

Certificate

This is to clarify that **veera venkata Pratap inolu** the Roll No “**22HU1A0412**” has carried out a research work entitled “ Enchanted wings marvels of butterfly species” for a project work ,2025. The study was conducted under my supervision. I further certify that project work has been submitted to the smart Bridge

Veera Venkata Pratap

Department of ECE

Chebrolu engineering college

Declaratipon

I do here by declare that the project work entitled “**Enchanted wings; marvels of butterfly species**” presented for the fulfilment of +3 final year ECE of 6th semester, 2025 has been carried out by me and has not been previously submitted to any other university , college or organization for academic qualification on certificate or any degree.

I do here by warrant that the work, I have presented does not match to any existing copy right acts.

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Acknowledgement

I would like to gratefully acknowledge the following people and organization for their assistance and advice that have made the project successful. I am grateful to honorable.

SmartBridge for giving me permission to pursue this study. I am especially thankful to my friend Rajesh for this guidance and cooperation during my project work.. they have encouraged me during my project work . a special word . of thanks to him .

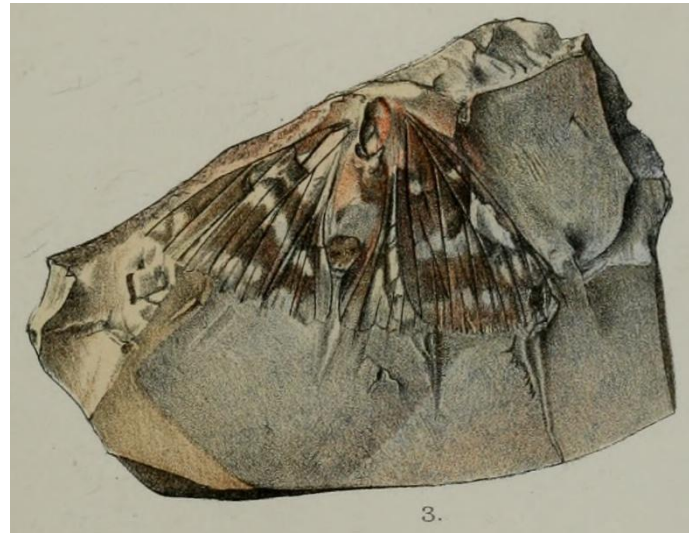
Financial support for publication of booklet under National Mission on Himalayan Studies (NMHS) is gratefully acknowledged. The assistance and motivation provided by Peter Smetachek of Butterfly Research Centre, Bhimtal and Dr. L. M. S. Palni (former Director of the Institute) during the progression of information compilation is sincerely thanked.

The auspices of the Ministry of Environment, Forest and Climate Change (MoEF & CC) is gratefully acknowledged for being extremely supportive and inspiring all through this work. More importantly, we would like to place on record our appreciations for the lively atmosphere provided and enthusiasm expressed by school children during Nature Camps at *Surya-Kunj*, and critical comments by the Researchers of the Institute remained most effective motivation for this compilation

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Introduction

Butterflies and moths are members of the order Lepidoptera, meaning “scale wing”. The wings of these insects are covered with microscopic scales, which are iridescent and brightly coloured. It is one of the most species rich orders in the class Insecta, encompassing moths and the three super families of butterflies, skipper butterflies, and moth butterflies. It is estimated that globally this order has more than 180,000 species in 128 families and 47 super families. The butterflies have a special place in the insect world. They are beautiful, elusive and fascinating. The synonyms used for butterflies include ‘flying feathers’ or ‘flying jewels’ which reflects their delicate but attractive habits. The influence of these creatures on many cultures and civilizations is very strong. In ancient Greek, same word ‘psyche’ was used for soul and butterfly. And, it is believed that human soul travels to the heaven just as a butterfly flies. Similarly, in India names of some butterflies indicate the strong influence of Hindu culture such as *Durga* and *Saraswati*. Butterflies are usually appreciated very differently to their close relatives, the insects, due to its magnificent colours and associated cheerfulness. Also, they do not bite or sting because they do not have the necessary mouth parts. These features are not true for the other relatives, like wasps, bees, grasshoppers and mosquitoes. Such characteristics



make butterflies a model of innocence among all other relatives of the group.

The Butterflies⁹ Lepidoptera- The Importance

Besides providing a nutritious diet to many predators during different stages of its life cycle, butterflies

and moths are important pollinators. Although are less efficient as compared to others such as bees.

Similarly, their roles as agricultural pests and in silk production can not be overlooked. Moreover, their

wing patterns provide the opportunity to address key issues in evolutionary-developmental biology,

including the evolution of morphological innovations, constraints in evolutionary change, phenotypic

plasticity, environmental influence, etc. They also have characteristic biological properties that

distinguish them from all other insects (e.g. females as heterogametic sex, derived wing colour patterns,

colour vision and holocentric chromosomes). Above all, butterflies could play a significant and genuine

role if they are used as important tools in demonstrating remarkable diversity of nature and promoting

public understanding of science through the common language of beauty.

Threats

Like most of other animal groups, populations of known many species of butterflies and moths are

reported declining, partially due to loss of migratory and nectar corridors. Many species of butterflies

and moths undergo some type of migration, and due to the loss of appropriate habitats and the distance

of the migration routes has resulted in declining populations. Habitat loss, alteration, use of pesticides

etc., are other key factors which significantly contribute in their decline. Some of the threatened species



of butterflies of the Himalayan region include: Kaiser-I-Hind, Bhutan Glory, some of Apollos, Chumbi

White, and Common Jezebel, etc. Considering importance of the group it is imperative to attempt to

reverse this trend through various conservation efforts including community participation for habitat

restoration and their increased appreciation for these beautiful creatures.

The insects

The insects belong to the largest phylum of the animal kingdom, the Arthropoda. The Crustacea (lobsters,

crabs and wood lice), the Arachnids (spiders, scorpions, mites and harvestmen) and the Centipede-like

insects (millipedes and centipedes) are also included in this group. They form by far the largest and most

richly diverse group in the animal kingdom. No less than 70% of the over 1 million species described till

date are insects. The main features that all these generally small animals have in common are 6 legs, 1

pair of antennae and a segmented body with head, thorax and an abdomen. The insects are subdivided

in to orders on the basis of their wing features. Some of these orders include Coleoptera (beetles),

Hymenoptera (bees, wasps and ants), Orthoptera (grasshoppers and crickets) and the Lepidoptera

(butterflies and moths).

Reproduction

Butterflies reproduce sexually and undergo a complete metamorphosis, which includes four stages: egg, larva (caterpillar), pupa (chrysalis), and adult. The process begins with mating, where males attract females through visual signals and scent chemicals called pheromones. During mating, the male transfers a spermatophore—a packet of sperm and nutrients—to the female. This mating process can last from a few minutes to several hours. After mating, the female stores the sperm and uses it gradually to fertilize her eggs. She lays hundreds of tiny eggs on specific host plants that are suitable for the caterpillars to feed on once they hatch. Each butterfly species has preferred host plants; for example, monarch butterflies lay eggs only on milkweed.

The eggs hatch into larvae or caterpillars, which are the main feeding stage of the butterfly's life cycle. Caterpillars eat voraciously, mostly feeding on the leaves of the host plant. As they grow, they molt several times, shedding their skin. Once fully grown, the caterpillar forms a protective casing called a chrysalis, entering the pupal stage. Inside the chrysalis, the caterpillar undergoes metamorphosis, transforming into an adult butterfly through the breakdown and reformation of its body structures. After days or weeks, the adult butterfly emerges from the chrysalis with soft wings, which it expands and dries before flying. Soon after, it begins the search for a mate, continuing the reproductive cycle.

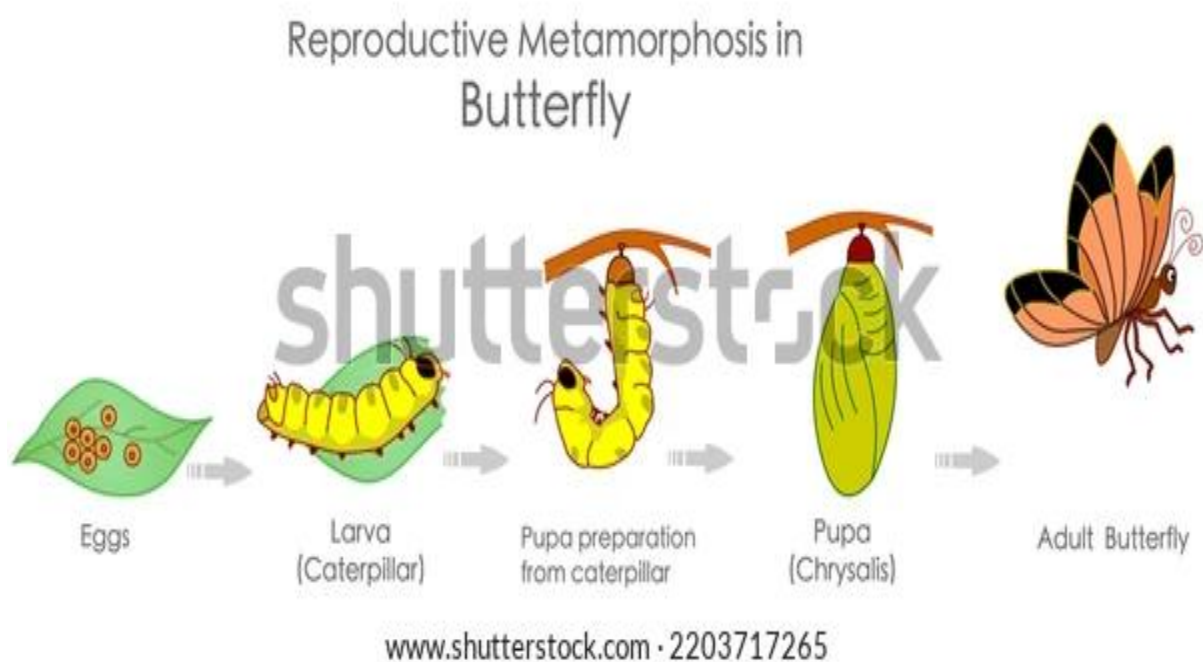


Butterflies are fascinating insects that reproduce sexually and go through a complete metamorphosis. Their life cycle has four distinct stages: egg, larva (caterpillar), pupa (chrysalis), and adult. The reproductive process begins when adult butterflies become sexually mature, usually within a few days after emerging from the chrysalis.

Males actively search for females using visual cues and chemical signals called pheromones. Some species perform courtship dances or display bright wing colors to attract mates. Once a male finds a receptive female, they join at their abdomens to mate. During this process, the male transfers a packet of sperm, called a spermatophore, into the female's body.

Mating can take anywhere from a few minutes to several hours. After mating, the female stores the sperm inside her body and can use it over time to fertilize hundreds of eggs. She lays these eggs on specific host plants that will serve as food for the larvae once they hatch.

Egg-laying is a critical part of the butterfly's reproductive success. Females carefully choose host plants using their antennae and feet, which have sensors to detect the right chemical composition. For example, monarch butterflies only lay eggs on milkweed plants because their caterpillars can eat only that species.



The eggs are usually tiny, round or oval-shaped, and may be laid singly or in clusters depending on the butterfly species. After a few days (or longer, depending on temperature and species), the eggs hatch into larvae, commonly known as caterpillars.

Caterpillars are the main feeding stage of the butterfly's life. They begin feeding immediately, usually on the leaves of the host plant. They have powerful jaws (mandibles) to chew plant material and grow very quickly. As they grow, they go through several stages called instars, shedding their outer skin each time.

Most caterpillars molt 4–5 times before they reach full size. Once mature, the caterpillar stops feeding and searches for a safe spot to begin pupation. It attaches itself to a surface using silk

and transforms into a chrysalis (pupa). Inside the chrysalis, an incredible transformation takes place.

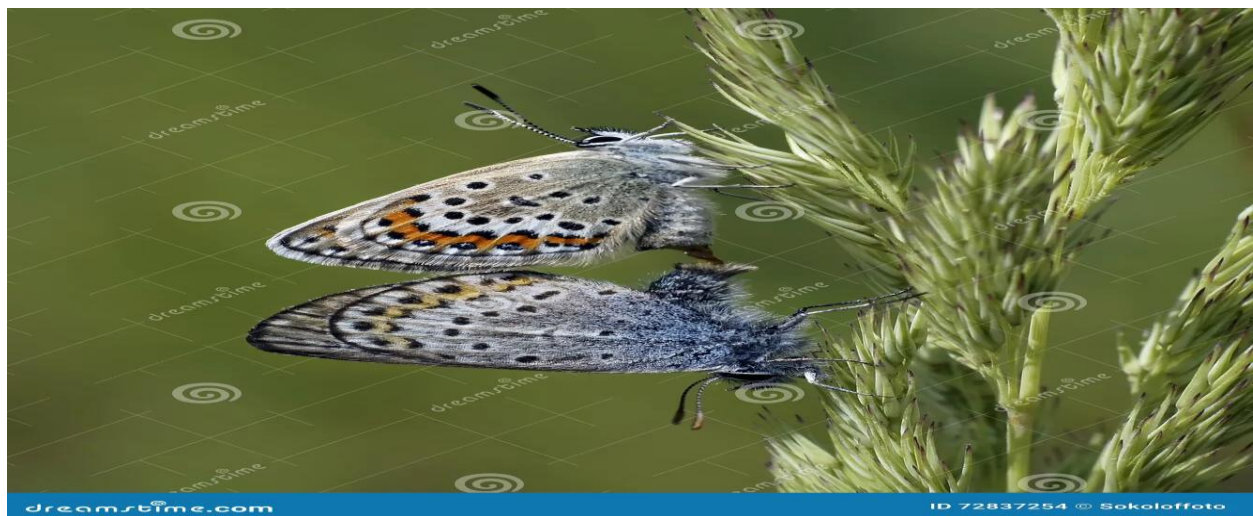
This process, called metamorphosis, involves the breakdown of larval tissues and the development of adult structures like wings, antennae, and compound eyes. The pupal stage may last several days or weeks, depending on the species and environmental conditions.

When development is complete, the adult butterfly emerges from the chrysalis in a process known as eclosion. At first, the butterfly's wings are soft and crumpled. It pumps a fluid called hemolymph into the wings to expand and strengthen them.

After resting and drying its wings, the butterfly becomes ready to fly. Within a short time, it begins to seek a mate and repeat the cycle. Most butterflies live for a few weeks as adults, although some migratory species like monarchs can live for several months.

Butterfly reproduction is a complex and delicate process that depends on environmental factors like temperature, humidity, and availability of host plants. It ensures the continuation of butterfly populations and their vital role in pollination and ecosystems.

From the tiny egg to the flying adult, the butterfly's life is a remarkable journey of change and adaptation. Each stage plays a crucial role in its survival and reproduction, contributing to the diversity and beauty of butterflies around the world.



Behaviour of butterflies

Butterflies are known for their vibrant colors and delicate wings, but they also display a wide range of fascinating behaviors that help them survive, reproduce, and interact with their environment. One of their most noticeable behaviors is **flight**. Butterflies are active during the day (diurnal) and use their flight not only to move from place to place but also to escape predators, search for food, and find mates. Their flight patterns vary between species—some glide gracefully while others flutter quickly and erratically to confuse predators.

Butterflies are highly **dependent on sunlight** for activity. They are cold-blooded, which means they rely on external temperatures to warm up. You can often see butterflies basking in the sun with their wings spread wide to absorb heat. In cooler temperatures or cloudy weather, they become sluggish and may hide under leaves or among grasses.



Feeding behavior in butterflies involves sipping nectar from flowers using a long, tube-like tongue called a **proboscis**. This feeding not only provides them with energy but also plays a vital role in pollination. Some species also feed on rotting fruit, tree sap, or even animal dung and mud puddles—a behavior known as **puddling**, which helps them obtain minerals and salts, especially important for males in reproduction.



Social behavior in butterflies is generally limited, but they do interact during **courtship and mating**. Males often patrol or perch in sunny spots waiting for females. Some species engage in aerial courtship dances, while others release special pheromones to attract mates. Once a female is fertilized, she shows **selective egg-laying behavior**, choosing host plants carefully to ensure the survival of her caterpillars.

Butterflies also display a range of **defensive behaviors**. Many have wing patterns that act as camouflage, helping them blend in with their surroundings. Some species mimic leaves, bark, or even other toxic species—a survival strategy called **mimicry**. Bright colors can act as warning signs to predators, signaling that the butterfly may be toxic or unpalatable.

In addition to these, butterflies are known for their **migratory behavior**. One of the most famous examples is the monarch butterfly, which migrates thousands of kilometers between North America and Mexico each year, guided by environmental cues such as sunlight, temperature, and magnetic fields.

Overall, the behavior of butterflies reflects a finely tuned relationship with nature. From feeding and mating to migration and defense, every action helps butterflies survive and reproduce in a constantly changing environment.

Lepidoptera-

The Importance

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Monarch Butterfly (*Danaus plexippus*):

The iconic Monarch is renowned for its brilliant orange wings with black veins and white spots. With an average wingspan of about 10 cm, it is famous for its incredible multigenerational migration—traveling up to 3,000 miles each fall from North America to central Mexico, guided by the sun and Earth's magnetic field. Monarchs lay eggs exclusively on milkweed plants; their caterpillars sequester toxic cardenolides from milkweed, making both larvae and adults unpalatable to predators. Although once abundant, monarch populations have recently declined dramatically due to habitat loss, pesticide use, and climate change, prompting consideration of endangered listing in the U.S

Blue Morpho (*Morpho peleides*):

The Blue Morpho dazzles with its iridescent blue wings—among the largest in the world, spanning 12–20 cm. This brightness comes from microscopic scales reflecting light, while the wing undersides have dull brown camouflage and eyespots to deter predators. Native to tropical rainforests from Mexico to Peru, Blue Morphos spend most of their time in the understory, flying into clearings and riverbanks where their brilliant color becomes visible. Their caterpillars feed on pea family plants and can turn cannibalistic, while adults sip juices from rotting fruit, tree sap, and mud using their proboscis





The Common Jezebel is a striking medium-sized pierid butterfly found across South and Southeast Asia, including India and Sri Lanka. It features a dull upperside and a brilliant underside of red, yellow, and white markings—a visual signal to birds, warning of its unpalatability from larval toxins. Females fly through tree canopies in search of parasitic mistletoe and shrubs to lay eggs, while males frequent flowers for nectar. The butterfly is known for its nomadic behavior in various habitats, from hill forests to urban gardens, and often rests with wings closed to display its vivid warning patterns

