Mutalism

Evolution of Plant Pollinator Interactions

Introduction - Mutalism is an obligatory interspecific interactions that is strongly beneficial to both species. In past, it was termed symbiosis. In this case both of the species derive benefit and there exists a close often permanent and obligatory contact which is more or less essential for survival of each. In mutalism, two populations enter into some sort of physiological exchange and resulted in coevolution of both species.

Types of mutalism -

mutalism is of the following two types -

[A] Mutalism with continuous contact -

This is often a permanent type of relationship in which two symbionts are in close contact and physiologically interdependent on each other.

Example - The well known example of mutalism is established by the bacteria of the genus Rhizobium. These bacteria form nodules on the roots of leguminous plants and obtain carbohydrates and other substances from the plants. In return the bacteria fix the gaseous nitrogen and pass it on the host.

[B] mutalism without continuous contact -

In this type of mutalism partners are rarely attached to each other and if so it is only for a short duration. However both partners are benefited from each other but the nutritional need is primary at least for one of the species.

Examples - ① Pollination by animals -

certain animals such as bees, moths, butterflies etc. and birds derive food from the nectar, pollen, or other plant products, and in return bring about cross ~~fertilization~~ pollination. To ensure the success of this function, various structural adaptations have occurred in both plants and animals, leading to coevolution.

② Dispersal of fruits and seeds -

Birds and mammals are of great importance as agents of plant distribution. Seeds, fruits, even entire plants become attached to feathers or fur or ingested seeds are eaten and eliminated unharmed with the faeces.

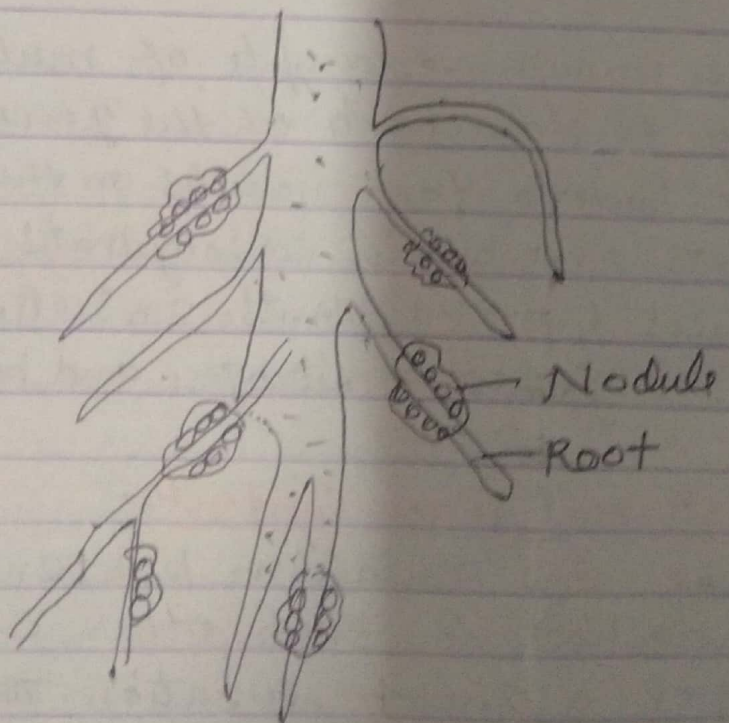

Fig- Mutalism between nitrogen fixing bacteria Rhizobium and leguminous roots.

Coevolution of Plant Pollinator Interaction

The transfer of pollen from the anthers of a flower to the stigma of the same flower or of another flower is called pollination. A pollinator is the biotic agent (animal) that makes pollen from the male anthers of a flower to the female stigma of flower to accomplish fertilization. The plants and pollinator animals develop various adaptation to ensure the success of pollination. The interaction between two different species affect the development of each other's characteristics during the course of evolution. Many plants have evolved relationships with animals that are their pollinators.

Coevolution in Flowering plants to attract animal pollinator

The primary function of flowering plants is to attract pollinators with colourful petals, scent, nectar and pollen. Many plants develop various adaptation like hooks etc for attachment of their seeds to animals. The fruits by their colour, taste, aroma etc attract the animals which feed on them. The course of evolution of these plants in relation to the animals does not stop here but proceeds further so that even the seeds are able to withstand the effect of digestive juices of their hosts. Some of the seeds even germinate faster after they pass through the intestines of the birds. All intact pollinated plants produce peculiar arrangement of petals or pollen colour, nectar and floral odours to

Co-Evolution in Pollinator Animals.

The interactions between plants and animal species are beneficial to each others. Animals evolved specialized body parts and behaviours that aid plant pollination. Coevolution same time results in plants and its pollinator species being totally dependent on one another.

Various animal groups are as important pollinators of various types of flowering plants. The important pollinator animals are bees, moths, butterflies, beetles, birds and mammals.

i) Bees - The most recognized pollinators are the various species of bees which are blainly adopted to pollination. Bees typically are fuzzy and carry on electrostatic charge. Both features help pollen grains adhere to their bodies; but they also have specialized pollen-carrying structures. in most bees this takes the form of a structure known as the scopa which is in the hindlegs of most bees and/or the lower abdomen [e.g. of megachilid bees] made up of thick, plumose setae. Honey bees bumblebees and their relatives do not have a scopa but the hindleg is modified into a structure called the corbicula [also known as pollen basket].

ii) Honeybees - Honey bees have a pollen basket and travel to flower to flower for collecting nectar [later converted to honey] and pollen grains.

The honey bee collects the pollen by rubbing against the anthers. The pollen collects on the hind legs in a structure called as pollen basket. As the honey bee flies from flowers to flowers some of the pollen are transferred on to the stigma of other flowers. Honey bees are guided by light and smell. Honey bee have special mouth parts suited to collect and carry the nectar. Bees see yellow and blue colours. They also see ultraviolet light as a distinct colour and many flowers have ultraviolet markings are pollinated by bees. Bees are not able to see red colour hence rarely pollinate red flowers.

Butterflies and moth- Butterflies are guided by light and smell. Some butterflies are able to see red as a distinct colour. So some butterflies pollinated flowers are red and orange. Butterflies and moth pollinated flowers are often in the shape of a long tube because each insect has a long proboscis. The pollen of tube flowers is normally large and sticky.

Beetles- Beetles are active in night and pollinated flowers are often dull in colour or white but produce strong odors.

Birds- Birds have a good sense of colour and are attracted to colourful red or yellow flowers. They do not have a keen sense of smell, so bird pollinated flowers usually have little odor.

The Humming birds pollinated flowers usually have long tubular corolla suited to their long beak. The pollen is usually large and sticky.

Mammals - Bats are usually active at night so flowers they pollinate are often white. monkey's and Lemurs also participate in pollination of some plants. Humans can be pollinators as many gardeners have discovered that they must hand pollinate garden vegetables.

Why Animal pollinators "service" flowering plants? A rewards for the pollinators food "Nectar" (a sugar solution). In exchange for moving their pollen, flowers have evolved many rewards to attract pollinators. The most common attraction is food, either nectar or pollen. The concentration of sugar present in nectar has evolved match the energy requirements of the specific animal pollinator.

Example - Honey bee needs 30-35% sugar to make honey thise bees will not visit flowers with low sugar concentration in their nectar.

Birds needs dilute nectar because their mouthparts cannot suck up a thick syrup nectar. Beetles eat pollen directly.