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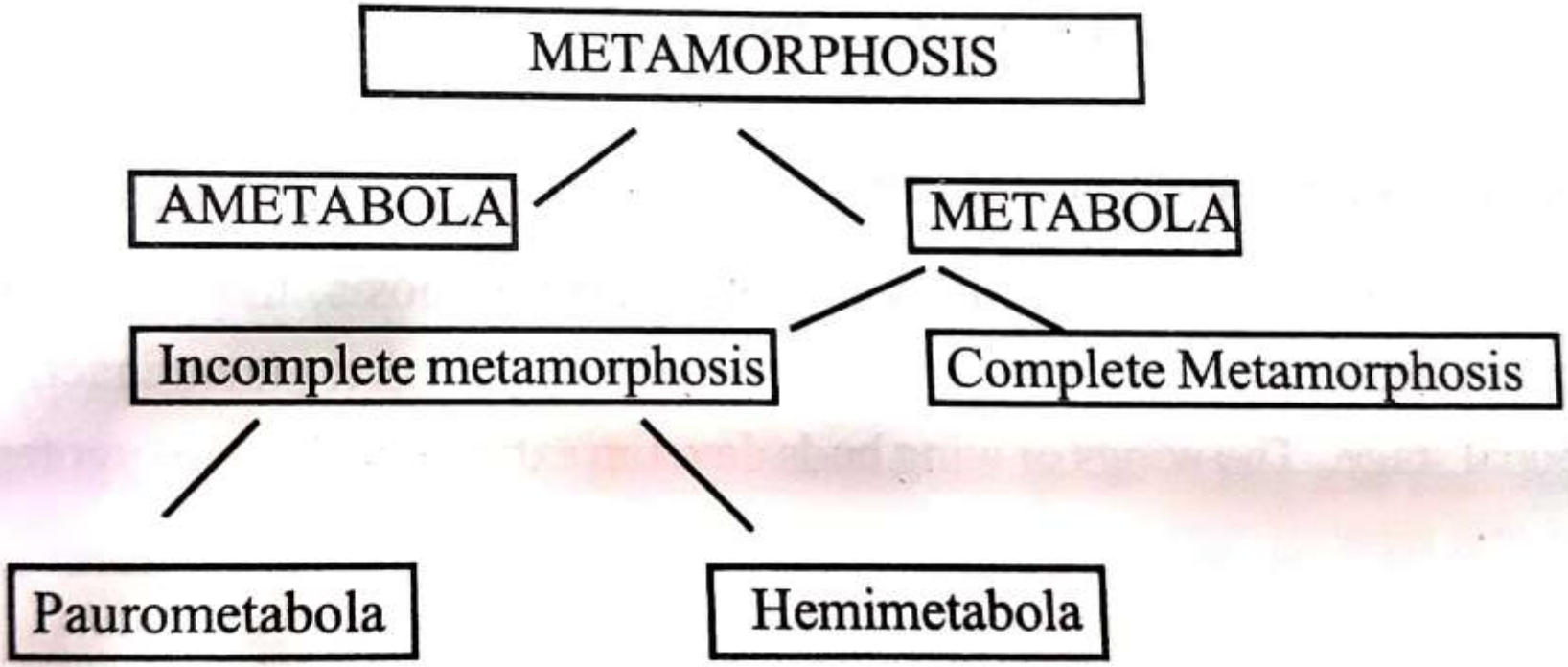
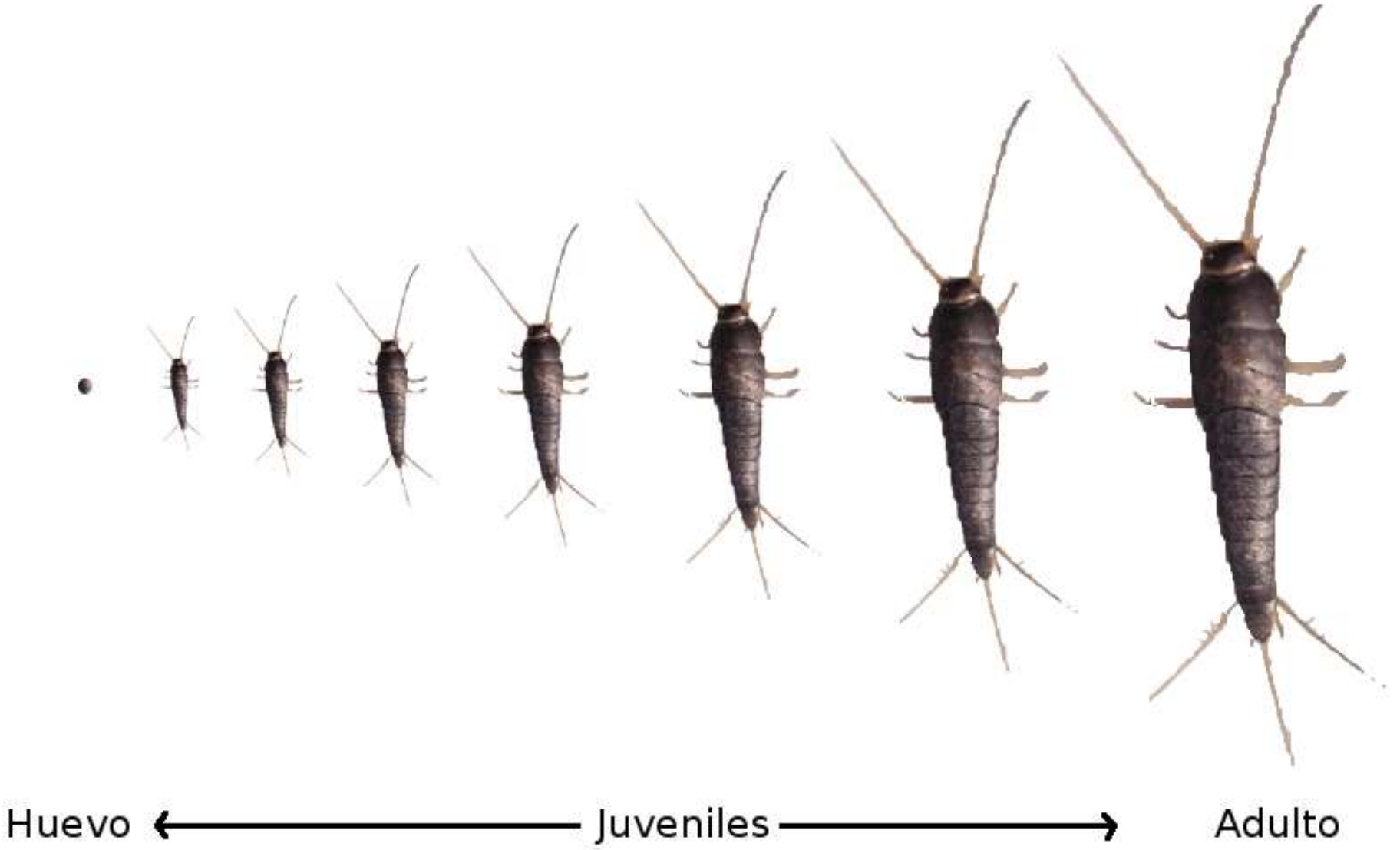
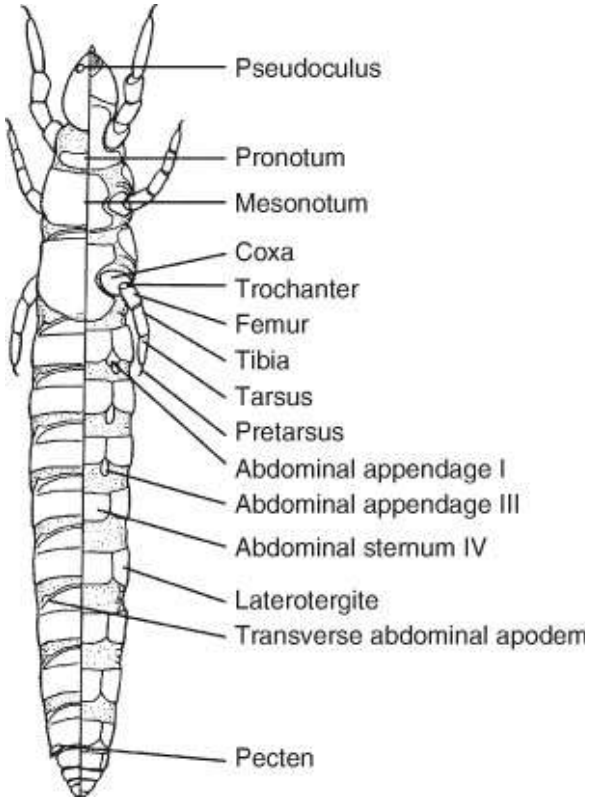
ENTO 131 - Fundamentals of Entomology (3+1)

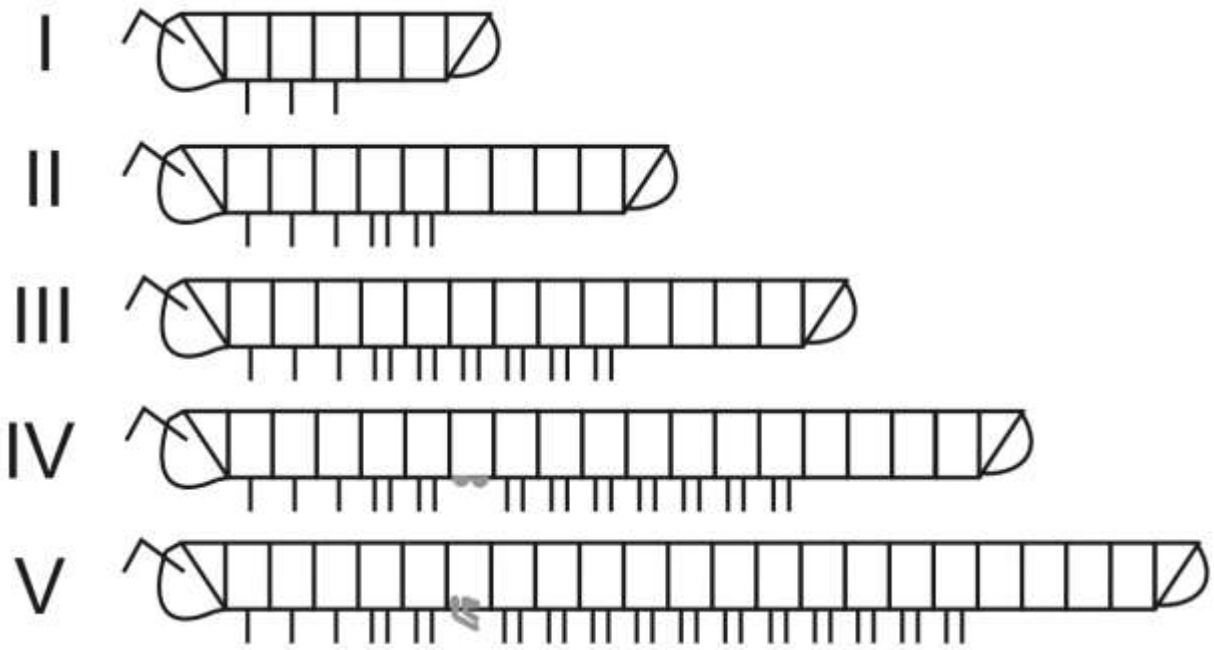
Metamorphosis and immature stages in insects



1. **Ametabola:** (No metamorphosis) e.g. Silver fish.



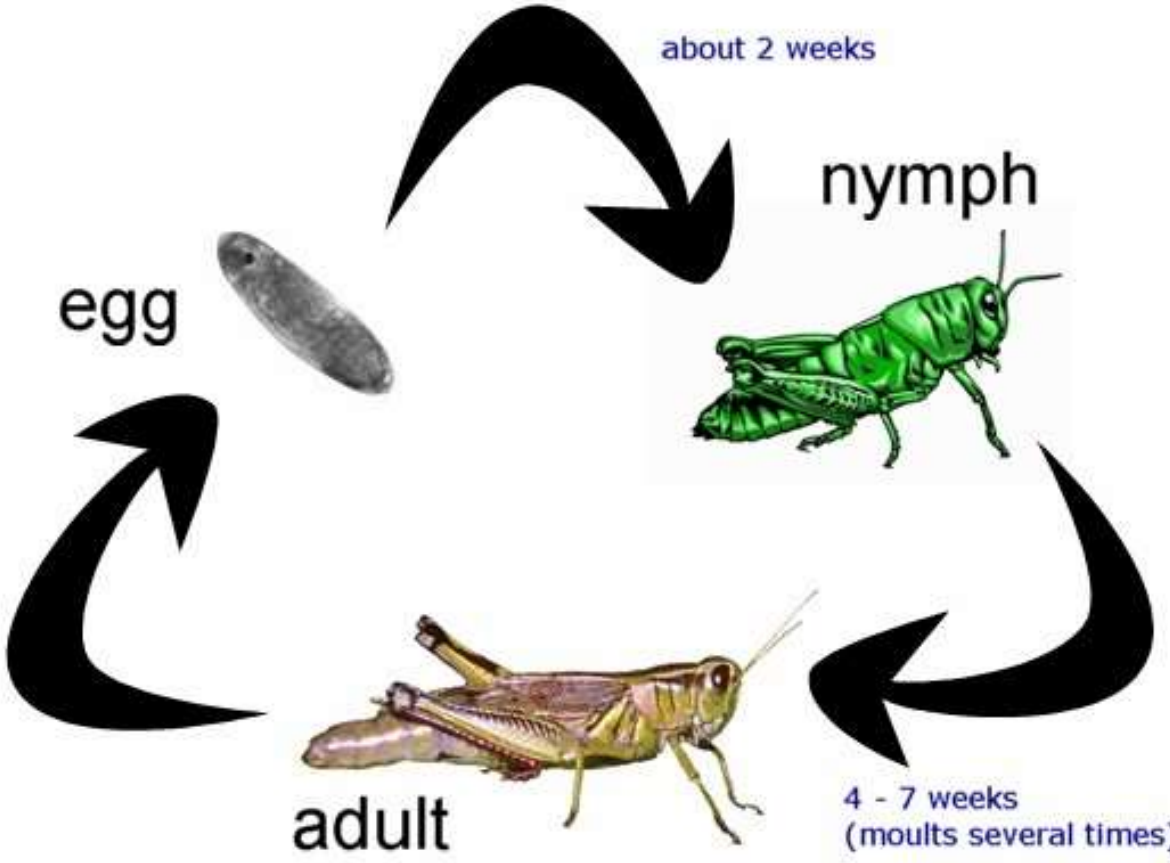


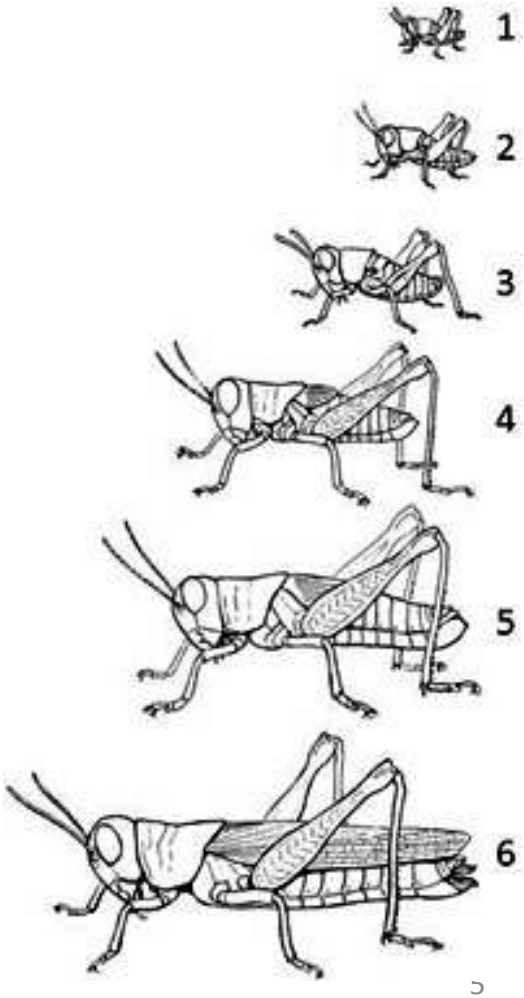


In Protura, during each moult in the juvenile stage, addition of abdominal segments anterior to the telson is witnessed and this is termed **anamorphosis**.

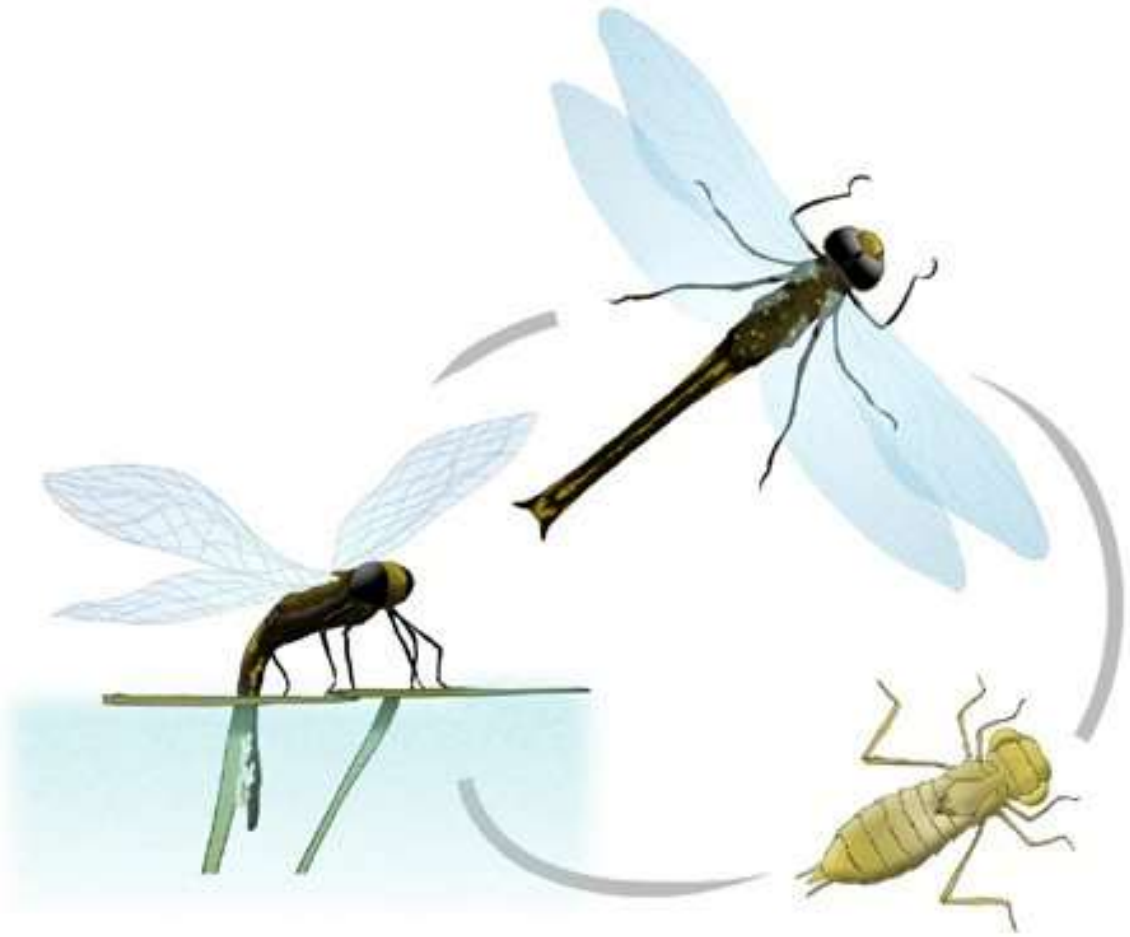
2. Metabola:

a. **Paurometabola:** (Gradual metamorphosis) e.g. Cockroach, grasshopper, bugs.

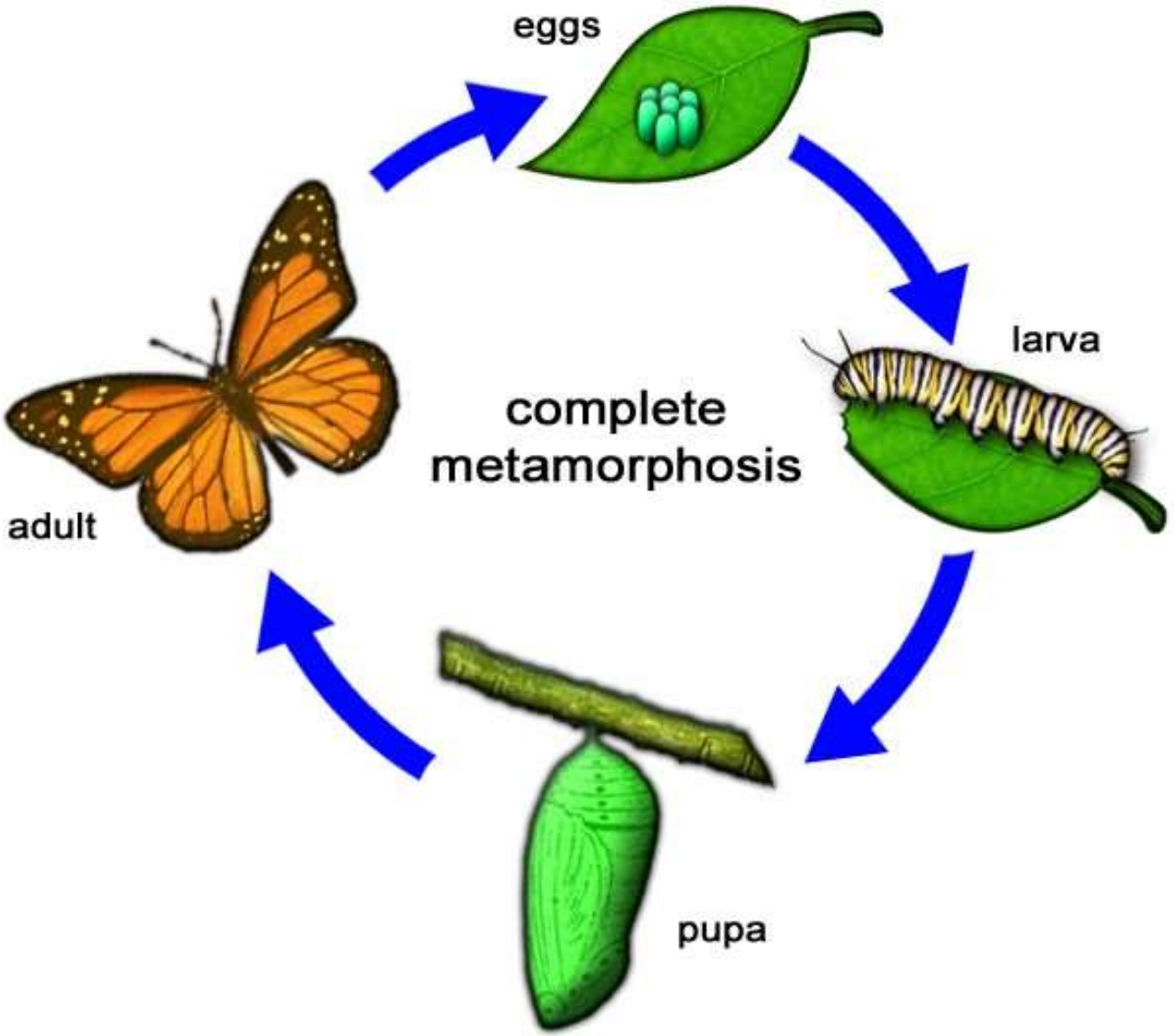


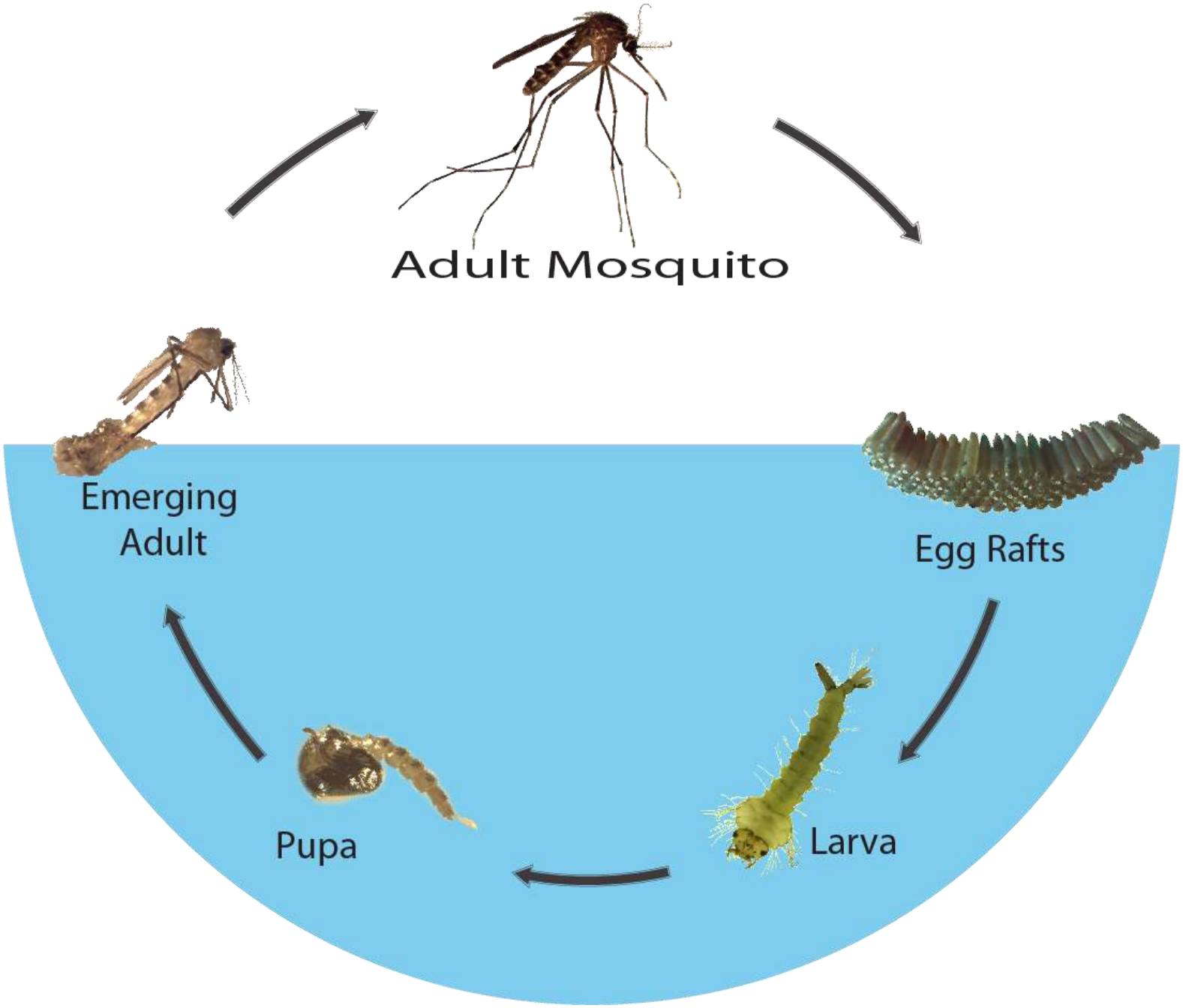


b. **Hemimetabola**: (Incomplete metamorphosis) e.g. Dragonfly, damselfly and may fly



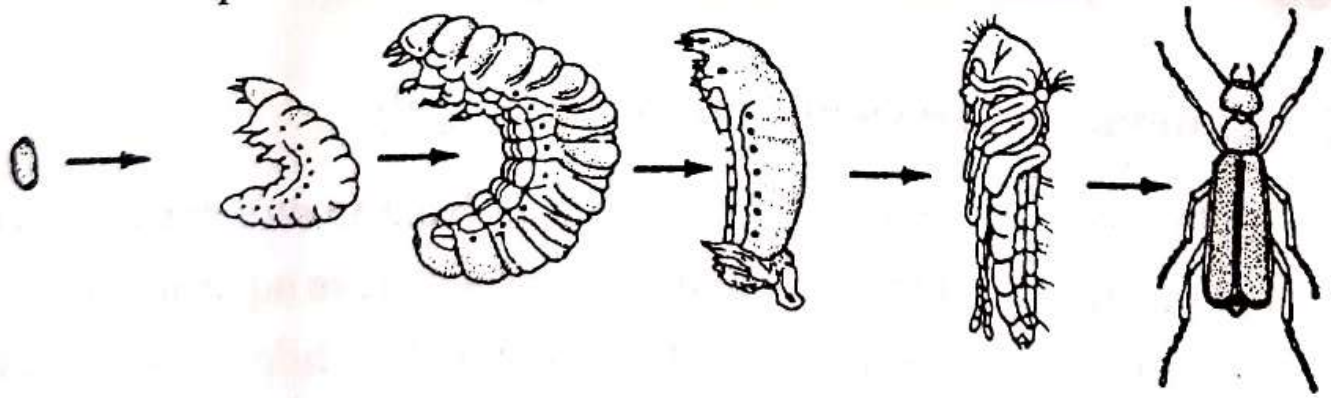
4. **Holometabola**: (Complete metamorphosis) e.g. Butterfly, moth, fly and bees.




Adult Mosquito
Emerging Adult
Egg Rafts
Pupa
Larva

a) Hypermetamorphosis:

In holometabolans, larval instars are similar in form, habit and habitat. However, in blister beetles, stylopids and parasitic hymenopterans, different larval forms occur in successive instars. The first intar larva is called triungulin and the larval instars differ in body form, feeding habit and habitat. This type of development is called hypermetamorphosis.



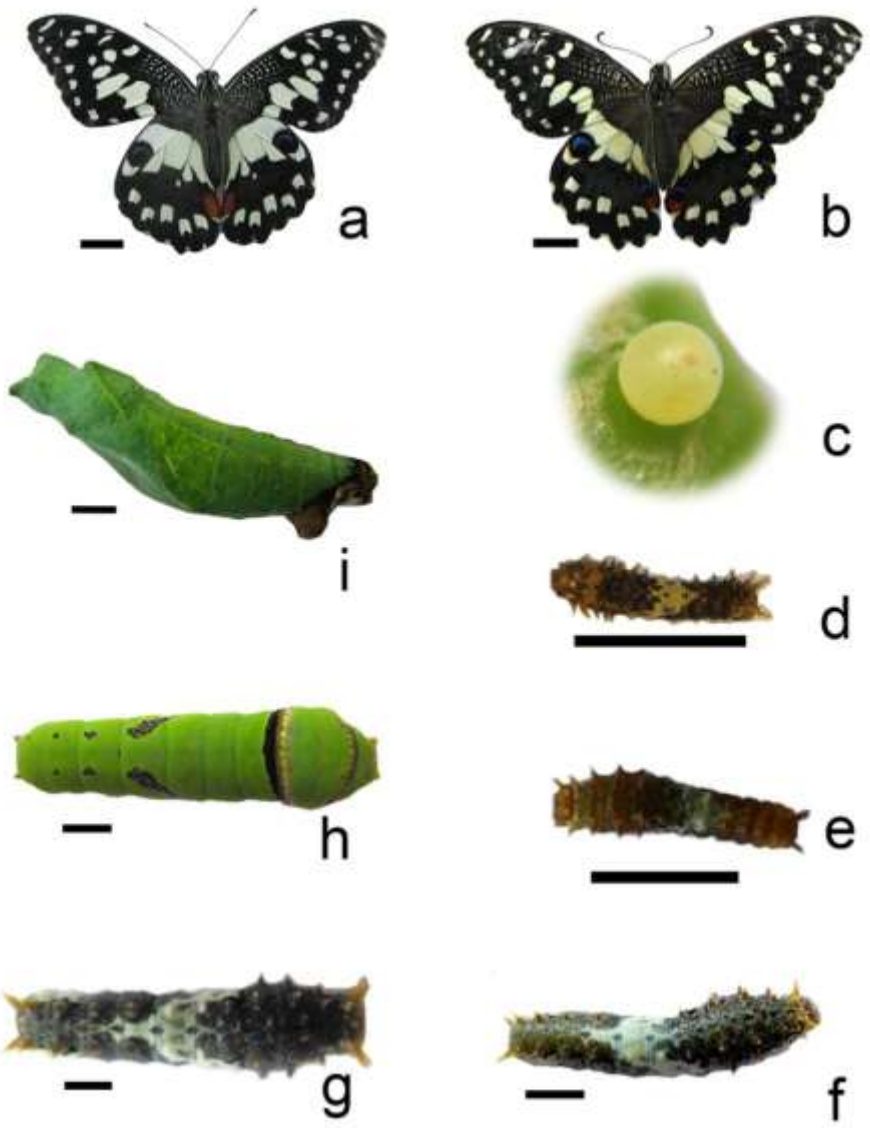
TYPES OF EGGS:

a) SINGLY LAID:

1) **Sculptured egg:** Chorion with reticulate markings and ridges e.g. Castor butterfly.

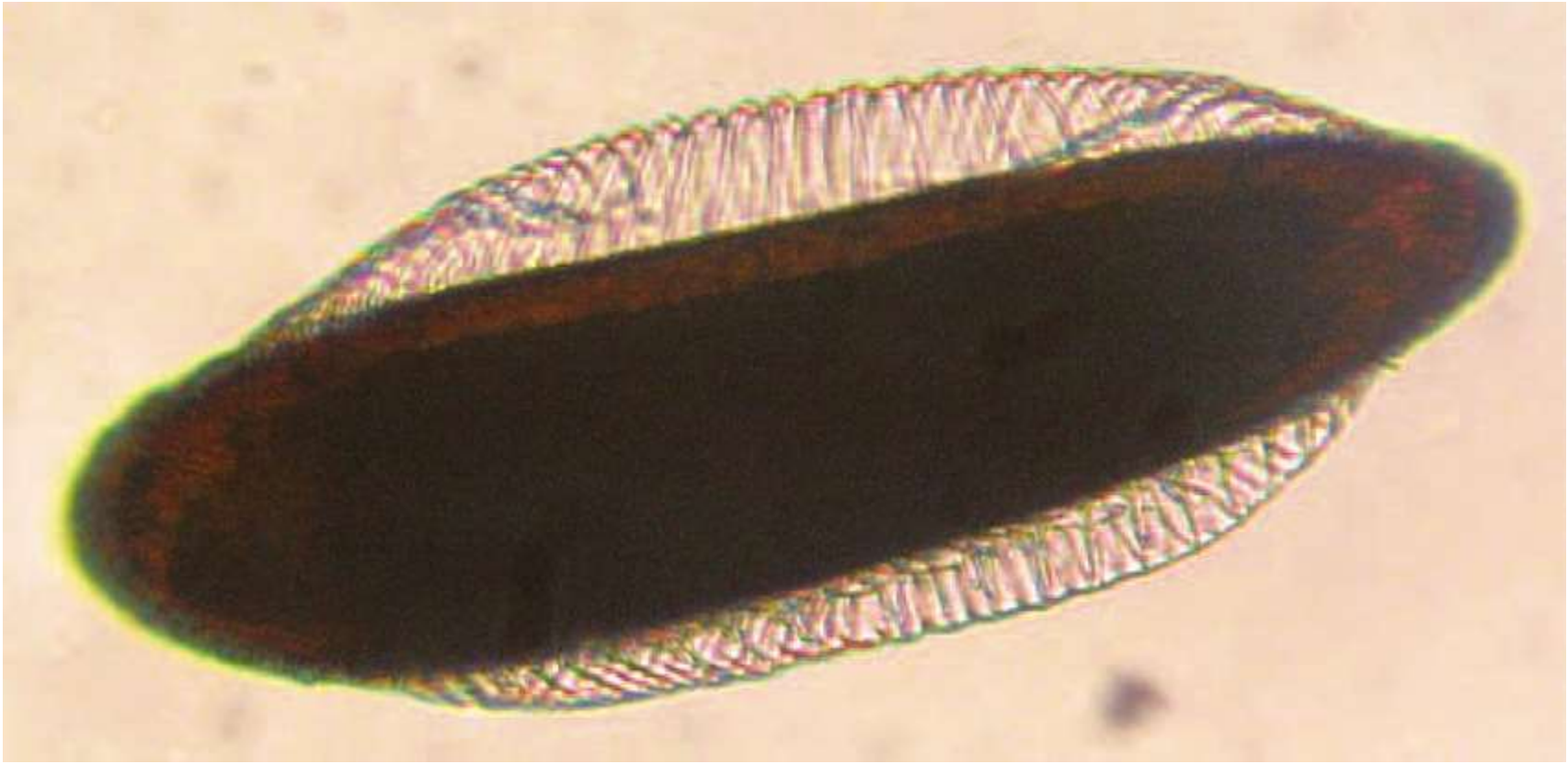
2) **Elongate egg**: Eggs are cigar shaped. e.g. Sorghum shoot fly.

3) **Rounded egg**: Eggs are either spherical or globular. e.g. Citrus butterfly



4) **Nit:** Egg of head louse is called nit. It is cemented to the base of the hair. There is an egg stigma at the posterior end, which assists in attachment. At the anterior end, there is an oval lid which is lifted at time of hatching.

5) **Egg with float:** Egg is boat shaped with a conspicuous float on either side. The lateral sides are expanded. The expansions serve as floats. e.g. *Anopheles* mosquito.



b) EGGS LAID IN GROUPS:

1) **Pedicellate eggs:** Eggs are laid in silken stalks of about 1.25mm length in one groups on plants. e.g. Green lacewing fly.

2) **Barrel shaped eggs:** Eggs are barrel shaped. They look like miniature batteries. They are deposited in compactly arranged masses. e.g. Stink bug.

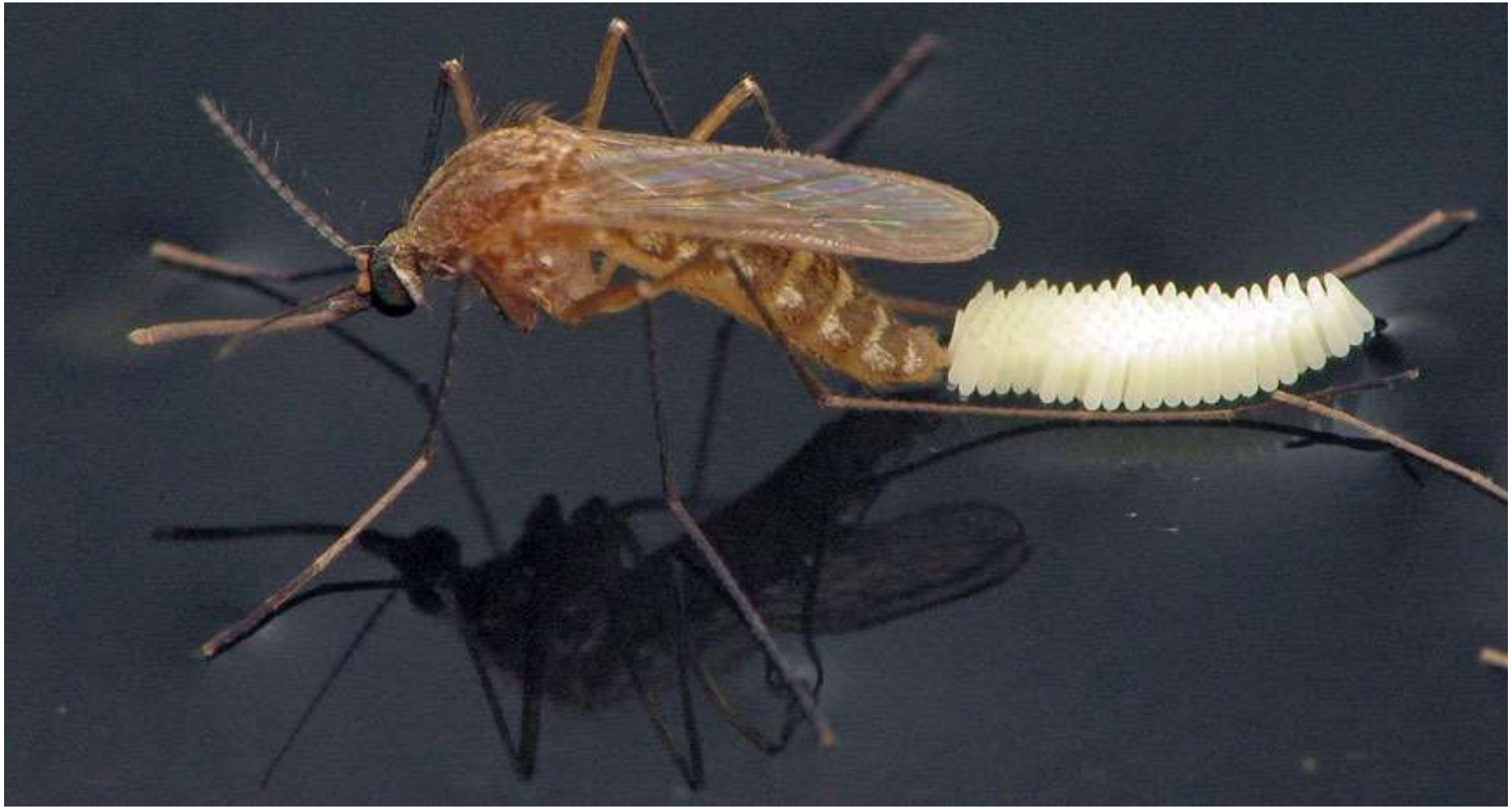
3) **Ootheca** (Oothecae): Eggs are deposited by cockroach in a brown bean like chitinous capsule.

4) **Egg pod:** Grasshoppers secrete a frothy material that encases an egg mass which is deposited in the ground. The egg mass lacks a definite covering. On the top of the egg, the frothy substance hardens to form a plug which prevents the drying of eggs.

5. **Egg cass**: Mantids deposit their eggs on twigs in a foamy secretion called spumaline which eventually hardens to produce an egg case or ootheca. Inside the egg case, eggs are aligned in rows inside the egg chambers.

6. **Egg mass:** Moths lay eggs in groups in a mass of its body hairs. Anal tuft of hairs found at the end of the abdomen is mainly used for this purpose. e.g. Rice stem borer.

7. Egg raft: In *Culex* mosquitoes, the eggs are laid in a compact mass consisting of 200-300 eggs called egg raft in water.



TYPES OF LARVAE: There are three main types of insect larvae namely oligopod, polypod and apodous.

1. OLIGOPOD: Thoracic legs are well developed. Abdominal legs are absent. There are two subtypes.

a. Campodeiform: e.g. grub of antlion or grub of lady brid beetle.

b. Scarabaeiform: Body is `C' shaped, stout and subcylindrical. Head is well developed. Thoracic legs are short. Caudal processes are absent. Larva is sluggish, burrowing into wood or soil. e.g. grub of rhinoceros' beetle.

2. POLYPOD or ERUCIFORM: The body consists of an elongate trunk

a. Hairy caterpillar: The body hairs may be dense, sparse or arranged in tufts. Hairs may cause irritation, when touched. e.g. Red hairy caterpillar.

b. Slug caterpillar: Larva is thick, short, stout and fleshy. Laval head is small and retractile. Thoracic legs are minute. Abdominal legs are absent. Abdominal segmentation is indistinct. Larva has poisonous spines called scoli distributed all over the body. Such larva is also called platyform larva.

c. Semi looper: Either three or four pairs of prolegs are present. Prolegs are either wanting or rudimentary in either third or third and fourth abdominal segments. e.g. castor semilooper.

d. Looper: They are also called measuring worm or earth measurer or inch worm. In this type, only two pairs of prolegs are present in sixth and tenth abdominal segments. e.g. Daincha looper.

3. APODOUS: They are larvae without appendages for locomotion. Based on the degree of development and sclerotization of head capsule there are three subtypes.

a. Eucepalous: Larva with well developed head capsule with functional mandibles, maxillae, stemmata and antennae. Mandibles act transversely. e.g. Wriggler (larva of mosquito) and grub of red palm weevil.

b. Hemicephalous: Head capsule is reduced and can be withdrawn into thorax. Mandibles act vertically.

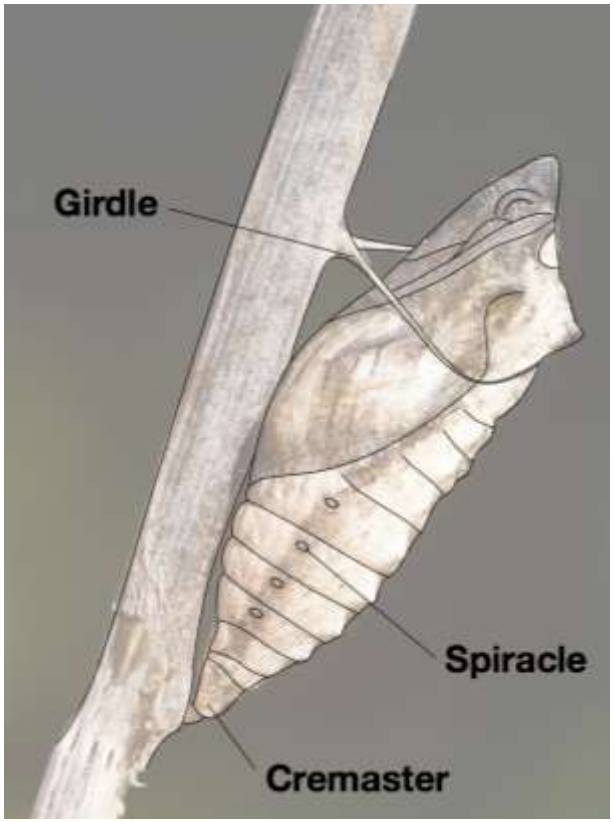
e.g. Larva of horse fly and robber fly.

c. Acephalous: Head capsule is absent. Mouthparts consist of a pair of protrusible curved mouth hooks and associated internal sclerites. They are also called vermiform larvae. e.g. Maggot (larva of house fly).

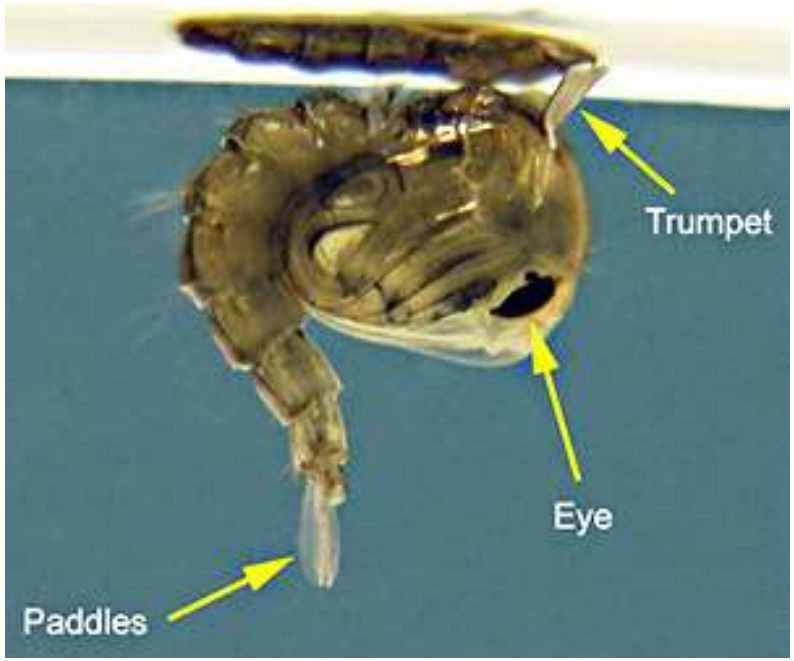
III. Types of Pupa

1. OBTECT: Various appendages of the pupa *viz*., antennae, legs and wing pads are glued to the body by a secretion produced during the last larval moult. e.g. moth pupa.

a. Chrysalis: The pupa is attached to the substratum by hooks present at the terminal end of the abdomen called cremaster. The middle part of the chrysalis is attached to the substratum by two strong silken threads called gridle.

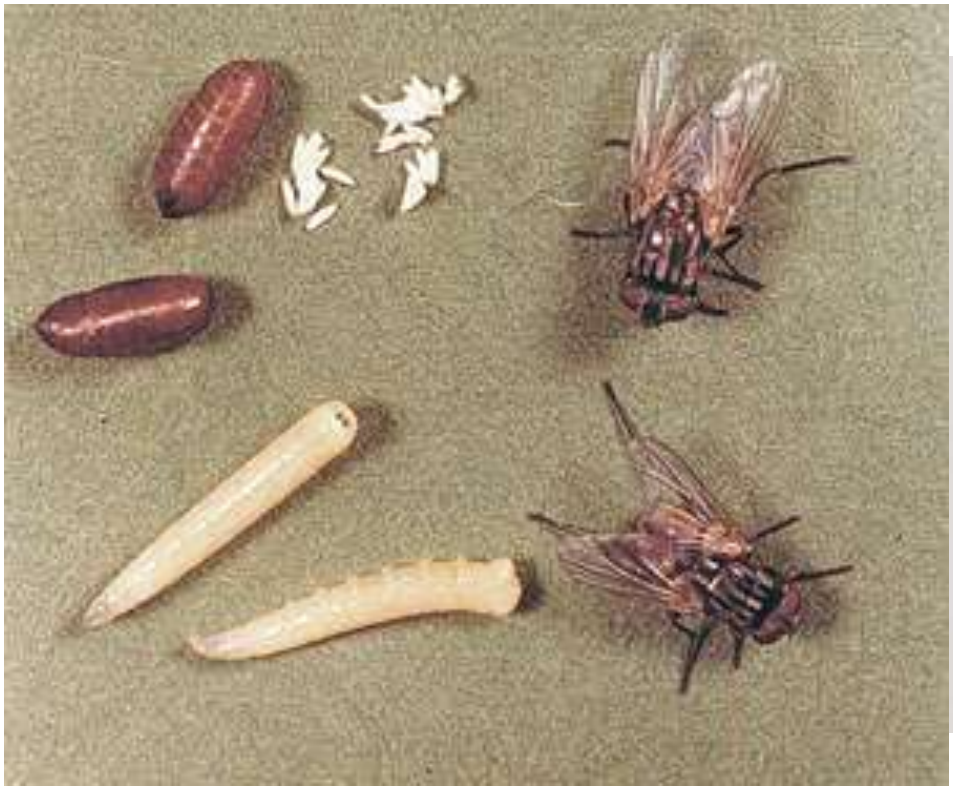


b. Tumbler: Pupa of mosquito is called tumbler. The pupa is very active.



2. EXARATE: Various appendages *viz*., antennae, legs and wing pads are not glued to the body. They are free. All oligopod larvae will turn into exarate pupae. The pupa is soft and pale e.g. Pupa of rhinoceros' beetle.

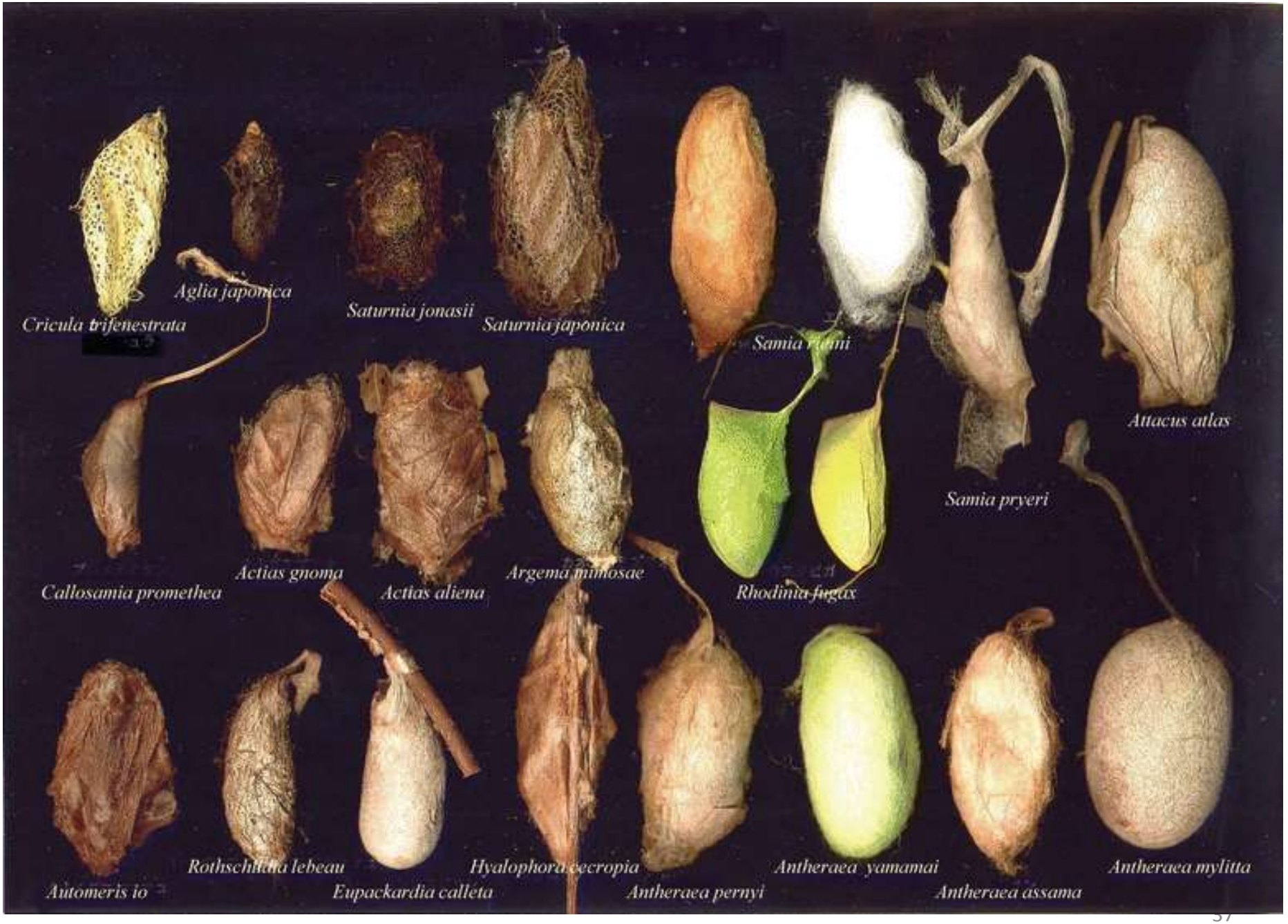
3. COARCTATE: The pupal case is barrel shaped, smooth with no apparent appendages. The last larval skin is changed into case containing the exarate pupa. The hardened dark brown pupal case is called puparium. e.g. Fly pupa.



PUPAL PROTECTION

Types of cocoon	Materials used	Example
silken cocoon	Silk	Silk worm
Earthen cocoon	Soil + saliva	Gram pod borer
Hairy cocoon	Body hairs	Woolly bear
Frassy cocoon	Frass + saliva	Coconut black headed caterpillar
Fibrous cocoon	Fibres	Red plam weevil
Puparium	Hardened last larval skin	House fly


Moth pupa inside a cocoon


Cricula trifenestrata
Aglia japonica
Saturnia jonasii
Saturnia japonica
Samia wangi
Attacus atlas
Samia pryeri
Callosamia promethea
Actias gnoma
Actias aliena
Argema mimosae
Rhodinia fugax
Automeris io
Rothschildia lebeau
Eupackardia calleta
Hyalophora cecropia
Antheraea pernyi
Antheraea yamamai
Antheraea assama
Antheraea mylitta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