PESTICIDE HAZARDS IN BEE COLONIES AND HIVE PRODUCTS

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Pesticides

- A chemical, physical or biological agent that destroys or controls pest organisms
Insects, rodents, weeds, fungi are competitors in humanity feeding.
Classification of Pesticides

Pesticides (by Effects)

Target Organism - Insecticides, herbicides, fungicides, miticides, rodenticides, etc

Chemical structure

FUNGICIDES
• Thiocarbamates
• Dithiocarbamates
• Cupric salts
• Tiabendazoles
• Triazoles
• Dicarboximides
• Dinitrophenoles
• Organotin compounds

INSECTICIDES
• Pyrethroids
• Organophosphorus
• Carbamates
• Organochlorine

FUMIGANTS
• Aluminium and zinc phosphide
• Methyl bromide
• Ethylene dibromide

HERBICIDES
• Bipyridyls
• Chlorophenoxy
• Glyphosate
• Acetanilides
• Triazines

Polar vs Non-polar

Volatile vs Non-volatile
**Risks and Benefits**

**Benefits**
- Crop protection
- Food preservation
- Material preservation
- Disease control
- Improved the living standards of farmers
- Benefits whole society

**Risks**
- Toxic to humans
- Impact on environment and ecosystems
- Toxic to pollinators
Public health: disease prevention (malaria, typhus, yellow fever) and increased agricultural production

DDT Story? “wonder chemical”

- Saves lives through prevention of malaria, DDT kills mosquito’s

- Malaria kills over 800,000 people every year and about 100 children every day.

- DDT and its byproducts cause
  - breast & other cancers
  - male infertility
  - miscarriages & low birth weight
  - developmental delay
  - nervous system & liver damage

- Banned or restricted in most countries due to its bioaccumulation in the food chain
DDT – A Chlorinated Hydrocarbon

Forbidden or significantly limited: on northern hemisphere of Earth

Developing countries: large number of infection (malaria, yellow fever) pest: threat of food production (e.g. termites)

Options in Africa

- premature death (famine or infection)
- longer life (chronic effect of chlorinated hydrocarbons)

http://www.eoearth.org/article/Chemical_use_in_Africa:_opportunities_and_risks
Pesticide Residues
How Do these Residues Move?

The pesticide cycle

- Degraded by ultra-violet light
- Vaporized to atmosphere
- Deposited by rainfall
- Absorbed by crop
- Leached below root zone by rain or irrigation
- Adheres to soil particles
- Degraded by bacterial oxidation or chemical hydrolysis
- Leached to water courses

http://www.ecifm.rdg.ac.uk/pesticides.htm
Environmental Aspects of Pesticides

Life of pesticides:
- Effect reduction - 95% environmental conditions

Fast degradable agent: degradation 1 – 12 weeks
Moderately fast degradable agent: degradation 1 – 18 months
Slowly degradable agent: degradation more than 2 years

Disadvantage of slowly degradable agents:
- a. Accumulation in food chain
- b. Development of resistance

New type pesticides: fast degradation advantageous
Degradation types: biological, photochemical, water hydrolyses
Commercial interest of pesticide industry

Inaccurate prediction of the occurrence of pests

Purchase in excess or requirements

Unsuitable products or packaging

Weak law enforcement and institutional framework.

Banning of products

Donations

Poor pesticides management
Protect bees as a matter of life or death

Bees are important for crop pollination, hence sustaining agriculture, yet chemicals banned elsewhere for killing bees are still on sale in Africa

Bees provide 1/3 of the food we eat......
Major Routes of Exposure for Bees to Pesticides

**Spray Application**
- Deposition on flowering plants
- Deposition on flying bees
- Spray drift
- Dust

**Systemic Pesticides**
- Guttation fluid or honeydew on leaves
- Migration through soil

**Deposition on flowering weeds**
- Pollen and nectar

**Foraging bees returning to hive**
- Non-Apis nest

**Plant uptake**
Pesticides Impact on HoneyBees

- Acute kills
  - Impaired immune function
  - Impaired reproduction
  - Lowered queen survival

- Chronic Effects
  - Habitats in agricultural areas

- Habitat Effects
  - Herbicide use reduces roadside and fieldside forage
  - Invasive weed management efforts using herbicides reduce forage availability

- Other Effects
  - Impaired navigation
Hive Products: Samples from Colonies

Flower pollen

Bee bread

Honey

Propolis

Beeswax

Royal jelly
Goal: To comply with International Honey Standards specified in the Codex Alimentarius Standard for Honey.

- Contaminants
- Moisture content
- Mineral content (ash)
- Sugar content
- Proline content
- Acidity
- Hydroxymethylfurfural content
- Diastase activity
- Invertase activity

Go Organic!!!!!!
Sample Storage and Shipping
Pesticide Residue Analysis: LC-MSMS

Liquid Chromatography/Mass Spectrometry
Quality Control Analysis

Gas Chromatography/Mass Spectrometry (GC-MS)

High Performance Liquid Chromatography (HPLC)