

An Insight into the Life Cycle of Butterflies: A Case Study of Karjat Tehsil, Ahmednagar District, (MS), India

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Article DOI Link: <https://zenodo.org/uploads/19837206>

DOI: [10.5281/zenodo.19837206](https://doi.org/10.5281/zenodo.19837206)

Introduction

Butterflies are among the most captivating and ecologically significant insects, representing both beauty and biological precision in nature. Their life cycle, characterized by complete metamorphosis, offers a remarkable example of transformation and adaptation. The present chapter provides a detailed account of the life cycle of butterflies, contextualized through a case study conducted in Karjat tehsil of Ahmednagar district in Maharashtra, India. This semi-arid region, with its mosaic of agricultural lands, scrub forests, grasslands, and seasonal water bodies, provides a unique habitat that supports a diverse assemblage of butterfly species.

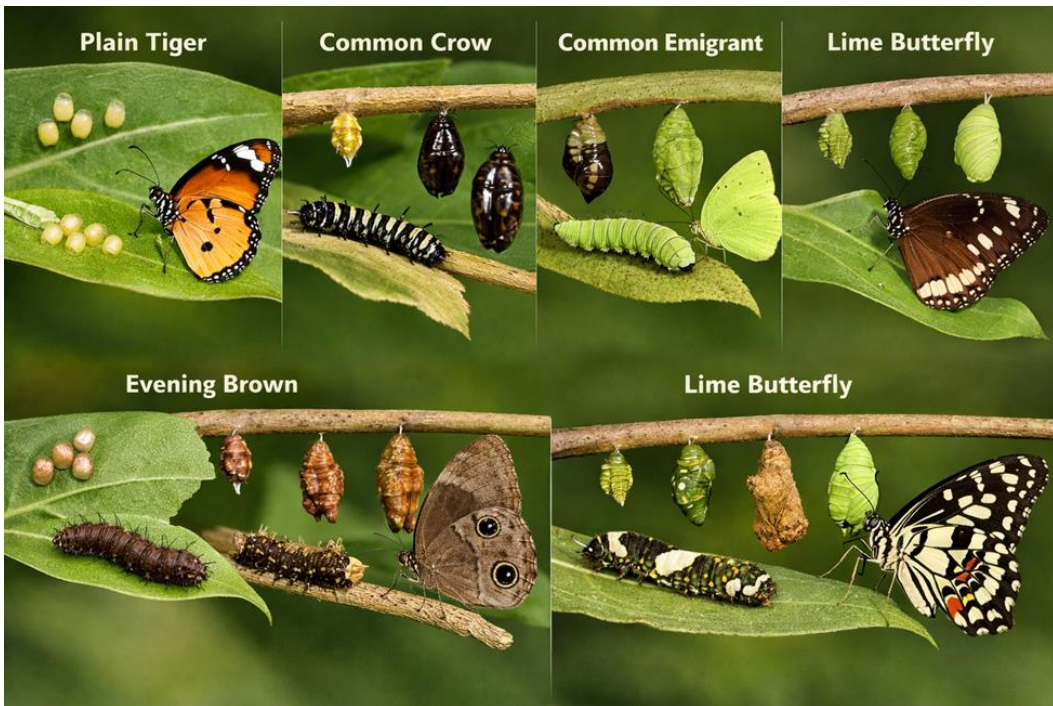
Karjat tehsil lies in the rain-shadow zone of the Western Ghats and experiences a tropical semi-arid climate. The region is characterized by moderate rainfall, hot summers, and mild winters. Vegetation primarily consists of dry deciduous elements, interspersed with cultivated crops such as sugarcane, millet, and pulses. This heterogeneity in habitat structure plays a crucial role in supporting butterfly diversity, as different species rely on specific host plants and microhabitats for survival and reproduction.

The butterfly life cycle consists of four distinct stages: egg, larva (caterpillar), pupa (chrysalis), and adult. Each stage is morphologically and functionally distinct, allowing butterflies to exploit different ecological niches during their development.

The life cycle begins with the egg stage. Female butterflies exhibit remarkable selectivity in choosing oviposition sites. In Karjat tehsil, species such as the Common Mormon, Plain Tiger, and Lemon Butterfly are commonly observed laying eggs on host plants like curry leaves, Calotropis, and citrus plants, respectively. Eggs are usually laid on the underside of leaves to protect them from predators and environmental stress. They vary in shape, size, and texture depending on the species, ranging from spherical to elongated forms with intricate surface sculpturing. The incubation period typically lasts from three to

seven days, influenced by temperature and humidity. In the relatively warm climate of Karjat, embryonic development tends to be rapid, ensuring timely progression to the larval stage.

Upon hatching, the larval stage begins, marking a phase of intense feeding and growth. Caterpillars are voracious feeders and primarily consume the leaves of their host plants. This stage is critical for energy accumulation required for metamorphosis. In agricultural landscapes of Karjat, caterpillars often feed on crop plants, sometimes being considered pests. However, their ecological role extends beyond herbivory, as they contribute to nutrient cycling and serve as prey for birds, reptiles, and other insects.



Caterpillars undergo multiple molts, known as instars, during which they shed their exoskeleton to accommodate growth. Morphological adaptations such as cryptic coloration, spines, or chemical defenses are commonly observed. For instance, caterpillars of the Plain Tiger butterfly sequester toxic compounds from their host plant, making them unpalatable to predators. Field observations in Karjat indicate that larval survival is influenced by predation pressure, availability of host plants, and climatic conditions. Heavy rainfall during the monsoon can dislodge larvae, while extreme heat during summer may lead to desiccation.

Following the larval stage, the butterfly enters the pupal stage, also known as the chrysalis. This is a transitional phase during which the caterpillar undergoes

profound physiological and morphological changes. The pupa is typically immobile and often camouflaged to blend with the surroundings, reducing the risk of predation. In Karjat tehsil, pupae are commonly found attached to plant stems, leaves, or even man-made structures such as walls and fences.

Inside the chrysalis, a process known as histolysis and histogenesis takes place. Larval tissues break down and reorganize to form adult structures such as wings, antennae, and reproductive organs. This stage may last from one to two weeks, depending on environmental conditions. In cooler months, pupal duration may be slightly extended. The transformation occurring within the chrysalis is one of the most fascinating phenomena in biology, symbolizing renewal and adaptation.

The final stage of the life cycle is the adult butterfly. Upon emergence, the butterfly expands and dries its wings before taking its first flight. Adult butterflies are primarily involved in reproduction and dispersal. They feed on nectar, which provides the energy required for flight and mating activities. In the Karjat region, flowering plants such as lantana, cosmos, and sunflower serve as important nectar sources.

Adult butterflies exhibit a range of behaviors including territoriality, courtship, and migration. Males often establish territories and engage in aerial displays to attract females. Courtship involves visual and chemical cues, culminating in mating. After fertilization, females seek suitable host plants to lay eggs, thus completing the life cycle.

Seasonal variations significantly influence butterfly populations in Karjat tehsil. The monsoon season, with its abundance of vegetation, supports high larval and adult populations. Post-monsoon months are particularly rich in butterfly diversity due to the availability of nectar sources and favorable climatic conditions. Conversely, the harsh summer months may lead to reduced activity and population decline. Some species adopt survival strategies such as diapause or migration to cope with adverse conditions.

Human activities also play a crucial role in shaping butterfly habitats. Agricultural practices, use of pesticides, urbanization, and deforestation can negatively impact butterfly populations by reducing host plant availability and increasing mortality rates. However, the presence of home gardens, roadside vegetation, and conservation efforts can provide refuge and support biodiversity. In Karjat, traditional farming practices and the cultivation of diverse crops contribute to maintaining ecological balance and supporting butterfly life cycles. The study of butterfly life cycles in Karjat tehsil highlights the intricate relationship between organisms and their environment. Butterflies serve as important bioindicators, reflecting the health of ecosystems. Their sensitivity to environmental changes makes them valuable in monitoring biodiversity and assessing the impact of anthropogenic activities.

Conclusion

In conclusion, the life cycle of butterflies is a complex and finely tuned process that exemplifies the adaptability and resilience of living organisms. The case study of Karjat tehsil underscores the importance of habitat diversity, climatic factors, and ecological interactions in shaping butterfly populations. Conservation of natural habitats, promotion of sustainable agricultural practices, and awareness about the ecological significance of butterflies are essential for ensuring their continued survival. Through understanding and appreciating their life cycle, we gain deeper insight into the delicate balance of nature and the need to preserve it for future generations.

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