
LEPIDOPTERA
(Butterflies and Moths)
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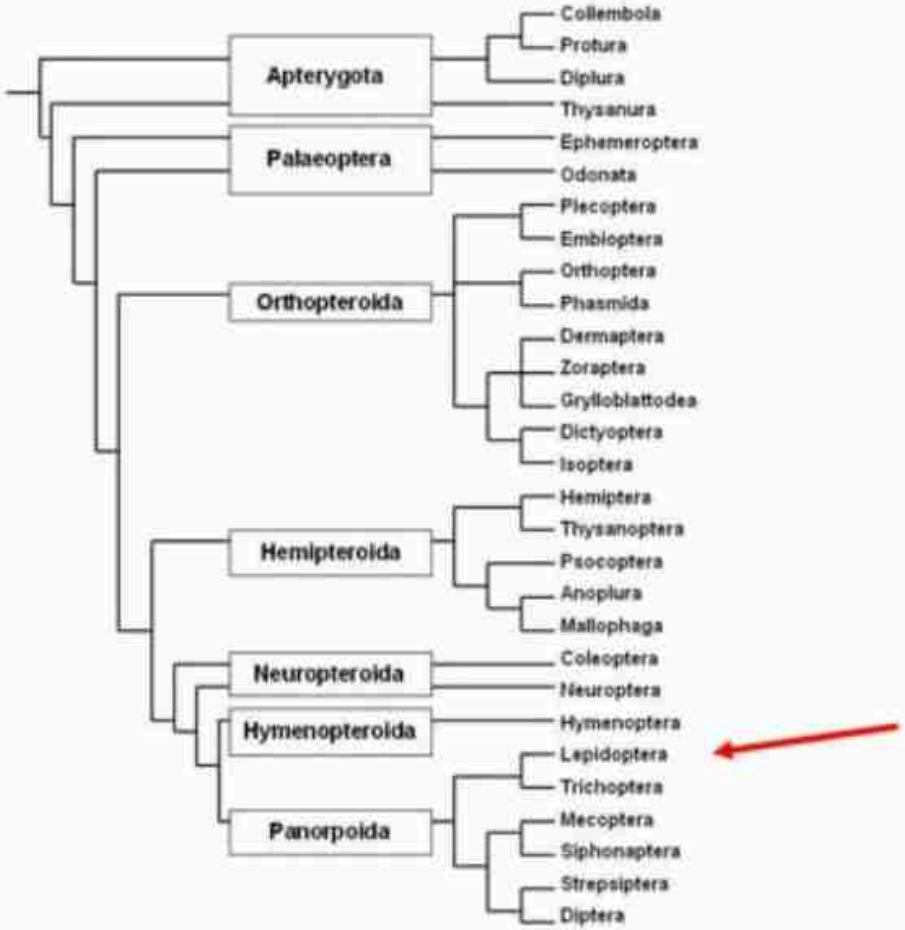
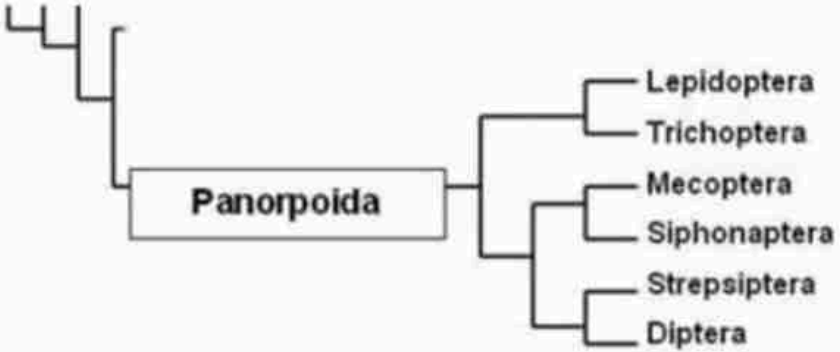
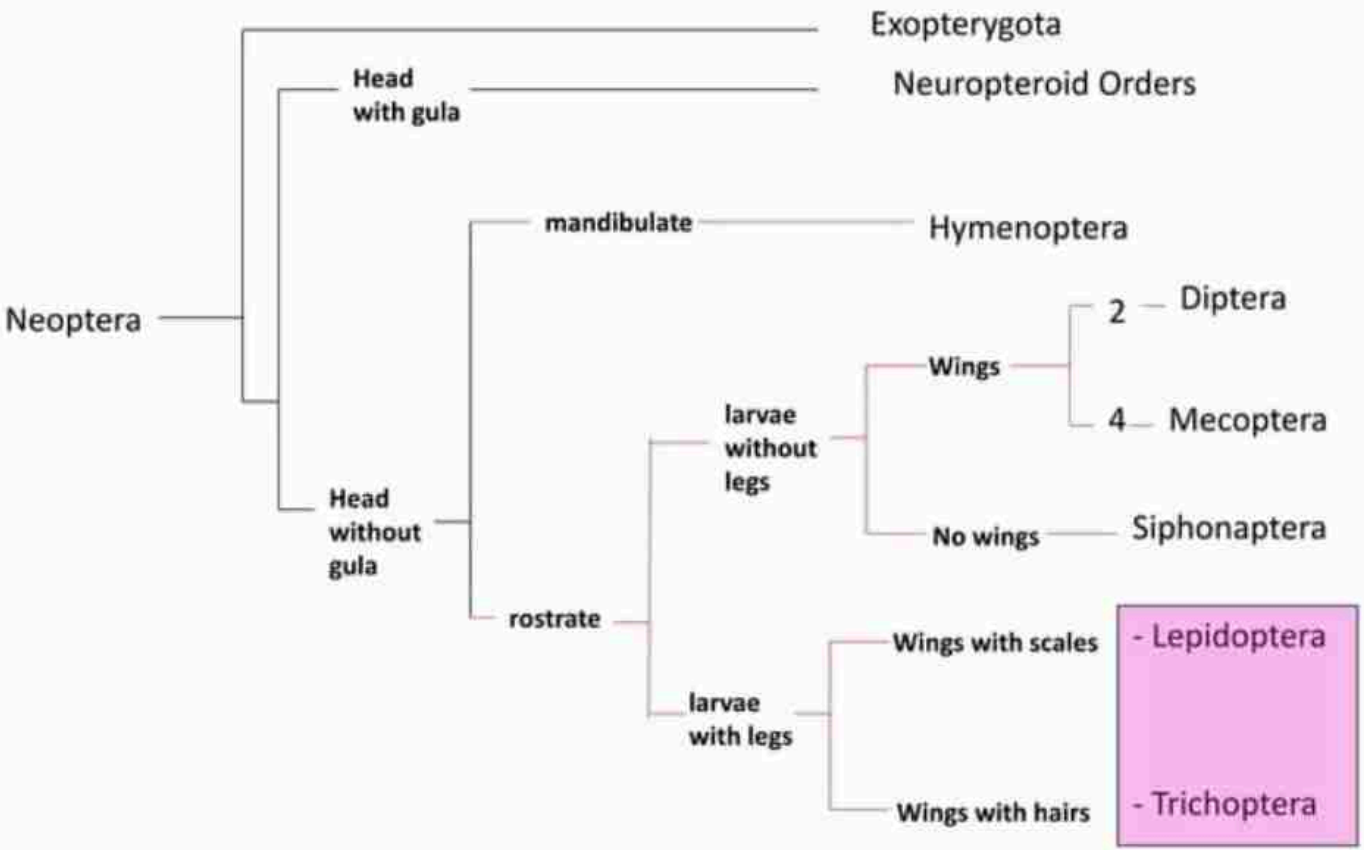
Evolutionary Placement



- Panorpoida = those with sucking mouth parts (not biting)
- Two closely related orders within Panorpoida: Trichoptera and Lepidoptera



So far in classification



Etymology of Lepidoptera

- Comes from Greek language:
  - Lepido meaning "scale"
  - Ptera meaning "wing"

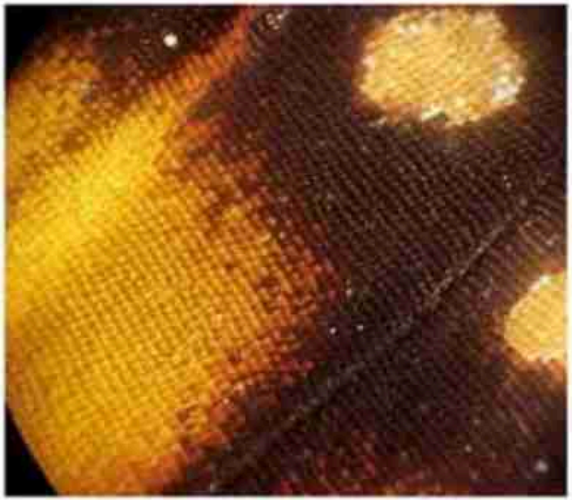
- This makes sense because the insects in this order all have wings in their adult stage and the scales refer to the small flakes that coats the wings of these insects.

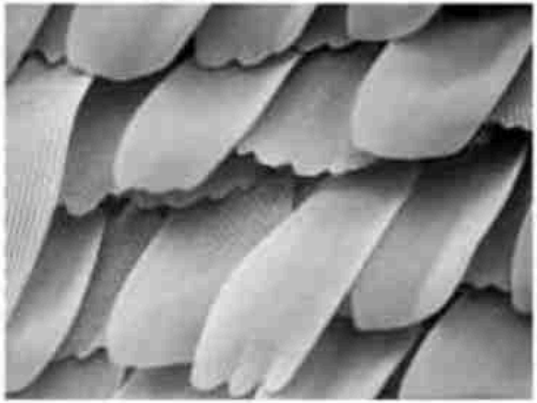
General Characteristics

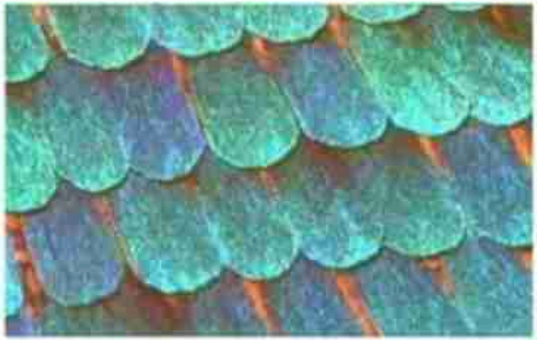
- Two pairs of membranous (transparent) wings that are covered with tiny scales which give colour, rigidity and strength.
- Large compound eyes that consists of many light-sensitive lens, each with its own refractive system and each forming its own portion of the image.

Lepidoptera - Distinguishing Characteristics

Scales on the wings

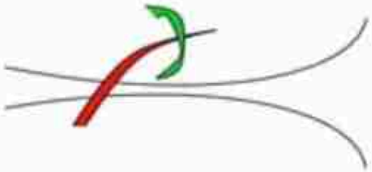




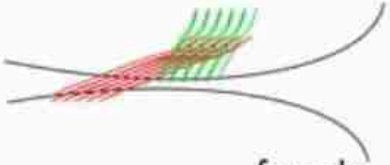


Wing Coupling mechanism in Lepidoptera is either 'Frenate' or 'Amplexiform'

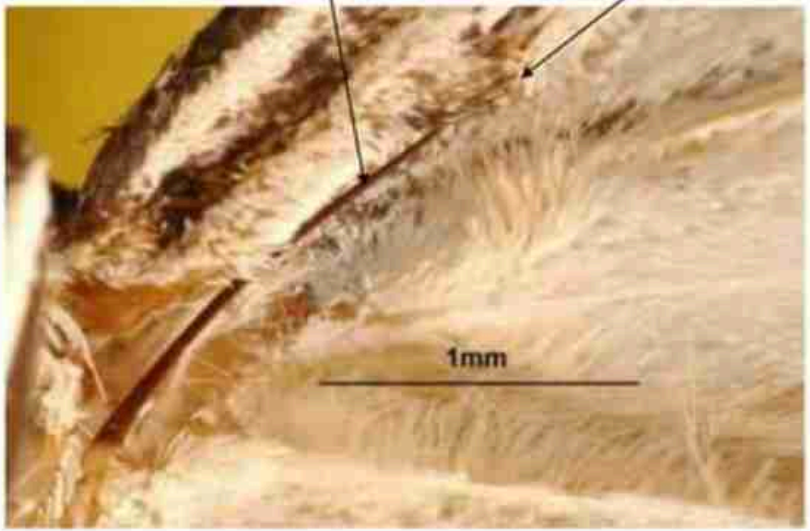
Frenate (Lepidoptera)



male

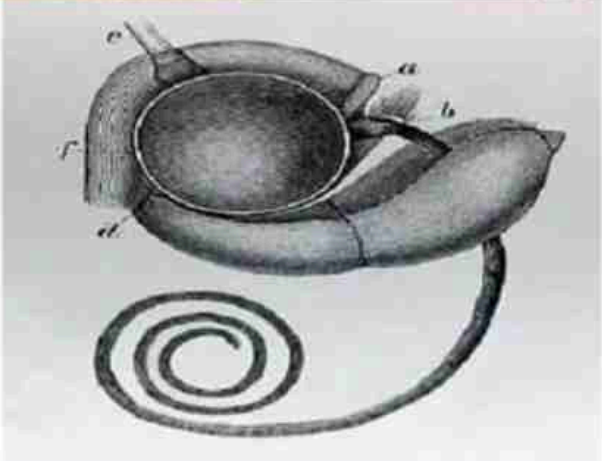


female



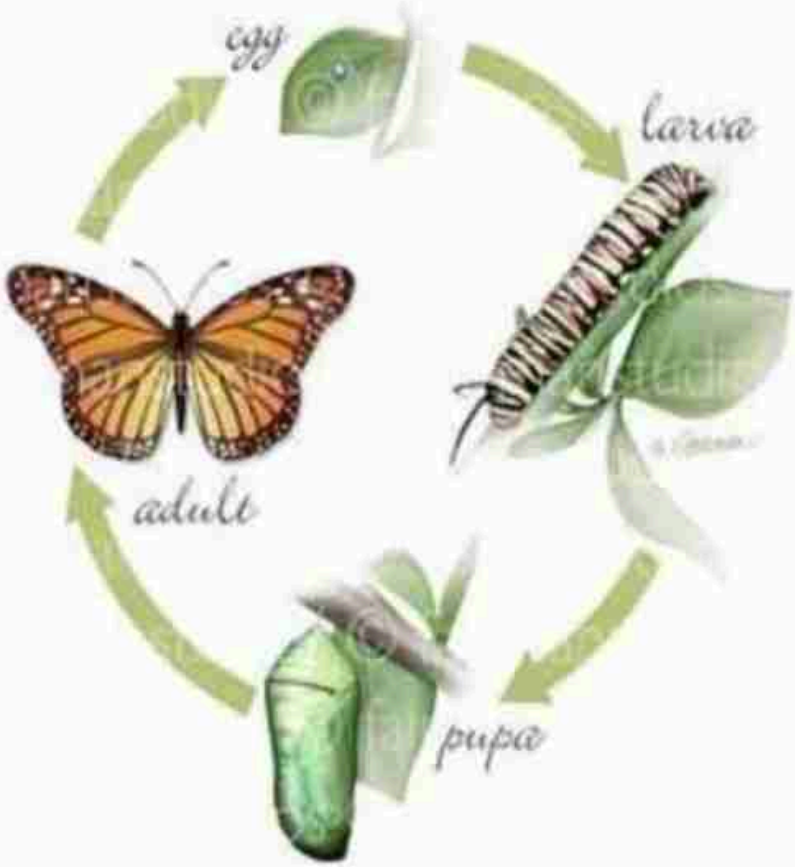
General Characteristics

- One ocelli (simple eye) with simple lens, present above each eye.
- Antennae present.
  - Butterflies generally have Clavate antennae. Sometimes clubbed.
- Mouth parts are formed into a sucking tube known as proboscis by elongation of galeae i.e Siphoning type.



Life Cycle of Lepidoptera

- Moths and butterflies undergo a complete life cycle.
  - Egg
  - Caterpillar (larvae)
  - Pupae
  - Adult



Life Cycle of Lepidoptera

- A female may lay only a few eggs or tens of thousands.
- After the caterpillars hatch, they usually develop through 4 to 7 instars over a period of a few weeks.
- When the caterpillar is ready to pupate they generally find shelter to spin their cocoons.

Lepidoptera Larvae - Distinguishing Characteristics

- Larval Lepidopterans are polypods (caterpillars) and found in a variety of terrestrial habitats.
- Chewing mouthparts: To feed on plant materials.
- Mostly are regarded as serious agricultural pests.

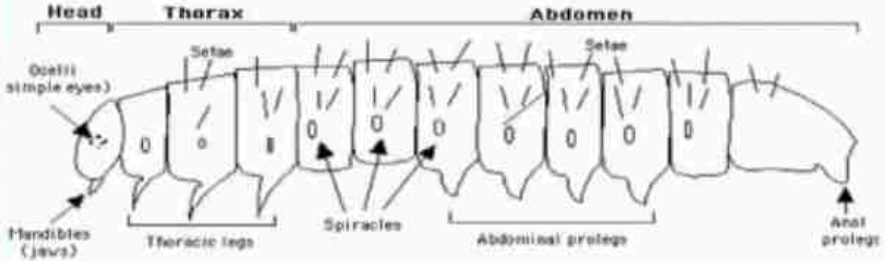


Fig :- Caterpillars

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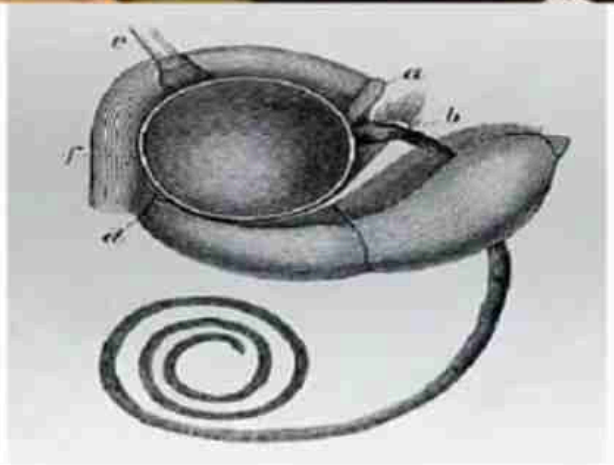
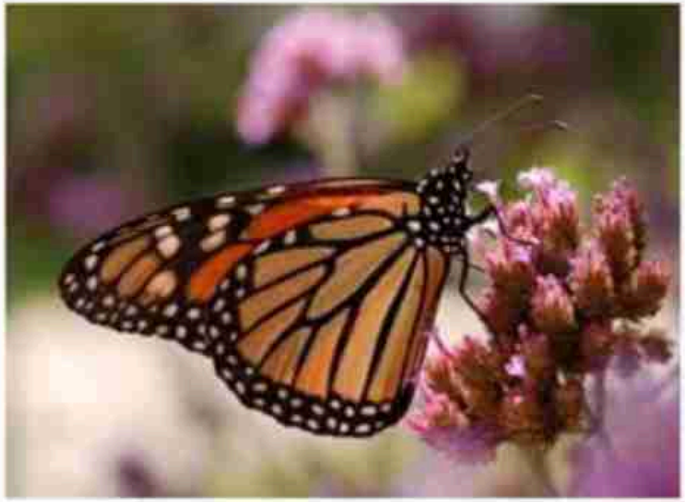


Feeding Habits

- Most larvae of moths and butterflies are neroivores
  - Either eating foliage or wood
- Some are carnivorous
  - Eating other caterpillars
  - Feeding on soft bodied insects
- Adults are generally nectar feeders

General Niche of Lepidoptera

- The Lepidoptera insects feed on the nectar in flowers and then they can pollinate the other flowers they go to. The flowers are dependant on these insects for pollination.



Common Members of Lepidoptera

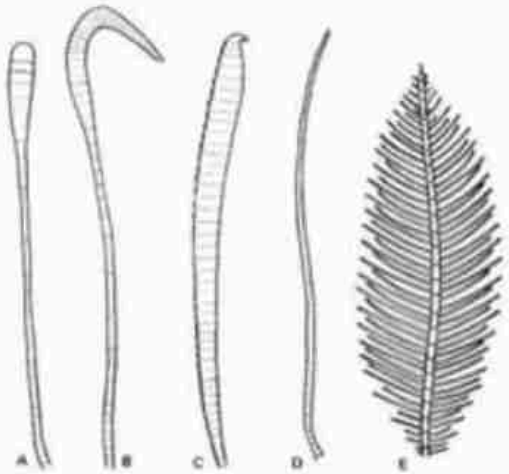
butterfly

moth

Moth vs. Butterfly

- Butterflies have clubbed antennas and the habit of holding their wings vertically when at rest.
- Moths sit with their wings flat.

"Moth" or "Butterfly"?



Lepidopterous antennal types.

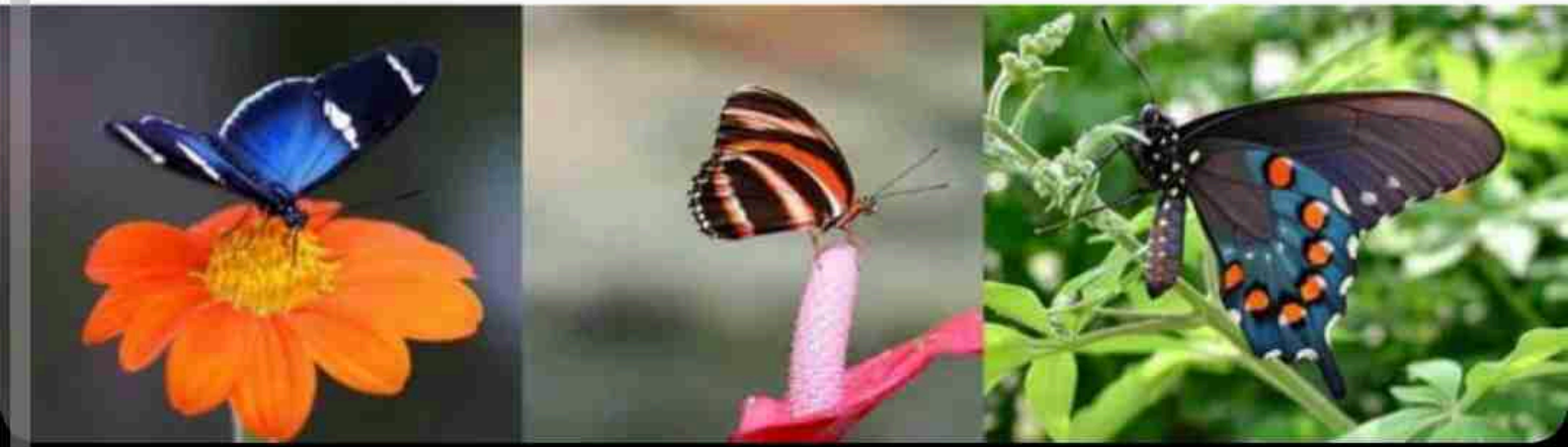
▾ Character / Group ▸	Moth	Butterfly
~ Species Richness	91%	9%
Activity Period	Nocturnal	Diurnal
Eggs	Laid in batches	Laid singly
Antennal Morphology	Plumose, pectinate, thickened, or filiform	Clubbed or knobbed (hooked in the Hesperiidae)
Sexual Attraction	Pheromones	(primarily) Visual + (secondarily) Pheromones

...more "Moth or Butterfly?"

▾ Character / Group ▸	Moth	Butterfly
Pupal Morphology	Usually in a cocoon made of silk and sometimes hair from last larval instar.	Usually a bare "chrysalis" (last larval instar skin).
Body hair	Often dense	Usually sparse
Wing Coupling	"Frenulum", one or more stiff bristle at the base of HW that hooks to the underside of the FW for flight.	Lobed process at the base of HW that holds the wings together for flight.
Wing Position	Held "flat" or rooflike over the body.	Held vertically upright.
Color	Typically drab but many exceptions	Usually brightly colored, at least dorsal wing surfaces
Size	Minute to giant	Medium to large
Archtypal family	Noctuidae, noctuids	Papilionidae, swallowtails

Why are butterflies so colorful?

- Sometimes the colors are bright and are intended to warn away potential predators.
- This indicates that they taste bad to a predator.
- Other times the bright colors are meant to attract mates.
- Some are colored to look very much like a food plant in order to help the insect hide.



Classification

➢About 150,000 species of living Lepidoptera have been described in approximately 124 families.

➢ Have 4 Sub – orders :-

1. Zeugloptera
2. Aglossata
3. Heterobathmiina
4. Glossata

➢ Some scientists divide order into 2 suborders :-

1. Ditrysia (Majority of Lepidopterans i.e 97%)
2. Monotrysia (Remaining 3%)

➢ A informal method divides order into 2 categories :-

1. Microlepidoptera
2. Macrolepidoptera

➢ Another informal scheme divides the Lepidoptera into moths, butterflies and skippers.

➢ Some common families of Butterflies

1. Superfamily :- Papilionoidea

1. Family :- Nymphalidae (Brush footed butterflies)

- Forelegs are short, functionless, hairy and folded on thorax.
- Larva is with many proccesses or spines on the body e.g. Painted lady butterflies *Vanessa cardui*.

2. Family :- Lycaenidae (Blues, coppers, hair streaks)

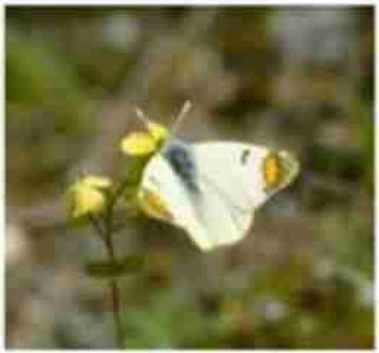
- Compound eyes are white rimmed.
- Antennae are with white rings.
- Upper wing surface is either metallic blue or coppery. Lower wing surface is lighter in colour.
- Larvae are flattened with retractile head. E.g. Blue butterflies and pomegranate fruit borer *Virachola isocrates*.

3. Family :- Papilionidae (Swallow tails)

- Often large and brightly coloured.
- Prothoracic legs have tibial epiphysis.
- In many spp hind wings has tail like prolongations.
- Amplexiform type of wing coupling is present.
- Larval body is either smooth or with tubercles. Retractile osmeteria are present on the prothoracic tergum of the caterpillar. E.g. Citrus butterfly *Papilio demoleus* .

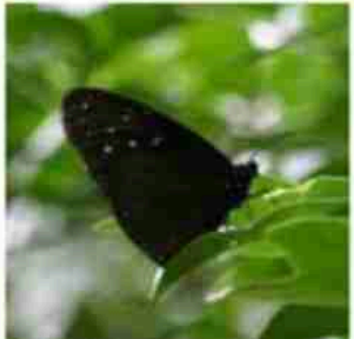
4. Family :- Pieridae (White and sulphur butterflies)

- They are white or yellow or orange coloured with black markings.
- Larva is green, elongate and covered with fine hairs.
- Larval body segments have annulates. E.g. Cabbage butterfly *Pieris brassicae.*



5. Family :- Danaidae (milkweed butterflies)

- Also known as brush-footed butterflies.
- Most of the spp are found in tropical Asia and Africa.
- Larvae have thoracic tubercles and use plants within the family Apocynaceae that often contain latex like compounds in the stem as hosts.
- Adults are aposematic.



➢ Some common families of moths

2. Superfamily : Tineoidea

6. Family :- Tineidae (Cloth moths)

- Small moths with large maxillary palps.
- Caterpillars feed on wool, furs, feathers and other organic products causing considerable damage to fabrics.
- They produce a weblike mass over fabrics as they feed.

3. Superfamily Bombycoidea

7. Family :- Saturniidae (giant silk moths)

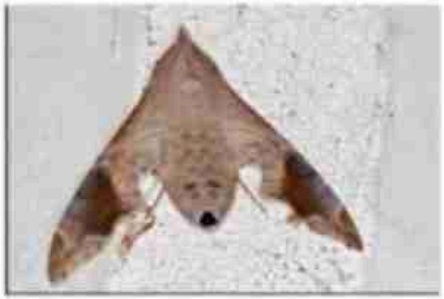
- They are large sized moths.
- Antenna is bipectinate.
- Transparent circular or crescent transparent eye spots are present near the centre of each wing.
- Larva is stout and smooth with scoli.
- Cocoon is dense and firm. E.g. Tussor silk worm *Antherea paphia*.

8. Family :- Bombycidae (Silk worm moths)

- Antenna is bipectinate.
- Larva is either with tuft of hairs or glabrous with medio dorsal horn on the eighth abdominal segment.
- Pupation occurs in dense silken cocoon. E.g. Mulberry silk worm *Bombyx mori.*

9. Family :- Sphingidae (Hawk moths, sphinx moths, horn worms)

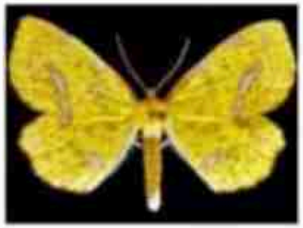
- They are large sized, stotly built moths.
- Antenna is thick towards middle and hooked at the tip.
- Proboscis is very long.
- Fore wings are elongated and pointed with very oblique outer margin.
- Hind wings are reduced in width fitting into the indented margin of fore wings.
- Adult moth resembles with human skull.



4. Superfamily : Geometroidea

10. Family :- Geometridae (Loopers)

- Both pair of wings are angular and thin.
- Larva is naked and elongate. It shows protective resemblance to twigs or stems.
- Only two pairs of prolegs are present in sixth and tenth abdominal segments.
- It walks by drawing the posterior part of the body close to thorax, the body forming a loop.
- Also called as inch worm. E.g. Tea looper *Biston suppressaria*.


5. Superfamily : Pyraloidea

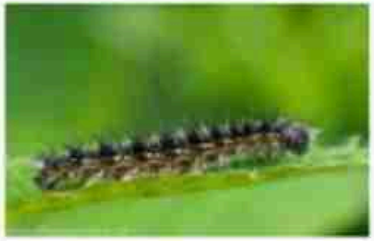
11. Families :- Crambidae and Pyralidae (Grass moths)

- Labial palps are extended.
- Forewings are narrow and elongated.
- At rest they are wrapped around the body.
- Larva bores into the root, stem or crown of graminaceous plants. E.g. Sorghum stem borer *Chilo partellus.*

6. Superfamily : Zygaenoidea

13. Family :- Cochilididae (Slug caterpillars)

- They are medium sized moths with stoutly built body.
- Larva resembles the slug and is thick, short fleshy and stout.
- Larval head is small and retractile.
- Thoracic legs are minute.
- Abdominal segmentation is indistinct.
- Prolegs are rudimentary or absent.
- Poisonous urticating hairs are present on the body (scopa).
- For example : Castor slug caterpillar *Latoia lepida*.



7. Superfamily : Gelechioidea

14. Family :- Gelechiidae (Paddy moth)

- Forewings trapezoidal and narrower than hind wings.
- Caterpillars bore into the seeds, tubers and leaves.
- E.g. Cotton pink boll worm *Pectinophora gossypiella.*

8. Superfamily : Noctuoidea

15. Family :- Arctiidae (Tiger moths)

- Wings are conspicuously spotted or banded.
- They are nocturnal and attracted to light.
- Larva is either sparsely hairy or densely hairy (wooly bear).
- E.g. Black hairy caterpillar *Estigmene lactinea.*






16. Family :- Noctuidae (Noctua moths)

- They are medium sized, stoutly built moths.
- They are nocturnal and attracted to light.
- Labial palpi is well developed.
- All crochets on the larval prolegs are of same size and arranged in semi-circle. Some larvae are semiloopers.
- They have either 3 or 4 pairs of legs.
- Often cut small seedlings close to ground and hence called cut worms.
- E.g. Tobacco cut worm *Spodoptera litura*.