

Coleoptera pupae:

Pupa is a non-feeding and inactive stage of insect between the larva and adult with complete metamorphosis. The insect pupae are classified into two types based on mode of emergence of adults from the pupal case.

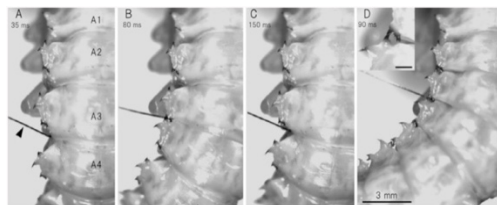
1. Decticous Pupa: In this of pupa, fully formed adult, within the pupal case has relatively powerful sclerotized mandibles by means of which it comes out from the pupa. This type of pupa is always excreted (free) type e.g. Lace wing, Scorpion flies.

2. Adecticous Pupa: In this of pupa, the adult developed within pupal case, often possess reduced and non-articulating mandibles which are not utilized for escaping from the pupa. Beetle pupa are always **adecticous** (without functional mandibles); and almost always exarate (free appendages). **Obtect pupae** (appendages more or less fixed with the body) are found in some Coleoptera groups, examples: some Staphylinidae, Coccinellidae, Chrysomelidae. Many pupae are found within substrates or in pupal cells of various kinds; others occur on surfaces partly enclosed within the last larval exuviae. These exuviae may be armed with modified setae, spines, or glandular reservoirs.

Significance of Pupal Stage:

1. Being non feeding stage it avoids or reduces the competition for food.
2. Helps in re-modeling and re-structuring of the body to exploit many habitats.
3. Chances of survival of insects are increased by entering in inactive stages.

Defensive structures on pupae include long setae or spines; glands (Cantharidae); and gin traps. **Gin traps** are protective pinching devices formed between sclerotized edges of two adjacent abdominal sclerites (abdominal segments 2-7 may be involved). Examples of groups that are known to have gin traps: Dermestidae, Dryopidae, Scarabaeidae (Dynastinae and some Rutelinae), some Cerambycidae (Prioninae); some Tenebrionidae.



Reproductive Behavior:

Beetle reproductive behavior has been understudied compared to other insect groups. Many species have courtship sequences prior to copulation, often using antennae in various ways to detect the presence of the other, etc. In general: the male mounts the back of the female

and often grabs at the back of her head. Pheromones have been reported/isolated in some groups; sound production/stridulation plays a role in courtship/mating in some species

Economic Importance:

A considerable number of beetles are crop pests.

Examples: **Scarabaeidae:** larvae of some species feed on roots of crops, turf: Japanese beetle, *Popillia japonica* Newman

Phyllophaga sp. , June or May beetles, *Cotinis nitida* (L.) green june beetles,

Cyclocephala spp. masked chafers annual grubs

Elateridae: larvae of *Conoderus*, *Agriotes*, *Limoni*us, etc. can cause serious stand reductions in field crops.

Meloidae: adults of some species are crop pests-- feed on foliage; other species that are common in alfalfa hay fields get trapped in bales during hay harvest and have killed or made ill valuable race horses (cantharidin-- can cause blisters in humans; also is being looked at as a medicinal compound for urogenital diseases.

Coccinellidae: includes many valuable predator species; but also includes the Mexican bean beetle, *Epilachna varivestis* Mulsant which is a pest species on various types of beans.

Chrysomelidae: *Diabrotica* spp. , includes the western, northern, southern corn rootworms which can be adult and larval pests of vegetables, and field corn.

Acalymma spp. e.g. , the striped cucumber beetle, which is the pest of cucurbits.

Cerotoma trifurcata (Forster), the bean leaf beetle which is common pest of soybean.

Altica, *Chaetocnema* spp. , flea beetles which are pests of various crops. Asparagus beetle, *Crioceris asparagi* (L.). Many Chrysomelid species have also been implicated as vectors of various plant diseases.

Languriidae (now subfamily of Erotylidae): clover stem borer, *Languria mozardi* Latreille, pest of various legumes.

Curculionidae: sweet potato weevil, carrot weevil, rice water weevil, alfalfa weevil.

Tree pests: many **Buprestids** (e.g. , Emerald Ash Borer), **Cerambycids** (e.g. , cottonwood borer, Asian longhorned beetle), **Curculionidae** (e.g. , plum curculio), **Scolytinae** (e.g. , bark beetles-- European elm bark beetles transmits the fungus that cause Dutch elm disease;

Chrysomelidae: e.g. , elm leaf beetle; **Bostrichidae**-- e.g. , powderpost beetles.

Stored grain pests: **Dermestidae:** e.g. , khapra beetle, *Trogoderma granarium* Everts -is one of worst stored grain pests in world; **Tenebrionidae:** e.g. , *Tribolium* spp. flour beetles;

Anobiidae: drugstore beetles-- can be museum specimen pests or stored product pests;

Chrysomelidae: Bruchinae (seed beetles).

Many species are important scavengers (break down carrion, dung-- i.e. Silphidae, Scarabaeidae) and detritivores. Carabidae are important predators.