



Tracing the Evolution of Flower Beetles in Pollination Systems

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The first thing most people think of when they think of pollination is bees and butterflies. But flower beetles have been pollinating plants for millions of years before the introduction of the bee. They are generally not a focal point of research or discussion, but they are important in natural ecosystems and in agriculture. Pollination is necessary for fruit, seed and new plant production. It helps preserve biodiversity and is used the production of food worldwide. There are over 400,000 species of beetles. Beetles are part of the Coleoptera order of insects. Almost 20% of them regularly visit flowers. Previously, scientists thought that beetles were not good pollinators since they eat petals, pollen and other parts of flowers. In the past, this is why they were known as "mess-and-soil pollinators" Research today has revealed that when feeding, the beetles transfer pollen from flower to flower and carry it on their bodies making them good pollinators.

Help pollinators: adaptations for flower beetles

There are several interesting adaptations that make the flower beetle able to pollinate. Flowers visited by beetles are host to a variety of mouthparts on the insects. The mouthparts of these beetles are long and adapted for them to access nectar in the deep interior of flowers, in the families *Lycidae*, *Mycteridae* and *Meloidae*. In contrast, the mouthpart of the *Nitidulidae*, *Hydrophilidae* and *Staphylinidae* are short, with minute hairs that are very effective for pollen collection. Weevils (*Curculionidae*) eat pollen within flowers with their long snout. Sensory organs are also crucial to them. They have big compound eyes that enable them to see the colourful flowers, and their long, sensitive antennae sense the flowers' aroma far away. The cycad weevil *Rhopalotria* is an example – it can even perceive the humidity that is emitted from cycad cones and readily find its host plant. There are also many flower beetles that are hairy. As they go from flower to flower in search for food, pollen grains get attached to these hairs which are carried to other flowers and successful pollination is achieved. Among the well-known efficient pollinators are the Monkey beetles (*Hopliini*), flower chafer (*Cetoniinae*) and *Glaphyridae*.

Behaviour Inside Flowers The activity of flower beetles varies. A few of the species are active during the day, a few are active at night, and a few remain active all day. An important pollinator, *Anchylorhynchus trapezicollis*, continues to fly both day and night, for instance in the case of the palm *Syagrus coronata*. *Elaeidobius kamerunicus* is the main pollinator of African oil palm (*Elaeis guineensis*). It can be active all day long or primarily in the morning. The bright colour, sweet smell, heat and profusion of pollen inside flowers make them attractive to beetles. Flowers are particularly appealing if they are white, cream, yellow or brightly coloured. Even some flowers generate heat, known as thermogenesis. These warm flowers offer food, shelter and a safe mating environment for the beetles. The longer the duration of stay in a flower, the more pollen the beetles will move. Some beetles also lay their eggs inside flowers. Larvae are pollinator or decomposer feeders. These bugs pollinate flowers during development and are known as brood pollinators. another well-known species, the major pollinator of African oil palm (*Elaeis guineensis*). It is active

during the day, or primarily in the morning, depending on the weather. Many types of flower-visiting beetles. There are approximately 50 families of beetles that are important as flower visitors and nearly 70 beetle families in total.

Some of the major pollinating groups are:

- Scarab beetles (*Scarabaeidae*)
- Weevils (*Curculionidae*)
- Sap beetles (*Nitidulidae*)
- Rove beetles (*Staphylinidae*)

Even though beetles are insects that have been around for millions of years, certain families of beetles, like *Nemonychidae*, *Kateretidae* and *Glaphyridae*, have long been closely connected with flowering plants. Some ground beetles (*Carabidae*) and pill beetles (*Byrrhidae*), which are not frequent visitors of the flowers, visit them for feeding or shelter.

The beetle and flower are in a special relationship.

The beetles and flowering plants have been evolving together over millions of years in a relationship called cantharophily, or beetle pollination. Beetle-pollinated flowers are large, strong and often plentiful in pollen. They tend to emit large amounts of scent, and can become sources of food, warmth, shelter, and breeding sites for beetles. Examples are water lilies (*Nymphaeaceae*), magnolias (*Magnoliaceae*), and custard apples (*Annonaceae*). Beetles like *Rhopalotria* and some weevil species are essential to the pollination of ancient cycads, also known as "living fossils". It is also a good example of the introduction of *Elaeidobius kamerunicus* into some of the world's oil palm producing countries where it has significantly increased fruit production in the African oil palm. In South Africa and Mediterranean regions bowl shaped flowers attract coloured scarab beetles of the groups *Hopliini* and *Glaphyridae*. The flower beetles pollinate orchids, arums, legumes, sunflowers and ginger plants.

What are flower beetles – friends or pests?

Most flower beetles are beneficial as they assist plants to reproduce. As an instance, orchids of the genera *Dichaea* and *Grobya* are pollinated by *Montella* weevils, and the palm *Acrocomia aculeata* is pollinated by *Andranthobius* weevils. But not all flower beetles are beneficial in all circumstances. Such as the *Endaeus* weevil. It is a natural pollinator of the wild relatives of the custard apple, but when the sugar apple (*Annona squamosa*) was introduced, the beetle started to injure flowers as opposed to pollinating them. Consequently, there was a reduction in the yield of fruit. This indicates that the beetle can be a pollinator or a pest, depending on the species of plant and environmental factors.

The role of the people in Agriculture and Biodiversity.

The significance of the people in Agriculture and Biodiversity. Flower beetles are significant pollinators of the oil palm, custard apple, magnolia and other tropical fruit plants that are of importance to agriculture. They also serve to preserve the health of the forests and natural ecosystems by contributing to the reproduction of many wild flowering plants. The conservation of these insects is important for sustainable agriculture. The conservation of natural habitat, and the reduction of excessive use of pesticides and variety of flowering plants, will help maintain the diversity of flower beetles and the services they provide.

Conclusion

Flower beetles are one of the oldest and most interesting of the natural pollinators. They have special mouth parts, antennae which are extremely sensitive, their hairy bodies and distinctive behaviour which enables them to carry pollen effectively from one flower to another. These insects have been involved in the evolution of plants for millions of years, both ancient cycads and magnolias, as well as economically important crops such as the oil palm and custard apple. While they may be dominated by bees and butterflies, flower beetles are no less worthy of being recognized for their role in ecosystems. These conservation measures will benefit biodiversity and improve sustainable agriculture and healthy ecosystems for future generations.