

**SIZE: Largest and Smallest**

The largest butterflies in the world are among the birdwings (family Papilionidae). The goliath birdwing of New Guinea, *Ornithoptera goliath*, is the largest, with females having wingspans up to 280 mm (ca. 11 inches). The smallest butterflies are among the blues (family Lycaenidae), where some are as small as 6 mm in wingspan (ca. 1/4 inch). For example, among high desert species found in the Andes of Bolivia and northern Chile, in the genus *Itylos*, and in such desert regions as Afghanistan, as in the genus *Micropsyche*. Our own native pygmy blue (*Brephidium exilis*) also has some dwarf individuals as small as 6 mm, although most of them are closer to 10 mm in wingspan. The average butterfly, however, is about 30 mm in wingspan (ca. 1-1/4 inches), since there are a great number of very small butterflies among the blues (Lycaenidae) and skippers (family Hesperiidae).

Most moths tend to be smaller, but some are also very large. The largest known lepidopterans are moths, where among emperor moths some of the atlas moths (genus *Attacus*, family Saturniidae) have wingspans as large as 300 mm (ca. 12 inches). The smallest moths are some leafminers of the pygmy moth family (Nepticulidae), where the smallest known species are but 2.5 mm in wingspan (ca. 3/32 inch). The average moth, however, is about 25 mm in wingspan (ca. 1 inch).

**BUTTERFLY WORD ORIGINS**

The word "butterfly" is thought to come from the Old English and Old German word "buterfloege", or literally "butter fly". This comes from the yellow butterflies in Europe that looked like slices of butter on the wing to people in those times. Likewise, there is English folklore of fairies stealing butter, thus "butter flies."

All languages have a word for butterfly, as the following examples show:

farfalla (Italian)	borborleta (Portuguese)
lepke (Hungarian)	mariposa (Spanish)
Schmetterling or Tagfalter (German)	fluture (Romanian)
papillon (French)	farasha (Arabic)
vlinder (Dutch)	kupu-kupu (Indonesian)
sommerfugl (Danish)	rama-rama (Malaysian)
psyche (Greek)	titli (Urdu)
chô-chô (Japanese)	boboochka (Russian)
hú díeh (Chinese)	kipepeo (Swahili)

**MIGRATION**

Many butterfly species are well known migrants. Perhaps the most famous is the migration of the monarch butterfly, *Danaus plexippus* (family Nymphalidae, subfamily Danainae), which makes long directed flights from as far north as southern Canada, all the way to central Mexico where they overwinter in mountain refuges and then make the return trip the next spring. Years of tagging of butterflies discovered the purpose and goal of these flights. Most fly along the Gulf Coast and then into Mexico, but some monarchs come to Florida and then fly over the water to Cuba and Yucatan, while a few stay in southern Florida to overwinter.

Other migrations have been recorded among other species of butterflies in other areas of

the world. For example, the snout butterflies (family Libytheidae) almost all have directed migrations at some time during the year. Likewise, for some of the white butterflies (family Pieridae), and others. In Taiwan, the black monarchs of that region (genus *Euploea*), also Danaeinae (family Nymphalidae), have short migrations to overwinter in warm mountain valleys of southern Taiwan, before returning in spring to higher elevations in the high mountains of Taiwan. Some moths also have migrations, as for example the urania moths of South America (family Uraniidae).

## FLIGHT

Most butterflies have a rather slow flight pattern, with slowly flapping wings, in their normal flight behavior. However, many butterflies fly faster and have strong bodies and flight muscles. For example, the *Charaxes* butterflies of Africa and the *Prepona* butterflies of South America all fly very fast (both in family Nymphalidae). Our own hackberry butterflies, genus *Asterocampa* (family Nymphalidae), also tend to fly rather fast among the forest trees where they are mostly found. The small skipper butterflies (family Hesperidae) also mostly fly rather fast, especially the yucca skippers, subfamily Megathyminae. The fastest lepidopterans, however, are among the moths, where some of the day-flying hawk moths (family Sphingidae) have been recorded flying at up to 35 mph.

Butterflies can also hover over flowers when nectaring, but the best hoverers are among the hawk moths (family Sphingidae) that fly during the day, which can fly in place like hummingbirds. For example, in Florida we have 3 species in the genus *Hemaris* that fly like this. These moths are also sometimes called bee moths, or hummingbird moths.

## MIMICRY

Some butterflies are poisonous because of the plants their caterpillars feed on. For example, our monarchs are distasteful to birds because of the plant chemicals the caterpillars get from the milkweed leaves they eat, which are poisonous to most animals. Mimicry enters the picture, because some butterflies have evolved to look like these poisonous species, yet are themselves not poisonous. Once a bird knows a monarch does not taste good, they will also not try to eat any other butterfly that looks like a monarch. Thus, in Florida we have the viceroy butterfly, *Limenitis archippus* (family Nymphalidae), which mimics the monarch (the model in this case) in coloration and wing pattern. This phenomenon is called Batesian mimicry, in that only the model gets any benefit from this mimicry, since to work it requires that there are many more models than mimics. It is named after the man that first defined this kind of mimicry, H. W. Bates, who presented his ideas back in 1862. Some moths also mimic poisonous moths, or even other insects, like some poisonous beetles and bugs. For example, in Florida we have wasp moths, subfamily Ctenuchinae (family Arctiidae), which mimic various wasps, and on the wing it is hard to tell them apart, both in color pattern and flight behavior.

Another kind of mimicry is Müllerian mimicry, named after F. Müller, who defined this mimicry in 1879. In this mimicry, the numbers of similar looking butterflies all get a benefit in looking like species that are poisonous since any butterfly that looks like the model will help educate birds and other predators that any butterfly with a particular coloration and pattern should be avoided. For example, in Florida we have some similarity between tiger swallowtails (genus *Papilio*, family Papilionidae), zebra swallowtails (genus *Eurytides*, family Papilionidae), and the zebra longwing (genus *Heliconius*), which all have a striped color pattern but only the

zebra longwing is poisonous. In the tropics, some mimicry complexes like this have even more strikingly similar species among several families of moths and butterflies.

### BUTTERFLY COWS

Some butterflies have caterpillars that are like cows and live among ants. Most all the blues and hairstreaks (family Lycaenidae), have caterpillars tended by ants like we do with milk cows. The butterfly caterpillars get protection from predators, since the ants will chase away anything coming close to their "cows", and the caterpillars give ants a sweet liquid that ants like to gather and eat. The caterpillars have special organs on their body that ants can lick to get this liquid. Usually, at least one ant is assigned to watch each caterpillar. This kind of caterpillar-ant behavior is called commensal behavior, where one lives with the other and gets some benefit from the other, and the caterpillars are also called myrmecophilous, or ant-loving. Some caterpillars of blue butterflies even live inside the nests of ants, as among some Southeast Asian species.

### BUTTERFLY LIONS

Some butterfly caterpillars are like leopards or lions, living with ants but actually eating the ant larvae. This is known in a few of the blue butterflies in Southeast Asia. The ants tolerate the feeding of the caterpillars because they want the sweet liquids the caterpillars give them. Some moths in Australia (family Chrysopolomidae) also are carnivorous on ant larvae in the same way but hide in the ant nests and attack clandestinely. In Hawaii, there is the only known group of moths whose caterpillars stalk, attack and eat other insects. These are among the genus *Eupithecia* (family Geometridae), which have enlarged claws on their front legs to grab flies that come near them.

### LEPIDOPTERA BIODIVERSITY

Moths and butterflies form the insect order Lepidoptera. There are 124 families of Lepidoptera in the world, most of them moths. Butterflies include only 7 families, and total about 20,400 known species, but when all are discovered, it is believed there actually are about 23,500 living species in the world. Moths total about 135,700 known species. It is believed there are another 100,000 lepidopterans in the world awaiting discovery and naming, bringing the real world total to about 255,000 living species of Lepidoptera. The largest moth family is Noctuidae, the owl moths, with about 26,300 known species. The largest butterfly family is Nymphalidae, the brush-footed butterflies, with about 7,080 known species. Butterflies represent only 9% of the total of all lepidopterans.

Most lepidopterans are tropical. We have over 12,500 species in North America, of which only 765 species are butterflies, the rest are moths. In Florida, we have 2,932 Lepidoptera species, of which 189 species are butterflies and 2,743 species are moths.

### BUTTERFLY FEEDING

Butterflies have a tongue formed from two mouth parts, called galeae, that are joined together to form a sucking tube, or haustellum. This tube is curled under their head and can be extended into flower heads to suck nectar, which is the main food of adult butterflies. Almost all butterfly caterpillars feed on plant leaves of various kinds. Moths are the same, but some moths do not feed as adults and even have lost the haustellum: for example, the emperor moths (family Saturniidae) do not have mouthparts and do not feed as adults. Nectaring among butterflies

involves many plants that have flowers with desired nectar and different species prefer different flowers. Some butterflies will also often suck juices from other sources, like rotting fruit, and all obtain water from moist sand, for example.

### BUTTERFLY FORM

Butterflies all have a head, thorax, and abdomen. The 3 walking legs are on the thorax. The head has mouthparts and antennae, plus large compound eyes. Butterfly antennae have clubs or knobs on the ends, although among some skippers (family Hesperiidae) the clubs are elongated and bent. Moths mostly have thin filiform antennae, but a few unusual moths, especially among some that also fly during the day, also have clubbed antennae. The brush-footed butterflies (family Nymphalidae) are unusual in not using their front legs, which they keep tucked under the front of the thorax, using only the other 4 legs for walking. The wings are attached to the central and last thoracic segments. Wing shapes are greatly varied, but typical butterfly wings are rather triangular for the front pair (forewings) and somewhat rounded for the second pair (hindwings), but great variety in shape is known and many butterflies have tails on the hindwings.

### BUTTERFLY LIFE HISTORY

Like all lepidopterans, butterflies have a transformation life cycle of complete metamorphosis, which includes an egg stage, a larval or caterpillar stage, a pupal stage, and an adult stage. Typically, each stage takes at least a week on average, but often can be longer. Most butterflies pupate in exposed pupae, usually attached to the plant they were feeding on as caterpillars. Moths mostly seclude their pupae within a cocoon, even sometimes hidden underground. Most butterflies have several generations per year, every few months, but northern species like we have in Florida often are seen as adults only once or twice during the warmer months. Most moths live but a few days as adults. Butterflies mostly live only some days or a few weeks, but a few species are very long lived for lepidopterans, living overwinter or for many months. For example, the mourning cloak butterfly, *Nymphalis antiopa* (family Nymphalidae), can live over most of the winter, and monarchs (*Danaus plexippus*) likewise make the long flight to Mexico before heading north again the following spring. Among all lepidopterans, the longest period in their lives is as caterpillars, when they may live for many months while they eat and grow. Some moths are known to take up to several years as larvae before pupating to become adults. Some delay in pupating or in becoming adults is due to dry periods or cold periods, which can more easily be survived as caterpillars or pupae than as adults.

### BUTTERFLY COLORS

Many butterflies are brilliantly colored, while others can be very drab and somber in coloration. The same is true for moths, and a few day-flying moths are as colorful as many butterflies, but most moths tend to be more subdued in coloration. Some of the most brilliant colored butterflies are among the tropical morpho butterflies (genus *Morpho*, family Nymphalidae). The iridescent blue of morpho butterflies is due to reflection of light from the structure of the scales on the wings of the butterflies. Most butterflies have less shiny colors and these colors are due to pigments embedded within the scales. This is why butterflies tend to fade in bright lights over time, since the pigments fade, and only species like morphos, with structural colors, will not fade over time. However, even with morphos, the black wing margins, which are pigment colors, will turn white over time while the blue structural colors will remain blue.