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## Butterflies and their contribution in ecosystem: A review

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### Abstract

Butterflies play vital role in the ecosystem, there is co-evolutionary relationship between butterflies and plants, their lives are interlinked. Butterflies are also called flying flower, displaying its beauty. These insects enhance the aesthetic value of the environments by their exquisite wing colors. Butterflies are the wild indicators of the ecosystem; these insects tell us everything about the healthier ecosystem. These are effective pollinators, butterflies visit the flower to eat nectar and this is mutually beneficial relationship. Some species of butterflies migrate over long distance; carry pollen to be shared across plants which are far apart from one another. This migration of pollens induces genetic variation in plants species and give a better chance at survival against different disease. These insects also provide food for other organisms, for example; birds, reptiles amphibians and also acts as biological pest control. But the population of these insects decline rapidly due to human activities, habitat destruction, uses of pesticides and unawareness of people about the importance of flying flowers.

**Keywords:** Butterflies, ecological indicators, pollinators, flying flower, nectar eater

### Introduction

The butterfly is a diverse insect, found in many colours and sizes. Worldwide, there are more than 28,000 species of butterflies, with about 80 percent in tropical regions. Butterflies require food in liquid form<sup>[40]</sup>. Their survival depends on nectar that is produced in flowers and also extra-ripe fruits. The butterfly plays an important role in ecosystems, acting as a pollinator, a food source and an indicator of the ecosystem's well being. Butterflies play a big role in pollinating flowers that open during the day.

Butterflies tend to favor big, colorful flowers that have a landing platform and gather pollen on their long, thin legs as they sip nectar from a flower<sup>[41]</sup>. Butterflies are sensitive to climate change, such as pollination and habitat loss, and cause them to be more responsive. Therefore, an abundance of butterflies usually indicates a healthier ecosystem.

Many butterfly species migrate over long distances as many as 3,000 miles. These migrations allow for pollination across long distances and have increased human interest in the species<sup>[42]</sup>. Butterflies contribute to ecosystem restoration because they supply pollination and a source of food. Increased butterfly populations may indicate an increase in plant diversity and other pollinator groups within restored areas.

Butterflies are attractive addition to flower garden and more important insect than most people realize. As a wildlife indicator, butterflies tell us almost everything we need to know about the health of an ecosystem Dobson, 2012<sup>[1]</sup>.

Swengel demonstrated that in ecosystem, plant and animal species live in sites with similar combinations of soil, topography, climate and geography. Some types of vegetation must be required for Butterfly species existence. Butterflies living in particular place have particular habitat requirements. An interesting part of studying, localized butterflies is learning to find out the microhabitats they require. In ecosystem natural events either favor or reduce butterfly population's characteristics of microhabitats occurring in that ecosystem<sup>[2]</sup>.

### Review of Literature

#### Co-Evolution of Butterflies and Plants

In plant reproductive phenology, general flowering reported from West Malaysia, it might be expected that there is co- evolution between plants and pollinators demonstrated by Asthon *et al*<sup>[3]</sup>. Ehrlich demonstrates that butterflies herbivorous organisms' coevolved with plants<sup>[4]</sup>.

Ehrlich and Raven [5] developed model for the co-evolution of plants and butterflies and summarized the host plant information for the butterflies. Feeny and Gilbert described that Co-evolution involve adaptive radiation of plants that have evolved relative chemical protection from herbivores, followed by adaptive radiation on these plant groups of herbivores able to get around their defenses [6,7]. Feltwell point out that the lives of plants and butterflies are exceptionally interlinked [8].

Heliconius butterflies are herbivores in simple food webs consist of coevolved Host specific parasitoids and larval host plants. Some butterflies pass plant poisons to the next trophic level which has many evolutionary and ecological effects at the food web level [9-13].

### Pollination

According to Webb, Pollination is the process in which pollens are transferred from male parts of flower to female parts of flower and reproduce sexually even over large areas. Nectar produced from flower contains nutritious vitamins, lipids, sugar, amino acid etc. which is important food source for pollinators. Butterflies are also pollinators and visit the flower to eat nectar; tiny scales on the butterfly bodies brush against anthers and pollen adhere to scales. Now the butterfly visit to another flower, the pollen which attach to its scales brush in to the flower's stigma. These insects are attractive and interesting [14].

Baker demonstrates that nectar of many flowers, at which adult Lepidoptera feed, contains significant concentrations of a wide range of amino acids, which must contribute to its nutritional value [15]. American Heliconius butterflies enrich their nectar diet by collecting pollen grains, mixing them with nectar in the coils of the haustellum and ingesting the amino acids that diffuse from pollen grains [7]. Amino acids ingested are of major significance in adult maintenance and reproductive capacity [10]. Breeden demonstrates that the butterfly proboscis adapted for reaching nectar at the base of long tubed flowers. Different species vary greatly in proboscis length. Butterflies are diurnal and some smaller skippers (*Hesperiidae*), are only capable of using shallow blossoms like *Melaleuca sieberi* (*Myrtaceae*), in which the nectar is easily accessible [16]. Butterflies with longer proboscides can use the long, narrowly tubular blossoms of such genera as *Pimelea* (*Thymelaeaceae*) and *Calytrix* (*Myrtaceae*), in which the nectar are deeply concealed in the *Calytrix* flower type.

In Sarawak, Malaysia, (Momose) Butterfly pollinated flowers are tubular and brush likes shapes. Butterfly pollinated flowers of family *Leguminosae*, *Verbenaceae* and *Rubiaceae* were odorless and orange in color when fresh, but they remained in inflorescence, turn reddish even after pollination and this phenomenon was common in tubular flowers like *Ixora* spp., *Rubiaceae* and brush flowers like *Bauhinia* spp. *Leguminosae* [17].

### Genetic Variation in Plant Species

Kearney point out that butterflies collect nectar from plant species, which induce genetic variation in the plants. Some butterfly species migrate over long distance and share pollens across plants which are far away from one another. This helps plants to recover against disease and gives them a better chance at survival [18].

### Reduce Pollution

Some species of butterfly help to reduce the air pollution. These species decrease the carbon dioxide in the air. The host plants of monarch butterflies and caterpillars absorb carbon

dioxide and reduce the amount of air pollution. The caterpillars eat host plant and grow back bigger and better so, it can absorb more carbon dioxide [19].

### Ecological Indicators of Healthier Ecosystem

In 1988 Landres and Simberlof demonstrated that Indicator species indicate the physical and chemical changes in the environment, or the abundance of other species through changes in their own abundance [20, 21]. These indicators are known as ecological indicators [22] and main goal of indicators is to measure the complex system without missing important information [23]. In many regions of the world Lepidoptera are accepted as the ecological indicators of the ecosystem health [24-27]. Butterflies have clear taxonomy their biology and life history are well defined [28, 29]. Physiological tolerances; habitat, temperature, light requirements have been quantified [30, 31] and correlations with changes in ecosystem conditions have been determined by Bowman [32].

Ehrlich, 1984; Oostermeijer and van Swaay 1998 described that Butterflies have high reproductive rates and are at low trophic level due to this, they response quickly to environmental stress. Many butterflies specialize on a specific plant species for oviposition or feeding [26, 33]. Butterflies tend to be easy to find and measure. In a particular habitat if butterfly is endangered then the plants, insects and vertebrates live in that habitat are also at risk. Therefore endangered butterflies serve as barometer of natural conditions in that habitat [34].

According to Dobson, 2012, in the last ten years 72% butterfly and moth species have declined. Butterflies react quickly to minor changes in the environment, providing an alarming signal for other reductions in wildlife and making them good indicator of biodiversity. So, they are best monitored group of insects in the world [1]. Some butterfly species are very sensitive to even light disturbance of natural forest. These species of butterflies are good indicators for natural forest [19].

### Provide Food for Other Organisms

Butterflies provide food for number of animals such as birds, reptiles, amphibians etc. and caterpillars provide an occasional meal for scorpions and ants. Eggs of some flies and wasps live as parasites inside caterpillar's body and feed on it. If populations of butterfly diminish, then population of birds, mice and other animals that rely on them as food source will also reduce. This loss will collapse the entire ecosystem [19]. Stephen Dickie, explains: "Birds plan their whole breeding season around when caterpillars will be most abundant. If butterflies and caterpillar are depleted then there will be less food for developing chicks" [1].

### Predators

Some butterfly larvae feed on harmful insect for example Hoverfly larvae are Predators of aphids [33] so, caterpillars are also use as biological pest control.

### A Flying Flower and Magic

Feltwell demonstrates that adults and larvae of butterflies are closely associated with plants; their beautiful and delicate wing colors enhance the aesthetic value of environment [8].

In 2013 Kumar explain that butterfly is a living flower, displaying its beauty wherever it goes. The bright colors of wings stand out against the blue sky and green foliage, attracting its mates. The bright colors prevent some potential predators by suggesting bad taste or poison. Before the start of winter, fragile Monarch butterfly migrate up to 2, 000 miles,

and form colonies in Mexico and part of California. When spring arrives they head north and east, laying eggs before they die. Though butterflies make the trip only once, they magically know where to go. Metamorphosis is magic in nature; a beautiful butterfly emerges fully formed from a chrysalis that was spun from a crawling caterpillar. The butterfly begins life as an egg that hatch in to larva or caterpillar which grows and pupa stage chrysalis <sup>[35]</sup>.

### Habitat Destruction

Human activities destroy the butterfly habitats. Global climate fluctuation also affects the butterfly habitats. Governmental policy on forestry, farming and road planning has great effect on the abundance and distribution of butterflies <sup>[36]</sup>.

### Pesticides

The distribution and abundance of butterflies decline due to the habitat destruction <sup>[37]</sup>. The use of pesticides on arable crops has profound harmful effects on farmland wildlife <sup>[38]</sup> but its impact on butterflies is unknown. The use of insecticides has little evidence for the reduction in numbers <sup>[39]</sup>. The use of Herbicides with chemical fertilizers and drainage reduce the butterfly number indirectly by changing the unimproved grassland in to improved pasture. Thomas explained that mostly butterfly rich farmland habitat is unimproved grassland. So, herbicides reduce the butterfly population <sup>[30]</sup>.

In 1984 Rands and Sothorn examined the butterfly numbers on two plots of arable farmland in southern England. The field edge of one plot was unsprayed with herbicides, fungicides and insecticides while other plot field was fully sprayed. Unsprayed and sprayed transect sections were paired up according to adjacent field boundary habitat type. On unsprayed plot 868 butterflies were recorded and 297 on the sprayed plot. In survey section 17 species of butterfly were recorded out of which 13 species of butterfly abundant on unsprayed field. Butterfly species were less able to breed in sprayed field. So, use of herbicides on cereal crops reduces the butterfly number <sup>[39]</sup>.

### Conclusion

Butterflies maintain the ecosystem by acting as pollinator, prey, biological pest control, induce genetic variation in plants, and enhance environmental beauty, reduce the level of carbon dioxide in air. But butterfly population is decline rapidly and it is suggest that greater emphasis should be placed on management of habitat and better integration of protected areas. Ecologist use butterflies as model organisms to study the impact of climate change, habitat loss.

### Recommendations

Never capture a butterfly. Encourage people to leave butterflies to fly free. We must admire their beauty. We should aware, the other peoples about the importance of butterflies and other insects. There should be introductory course about the protection and conservation of ecosystem and wildlife at school level.

A great way to help these insects survive is to eat organic foods, avoid the use of herbicides landscaping, and cultivate milkweed and other nectar plants in garden. These insects need our help and we need their invaluable contributions to save entire ecosystems.

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