

# THE IMPORTANCE OF HONEYBEES TO CROP POLLINATION IN VIETNAM



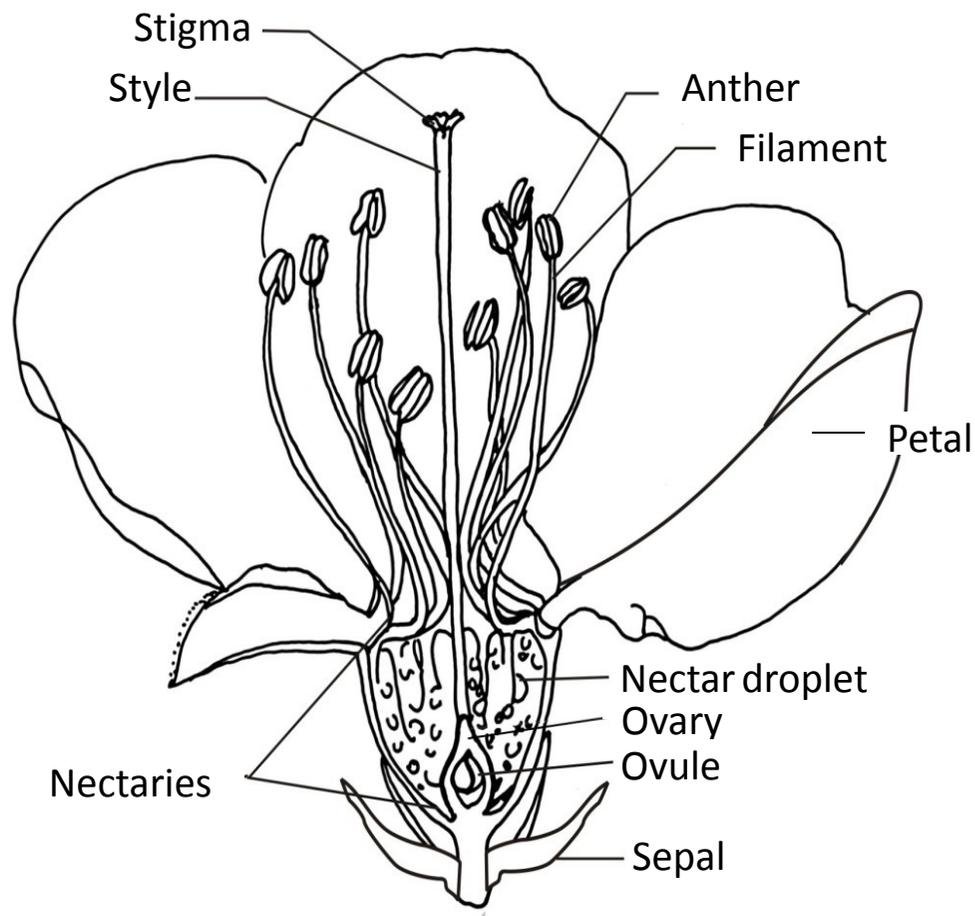
Hanh Duc Pham<sup>1</sup>

Dr. Gard W. Otis<sup>2</sup>

*(1) Bee Research and Development Centre, Hanoi, Vietnam*

*(2) Environmental Biology, University of Guelph, Guelph, Ontario, Canada, N1G 2W1*

# General structure of complete flower with both male and female structures



**Pollination: transfer of pollen from anthers to stigma of the flower**

**Self-pollination vs. cross pollination**

# Pollinators



- ❑ Insects:
  - Bees
  - Butterflies
  - Flies
- ❑ Birds
- ❑ Bats
- ❑ Wind

# The importance of pollination



- 30% of food in developed countries results from bee pollination
- Economic value of pollination worldwide
  - Amounted to CAD \$254 billion in 2005
  - Represented 9.5% of the value of the world agriculture production (Gallai, N., et al., 2008)

# The importance of pollination



- Canada:
  - 70% of Canadian food crops need insects for pollination
  - The value of honeybee pollination: about 9X more than the value of the honey and beeswax produced (\$443 million vs. \$49.6 million, 1985-1989) (Canadian Association of Professional Apiculturists, 1995)

# The importance of pollination



## □ USA:

- Number of colonies rented for pollination increased from 2,035,000 in 1989 to 2,500,000 in 1998 (22.8%)
- Value of the increased yield and quality achieved through pollination by honeybees was \$9.3 billion in 1989 and \$14.6 billion in 1998 (a 57% increase) (Morse R. & Calderone N., 2000).

# Situation of pollination in Vietnam

- Vietnam is tropical country
- Average temperatures:
  - \*Hanoi: 29.2°C (summer) and 17.2 C (winter)
  - \*HCM city: 26°C average
- Flowers and bee forage are available all year round
- Many crops require insect pollination



# Situation of pollination in Vietnam

## Honeybees in Vietnam



*Apis cerana*  
apiary



Pham Thi Huyen

*Apis dorsata*

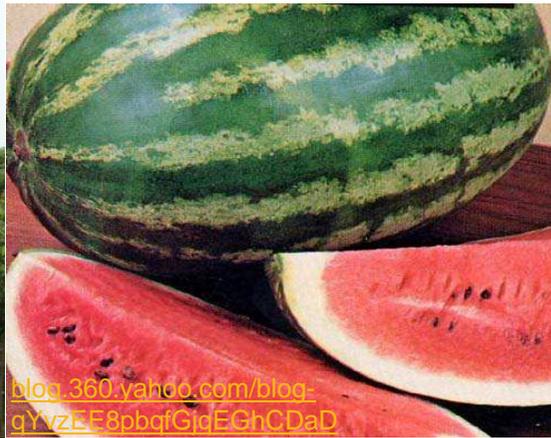
*Apis mellifera*  
colonies



Pham Thi Huyen

*Apis florea*

# Situation of pollination in Vietnam



Crops that benefit from bees and other insects:

- Fruit trees
- Melons
- Vegetables
- Oil-seed crops
- Perennial crops (e.g., coffee)



# Situation of pollination in Vietnam



- No commercial pollination services.
- Crops must rely on natural pollination
- Few research studies have been done
- Generally farmers do not know much about the importance of pollinators
- A few farmers take actions to improve crop yields.

# Avocado (*Persea americana*)



- Value of crop: 7.3 million \$US/year
- Pollinators: honeybees, stingless bees, flies, wasps
- Proportion of yield attributed to pollinators: 50% (Kalman, 1979)
- Value of honeybees regarding to pollination: from 3.6 to 5.9 million \$US/year

# Coffee (*Coffea arabica*, *C. canephora*, *C. excelsa*)



- Value of crop: 1,400 million \$US/year
  - Pollinators: honeybees, stingless bees, wasps
- 
- Proportion of yield attributed to pollinators : 50% + (Roubik, 2002; Raw & Free, 1977)
  - Value of honeybees regarding to pollination: over 700 million \$US/year

# Cucumber (*Cucumis sativus*)



- Value of crop: over 600 thousand \$US/year
- Pollinators: honeybees, stingless bees, solitary bees, butterflies
- Proportion of yield attributed to pollinators : 90% (Canadian Association of Professional Apiculturists, 1995)
- Value of honeybees regarding to pollination: 550,000 \$US/year

# Litchi (*Litchi chinensis*)



- Value of crop: 72.3 million \$US/year
  - Pollinators: honeybees, stingless bees, fly
  - Proportion of yield attributed to pollinators : 100% (Indian Bee Journal, 1981b; YaoChun, 1993)
- 
- Value of honeybees regarding to pollination: 72.3 million \$US/per year

# Longan (*Dimocarpus longan*)



- Value of crop: 245 million \$US/year
  - Pollinators: honeybees, stingless bees, fly
  - Proportion of yield attributed to pollinators : 30% (Wongsiri, 1984 (cited by Crane & Walker, 1984))
- 
- Value of honeybees regarding to pollination: 73.6 million \$US/year

# Melon and watermelon (*Citrullus* spp.)



- Value of crop: 102 million \$US per year
- Pollinators: honeybees, solitary bees, stingless bees
- Proportion of yield attributed to pollinators : 80% (Canadian Association of Professional Apiculturists, 1995)
- Value of honeybees regarding to pollination: \$81.2 million USD per year

# Pumpkin and Squash (*Cucurbita* spp.)



[http://a8.vietbao.vn/images/vn802/thu-viet-nam/2080461/images1627848\\_bingo.jpg](http://a8.vietbao.vn/images/vn802/thu-viet-nam/2080461/images1627848_bingo.jpg)

- Value of crop: 820 thousand \$US/year
- Pollinators: honeybees, flies, beetles
- Proportion of yield attributed to pollinators : 60% (Canadian Association of Professional Apiculturists, 1995)
- Value of honeybees regarding to pollination: over 490,000 \$US/year

# Sesame (*Sesamum indicum*)



- Value of crop: 42.5 million \$US/per year
- Pollinators: honeybees, stingless bees, solitary bees
- Proportion of yield attributed to pollinators: 32% (Indian Bee Journal, 1981b)
- Value of honeybees regarding to pollination: 13.6 million \$US/year.

## Summary

English name	Area (ha)	Total production (tons)	Total value (million \$US)	Increase due to honey bees pollination (%)	Value due to Honeybees (million \$US)
Avocado	2,694	40,000 t	\$7.3	50%; 81.25%	\$3.6-5.9
Coffee	506,400	961,000 t	\$1,400	over 50%	over \$700
Cucumber	316	2,500 t	\$0.6	90%	\$0.5
Litchi	87,296	596,000 t	\$72.3	100%	\$72.3
Longan	97,900	578,000 t	\$245.4	30%	\$73.6
Melons and water melons	3,223	837,000 t	\$101.5	80%	\$81.2
Pumpkin and Squash	900	9,000 t	\$0.8	60%	\$0.5
Sesame	44,700	28,000 t	\$42.5	32%	\$13.6
<b>Total</b>			<b>\$1,870</b>		<b>\$945</b>

# Discussion



- The table reveals that the honeybees contribute over 50% of the value of some important crops
- Value of animal pollinators, especially honeybees, that contribute to agriculture in Vietnam is enormous and significant
- Reasons that honeybees are important pollinators:
  - ▣ Managed easily
  - ▣ Transported easily
  - ▣ Kept for other purpose (honey) rather than pollination

# Discussion



- Reasons that honeybees are important pollinators:
  - Pollinate many crops
  - Can be present in large numbers where and when they are required to pollinate a crop; not possible with most other insects
  - Honeybees pollination is less costly (time and labor) than hand pollination
- Acreages for many crops are underestimated.
- Pollination requirements of many crops are still poorly understood

- Most research conducted in developed countries
- Research needs to be done in order to:
  - ▣ Identify diversity of pollinators for crops under different conditions
  - ▣ Identify modes of pollination for major crops
  - ▣ Identify contribution of pollination to total yield for each crop in different regions and countries
  - ▣ Raise awareness of extension agents and officers, beekeepers , and famers about the value of honeybees in Asian agriculture
  - ▣ Call for protection of honeybee and other insect pollinators.

Thank you for your attention!



# References



- Canadian Association of Professional Apiculturists. 1995. A guide to managing bees for crop pollination.
- Crane, E., and Walker, P. 1984. Pollination directory for world crops. International Bee Research Association, Hill House, Gerrards Cross, Bucks SL9 0NR, UK.
- Gallai, N., et al.,. 2008. Economic valuation of the vulnerability of world agriculture confronted with pollinator decline, ecological economics, doi:10.1016/j.ecolecon.2008.06.014.: .
- Indian Bee Journal. 1981. Work on bee pollination in India. Indian Bee Journal. **43**(4): 140-144.

# References



- Malerbo-Souza, D., Toledo, V., Silva, S.R. and Sousa, F.F. 2000. Pollination in avocado flowers (*Persea americana* mill.). *Acta Scientiarum*. **22**(4): 937-941.
- Morse R., and Calderone N. 2000. The value of honey bees as pollinators of U.S. crops in 2000. *Cornell Pollination Study*.: .
- Raw, A., and Free, J.B. 1977. The pollination of coffee (*Coffea arabica*) by honeybees. *Trop. Agric.* **54**(4): 365-370.
- Roubik, D.W. 2002. The value of bees to the coffee harvest. *Nature (London)*. **417**(6890): 708.
- YaoChun, C. 1993. *Apiculture in china*.