

Role of Birds in Pollination, Germination and Seed Dispersal System

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We have grown up watching birds chirping and fluttering since childhood. The ability of birds to soar high in the sky and their sweet sounds can be seen as a symbol of freedom and beauty, and as an attractive creation of nature due to the colourful feathers of their bodies. Birds provide various ecological services in our environment, which can be categorized as follows.

- 1) **Supporting services:** Cycling of nutrients and soil formation
- 2) **Provisioning services:** Use of birds as food, ornamental use of feathers, and use of bird's manure as fertilizer.
- 3) **Regulating services:** Disposal of dead livestock and waste, control over the population of animals such as insects and rats, pollination in plants and the spread of their seeds, large-scale destruction of certain seeds, and the widespread spread of disease-causing microorganisms in insects and plants.
- 4) **Cultural services:** Within arts and religion.

According to the above, when we talk about the management services provided by birds, it includes pollination in plants and the dispersal of their seeds. When we hear the word 'pollination', we typically imagine bees, butterflies, wind, and other insects, but birds also play an important role in this process.

Approximately 80 percent of flowering plants depend on pollinators. Of these, 73 percent rely on honeybees for pollination, while 19 percent rely on various flies, 6.5 percent on wasps, 10 percent on bumblebees, 4 percent on birds, and 4 percent on butterflies.

The process of pollination that occurs through birds is called ornithophily. In this process, hummingbirds, sunbirds, and honey eaters (nectar feeders) play a major role. When such birds drink nectar from flowers, their heads or beaks come into contact with the flower's pollen, causing the pollen to stick to the bird's feathers and beak. When the bird goes in search of another flower to drink nectar, the pollen that had previously stuck to it reaches the other flower. In this way, pollen is transferred from one flower to another, completing the pollination process, which helps plants in the production of fruits and seeds.

Birds are especially useful in regions where the number of insects is low, such as tropical areas where flowers are red or orange, have long tube shapes, and are scentless. The process of pollination mainly involves three families of birds. Let's start with the family Trochilidae, which includes hummingbirds. These small and colourful birds are found only in the Americas. Hummingbirds are known for their ability to remain stationary



Hummingbird



Sunbird



Honeyeaters

in the air by flapping their wings rapidly. Their long, slender beaks and specialized tongues help them reach inside tubular flowers to drink nectar, while pollen sticks to their heads, which they then transfer to other flowers. Next is the family Nectariniidae, which includes sunbirds. These beautiful, jewel-coloured birds are primarily found in Africa, Middle Eastern countries, parts of Asia, and Australia. Like hummingbirds, they also drink nectar from flowers with their long-curved beaks. However, they usually drink nectar while sitting on flowers, not hovering in the air like hummingbirds. Sunbirds also consume other insects, which provides them with more energy. They are particularly important pollinators in the tropical and subtropical regions of Africa and Asia. Lastly, the Meliphagidae family, which includes honeyeaters, comes into play. These birds are primarily found in Australia, New Guinea, and the Pacific Islands. In Australia, several plants, especially native trees like eucalyptus and banksia, rely on honeyeaters for pollination.

The specific characteristics of birds make them excellent pollinators

- **Beak:** Many nectar-feeding birds like hummingbirds, sunbirds, and honey eaters have long, slender, and curved beaks. This type of beak helps them reach deep inside flowers to drink nectar. While sipping nectar, their head or beak touches the flower's pollen, which they then carry to other flowers.
- **Tongue:** The tongues of these birds are of a specific type (some have a tubular structure, while others have a brush-like structure at the tip of their tongues), hummingbirds can sip nectar with their tongues. During the process of sipping nectar, they get pollen stuck to their bodies and transfer it to other flowers.
- **Wings and physical structure:** When a bird goes to drink nectar from a flower, pollen gets stuck to its head, beak, or wings. When it moves to another flower, it also carries the pollen with it, much like a honeybee. Nectar-drinking birds are territorial and often visit the same types of flowers repeatedly.
- **Memory and vision:** Birds can remember the location of flowers and can distinguish colours well (especially bright red, orange, and yellow colours, which are common in bird-pollinated flowers). They are more attracted to colour than to scent, which is why attractive flowers are usually odourless but are bright-coloured and filled with nectar.
- **Hovering:** Like hummingbirds, which can sip nectar while hovering in the air without perching on a flower. This ability helps them to find such delicate and hanging flowers and obtain food from places where other animals cannot reach.

Nectar-feeding birds like hummingbirds, sunbirds, and honey eaters are attracted to specific types of flowers where the special structure of the flower plays a role in attracting the birds.

The special structure of flowers that works to attract birds

- **Bright colours:** Bird-pollinated flowers are generally red, orange, or yellow in colour. Birds, especially hummingbirds and sunbirds, have excellent colour vision and are particularly attracted to bright colours.
- **Tube-like shape:** Bird-pollinated flowers are long and tubular in shape. This shape is similar to the long, curved beaks of birds, allowing the bird to easily drink nectar from inside. During this process, their head or beak comes in contact with the flower's pollen.
- **Strong structure:** Birds are larger than insects, so the flowers they visit must be strong and sturdy enough for the bird to perch comfortably. Birds like hummingbirds can drink nectar from flowers while hovering in the air, which is why some flowers hang, while others are upright and strong.
- **Nectar:** More nectar is found in flowering plants that are pollinated by birds, which are typically thin yet sweet. This is essential for the energetic lifestyle of birds. The nectar is located deep within the flower so that the bird can reach inside and come in contact with the pollen, carrying it along.

Why are bird-pollinated flowers mostly red in colour...?

Birds have the ability to see light in the range of 300-700 nm. While bees and other insects can see light from 344-544 nm, their ability to discern colours decreases above 550 nm. For

birds, the red colour is the most visible, and they consider red flowers as better indicators of nectar. Thus, red flowers mainly attract birds and are less attractive to insects, which reduces competition in pollination.

Chromatic perception and biochemical reasons

The red coloration of bird-pollinated flowers is attributed to pigments such as anthocyanins and carotenoids. These pigments absorb certain wavelengths and reflect others, giving them a red appearance. Anthocyanins are water-soluble flavonoid pigments that are synthesized through a biosynthetic pathway dependent on genetic and environmental factors. Depending on the acidity (pH) intensity in flowers, anthocyanins can provide a colour range from red to blue. In slightly acidic conditions, anthocyanins reflect red wavelengths (600-700 nm). Carotenoids are lipid-soluble pigments that typically produce yellow, orange, or red colours. Carotenoids absorb blue light in the 400-500 nm range and reflect red-yellow light.

Contribution of Birds in Germination and Seed Dispersal

- 1. Endozoochory (Dispersal through Digestive System):** One of the most important methods of seed dispersal by birds is endozoochory, where birds eat fruits and then disperse the seeds in distant locations. This method is extremely effective for long-distance dispersal and also enhances seed germination. As seeds pass through the bird's digestive system, their coatings soften, allowing water to penetrate easily, which accelerates germination. Fruit-eating birds like the Great Hornbill (*Rhinoceros Hornbill*) consume a variety of fruits and spread seeds over considerable distances.
- 2. Epizoochory (dispersal through external organs):** The epizoochory method involves small seeds sticking to the feathers, legs, or beak of birds. When a bird flies or moves in search of daily food or during migration, these seeds fall in new locations.
- 3. Seed cleaning and scarification:** When birds eat fruits, they often clean the seeds by removing the pulp and fleshy layer, a process that reduces the likelihood of mould and is useful for increasing germination rates. Additionally, some birds also mechanically scarify the seeds. They break the hard coat of the seeds with their beaks or digestive enzymes break down its outer layers, preparing the seeds for germination. This includes roles played by crows, jays, pigeons, and others.
- 4. Activity of nest building:** Some birds collect fruits or seeds to build nests or store food. Some of them eat what they collect, but many are forgotten by the birds, which causes the seeds to fall to the ground and grow into trees. For example, crows and jays collect acorns, many of which develop into trees.

Thus, birds play an important role in our environment through their contribution to pollination, germination, and seed dispersal.