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# **FACTORS RESPONSIBLE FOR ABUNDANCE OF INSECTS**

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Structural Perfections

Developmental Characters

Specificity of food

Reproductive potential

Protective Adaptations

Diverse habitat

**Structural perfections:-**

### 1) **Exoskeleton:**

The insect body has an outer exoskeleton or body wall made up of cuticular protein called as chitin. This is light in weight and gives strength, rigidity and flexibility to the insect body. It is responsible for

- Protection from desiccation or water loss from the body
- Protection from physical or mechanical injuries and to maintain shape and size of the body,
- Providing area for muscle attachment,
- Giving strength to the body appendages

### 2) **Small size:**

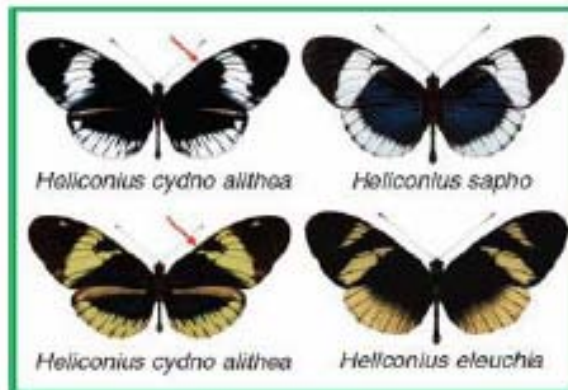
It helps the insects to exploit different/numerous ecological niches inaccessible for other animals. Insects, due to their small size, require less **space, food, time and energy** for development and survival and can easily escape from their natural enemies.

### 3) **Quicker speciation:**

Because of hard exoskeleton, smaller size and short life cycle there is a chance of quicker species formation (more number of species at a faster rate).

Nice armor, friend.

HISSESSS!!!!



#### **4) Functional wings:**

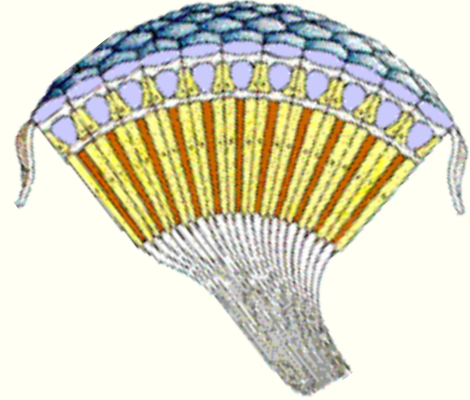
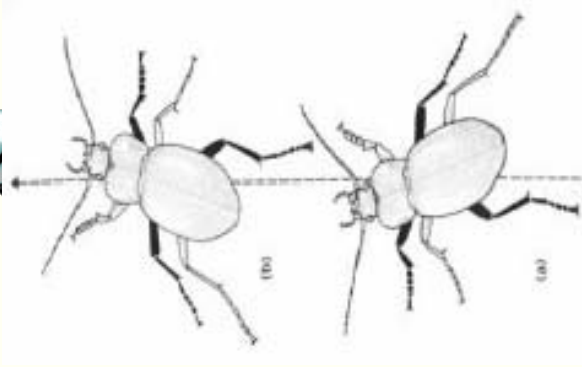
Two pairs of wings that are present on meso and meta thoracic segments are mainly helpful for taking flight from one place to another in search of food, shelter or to find a mate, to oviposit or to get escape from their natural enemies and unfavorable weather condition.

#### **5) Hexapod locomotion:**

Insects having six legs on the three thoracic segments. During locomotion, the insect body rests on a tripod, while the other three legs move forward. This **tripod mode** provides stability as well as easy maneuverability to insect locomotion.

#### **6) Compound eyes:**

Insects usually have a pair of compound eyes in nymphal and adult stage. These eyes are called compound because each eye instead of having a single large cornea, consists of a number of hexagonal area each reprinting the cornea of a discrete visual organ called ommatidium all of which are composed together. Because of presence of number of ommatidia in the compound eyes, even if some or few ommatidia get damaged, the insect does not lose the power of vision.



### **7) Scattered sense organs:**

The sense organs viz., visual organs, gustatory organs, organs of touch etc. are distributed on different parts of the body such as antennae, eyes, mouth parts in the head, legs with claws on thorax, tympanum, cerci in the abdomen etc. This scatteredness on all parts of the body prevents the chance of all being damaged.

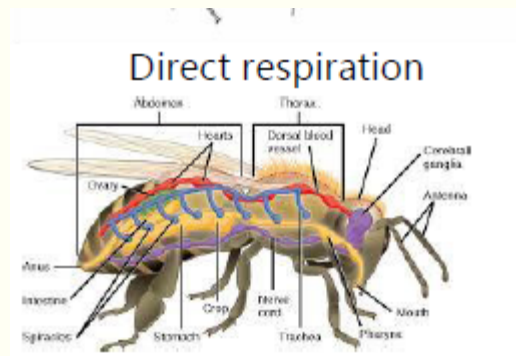
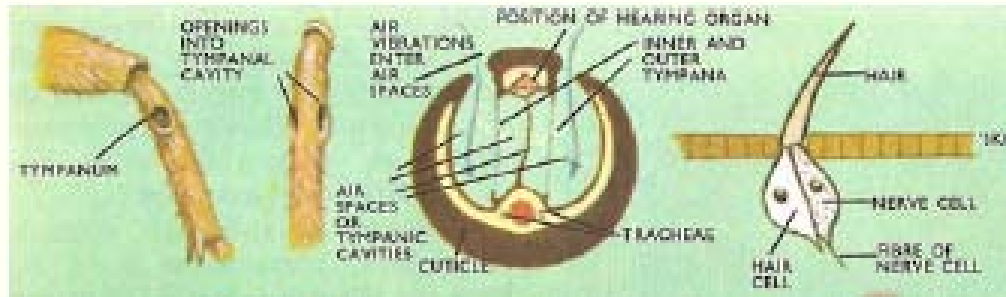
### **8) Tracheal respiration:**

Tracheal system supplies oxygen directly to each and every cell of the body. In this system water loss can be greatly reduced because contact with the external environment is only via the spiracles. This mechanism fits in very well with the requirements of terrestrial and aerial existence of insects.

### **9) Enteronephric excretion:**

In insects, excretion is mainly by means of malpighian tubules which open in between midgut and hindgut. This arrangement is well suited for water conservation as well as for the absorption of unwanted waste metabolites at a quicker rate.





## 9) **Resistance to desiccation:**

Insects minimize the water loss from their body surface through the following processes.

### **A. Prevention of water loss:**

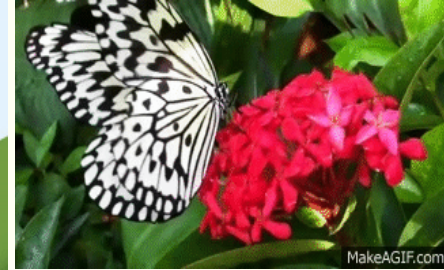
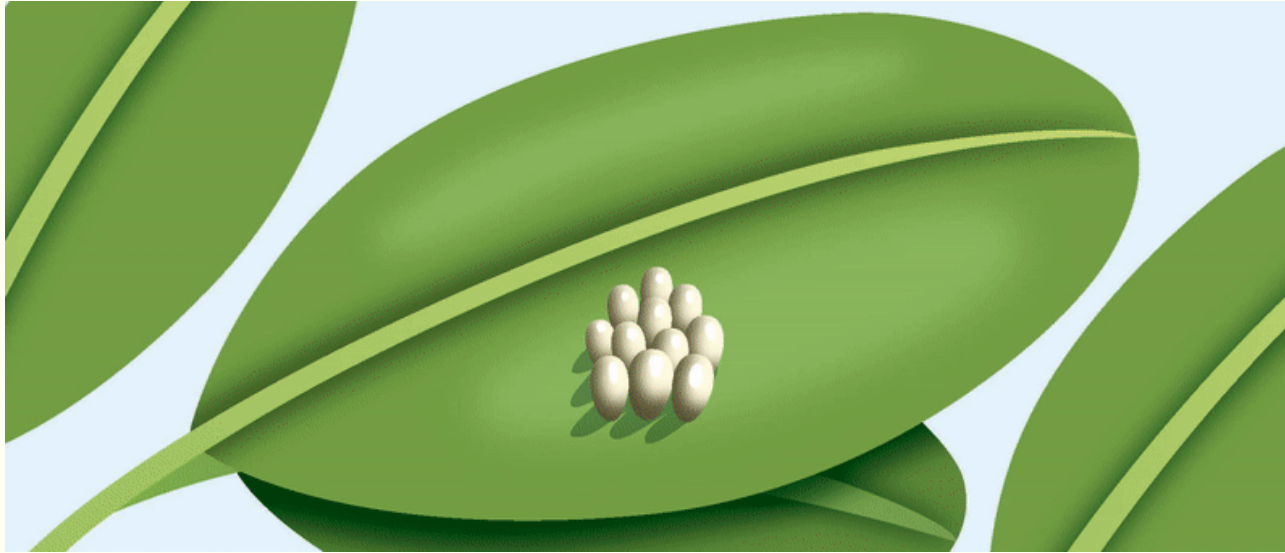
- i. Lipids and polyphenols present in the **Epicuticle** acts as water proofing.
- ii. **Was layer** with closely packed wax molecules prevents escape of water.
- iii. **Spiracles** are closed to prevent water loss.
- iv. In the egg stage **shell development** prevents water loss and desiccation of inner embryos.

### **B. Conservation of water**

- i. Capable of utilizing **metabolic water**
- ii. **Rectal resorption** of water from faeces.
- iii. Terrestrial insects use less quantity of water to remove the nitrogenous waste (**Uric acid**) which is water insoluble.

# **Developmental Characters:-**

The larval and adult stages of holometabolous insects are so different from each other not only in structural details but also in requirements of food and habitat that competition between parent and offspring for food or shelter is eliminated.



A quiescent stage of pupa with great resistance to adverse conditions and practically no food requirement is of further advantage.

# **Specificity of Food:-**

There is diversity in food habits among different species of insects. As they differ in their preference for particular type of food, there will not be any competition among them.

Some cases in which insects have tried to overcome or avoid inter-specific competition by extreme specialization in the direction of polyphagous nature (locust, army worms etc.) and in the direction of taking such foods for which there is no competition i.e, cellulose feeding termites.

Also there is sometimes extreme degree of specificity not only to different plant species or varieties but also to different parts of the same plant (eg. Top borer, internode borer, stalk borer, root borer etc).

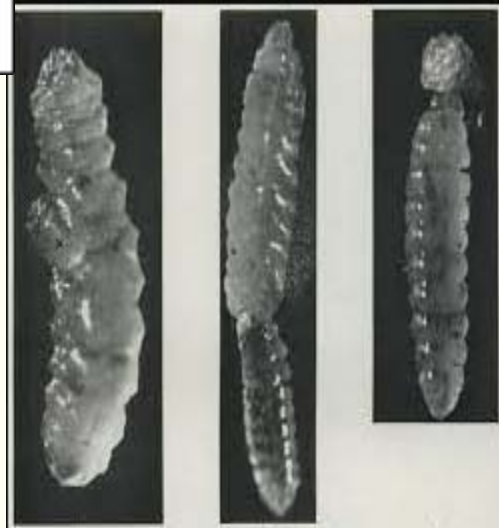
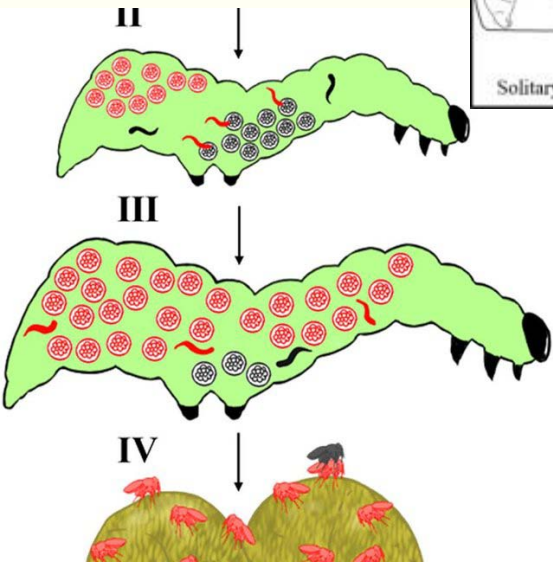
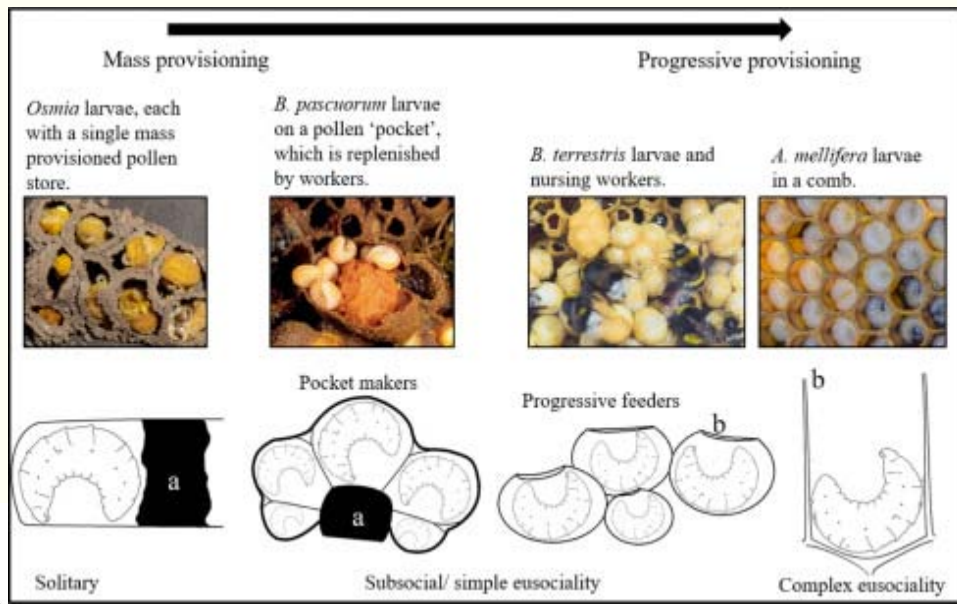
Less competition for food increases their chances of survival and further multiplication.

# **Reproductive Potential:-**

Reproductive potential of insect is high due to the following reasons:

- I. **High fecundity:** Egg laying capacity is high. e.g., Queen termite lays 6000 - 7000 eggs per day for 15 long years.
- II. Development period is short (short life cycle). e.g., Corn aphid produces 16 nymphs per female which reaches the adulthood within 16 days. There by one generation is completed within a short period of 16 days, which favors greater genetic changes in the insect population, like quicker development of insecticide resistant strains.
- III. Careful selection of egg laying sites and protection of eggs.
- IV. Exhibits parental care like **progressive provisioning** (e.g. bees) and **mass provisioning** (e.g. Wasps)
- V. Presence of special types of reproduction other than oviparity and viviparity.
  - Polyembryony:** Development of many individuals from a single egg. e.g. parasitic wasps.
  - Parthenogenesis:** Reproduction without male or without fertilization, e.g. aphids
  - Paedogenesis:** Reproduction by immature stages. e.g. certain flies.





**Protective adaptation and devices:-**

## 1 Morphological/Structural adaptations:

The body color and shape of some insects make them look like part of the plant, there by protecting themselves from natural enemies eg: stick insects and leaf insects. Hardened forewings of beetles known as **elytra** protect the beetles from predation of birds.



## 2 Physiological adaptations:

Some insects produce or release poisonous or unpleasant odors from their body or possess warning coloration by imitating certain distasteful insects.

- Stink bugs have specialized exocrine glands located in the thorax or abdomen that produce foul smelling.
- Larvae of swallow tail butterflies have eversible glands called osmeteria, located just behind the head when disturbed they release repellent odour.
- Some blister beetles (Meloidae) produce cantharidin, a strong irritant and blistering agent.



### 3) Behavioral adaptations:

Insects pretend as if dead (**Thanatosis**). It is a defense strategy adopted by some insects through feigning death or imitating the voice of dangerous insects or mimicry. Eg: Colorado potato beetles when disturbed draw their legs beneath and drop to the ground and pretend as if dead.



### 4) Construction of protective structures:

Some insects construct shelter with the available plant material for protecting themselves from adverse conditions, natural enemies and to store food material for use during the period of scarcity. Eg: Cases / Bags in case of case worms/bag worms, Termatoria in case of termites, Honey comb in case of honey bees



**Diverse Habitat:-**



No other groups of animals are adapted to live in so diverse habitat as the insects.

They live in all corners of the earth from poles to equator, in soil, fresh water, hot spring, deserts, mountains, hair and on all sort of plants and animals.



They can thus avoid competition for food, shelter and this leads to tremendous increase in their number and diversity.



Thank you...