Venomous & Toxic Insects
And Their Associated Problems

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Venomous vs. Poisonous

- ***Venomous*** **refers to animals that inject venom into their prey when hunting or as a self-defense mechanism. venoms are produced, stored and delivered by a very specific set of organs.**
- **Typical venomous Insects are bee, wasp and ant.**

- ***Poisonous*** **describes animals that are harmful when consumed or touched. These animals lack any specific or localized apparatus for producing, storing or delivering poisons. Instead, the whole body, or large parts of it, is toxic. poisons are absorbed by ingestion or through the skin.**
- **Typical poisonous insects blister beetles and Larval spines of some butterflies & moths.**

Venomous Insects

Best known are Social Hymenoptera:

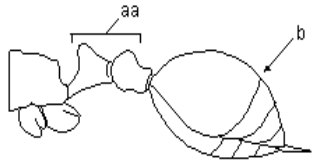
- **Bees, wasps & ants sting in defence of nests.**
- **Venom delivered via modified ovipositor.**

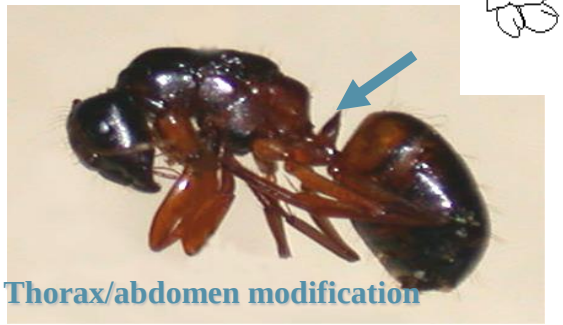
- **Honey-bee stings are barbed & used once (sting + venom sac remain in wound).**
- **Wasp & ant stings are smooth & used repeatedly.**
- **Some ants have reduced stings & spray venom into wound.**

Order : Hymenoptera

Suborder Symphata (sawflies and horntails)	Suborder Apocrita (ants, bees, and wasps)

- They are highly specialized in their habits and often social, living in large community.

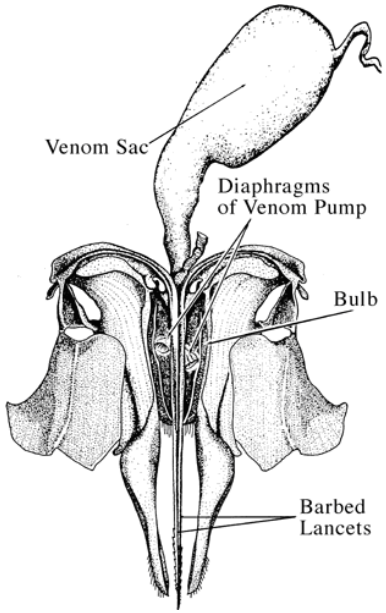




Thorax/abdomen modification

- Includes the vast majority of Hymenoptera, the abdomen is basally constricted.

- The ovipositor adapted for stinging in aculeats and for piercing in parasitic species

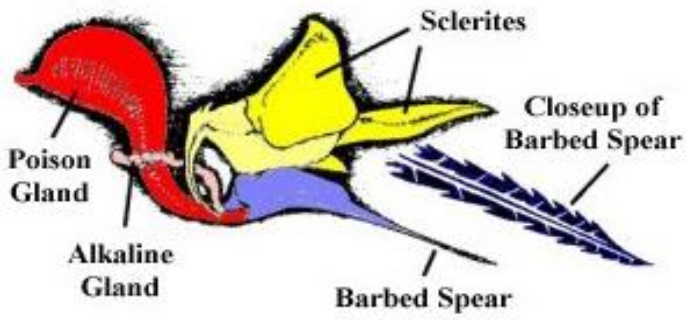


Stinger	Description
	***Honeybees***, the most common of the stingers. They aren't aggressive unless provoked. You can recognize them easily by their hairy bodies and bright yellow or black markings. They typically are found around flowers or clover. Once they sting, they die. They often leave their stinger behind.
	***Yellow jackets*** are the most aggressive of the stinging insects. Less chunky than bees and bright yellow with black markings, they hover around garbage and wherever there are exposed foods, particularly those containing sugar. They may sting repeatedly. They nest in the ground.
	***Hornets*** have short black bodies with yellow or white markings. They nest in trees or bushes and may sting repeatedly.
	***Fire ants*** attack people who walk on their nests. Their stings cause intense burning. A fire ant may bite into the skin and, while its head and jaw are locked in one place, quickly walk its abdomen and rear stinger in a wide arc, stinging repeatedly in a circle. Alternatively, it may leave a stripe of stings in its path as it runs across your leg.

Venomous Insects

Honey bee

A bee sting 1 day after

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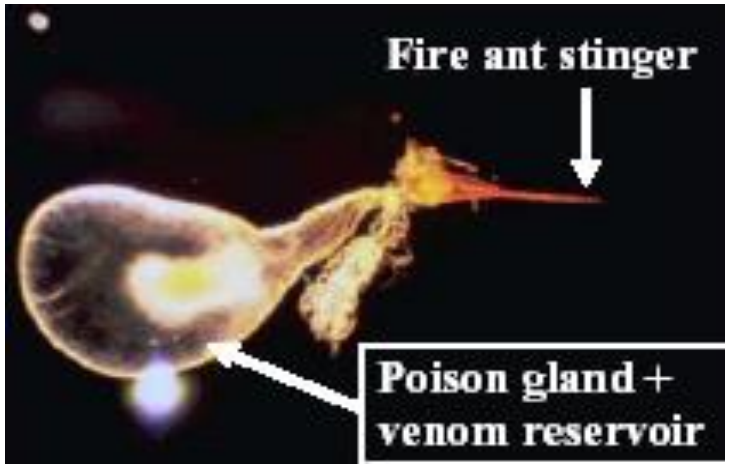
Venomous Insects

Fire ant

Fire ant



Poisonous Insects

Contact:-

Physical contact with body parts, haemolymph, poisonous spines & defensive secretions.

- **Blister beetles (Meloidae) release toxins (cantharidins) when crushed or handled.**
- **Some rove beetles of genus *Paederus* (Staphylinidae) have contact poisons (paederin) that cause blistering & long-lasting ulceration.**

- **Larval spines of some butterflies & moths penetrate skin causing skin irritations (urtication).**

Structure & function of hairs:

- Hollow spines with subcutaneous venom glands.
- Setae (bristles & hairs) with irritating toxins.

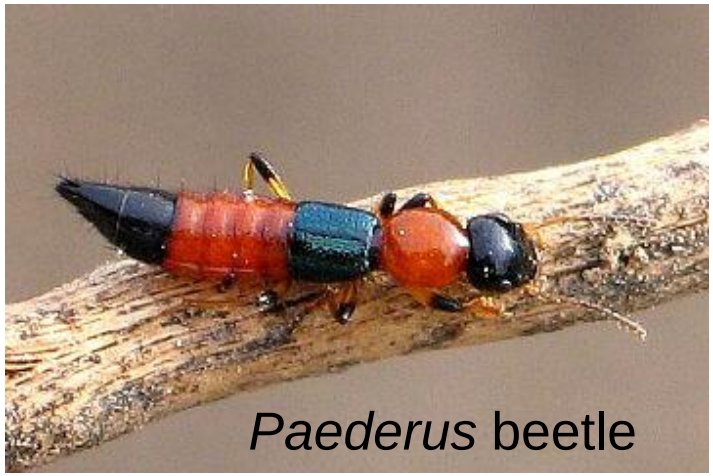
Biting:-

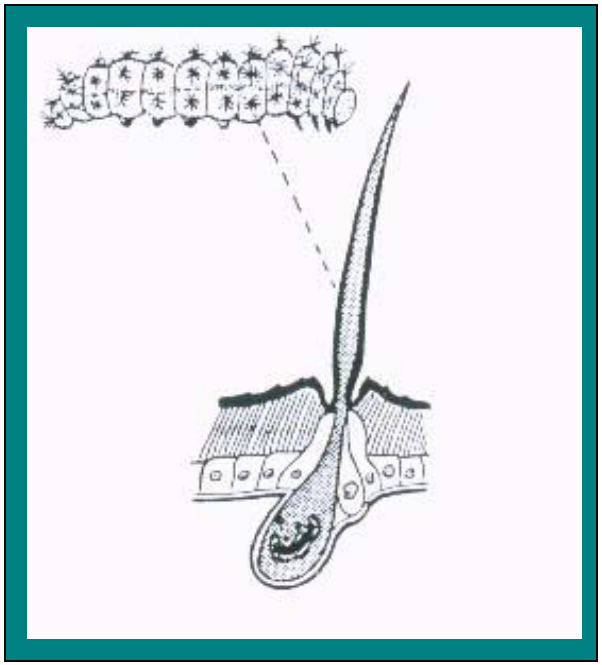
- **Insects pierce the skin to feed on the blood. This usually results in intense itching.**
- **Mosquitoes, fleas, bed bugs ……etc.**

Poisonous Insects- Contact

Blisters Beetles are able to release at their joints cantharidin, which is a chemical defense.

Note the droplets of cantharidin (see arrow).





Saddle back caterpillar- Notice the spines of the urticating hairs, which are hollow.

Poisonous Insects- Biting

Insect stings and bites

Insect bites and stings can be simply divided into 2 groups:

- **venomous**
- **non-venomous.**

A sting is usually from an attack by a venomous insect such as a bee or wasp, which uses this as a defense mechanism by injecting toxic and painful venom through its stinger.

Whereas non-venomous insect bites pierce the skin to feed on the blood. This usually results in intense itching.

Common biting and stinging insects	
Venomous (stingers)	**Non-venomous**
Social Hymenoptera ▪ Bees (Apidae) ▪ Wasps (Vespidae) ▪ Hornets (Vespidae) ▪ Yellow jackets (Vespidae) ▪ Fire ants (Formicidae)	**Biting** ▪ Mosquitoes ▪ Fleas ▪ Lice ▪ Bed bugs **Contact** ▪ Blisters Beetles ▪ ***Paederus* beetle** ▪ Larval spines of some butterflies & moths

What may happen after an insect sting or bite?

Envenomization - Action of Venom

- **Venoms that attack the central nervous system (neurotoxins) (e.g., Hymenoptera).**
- **Venoms that destroy tissue (cytolytic and haemolytic) (e.g., Hymenoptera, fire ants).**
- **Toxins that produce blisters (vesicating toxins) (e.g., blister beetles, certain stinging caterpillars).**
- **Toxins that prevent blood from clotting (haemorrhagic) (e.g., lice, fleas, t true bugs, biting flies).**

Reaction to the insect stings

A small local skin reaction - most cases

Most people will be familiar with the common local skin reactions caused by insects.

An insect sting - typically causes an intense, burning pain. This is quickly followed by a patch of redness and a small area of swelling (up to 1 cm) around the sting. This usually eases and goes within a few hours.

A localised allergic skin reaction - occurs in some cases

Some people have an allergic reaction to the venom in a sting. A localised reaction causes swelling at the site of the sting. This becomes larger over several hours, and then gradually goes away over a few days. The size of the swelling can vary, but can become many centimetres across. The swelling may even extend up an entire arm or leg. The swelling is not dangerous unless it affects your airway.

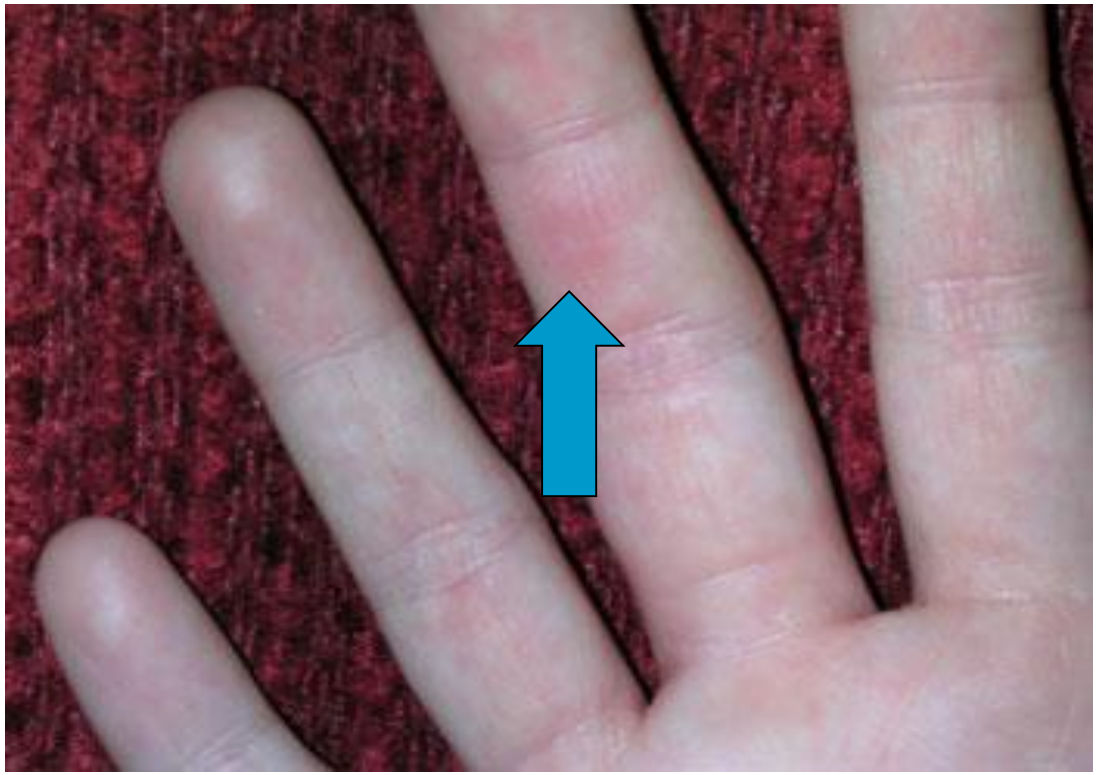
A generalised (systemic) allergic reaction - rare but serious

Systemic allergic reactions after several exposures (hypersensitivity). Release of histamine leads to dilation of blood vessels which cause:

- **general redness of the skin.**
- **a fast heart rate.**
- **low blood pressure which can make you feel faint, or even to collapse.**

Swelling of the face which may extend to the lips, tongue, throat, and upper airway.

- **Insect venom causes local pain, redness, and swelling in people who are not allergic.**



- Local response from wasp sting

- Systemic response from fire ants

Reaction to the insect bites

An insect bite - saliva from the insect can cause a skin reaction such as:

- **Irritation** and itch over the site of the bite.

- **A small itchy lump (papule)** which may develop up to 24 hours after a bite. This typically lasts for several days before fading away. Sometimes some redness (inflammation) surrounds each papule.

- **A weal** which is like a small fluid filled lump and is very itchy. It may develop immediately after being bitten. A weal lasts about two hours, but is often followed by a small itchy solid lump which develops up to 24 hours later. This can last for several days before fading away.

Reaction to the insect contacts

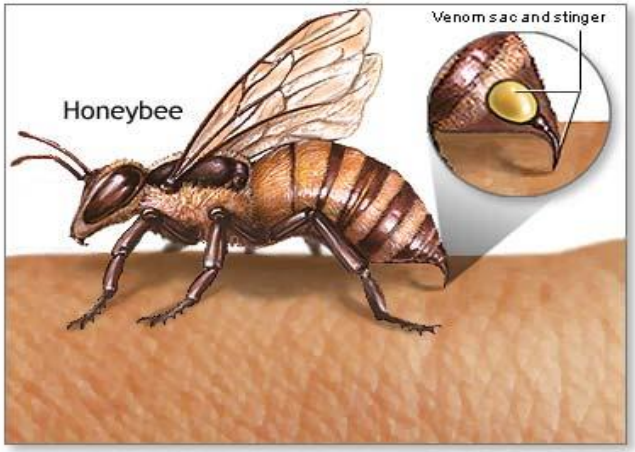
Urtication

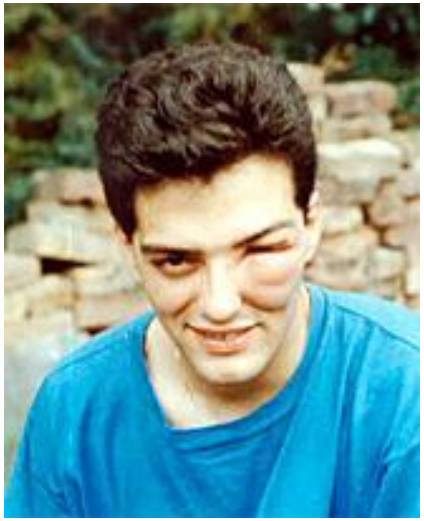
(irritating hairs)

Skin blistering

Toxicity & fatalities

- Most fatalities caused by honey bees
  - Shock from multiple stings.
  - Allergic response *(anaphylaxis) from single sting.
  - Allergic people must avoid allergens & carry medication





Normal appearance

Severe allergic reaction (anaphylaxis)

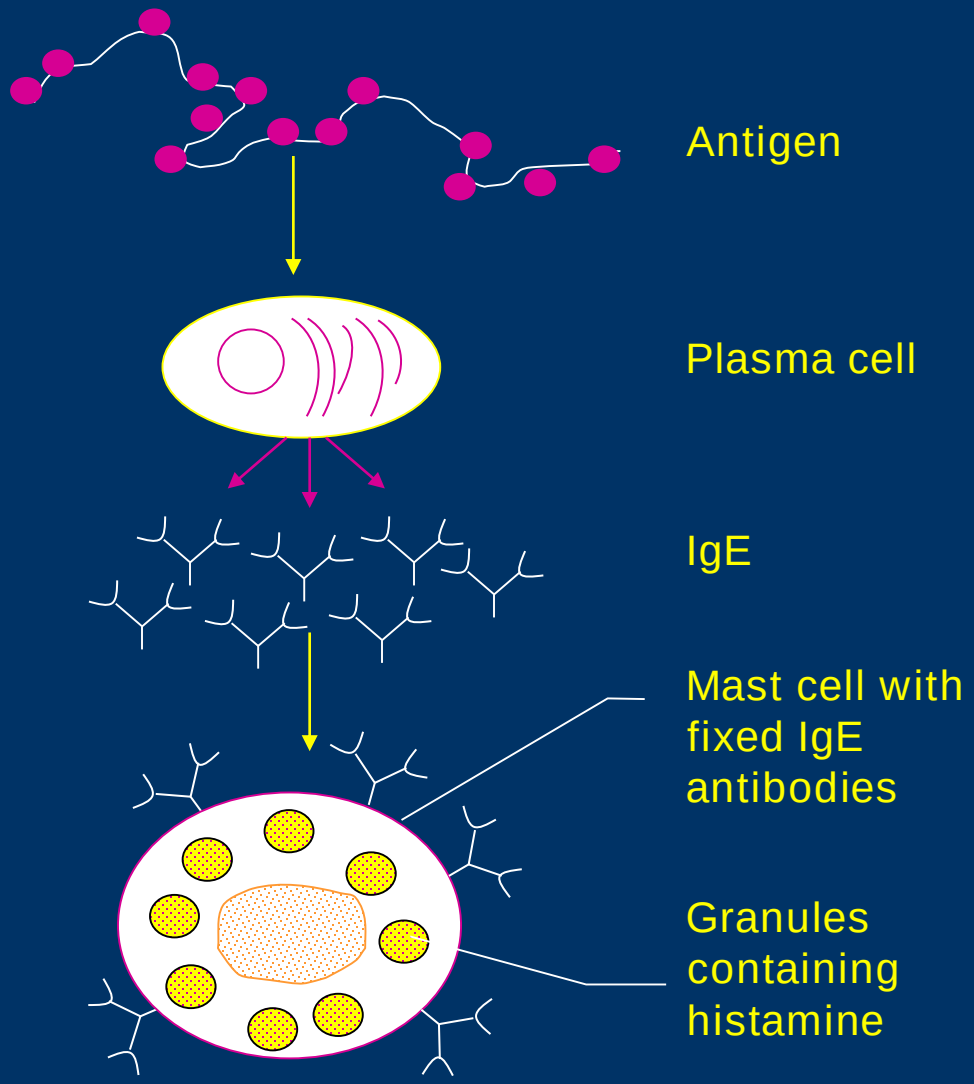
*A severe generalised allergic reaction is called anaphylaxis and is a medical emergency

Sensitization Stage

① Antigen (allergen) exposure

② Plasma cells produce IgE antibodies against the allergen

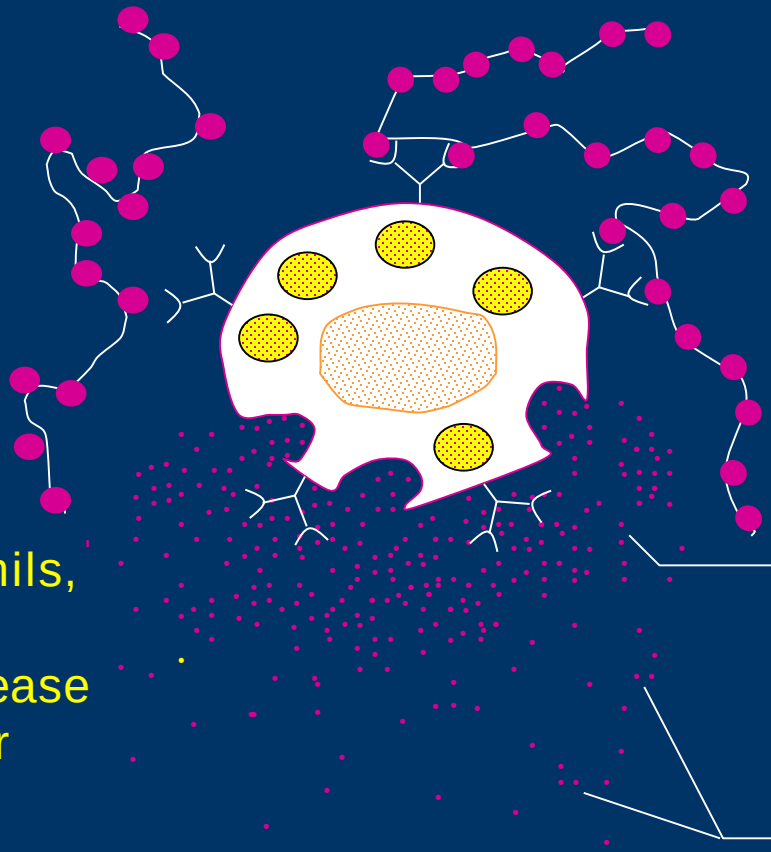
③ IgE antibodies attach to mast cells and basophils



Anaphylactic Reaction

④ More of same allergen invades body

⑤ Allergen combines with IgE attached to mast cells and basophils, which triggers degranulation and release of histamine and other chemical mediators



Wasps

Deadly Stings

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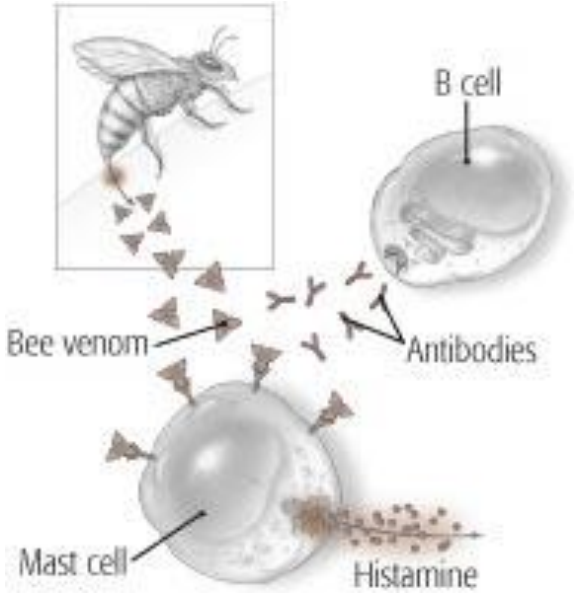

Skin infection

Occasionally, a skin infection develops following a bite. Particularly after scratching a lot, which can damage the skin and allow bacteria to get in. Infection causes redness and tendernessaround the bite. This may spread over several days, and sometimes can become serious.

Transmitted diseases (vector born diseases)