Lecture 4: ROLE OF HONEY BEES IN CROSS POLLINATION - THEIR EXPLOITATION - CASE STUDIES WITH SELECTED CROPS

For SEXUAL reproduction in flowering plants transfer of anther to stigma is essential - Pollination

Self pollination

Transfer to sligma of same plant

No external agents are involved

Cross pollination

Transfer pollen from one plant to stigma of another plant

External agents are involved

External agents involved in pollination

A. Abiotic agents

a. Wind (Anemophily)

Wind carries pollen from one plant to another

Flowers are small, inconspicuous, unattractive

Pollen are dry and light in weight

Stigma feathery with large surface area

eg: Maize, barley, wheat, sugarcane

b. Water (Hydrophily)

Water carries pollen from one plant to other

B. Biotic agents

Bird, bat and insects are important biotic agents

Among insects honey bees play major role

Honey bees and flowering plants have coevolved

In insect pollinated plants, flowers are large, brightly colour, distinct fragrance, presence of nectar and sticky pollen

True honeybees (*Apis* spp.) - Most valuable pollinators of commercial crop

Qualities of honeybees which make them good pollinators

1. Body covered with hairs and have structural adaptation for carrying nectar and pollen.
2. Bees - Not injurious to plants
3. Adult and larva feed on nectar and pollen - Available in plenty
4. Superior pollinators - Since store pollen and nectar for future use
5. No diapause - Need pollen throughout year
6. Body size and probascis length - Suitable for many crops

7. Pollinate wide variety of crops
8. Forage in extreme conditions also (weather)

Effect of bee pollination on crop

- It increases yield (seed yield, fruit yield) in many crops
- It improves quality of fruits and seeds
- Bee pollination increases oil content of seeds in sunflower
- Bee pollination is a must in some self incompatible crops for seed set

Crops benefited by bee pollination

Fruits and nuts	Vegetable and vegetable seed crops	Oil seed crops	Forage seed crops
Almond	Cabbage	Sunflower	Lucerve
Apple	Cauliflower	Niger	Clover
Apricot	Carrot	Rape seed	
Peach	Coriander	Mustard	
Strawberry	Cucumber, Melon	Safflower	
Citrus	Onion, Pumpkin	Gingelly	
Litchi	Radish, Turnip		

Per cent increase in yield due to bee pollination

Crop	Botanical name	Per cent yield increase
Mustard	*Brasica* sp	43
Sunflower	*Helianthus annus*	32 - 48
Cotton	*Gossypium* sp.	17-19
Lucerne	*Medicago sativa*	112
Onion	*Allium cepa*	93
Apple	*Purus malus*	44

Scope of beekeeping for pollination in India

- Total area under bee dependant crops - 50 million ha
- At the rate of 3 colonies/ha - 150 million colonies needed
- In India only 1.2 million colonies exist - There is scope

Management of bees for pollination

- Place hives very near the field (source) - to save bee's energy
- Migrate colonies near field at 10% flowering
- Place colonies at 3/ha - Italian bee; 5/ha - Indian honey bee
- The colonies should have 5-6 frame strength of bees, possess sealed brood, have young mated queen
- Allow sufficient space for pollen and honey storage

Pollination by bees - Cross studies with selected crops

1. Sunflower

- It is a cross-pollinated crop
- Self incompatability noticed - i.e. The pollen a plant cannot fertilize ovary of same plant
- Pollen should come from different plant
- Honey bees - Most important mode of pollination in sunflower
- Yield increase due to bee pollination - Even upto 600%
- Improves quality and quantity of seeds
- Oil content increases by 6.5% in seeds
- Requires 5 strong 4 *C. indica* colonies or 3 *A. mellifera* colonies
- Irrigated crop is preferred by bees

2. **Cucurbitaceous vegetables**

- Monoecious - Staminate and pistillate flowers in same plant
- 30-100% increase in fruit set due to bee pollination

3. **Alfalfa or Lucerne**

- Tubular flower - has 5 petals joined at base
- One large standard petal
- 2 smaller petals on sides
- 2 keel petals holding staminal column
- When bee sits on keel petal, staminal column strikes against standard petal and pollen shatters
- This is called TRIPPING
- Only if bee sits to trips the flowers seed set occurs

4. **Corinader**

- Yield increase upto 187% noted when pollinated by bees

5. **Cardamom**

- Important commercial crop depending on bee pollination. Yield increase upto 21-37%

6. **Gingelly**

- Another oilseed crop, bee pollination causes 25% increase in yield

7. **Apple**

- Only if pollinated by bees - feed set occurs
- Fruit is formed around seeds only
- If improper seed set - Fruit shape is lopsided (market value decreases)

Migratory Vs. Stationary beekeeping

- Migratory beekeeping - Advantageous to beekeeper and farmer