Papilio polyxenes*, *Pieris rapae*; *Coleoptera*; *Megilia maculata*, *Strigoderma arboricola*, *Disonycha pennsylvanica*, *Trirhabda tomentosa*; *Hymenoptera*; *Bombus virginicus*, *Agapostemon splendens*, *Agapostemon radiatus*, *Megachile* (several species unidentified)

In the above list of plants studied we have seen various types of pollination, in fact, hardly two of the families show any close similarity. Many more collections might have been made on the plants studied, as well as others of the same vicinity, but time would not permit. Insects laden with pollen and others who sought only nectar were observed but no special studies were made of these. It is the chief aim of this paper to emphasize the broadness of this field of work on Cedar Point and, possibly, to bring the subject to the attention of some one who can add or encourage succeeding chapters on this subject for the **NATURALIST**.