Chemistry and honey bee behavior

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Definition of terms

Chemistry

- a branch of physical science, is the study of the composition, structure, properties, change and uses of matter

Behaviour

- is the range of actions and manners made by organisms, systems, or artificial entities in conjunction with themselves or their environment (both biotic and abiotic)

Do you know what this is?

Do you know what this is?

Worker honey bee leaving a flower after pollen collection

Do you know what this is?

Do you know what this is?

honey bee mating swarm (left) and drone mating a queen in mid-air (right)

Do you know what this is?

Do you know what this is?

Worker honey bees attacking a hornet (honey bee predator)

what do you see ?

what do you see ?

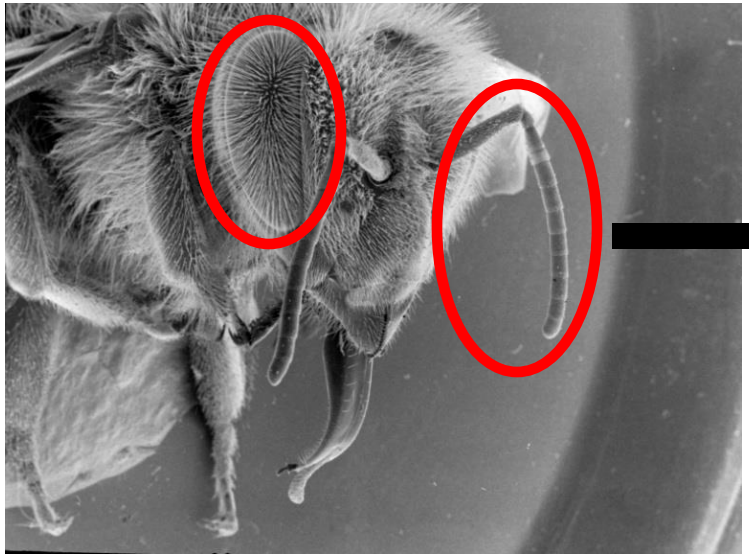
Inside a honey bee hive

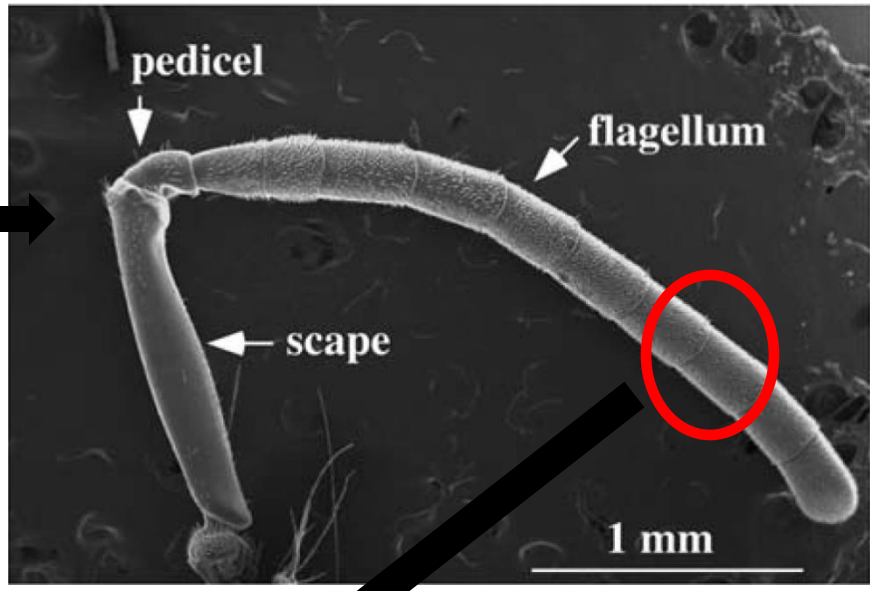
Summary of daily worker bee tasks

Inside Hive	Outside hive
Egg laying	Mating
Comb construction	Foraging for food
Nursing of young ones	Foraging for resins
Sealing of brood	Foraging for water
Storage of food	
Cleaning of old cells	
Guarding against intruders	

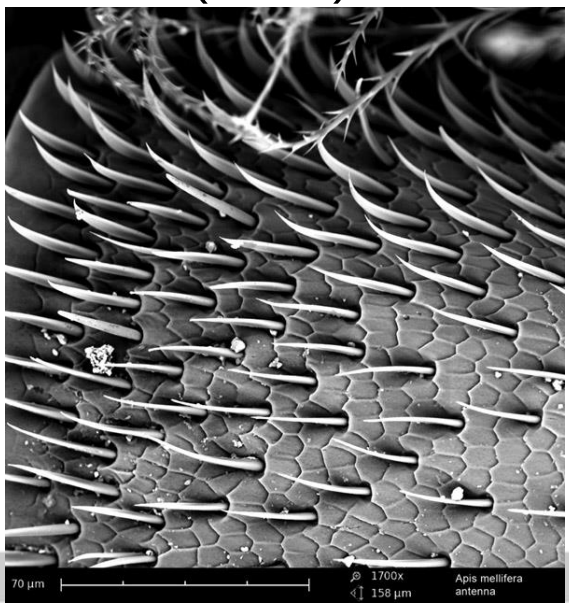
More indoor than outdoor chores

Main honey bee sensory organs





Eye (sight) and Antenna (smell)



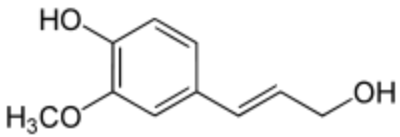
Sensory (sensilla) hair on antenna

Major honey bee pheromones & their roles

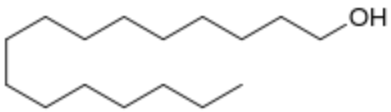
Queen Produced pheromone	Role(s)
Queen mandibular pheromone	attract drones during mating, maintains social cohesion in the colony
Queen retinue pheromone	attracts workers to queen
Drone produced pheromone	
Drone aggregation pheromone	attracts drones to congregation sites
Worker produced pheromone	
Alarm Pheromone	used to announce, mark & immobilise intruders
Brood recognition pheromone	differentiates larva from pupa, Stimulates foraging & inhibits ovarian development
Egg-marking pheromone	distinguishes queen from worker eggs
Footprint pheromone	Used to mark food resources by worker, used to mark hive by queen and prevent further queen rearing
Forager pheromone	Slows maturation of nurse bees, balances nurse to forager bee ratios

Some honey bee pheromones

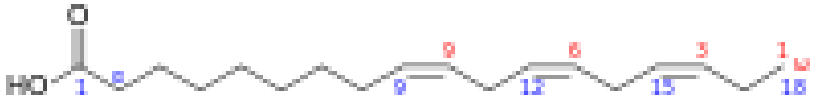
Queen retinue pheromone components



coniferol

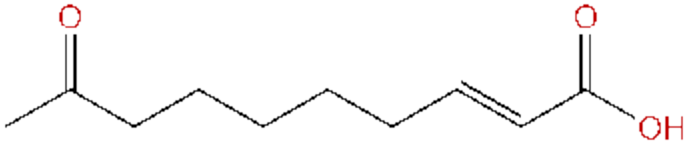


Cetyl alcohol



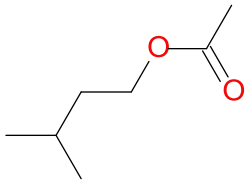
Alpha linolenic acid

Queen mandibular pheromone

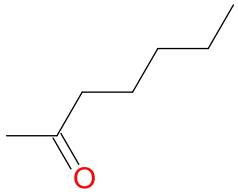


E-2-9-oxo-decenoic acid

Alarm pheromone components



Isopentyl acetate



2-heptanone

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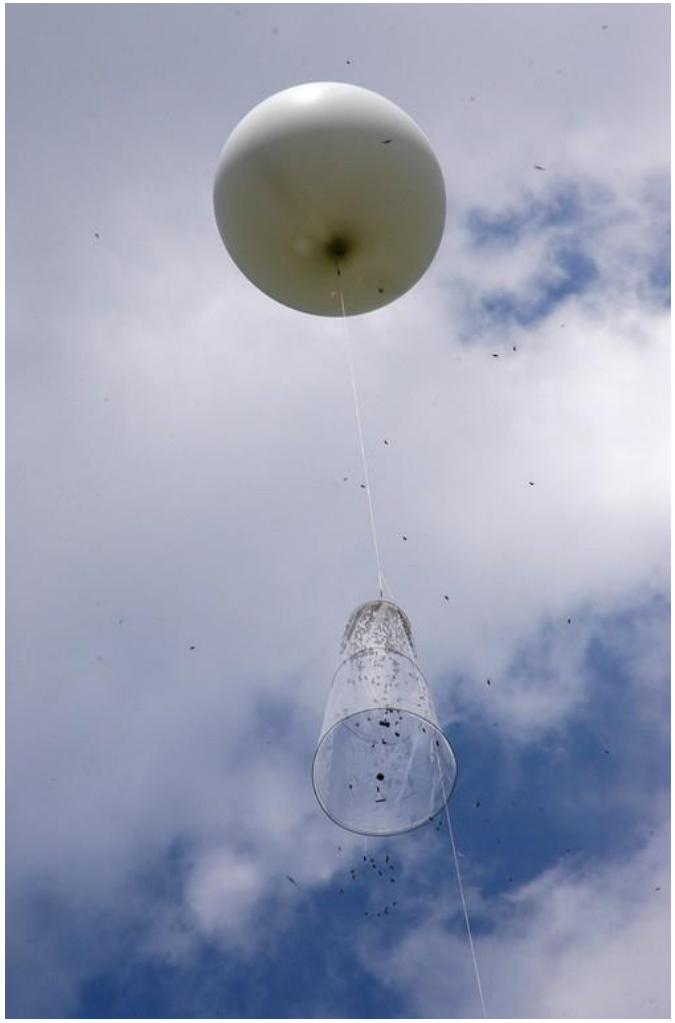
Why the need to understand honey bee behaviour and its underlying chemistry?

Advance our knowledge on bee behaviour

Estimating honey bee populations through drone diversity



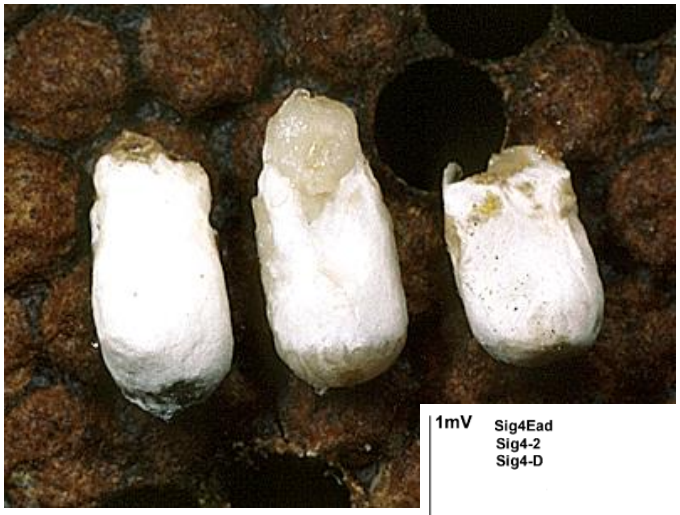
Foster knowledge on bee-pest-disease-pesticide interactions

Pests

Diseases

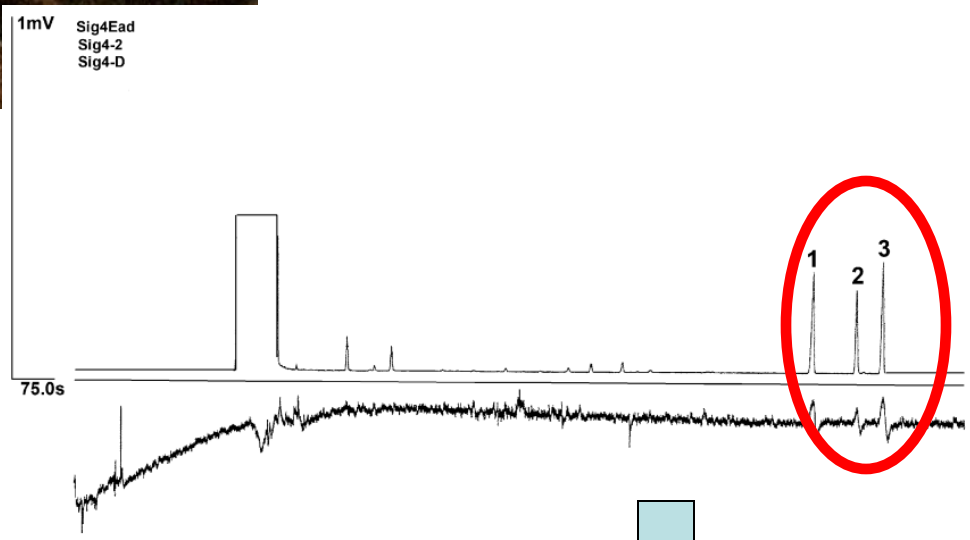
Agrochem icals

Foster knowledge on bee-disease interactions



Chalkbrood
(infected larvae)

1= phenethyl acetate, 2 = 2 phenyl ethanol & 3 = benzyl alcohols



Increased hygienic behaviour involving removal of infected brood

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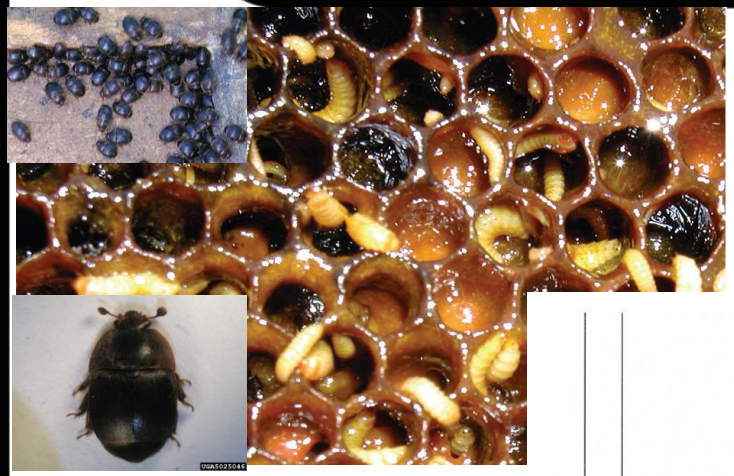
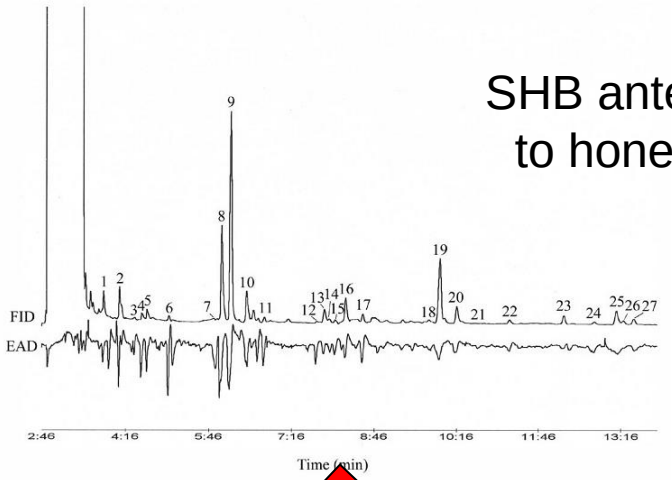
Foster knowledge on bee-pest interactions



Small hive beetle (SHB)



SHB antenna response to honey bee odours

Bait +

SHB bottom board trap

SHB flight trap

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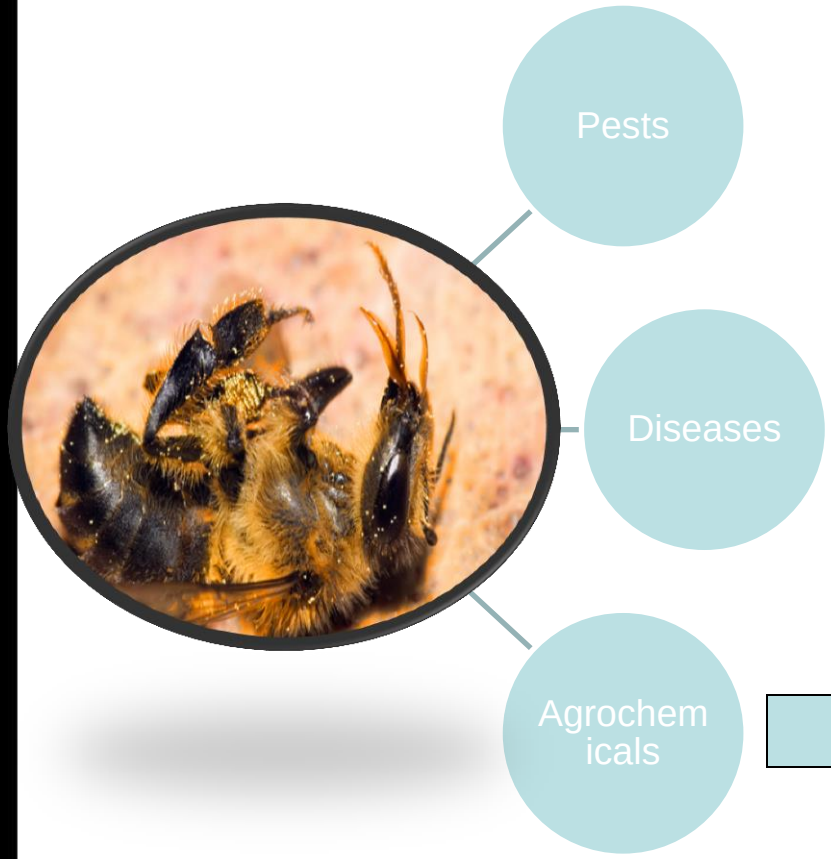
Understand the effect of agrochemicals on bees



- Kill bees
- Induce memory loss
- impair learning
- reduce reproduction
- Immune suppression

❑Neonicotinoids(clothianidin-GER, Imidacloprid -FRA), carbamates (Coumaphos), pyrethrins (permethrin, cypermethrin etc)

Take home message

"There is a chemical basis underlying all behavioural interactions between living organisms"

THANK YOU ALL
FOR YOUR
ATTENTION