INSECT COMMUNICATION

Contents

INTRODUCTION

- Communication Definition: It is the exchange of information between individuals

- Most insect language is innate and inherited .

- Each individual is born with a distinctive vocabulary that shared only with other members of its own species.

- **It is an essential part of all social interactions.**

- **Ethnologists often define communication as:**
  An action or condition on the part of one organism that alters the behavior of another organism in an adaptive way.

Why do insects communicate?

1. Recognition of nest mates .
2. Locating or identifying a member of the opposite sex .
3. Facilitation of mating .
4. Giving directions for location of food resources .
5. Warning of danger.
6. Deception (Trick) / mimicry .

How do insects communicate?

Like all other animals, insects use their five senses to acquire information about their environment; any of these sensory modalities may serve as a pathway for the exchange of information.

- Taste and touch are both contact senses, therefore, exchange of information can occur only when two individuals are touching one another.

- Vision, olfaction (smell), and hearing are remote senses -- information signals may propogate through the air (or water) over considerable distances.

- Thus, an insect may send a communication signal by doing something (e.g. make a noise, release a chemical, or flash a light)

or

- The signal may simply be an inherent part of the insect's physical makeup (e.g. wing pattern, body color, or surface chemistry). In either case, the signal must elicit some behavioral change in order for a human observer to recognize its existence.

Types of communication between insects:

1. Visual Communication.
2. Tactile communication.
3. Acoustic Communication .
4. Chemical Communication .

Types of communication between insects

1.Visual Communication :

- Many insects communicate with visual signals.

Type of Visual Communication :

a) The color patterns and other markings on the wings of butterflies and moths .

- The red admiral butterfly, for example, has bright, distinctive markings on the upper wing surface and protective coloration on the underside.

Type of Visual Communication :

b) Some insects communicate by produce light to communicate.

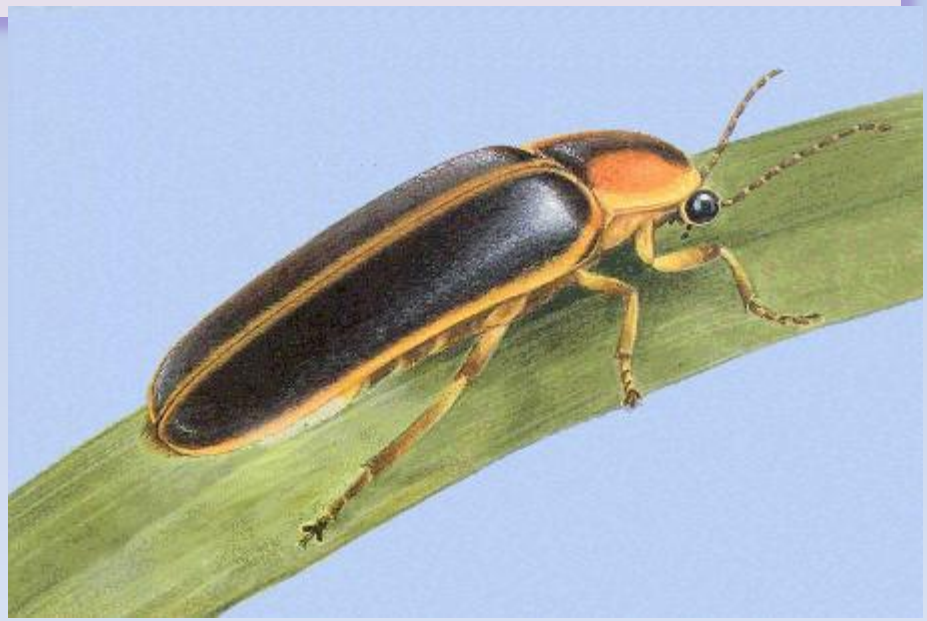
Example of this insects:

Lampyridae in the beetle order Coleoptera communicate with light.

Lampyridae

Fireflies

- Fire flies pulses of light are used in courtship dialogue between a male (usually flying) and a female (usually perched in the vegetation). Each species has a unique flash pattern and response time.



- Some insect can communicate using wavelength in the ultraviolet light.
- female cabbage butterflies have an ultraviolet reflecting scales on the dorsal wing surface, when they fly, each down stroke of the wing create a brief flash U.V. that male recognize them for mating.

Types of communication between insects

2.Tactile communication:

- Tactile contacts can form an important element in communication, although they are inevitably limited to interactions between two or just a few individuals.

  Many insects depend on physical contact because they have poor vision and sound receptor.

Common example of tactile communication is found in:

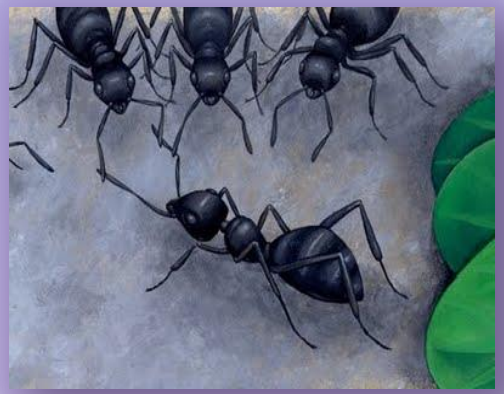
- The antennation between nest mates.
- Also the inter individual exchange of liquid material via trophallaxis is largely based on tactile interactions with mainly the antennae and the forelegs involved.

Example of tactile communication:

- Antennal tapping is an essential component of tactile communication in both ants and termites.

- It's not clear exactly what information may be exchanged, but it certainly involves nest mate recognition and leads to exchange of food through trophallaxis.

- They touch each other's feelers to exchange messages.



Example of tactile communication :

Blister beetles (family *Meloidae*), courtship begins with a series of antennal taps by the male on each side of the female body, and she signal her receptivity by lifting her wing covers and allowing him to clump on her back.

Example of tactile communication :

Certain treehoppers (order Hemiptera: family Membracidae) produce vibrations in the tissue of their host plant that can be felt by all other treehoppers on the same plant.

Example of tactile communication :

-Bees communicate by dance language.

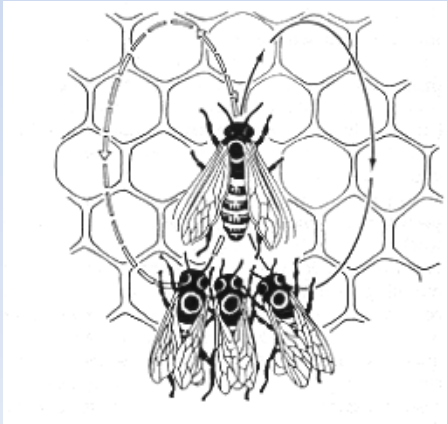
-Bees use dance as a form of communication for distance and direction of food sources or nest sites.

1- Round dance (running in a circle, is performed for close sites)

2- Transitional (or sickle) dance, For sites at an intermediate distance from the hive.

This dance involves running in a semicircular (or moon) shape.

3- Waggle dance, the most complex of the dance types performed by honeybees.



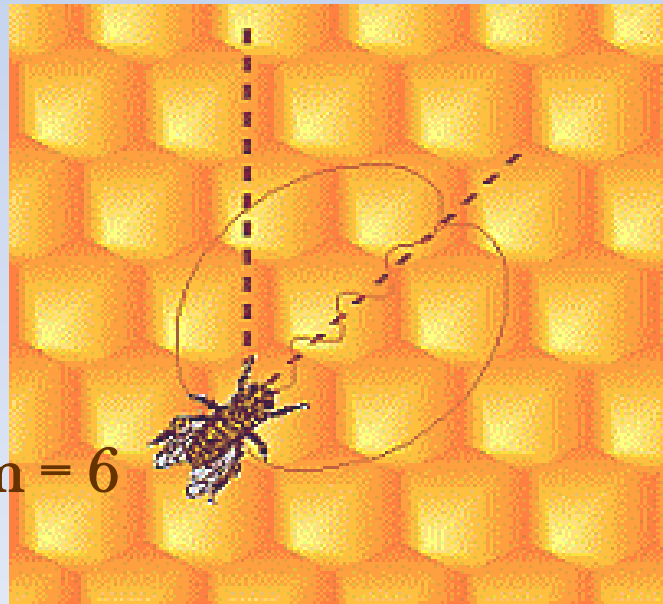
BEE WAGGLE DANCE

-The waggle dance is a language used by honey bee *Apis mellifera*. Which give the bees the ability to communicate the food sources locations.

-The dance consists of different units or words of honey bee language, these units consists of :

1. The pattern of the dance is conveying distance information.
2. The number of interactions of the dance that bee performs convey distance information as well.

For example 100m = 9-10 interactions, 500m = 6 interactions, and 1500 m= 4 interactions.



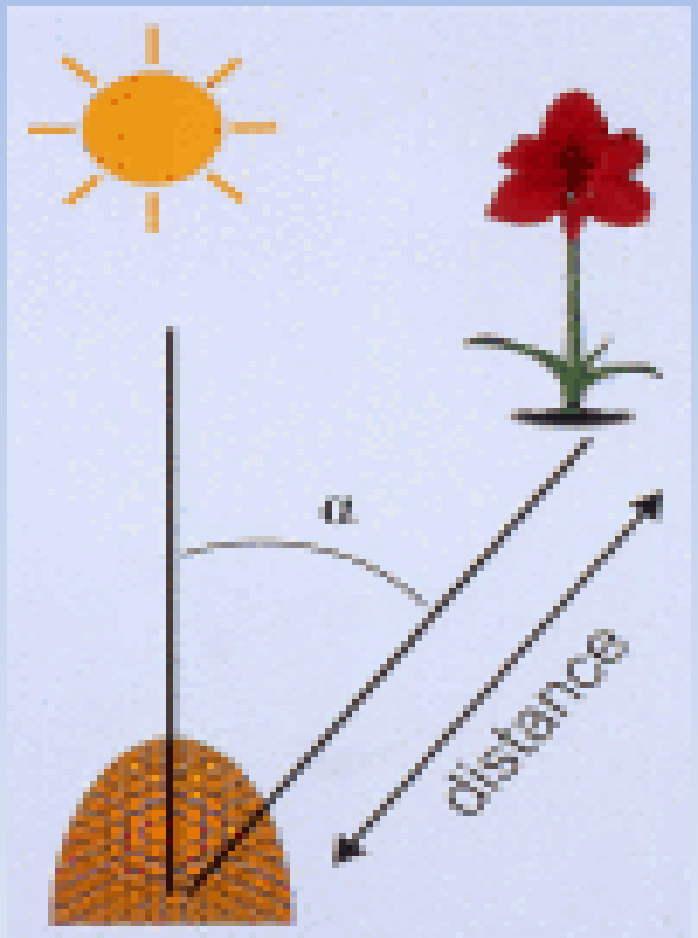
3. The liveliness of the dance conveys information about the quality of the food source. (The more excited the bee appears the better the quality of the food).

4. The angle of the dance conveys the direction of the food source

5. The bee will stop her dance and give out a food sample at other bee request.

6. Bee produce a sound to get attention of bees and to keep their attention.

7. The distance measurement by measuring the energy used in the fly.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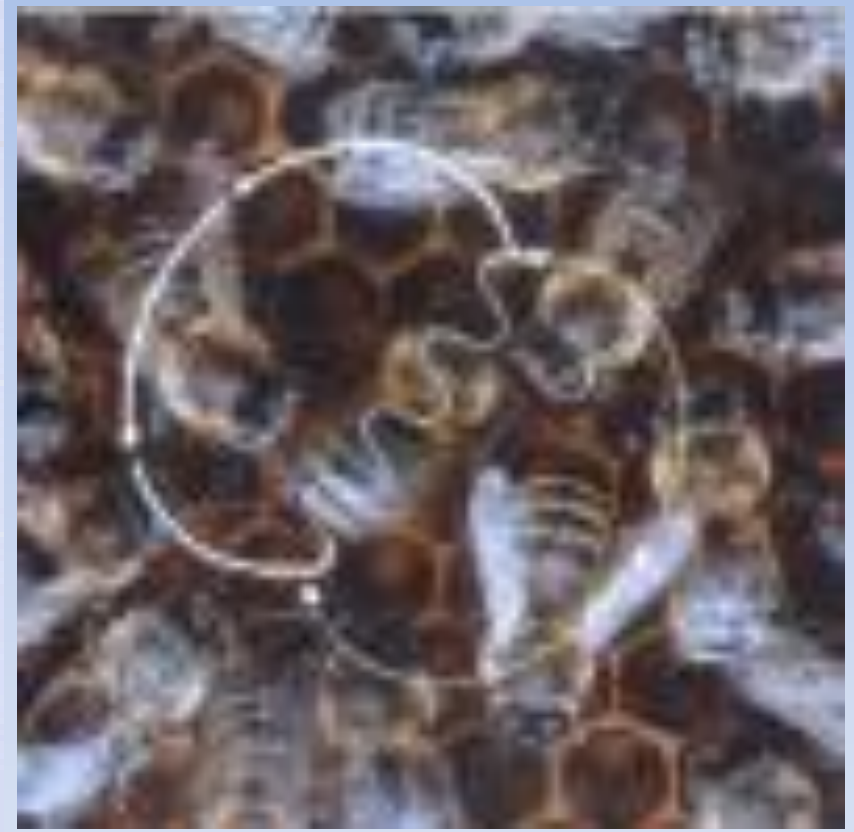


Pros and Cons of Tactile Communication

Advantages:

- Instantaneous feedback
- localized area
- Individual recipient
- Effective in the dark (*e. g.* caves, wood galleries).

Disadvantages:

- Not effective over distance
- Organisms must stay in direct contact
- Message must be repeated to each recipient
- Vibration signals can be intercepted by predators

Acoustic communication

3)Acoustic Communication

- Sounds are caused by vibrations that can pass through air, water, and solid structures
- There are many insects that can make sounds.
- They don't have vocal chords like people but they have other ways of producing sounds.

Ways of producing sounds:

A) Some do it by rubbing body-parts together.

Example :

CRICKETS - sing by rubbing one wing over the other wing.

- Others rub their legs, scratch their bodies, rub their jaws together.
- GRASSHOPPERS - make a buzzing sound by rubbing the hind legs against the wings.

Ways of producing sounds:

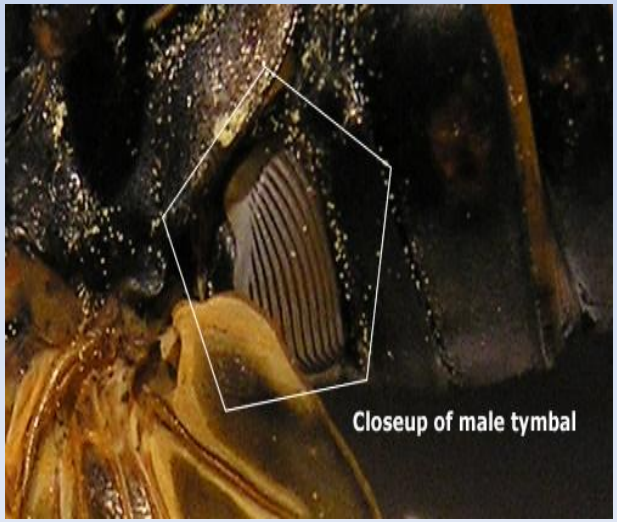
- Mosquitoes have antennal hairs that resonate to certain frequencies of sound.

Ways of producing sounds:

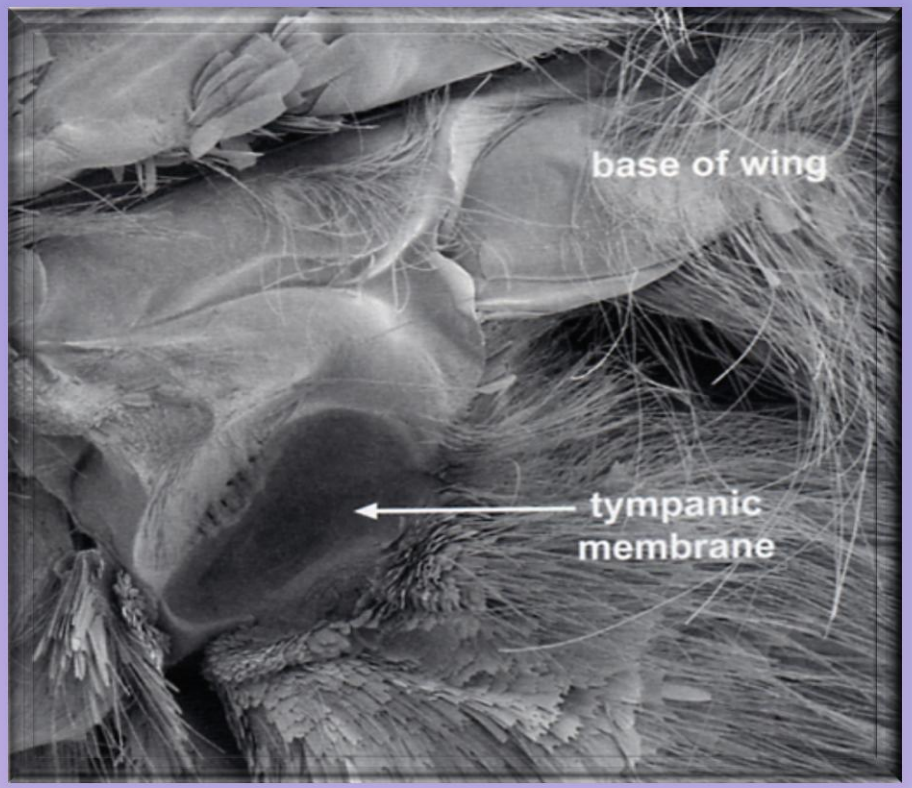
B) Some have special organs to produce sound.

Example:

- Male cicadas have special organs to produce sound these are called tymbals.
- Inside the tymbal there are membranes that can vibrate to produce a "singing" sound.



➢Most insects detect sound with a **tympanic mambrane** in the abdomen (e.g. grasshoppers and moths) or in the tibiae of the front legs (e.g. crickets and katydids).



- Although people can hear crickets, many insects make supersonic sounds that are above a person's range of hearing. These supersonic sounds have more than 20,000 vibrations each second.

- some grasshopper and moths produce ultrasonic sounds as 80000 hertz. Entomologist can study these sounds by using Audi-transducer.

4)Chemical Communication

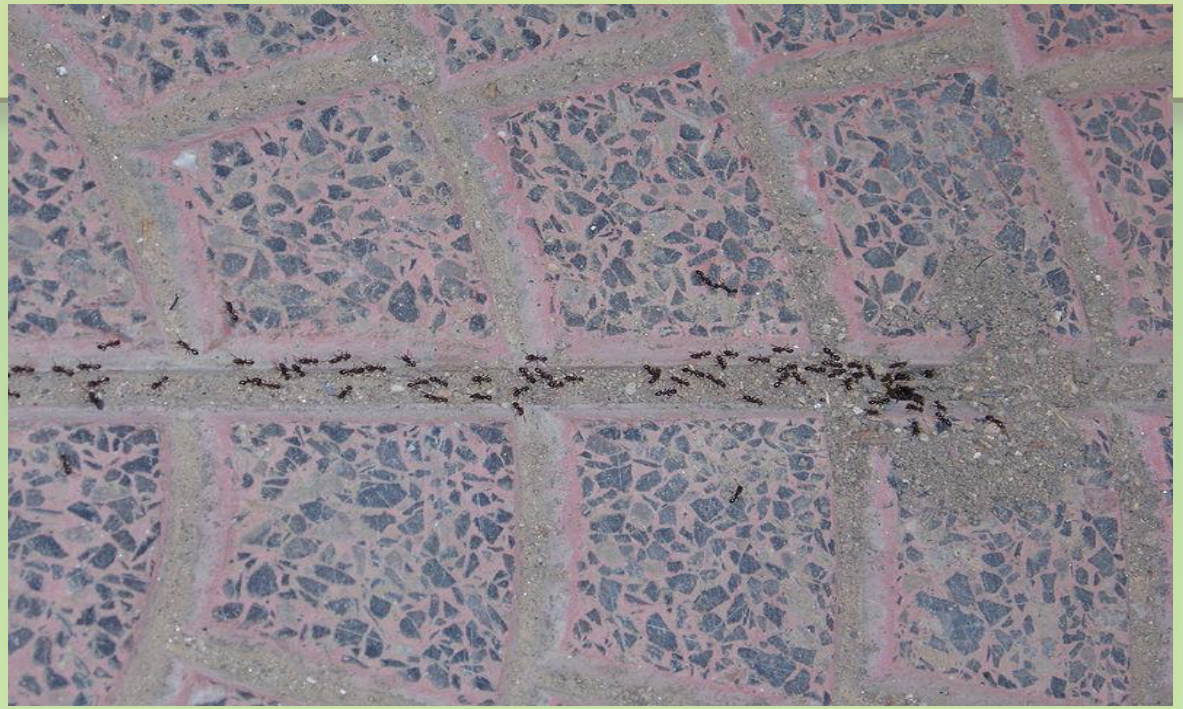
- Many insects communicate with each other by using smell .
- They can release odors from special scent glands in their body.
- These odors are called pheromones.
- In insects the females can produce specific smell to:

1) attract partners for mating. These are called "sex pheromones".
.e.g. Male moths can sense the pheromones of female moths over distances of many kilometers.

2)Odors are also used for other reasons for example ants use odors to mark a trail, so that other ants can use the trail to get back to the nest or to find food.

- ANTS know the other members of their colony by their special scent (smell).

3) Some insects use smell to warn each other for danger(alarm pheromones).

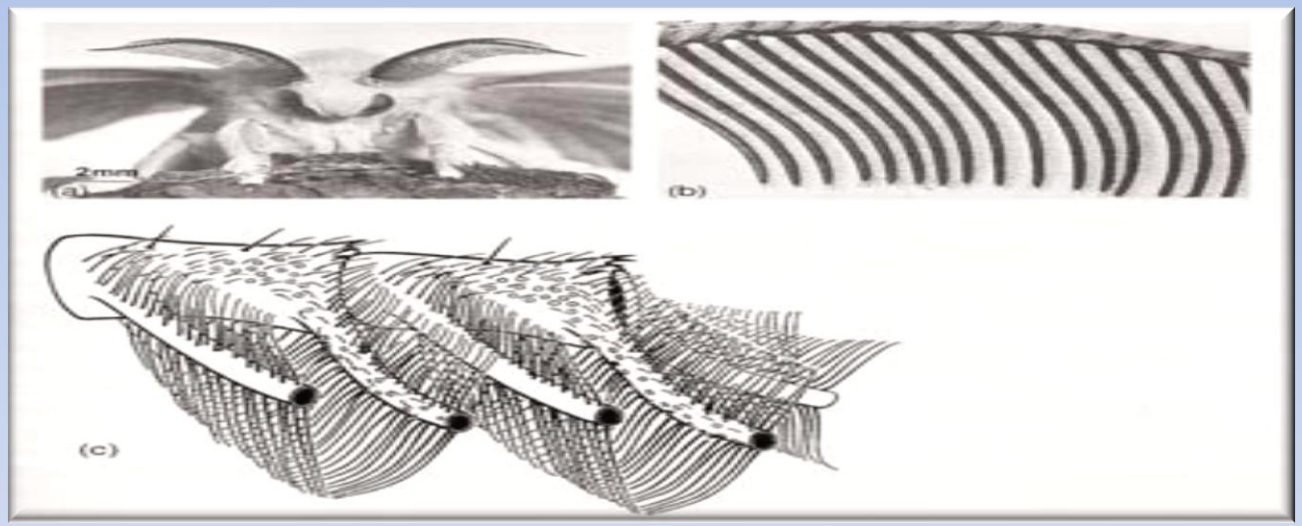


- Insects use their sense of taste or smell to detect the presence of odors.

- Specialized receptors may be located anywhere on the body, but are especially common on the

1) Feet.
2) Antennae.
3) ovipositor

- The insect antennae are the major organs for detect odors.
- In species where the female produces an odor, the males often have extra big antennae which help them to find the female.



Male silk moth *(Bombyx mori) showing the* numerous side branches and sensillary hairs of the antennae which form an effective olfactory sieve.
(b) Scanning electron micrograph close-up of antennae.
(c) Two segments of a moth antennae drawn in schematic detail.

- It is the most common way of insect communication.
- These chemicals are divided into 2 groups.

1- Pheromones: Chemical signals that carry information from one individual to another member of the same species. These includes sex attractants, alarm substance and many other intraspecific messages.

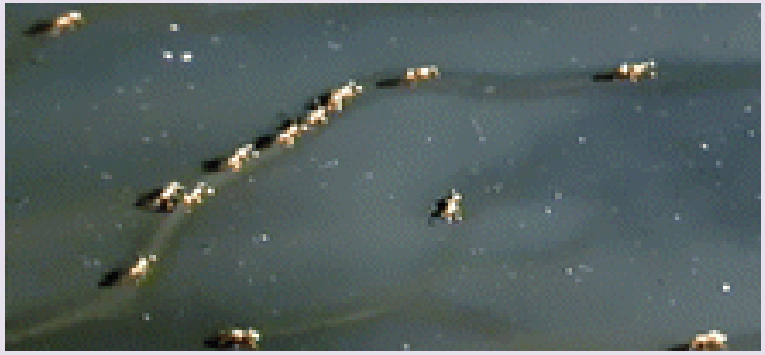
2- Allelochemicals: chemical signals that travel between individual of different species. These includes defensive signals such as repellents, compounds used to locate suitable host plant, and other signals to regulate interspecific behaviours.

-Pheromones communications found in 1600 insects species.

Functions of Pheromones:

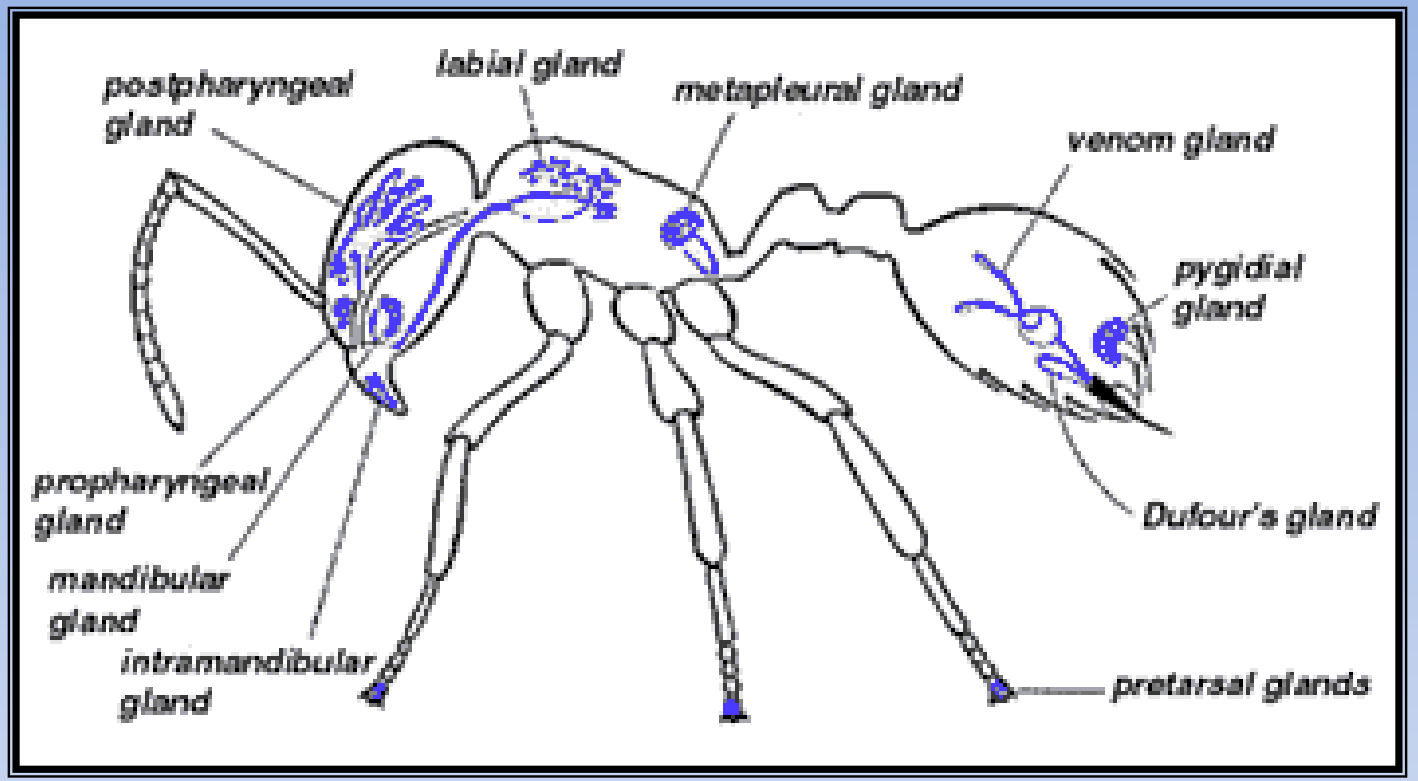
1- Queen bee emit pheromones that affects the development of workers bee.

2- Ant use pheromones to recruit nest mates to a food source.



3- When laying their eggs, some flies moths and beetles use certain pheromones to repel insects of the same and competing species, thereby protecting their progeny.

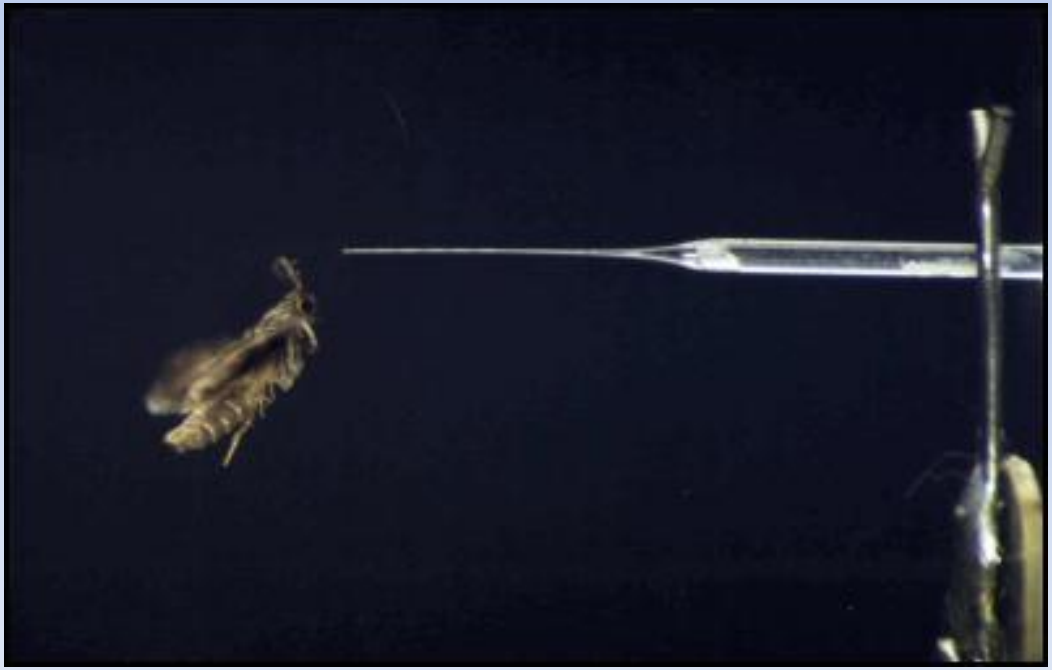
4- Aphids give alarm pheromones that urge neighbouring aphids to flee from nearby predators.



- some common exocrine glands that occur in ants
- Currently, over 70 distinct exocrine glands can be distinguished in the social insects (at least 45 in ants, 21 in bees, 14 in wasps and 11 in termites).

- **For many insects, love is truly blind.**

- **Using sex phermones in a tube made really try to mate with that tube.**




Any
Questions

References

1) Harun Yahya, The Miracle In The Ant ,2000,p50