

# Pollination modes and Floral types

Wind, water, insect, bird, bat

**By-Dhriti Ghose**  
**Assitant Professor**  
**Dept Of Botany**  
**Raja Narendra Lal Khan Women's**  
**College(Autonomous)**



## **Pollination mode- Wind pollination**

**Anemophily or anemogamy.** The pollination with the help of **wind** is called **anemophily or anemogamy**. The anemophilous plants **produce enormous amount** of pollen grains.

The pollen grains are **small, smooth, dry and light** in weight. Pollens of such plants are blown off at a distance more than 1,000 km.

A single plant of *Mercurialis annua* has been estimated to produce more than **135 crores of pollen grains**. The pollen grains of *Pinus* (Gymnosperm) are **winged** and help in wind pollination. In grasses, **the flowers may be borne on long axis** situated much above the leaves and the **anthers are versatile**, thereby the anther **can oscillate in all directions** at the tip of the filament.

On the other hand, flowers have **adequate device to catch the air-borne pollen grains**. In grasses, the **stigma is usually large and feathery**, which **helps to catch the pollen grains**. In *Typha*, the **stigma is brush-like** which helps to **catch more pollen grains**.

**Flower type-** Plants that use wind for cross-pollination generally have flowers that **appear early in the spring**, before or as the plant's leaves are emerging. This prevents **the leaves from interfering with the dispersal of the pollen from the anthers** and **provides for the reception of the pollen on the stigmas of the flowers.**

In species like **oaks, birch, or cottonwood**, male flowers are **arranged in long pendant catkins or long upright inflorescences** in which the **flowers are small, green, and grouped together, and produce very large amounts of pollen.** Pollen of wind-pollinated plants is **lightweight, smooth, and small.** Examples are **Maize, Rice** and others.



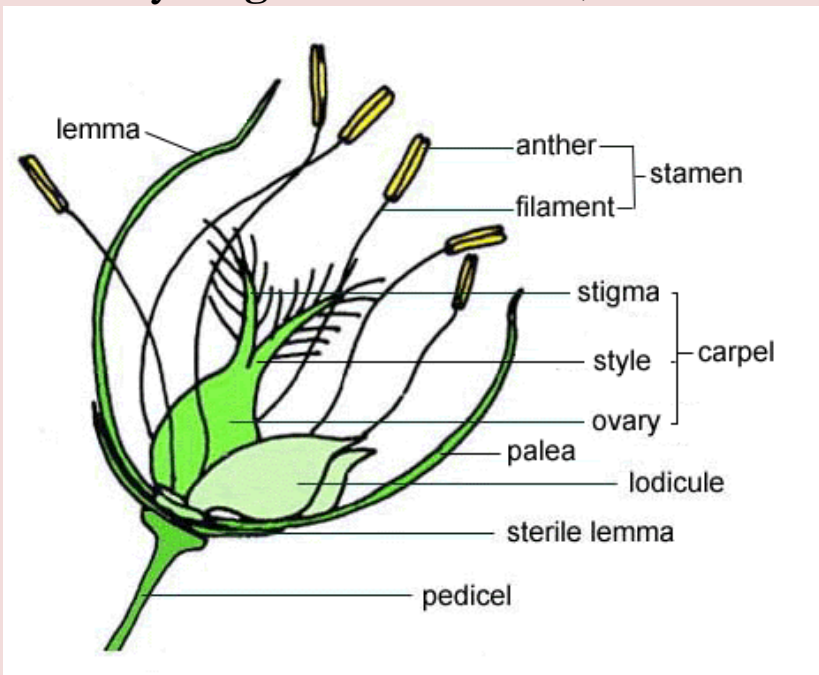
Wind-pollinated species like this cottonwood releases copious amounts of pollen from its catkins before the tree leafs out. Photo by Teresa Prendusi.

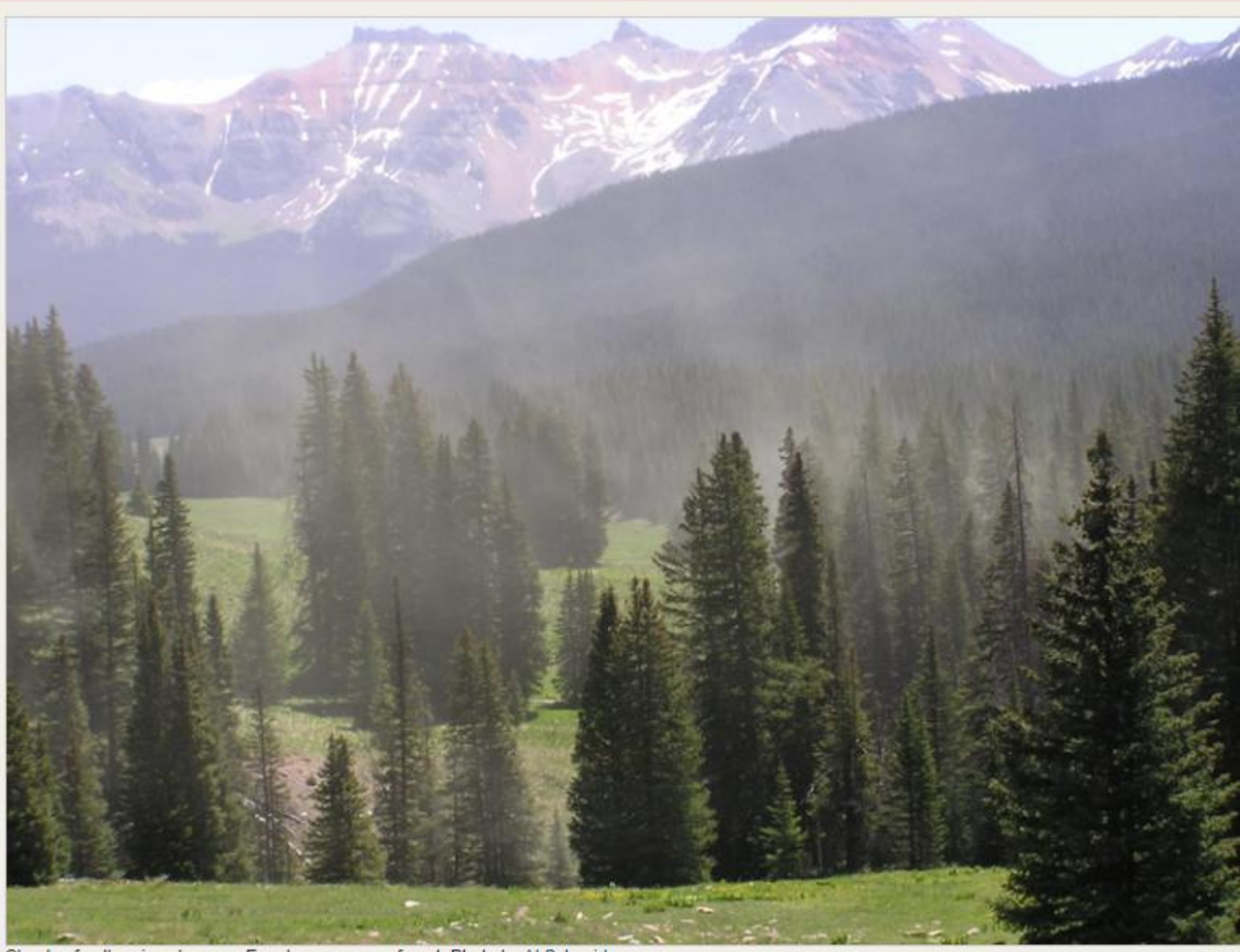


Grasslands ensure successful wind pollination through sheer number of flowering plants and the large quantities of pollen released. Photo by U.S. Forest Service. Inset photo: A grass plant (*Bouteloua gracilis*) in anthesis (anthers releasing pollen). Photo by Steve Olson.

## Adaptations of Wind-pollinated flowers :

- No bright colors, special odours, or nectar
- Small
- Most have no petals
- Stamens and stigmas exposed to air currents
- Large amount of pollen
- Pollen smooth, light, easily airborne
- Stigma are long, sticky, and feathery...the better to catch any floating pollen grains.
- May have staminate and pistillate flowers, may be monoecious or dioecious
- Usually single-seeded fruits, such as oak, grass, birch, poplar, hazel, dock, cat-





Clouds of pollen rise above an Engelmann spruce forest. Photo by [Al Schneider](#).

## **Pollination mode-Water**

**Hydrophily or hydrogamy.** The pollination with the help of water is called hydrophily or hydrogamy. It is of two types : a. **Hypohydrogamy** and b. **Epihydrogamy**.

**a) Hypohydrogamy**-When the pollination takes place inside the water, it is called hypohydrogamy, e.g. *Najas* sp. *Ceratophyllum* sp. etc

**b) Epihydrogamy.** When pollination takes place on the water surface, it is called Epihydrogamy, e.g., *Vallisneria spiralis* (ribbon weed). In *Vallisneria*, the flowers are borne under water. After maturation, the pistillate flowers are brought to the surface by their long stalk and form a cup-like depression. The male flowers get detached from the parent plant and float on the surface of water. If male flower gets lodged into the depression, pollination occurs. After pollination, the elongated stalk of the pistillate flower undergoes spiral coiling, thereby it again comes under the water.



Water pollinated plants are aquatic. Pollen floats on the water's surface drifting until it contacts flowers. This is called **surface hydrophily**, but is relatively rare (only 2% of pollination is hydrophily). This water-aided pollination occurs in **waterweeds and pondweeds**.

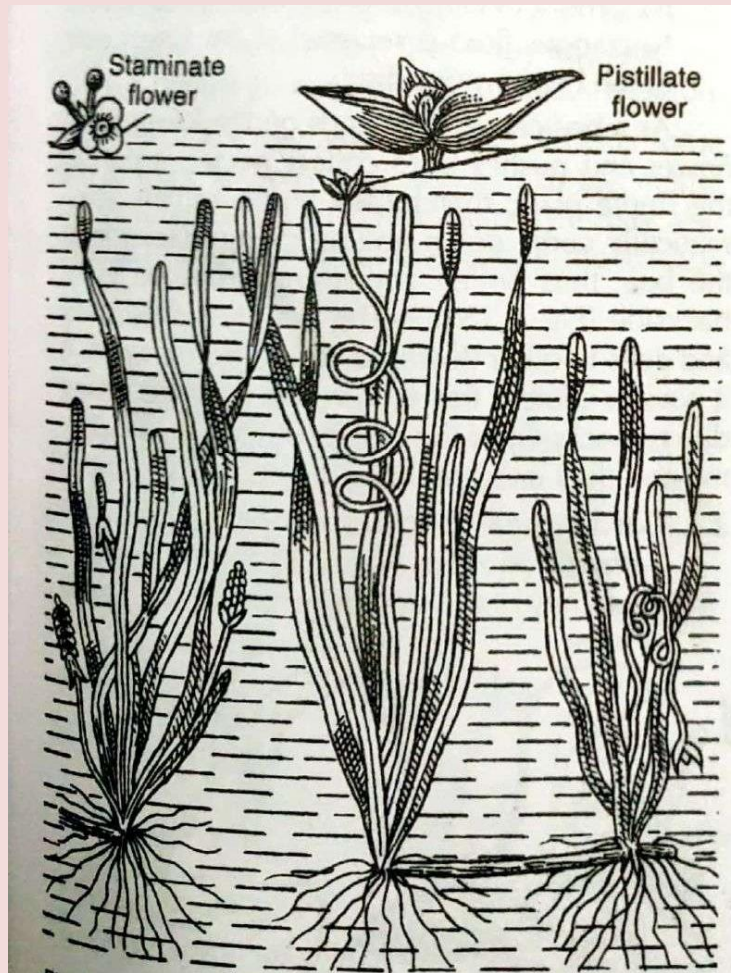


Fig. 2.149 : Pollination (epihydrogamy) in *Vallisneria spiralis*

It is widely accepted that **angiosperm flowers and their insect pollinators** have **influenced each other's evolution**. The concept of **coevolution** was first developed by **Darwin**, who used it to **explain how pollinators and food-rewarding flowers involved in specialized mutualisms could, over time, develop long tongues and deep tubes, respectively**.

**Entomophily or entomogamy-** When pollination takes place with the help of insects, it is called entomophily. The insects those help in pollination are bees, flies, beetles etc. The flowers which open during sunrise are generally brightly coloured, acting as flag apparatus for attracting insects. But the flowers those open after sunset are white in colour, thus become visible in night.

In addition to colour, other devises to attract the insects are smell and/or nectar. The pollen grains are larger in size, the exine is pitted, spiny etc., so they can be adhered firmly on the sticky stigma. Approximately, 80% of the pollination done by the insects is carried by bees.

## **Adaptations of insect pollinated flowers-**

- Adaptations such as **bright colors, strong fragrances, special shapes, and nectar guides are used to attract** suitable pollinators.
- Important insect pollinators **include bees, flies, wasps, butterflies, and moths.**
- **Bees and butterflies are attracted to brightly-colored** flowers that have a strong scent and are **open during the day, whereas moths are attracted to white flowers that are open at night.**
- **Flies are attracted to dull brown and purple flowers that have an odor of decaying meat.**
- **Nectar guides, which are only visible to certain insects, facilitate pollination by guiding bees to the pollen at the center of flowers.**
- **Insects and flowers both benefit from their specialized symbiotic relationships;** plants are pollinated while insects obtain valuable sources of food.

## Bees-

Bees are perhaps the **most important pollinator** of many garden plants and **most commercial fruit trees**. The most common species of bees are **bumblebees and honeybees**. Since bees **cannot see the color red**, **bee-pollinated flowers usually have shades of blue, yellow, or other colors**. Bees collect energy -**rich pollen or nectar** for their survival and energy needs. They visit flowers that **are open during the day, are brightly colored, have a strong aroma or scent**, and have a tubular shape, typically with **the presence of a nectar guide**. A **nectar guide includes regions on the flower petals that are visible only to bees, which help guide bees to the center of the flower, thus making the pollination process more efficient**. The pollen sticks to the **bees' fuzzy hair**; when the bee visits another flower, **some of the pollen is transferred to the second flower**. Recently, there have been many reports about the declining population of honeybees. Many flowers will remain unpollinated, failing to bear seeds if honeybees disappear. The impact on commercial fruit growers could be devastating.



In many bee-pollinated flowers, there is a **region of low ultraviolet reflectance** near the **center of each petal**. This pattern is **invisible to humans** because our visual spectrum **does not extend into the ultraviolet**. Bees, however, **can detect ultraviolet light**. The contrasting **ultraviolet pattern (called a nectar guide)** helps a bee quickly **locate the flower's center**. This adaptation **benefits both the flower (more efficient pollination) and the bee (rapid collection of nectar)**. The following pictures show a **flower as seen by us (left side)**, and as **seen by the bees (right side)**.





Nectar guide - Wikipedia  
[en.wikipedia.org](https://en.wikipedia.org)



Nectar guides are markings or patterns ...  
[facebook.com](https://facebook.com)



A UV-visible nectar guide. Photography ...  
[researchgate.net](https://researchgate.net)



Photo by: Jean-Yves Cretin 2005

## Flies

Many flies are **attracted to flowers that have a decaying smell or an odor of rotting flesh.** These flowers, which produce nectar sometimes, usually have dull colors, such as brown or purple. They are found on the corpse flower or voodoo lily (*Amorphophallus*), dragon arum (*Dracunculus*), and carrion flower (*Stapleia*, *Rafflesia*). The nectar provides energy while the pollen provides protein. Wasps are also important insect pollinators, pollinating many species of figs.



## Butterflies and Moths

Butterflies, such as the monarch, pollinate many **garden flowers and wildflowers, which are usually found in clusters. These flowers are brightly colored, have a strong fragrance, are open during the day, and have nectar guides.** The pollen is picked up and carried on the **butterfly's limbs. Moths, on the other hand, pollinate flowers during the late afternoon and night. The flowers pollinated by moths are pale or white and are flat, enabling the moths to land.** One well-studied example of a moth-pollinated plant is the **yucca plant, which is pollinated by the yucca moth.** The **shape of the flower and moth have adapted in a way to allow successful pollination.** The moth deposits pollen on the sticky stigma for fertilization to occur later. The female moth also deposits eggs into the ovary. As the eggs develop into larvae, they obtain food from the flower and developing seeds. Thus, both the insect and flower benefit from each other in this symbiotic relationship. The corn earworm moth and *Gaura* plant have a similar relation



A corn earworm (a moth) sips nectar from a night-blooming *Gaura* plant. Both the moth and plant benefit from each other as they have formed a symbiotic relationship; the plant is pollinated while the moth is able to obtain food.

**Chiropteriphily or chiropterigamy** When pollination takes place with the help of bats, it is called chiropterophily. The flowers of *Bombax ceiba* of Bombacaceae, *Anthocephalus cadamba* of Rubiaceae etc., are pollinated by bat.



More than **500** species of tropical plants are [pollinated](#) by nectar- and pollen-eating bats, and they have evolved **special features to make their nectar and pollen attractive to the nocturnal flyers**. Such plants are called **chiropterophilous, or “bat-loving”** (bats being mammals of the order Chiroptera).

### **Adaptations of bat pollinated flowers-**

- 1) Plants that rely primarily on bat pollinators cater to them with large, white flowers, which bats can spot easily at night.**
- 2) The flowers often have a fermented or musky odour, and they tend to open after sunset, just as bats leave their day roosts to feed.**
- 3) In order to accommodate a bat’s face, many bat-pollinated flowers are shaped like a vase, although some are flat and brushy in order to load a bat’s whiskers with pollen.**
- 4) Chiropterophilous plants even manufacture substances that are useless to the plant itself but helpful to the bat.** Because bats often eat the pollen as well as the nectar of their flowers, **the pollen of bat-loving plants is high in protein and contains two amino acids, [tyrosine](#) and [proline](#), that are crucial to bat health.** Proline is important in building strong wing and tail membranes, and tyrosine is essential for milk production.
- 5) Nectar-eating bats (of which there are more than 30 genera) have special adaptations also. They tend to have fleshy bristles on their long tongues, as do many bees, to scoop out pollen as well as nectar.**
- 6) They have good eyesight and a fine sense of smell; often their sonar is reduced. Migratory bats pollinate a variety of species as they travel, and plants are often seen to flower in sequence along a sort of “nectar corridor” corresponding to the bats’ migratory route.**

**Ornithophily or ornithogamy.** When pollination takes place with the help of birds, it is called ornithophily . The ornithophilous flowers are very large and showy, those secrete profuse nectar within them, thereby some birds get attracted. Ornithophily is visible in some flowers like *Bignonia capreolata* of Bignoniaceae, *Strelitzia reginae* of Musaceae, *Butea monosperma* map of Fabaceae, *Bombax ceiba* of Bombacaceae etc.





**What physical features make a flower ornithophilous?**



## **Adaptations of bird pollinated flowers-**

1) Scent is of little or no use for birds.

Flowers are usually produced with **a vivid floral display of mostly red, orange or purple hues.**

2) Hummingbirds lock onto **the warmer colors of the ultra-violet spectrum, not including yellow which is preferred by bees.**

3) **Floral posture** Flowers loosely clustered and on tips of flexible stalks. **Nectary usually deep within the long floral tube, enabling flower to accurately place pollen on bird's bodies.**

4) Some flowers **have structures to protect the plant from vigorous foraging by birds like hard tissue structure to provide mechanical strength, like *Sterlitzia*.**

5) **Ornithophilous flowers show a strong convergent evolution with shapes of bills.**

6) **Hummingbird-pollinated flowers** generally have **sucrose-dominant nectar**, whereas flowers pollinated by **passerine perching birds** tend to have **hexose-dominant nectar.**





## References-

**1.A Textbook of Botany: Vol II by Hait Bhattacharya Ghosh**

**2.**<https://www.fs.fed.us/wildflowers/pollinators/wind.shtml>

**3.**<https://evolution-outreach.biomedcentral.com/articles/10.1007/s12052-009-0192-6>

**4.**[https://bio.libretexts.org/Bookshelves/Introductory\\_and\\_General\\_Biology/Book%3A\\_General\\_Biology\\_\(Boundless\)/32%3A\\_Plant\\_Reproductive\\_Development\\_and\\_Structure/32.2%3A\\_Pollination\\_and\\_Fertilization/32.2B%3A\\_Pollination\\_by\\_Insects](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/32%3A_Plant_Reproductive_Development_and_Structure/32.2%3A_Pollination_and_Fertilization/32.2B%3A_Pollination_by_Insects)

**5.**<https://www.britannica.com/topic/Bat-loving-Flowers-1688510>

**6.Ornithophily and Ornithophilous Flowers Bird Pollinators**

**Presented by**

**Georgann Schmalz**

**Birding Adventures, Inc.**

**[www.birdingadventuresinc.com](http://www.birdingadventuresinc.com)**

**Images internet source**