

Behavior of Honey Bees



Introduction

- Among different insect orders, only **8 orders** have been recognized by insect taxonomists which have some communal life.
- Out of these 8 orders only two orders have well developed social organization i.e. **Isoptera** and **Hymenoptera**.
- Even in Hymenoptera, only two families namely **Apidae** and **Halictidae** of superfamily **Apoidea** contain fully social species.
- Most of other bees live solitary life.



Social Behavior

- Honey bees are fully social insects having overlap of many generations in the same nest.
- The colony is a well organized social group having division of labor in terms of laying of eggs, nursing, comb building, guarding, food collection and its storage.
- They have well developed communication system.
- **Biological communication** can be defined as an action on the part of one organism that alters the probability pattern of behavior in another organism in an adaptive fashion.



Communication in Honey Bees

Honey bees communicate through:

1. Trophallaxis
2. Different types of dances



Trophallaxis

- Mutual exchange of regurgitated liquids b/w adult social insects or between them and their larvae
- Food transmission (**exchange of food**) which is common between workers
- Also from workers to queen and drones.
- It is a sort of communication regarding **availability of food** and **water** and also a **medium for transfer of pheromone**.

Dances of Honey Bees

- **Father Spitzner** was the first person who described the bee dances as method of communication in **1788**.
- This communication occurs among inmates of the hive about **volume of honey flow** and **place of source of nectar**.
- **Karl von Frisch** got noble prize in **1973** (under physiology & medicine) on the basis of his honey bee behavioral work published in **1946**.
- In honey bees, **recruit communication** is very important mode of communication which is defined as a communication that brings nest mates to some point in space where work is required.
- Dances of honey bees are important recruit communication.

Dances of Honey Bees

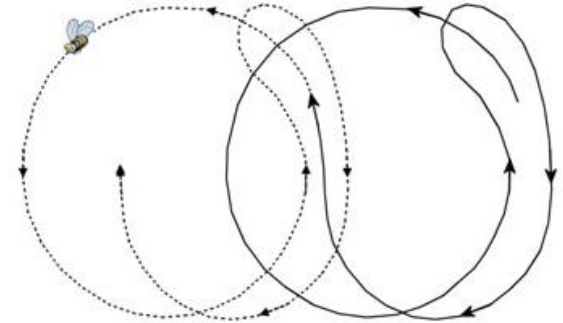
- In honey bees there is a well developed recruitment system to increase foraging efficiency.
- Some of the foraging force (5-35%) acts as scout bees/searcher bees.
- These bees may travel many kilometers.
- Average foraging radius of a colony is only few hundred metres in agricultural areas and about 2km in forested areas.
- Scouts communicate distance, direction and quality of flowers through different types of dances which in turn results in recruitment of other workers to forage on the best available sources.

Types of Dances

The scout bees perform two types of dances

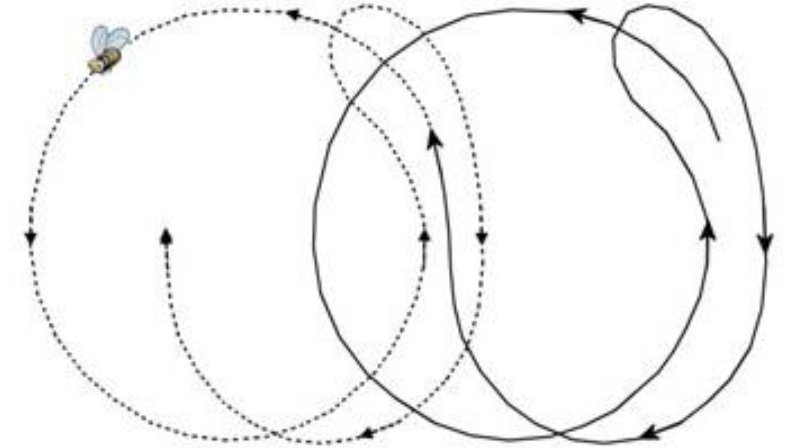
i) Round dance

ii) Wag-tail dance / Waggle dance



Round Dance

- This type of dance is performed if food source is nearby (within 100 metres in case of *A. mellifera* and 10 metres in *A. cerana*).



- The performing bee takes quick short steps and runs around in narrow circles on the comb; once to right and then left and then repeating for several seconds.
- The dance excites the bees and they touch the performer with their antennae and then leave the hive in search of source of food.
- In this dance there is **no indication of direction of food** and the foragers search within **100 metres** in all direction using floral odour clinging to hairy body of scout bee as cue as well as from the sips of nectar which they receive from the dancing bee.

Wag-Tail Dance



- This dance is performed when the distance of food source is **more than 100 metres** from the hive.
- In this dance the bee starts dancing on the comb making a half circle to one side and then takes a sharp turn and runs in a straight line to starting point.
- Thereafter takes another half circle on the opposite direction to complete one full circle.
- Again the bee runs in a straight line to the starting point.
- In the straight run the dancing bee makes wiggling motion with her body that is why this dance is known as wag-tail dance.
- Location of food is indicated by direction of straight run in relation to line of gravity.

Wag-Tail Dance

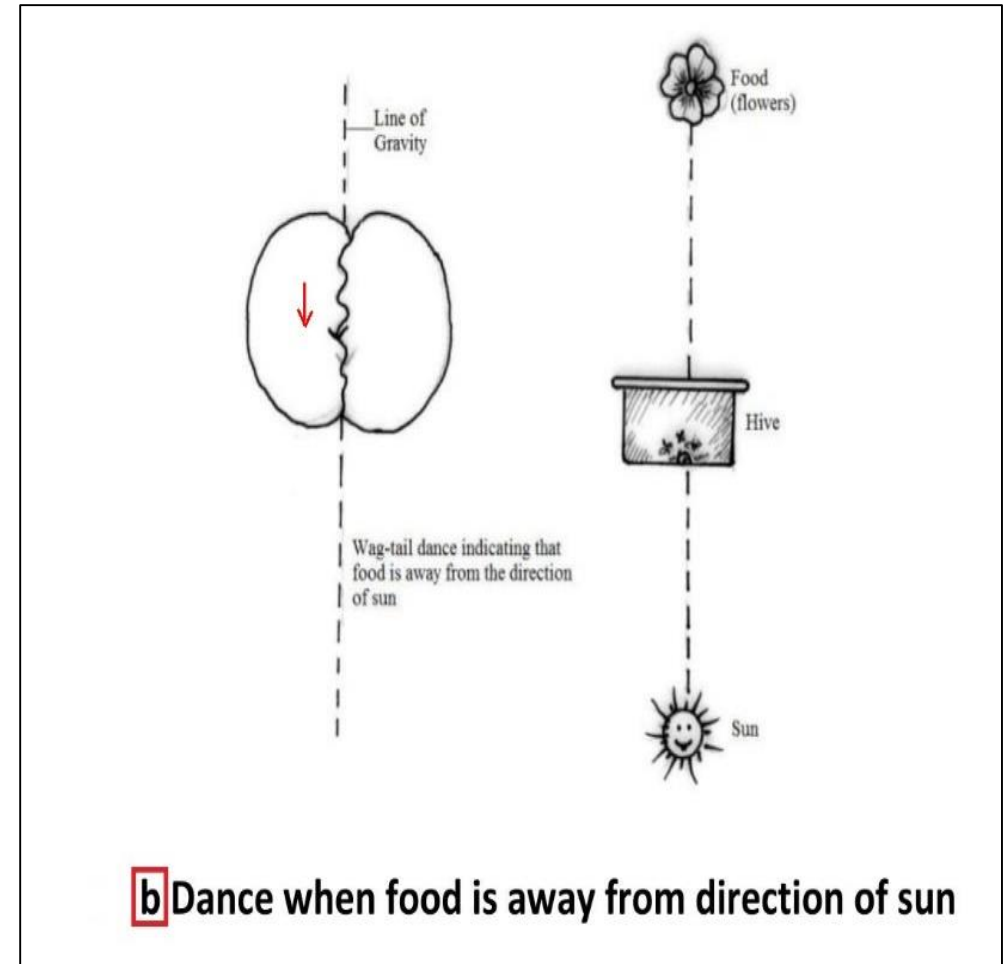
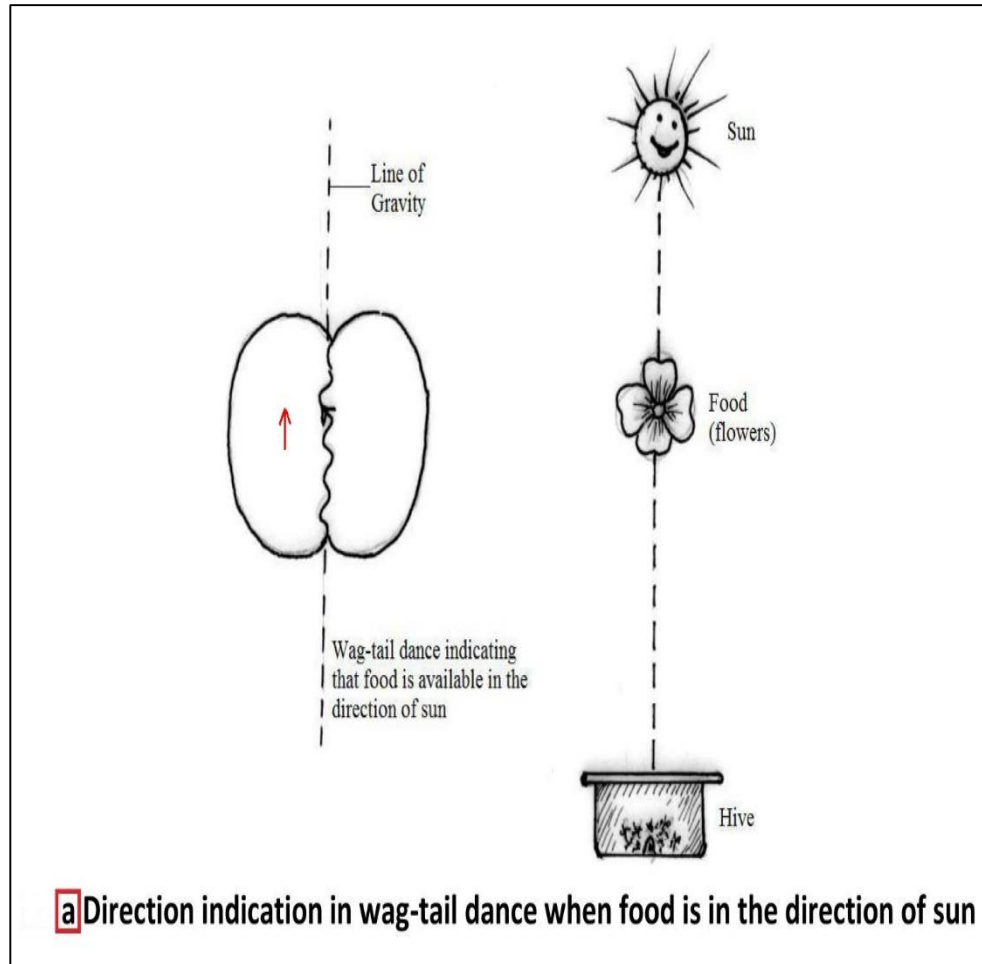
- If the food is in line with the sun, bee wag-tails upwards and if away from the sun, it performs downwards.
- If the food source is to the left of the sun the bees dance at an angle counterclockwise to the line of gravity, whereas, if it is to the right of the sun the bees dance to the right of the line of gravity.

Figure: Wag-tail dance in relation to direction of sun

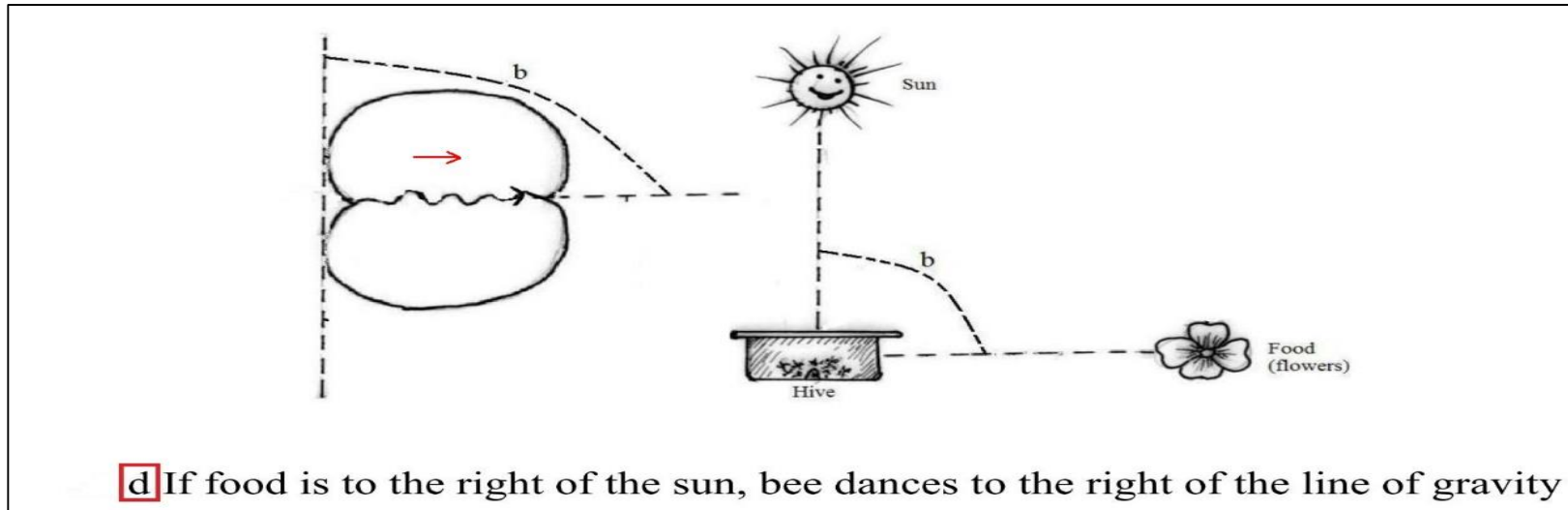
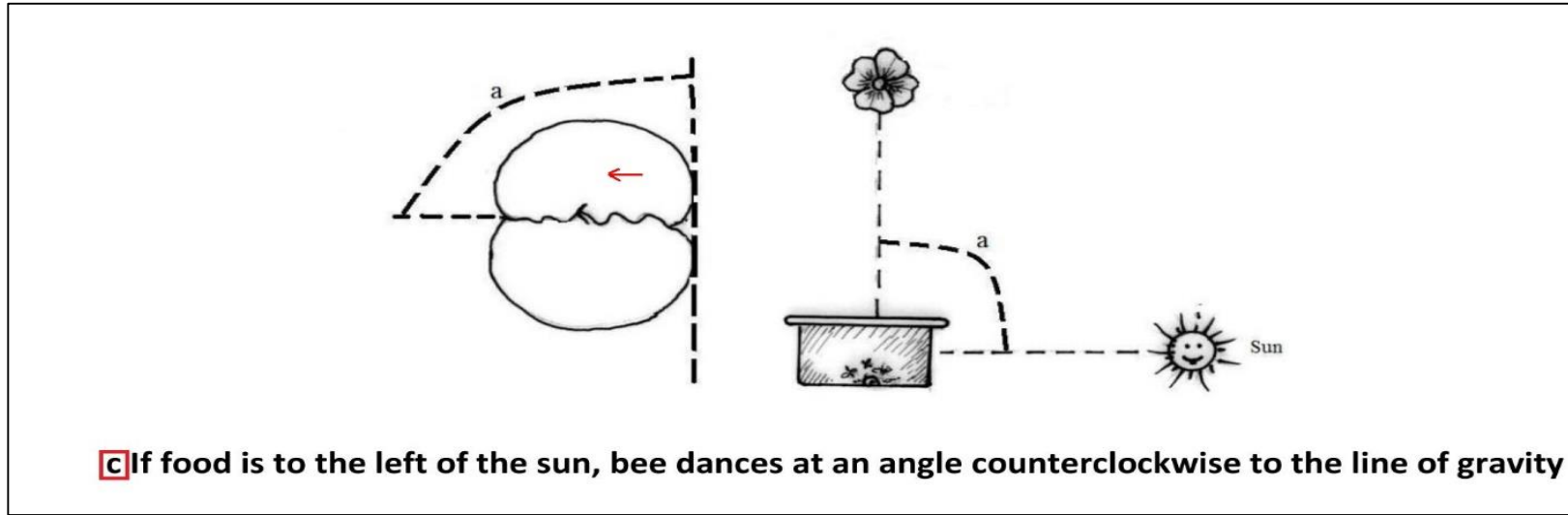
The distance is indicated by the number of straight runs per 15 seconds as given below:

Distance of food from hive (metres)	Number of straight runs/15 sec.
100	9-10
600	7
1000	4
6000	2

Wag-Tail Dance



Wag-Tail Dance



Other Behaviors

- As a social unit a bee colony maintains its hive temperature between 32-35 °C in the brood area.
- Queen substance **9-oxo-2-decenoic acid** (9-ODA) from the queen bee, **alarm pheromone** and alarm odour from worker bees play important role in the welfare of the colony and help in the social organization.