

Practical 5

SOCIAL BEHAVIOUR OF HONEY BEES

Aim: To understand communication system of a honey bee colony.

Introduction

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

Social behaviour

Honey bees are among the fully social insects having overlap of many generations in the same nest. The colony is a well organized social group having **division of labour** in terms of laying of eggs, nursing, comb building, guarding, food collection and its storage. They have **well developed communication system** through different types of dances as well as trophallaxis.

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. Adaptive means that the signaling or the response or both which have been genetically programmed to some extent by natural selection.

Trophallaxis is food transmission (exchange of food) which is common between workers and 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.

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: It was Father Spitzner in 1788 who for the first time described bee dances as method of communication among inmates of the hive about volume of honey flow and place of source of nectar. These observations remained unnoticed till Frisch (1920) published his observations. **Karl von Frisch** got **noble prize in 1973** (under physiology & medicine, who shared it with two other animal behaviourists) on the basis of his work published in 1946.

Types of dances: 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.

The scout bees perform two types of dances

i) Round dance

ii) Wag-tail dance

i) **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 (Fig. 5.1). 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.

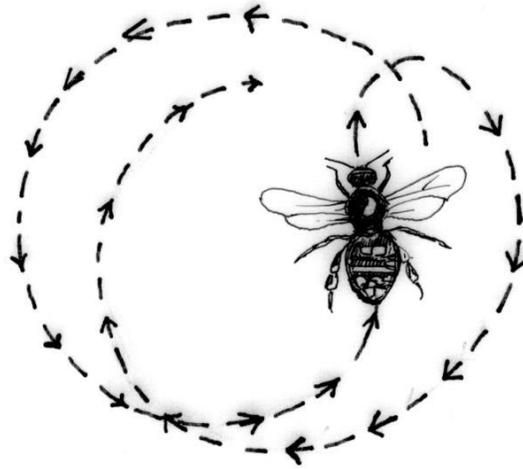


Figure 5.1 Round Dance

ii) 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 (Figure 5.2). 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. If the food is in line with the sun, bee wag-tails upwards (Figure 5.3a) and if away from the sun, it performs downwards (Figure 5.3b). If the food source is to the left of the sun the bees dance at an angle counterclockwise to the line of gravity (Figure 5.3c) whereas, if it is to the right of the sun the bees dance to the right of the line of gravity (Figure 5.3d).

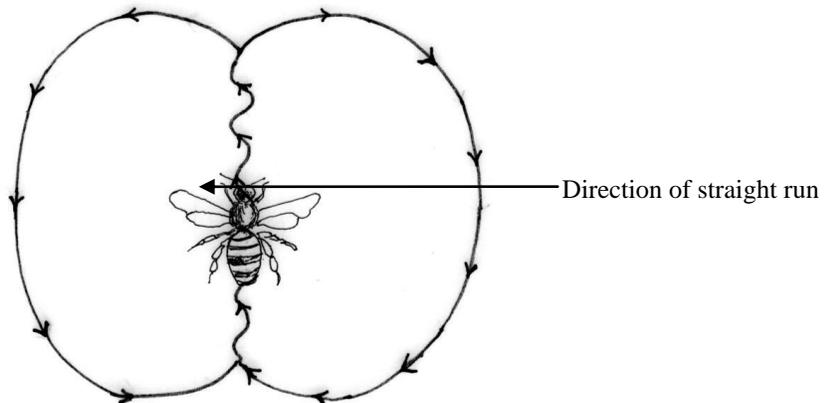
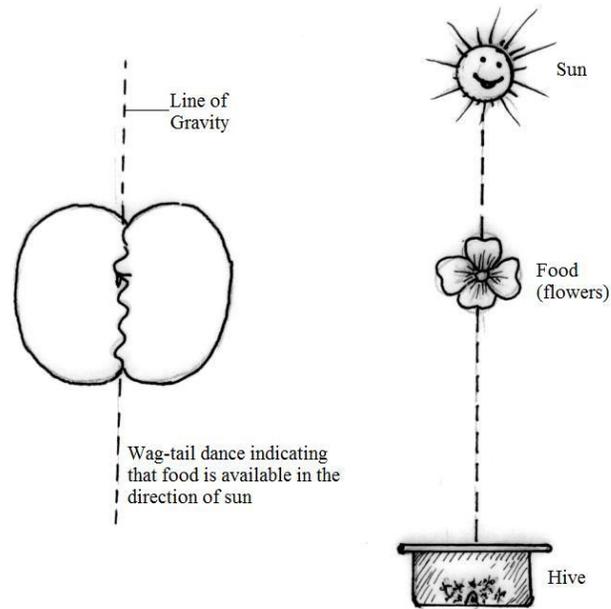
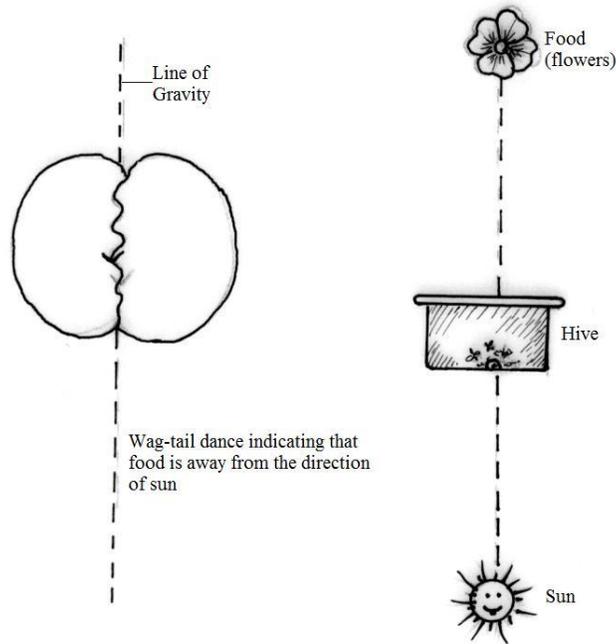


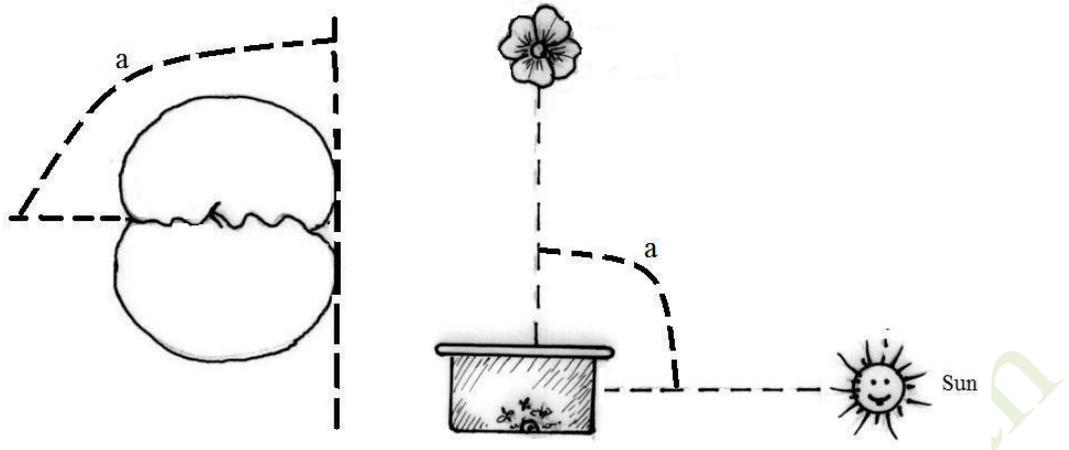
Figure 5.2 Wag-tail Dance



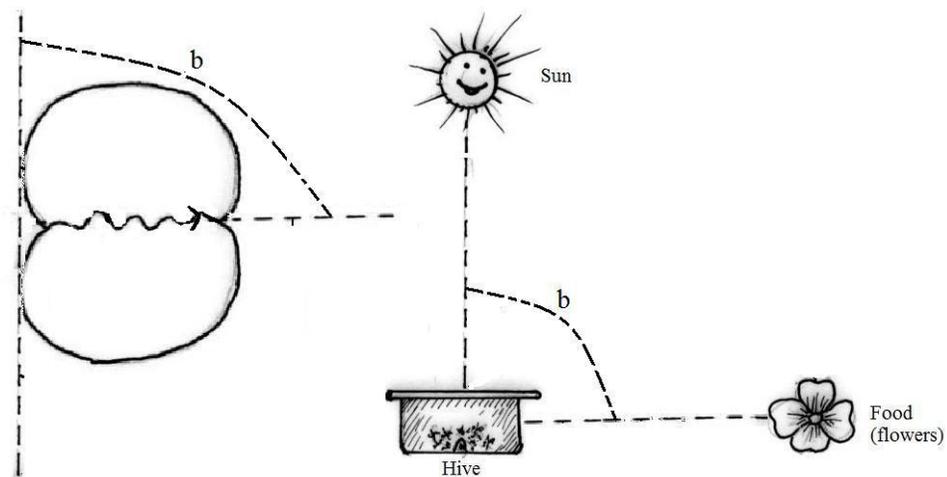
5.3a Direction indication in wag-tail dance when food is in the direction of sun



5.3b Dance when food is away from direction of sun



5.3c If food is to the left of the sun, bee dances at an angle counterclockwise to the line of gravity



5.3d If food is to the right of the sun, bee dances to the right of the line of gravity

Figure 5.3 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

As a social unit a bee colony maintains its hive temperature between 32-35⁰C 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.

Practical things to do:

- i. Check during summer season activities of bees related to thermoregulation in the colony (fanning, water collection etc)
- ii. During winter note the clustering of bees in the colony
- iii. Note exchange of food material among bees through trophallaxis.
- iv. Observe a returning forager for recruitment dance

Dr. YSPUH & F Solan