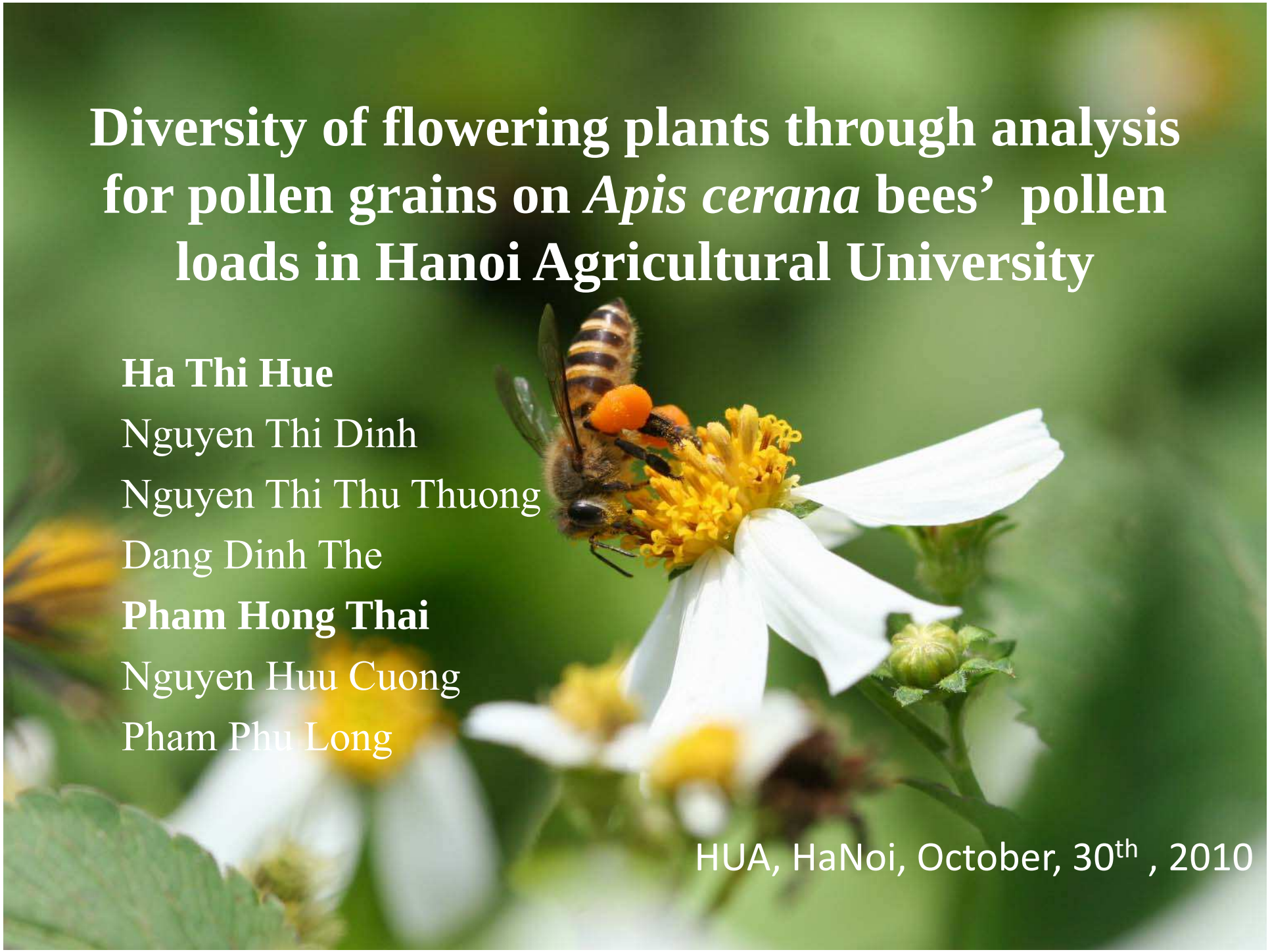
Diversity of flowering plants through analysis for pollen grains on *Apis cerana* bees' pollen loads in Hanoi Agricultural University



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HUA, HaNoi, October, 30th , 2010

Contents

- Introduction
- Material and methods
- Results and discussion

Introduction

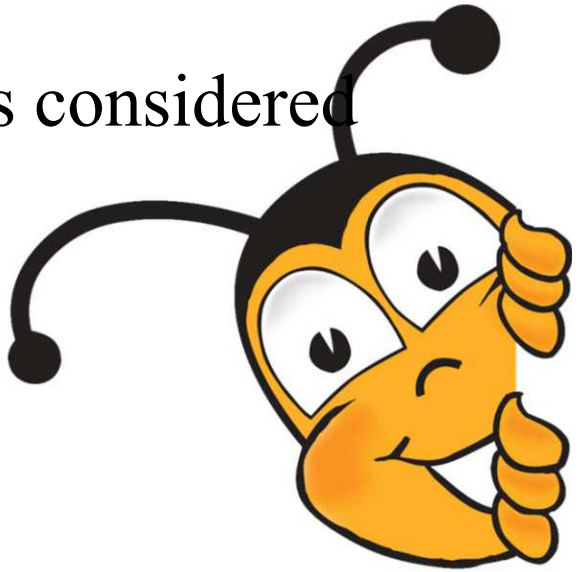
- Vietnam is tropical country, plants are very diversity
- There are over 7000 phanerogam plant species (Hoang Thi San, 2008)
- Plant diversity plays a very important role to maintain the environmental ecological balance.

Introduction

- Flowering plants require to pollinate by wind, water and animal. The result of pollination is to increases quantity and quality of seeds.
- Honeybees are significant pollinators for crossing pollination of flowering plants. Moreover, those bees support honey for people.
- Origin of honey (Mellisopalynology) is considered more and more (Sawyer, 1988;

  Goodacre et al., 2002; Adekanmbi and

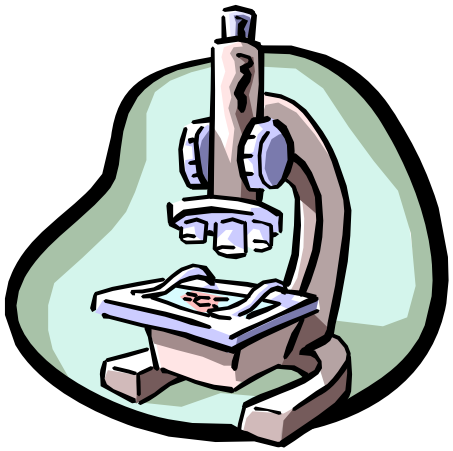
  Ogundipe, 2009).



Goals

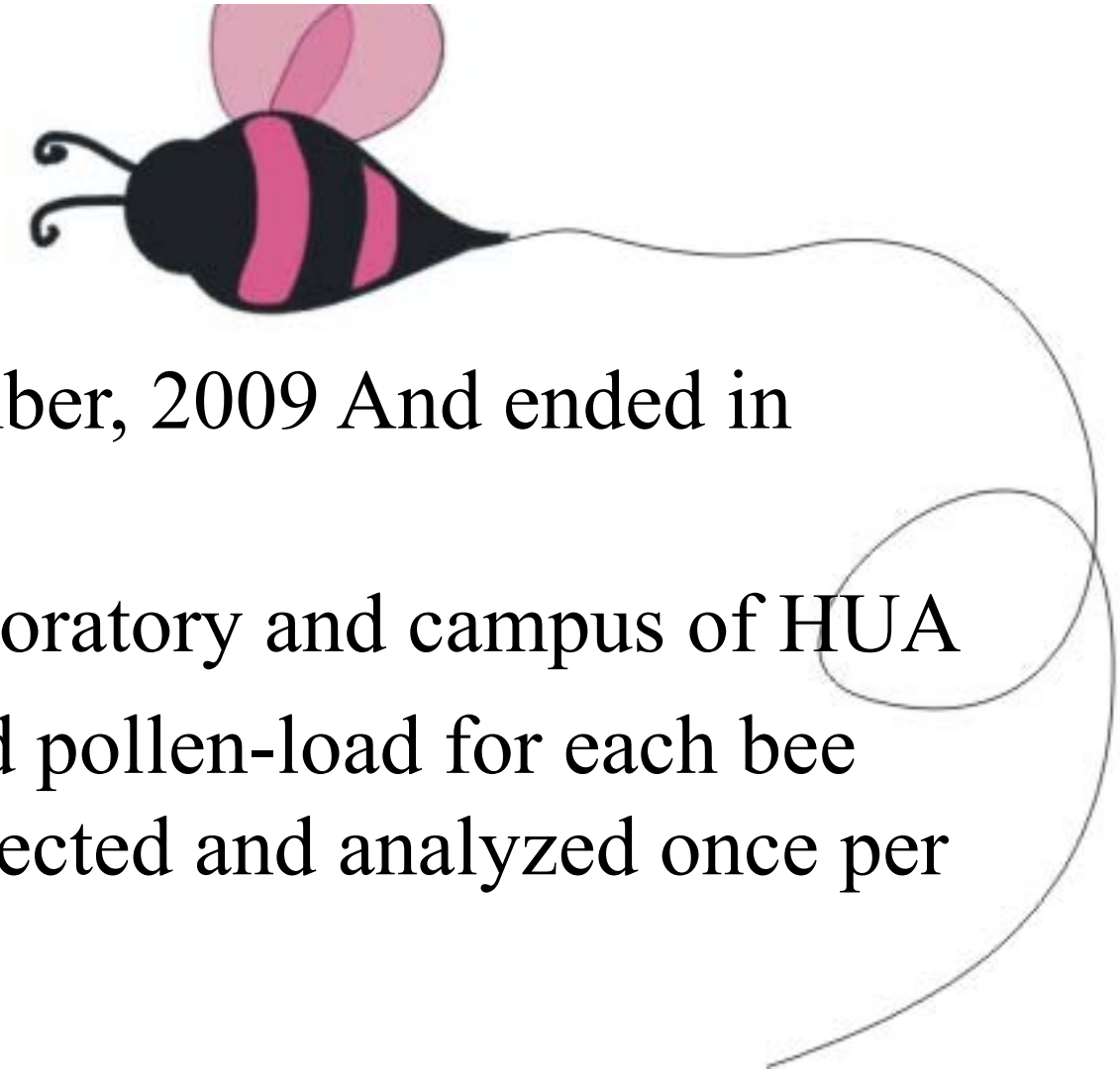
- Research on diversity of flowering plants as potential food sources of honeybees to develop beekeeping and determine honey origin.

Material



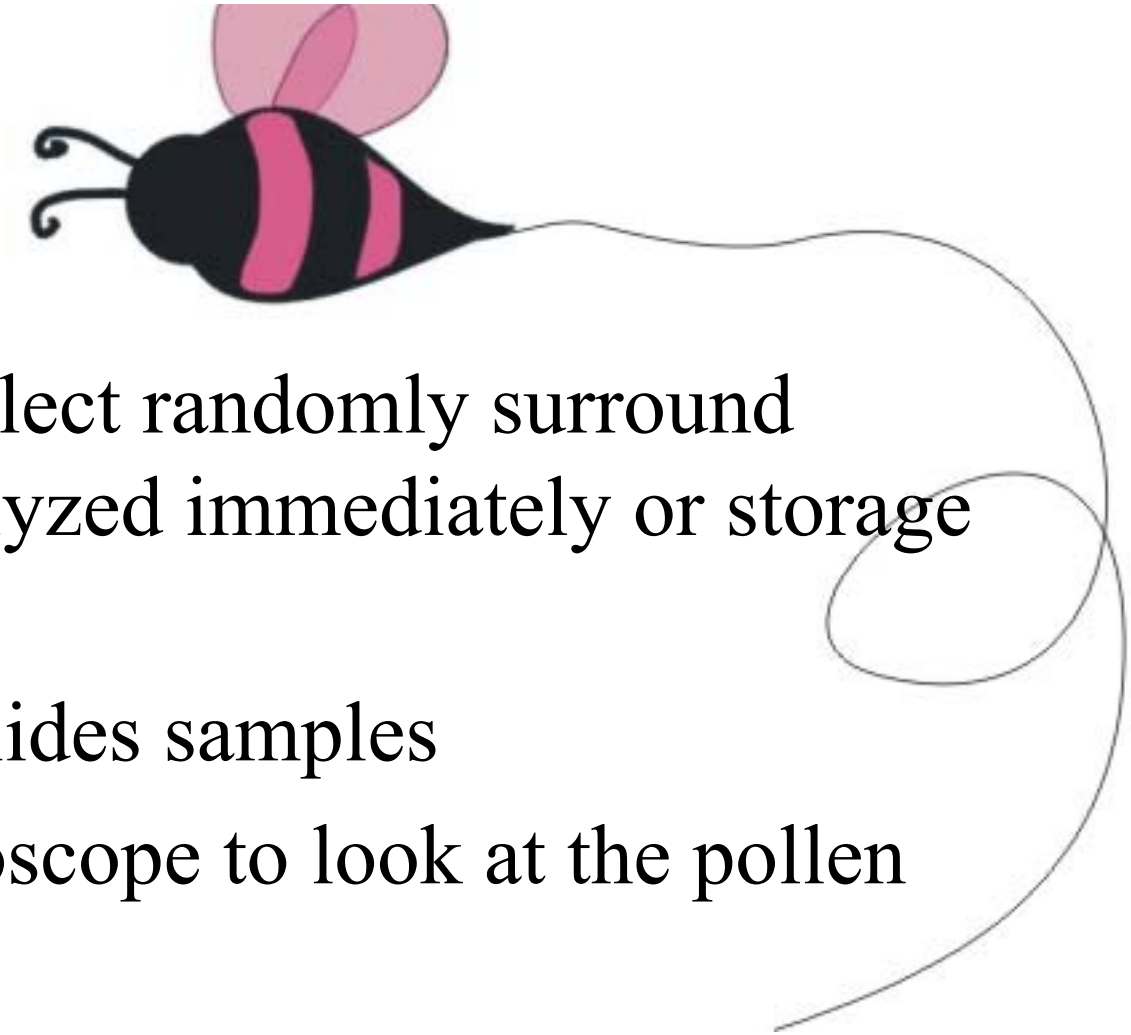
- Zeiss microscope which Epifluorescence microscope and digital camera connected to a computerized image analysis system
- Microscope with eyepiece graticules
- Slide and cover glasses
- Pure water, alcohol, panh, plates…

Methods



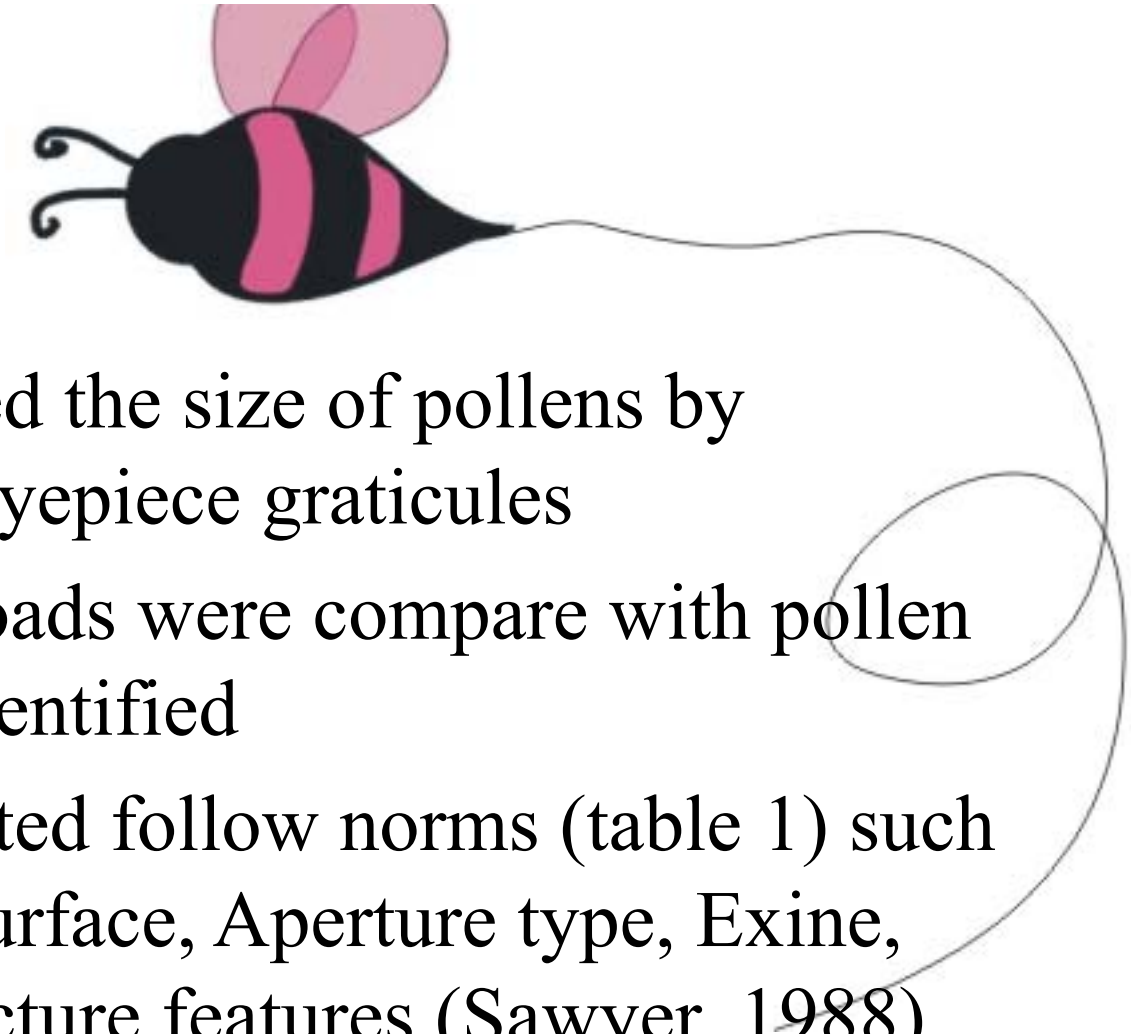
- Began in November, 2009 And ended in December, 2010
- Performed in laboratory and campus of HUA
- 5 bees which had pollen-load for each bee colony were collected and analyzed once per week.

Methods



- Flowers were collect randomly surround campus then analyzed immediately or storage in fridge
- The wet mount slides samples
- Used Zeiss microscope to look at the pollen and capture them
- Pollen-load also collected and analyzed by Zeiss microscope

Methods

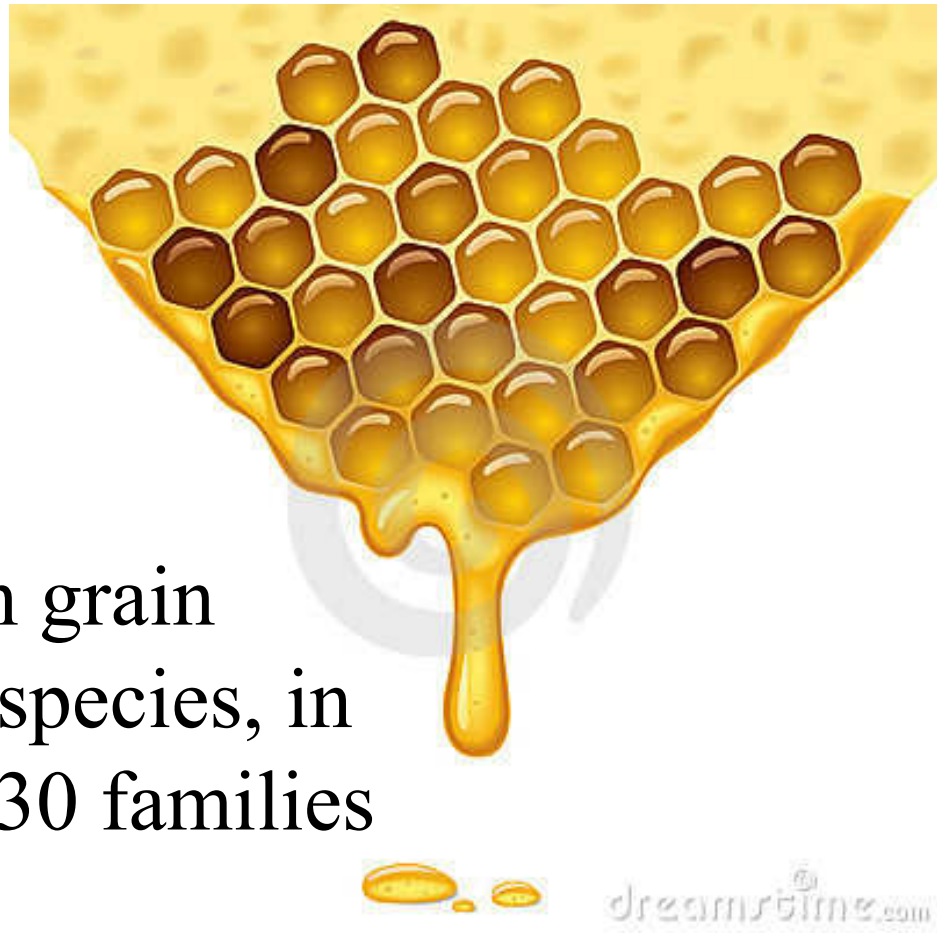


- We also determined the size of pollens by microscope with eyepiece graticules
- Pollen of pollen-loads were compare with pollen of flowers and indentified
- Pollens are estimated follow norms (table 1) such as: Shape, Size, Surface, Aperture type, Exine, section, other structure features (Sawyer, 1988).
- Excel used to static and analyze index such as size of pollens and plant list table

Table 1: List of pollen grain features (Sawyer, 1988)

1	2	3	4	5	6
Shape	Size	Surface	Aperture type	Exine, section	Other structure features
1) Round or irregularly round	1) Very small <20µm	1) Smooth or indefinite	1) Pores only	1) Thin	1) Grains compound
2) Oval	2) Small 20-30 µm	2) Granular	2) Furrows only	2) Medium, no rods	2) Thickened or projecting edges to apertures
3) Long	3) Medium : 30-50 µm	3) Striate	3) Furrows with pitted	3) Medium with spaced rods or beaded	3) Cap or streak on apertures
4) Triangular	4) Large : 50-100 µm	4) Net or pit	4) United or irregular furrows may occur	4) Medium or thick with coarse external rods	4) Granules or projections scattered on apertures
5)Semi_circular or boat shape	5) Very large :>100 µm	5) Isolated dots due to spines or other projection		5) Layer of close ,thin rods	5) Intine swollen beneath apertures
6) Multisided or irregular		6) Spines		6) Long ,broad-based spines	6) Cell contents granular
				8) Small or very small spines or warts	


Results & discussion



We have identified pollen grain features of over 75 plant species, in over 40 genuses, in over 30 families in HUA (Table 2).

Table 2: Pollen identification keys

FAMILY NAME	GENUS NAME	VIETNAMESE NAME	SCIENTIFIC NAME	Shape	Size	Surface	Aperture type	Exine, section	Other structure features
Acanthaceae	Gendarussa	Thanh táo	*Gendarussa vulgaris*	3		1	2	1	
Alliaceae	Allium	Hành tây	*Allium cepa*	5		1	2	3	
Amaryllidaceae	Hippeastrum	Hoa loa kèn đỏ (lan huệ)	*Hippeastrum puniceum*	4		4	4	1	
Anacardiaceae	Mangifera	Xoài	*Mangifera indica*	1		2	4	1	
	Allospondias	Dâu da xoan	*Allospondias lakonensis*	3		1	2	1	
Apiaceae or Umbelliferae	Coriandrum	Rau mùi	*Coriandrum sativum*	4	3	2	4	8	3
	Anethum	Thìa là	*Anethum graveolens*	4	3	3	4	8	
Araceae	Anthurium	Hồng môn trắng	*Anthurium* sp.	2		1	4	3	
Arecaceae	Areca	Cau	*Areca catechu*	1		4	4	1	

Table 2: Pollen identification keys (cont.)

FAMILY NAME	GENUS NAME	VIETNAMESE NAME	LATIN NAME	Shape	Size	Surface	Aperture type	Exine, section	Other structure features
Asteraceae	Aster	Cúc cánh mối	*Aster amellus*	1		6	(-)	8	
	Tagetes	Cúc vạn thọ	*Tagetes patula*	1		6	(-)	5	
	Melampodium	Cúc măt trời	*Melampodium paludosum*	1		6	(-)	8	
	Chrysanthemum	Rau cải cúc	*Chrysanthemum coronarium*	1		6	(-)	8	
	Leucanthemum	Cúc ta trắng (cúc trắng lớn)	*Leucanthemum vulgare*	1		6		3	
	Ageratum	Cỏ cứt lợn	*Ageratum conyzoides*	1		6	(-)	7	
	Bidens	Đơn buốt (xuyến chi)	*Bidens pilosa*	1	3	6	2	6	
	Gerbera	Hoa đồng tiền	*Gerbera jamesonii*	2		1	(-)	2	
Bignoniaceae	Bignonia	Hoa chùm ớt	*Bignonia* sp.	3		1	2	1	
Cactaceae	Nopalea	Xương rồng	*Nopalea* sp.	2		2	2	2	
Caricaceae	Carica	Đu đủ	*Carica papaya*	1		3	(-)	1	(-)

Table 2: Pollen identification keys (cont.)

FAMILY NAME	GENUS NAME	VIETNAMESE NAME	LATIN NAME	Shape	Size	Surface	Aperture type	Exine, section	Other structure features
Caesalpiniaceae	Cassia	Bọ cạp nước (Muồng hoàng yến)	*Cassia splendida*	1		1	4	1	
	Caesalpinia	Kim phượng	*Caesalpinia pulcherrima*	1		4	4	1	
	Delonix	Phượng vĩ	*Delonix regia*	1		4	2	3	
Cucurbitaceae	Cucurbita	Bí ngô	*Cucurbita maxima*	1		6	(-)	3	
	Sechium	Su su	*Sechium edule*	1		3	2	2	
	Luffa	Mướp	*Luffa acutangula*	2		2	4	1	3
Euphorbiaceae	Jatropha	Hồng mai	*Jatropha pandurifolia*	1		2	3	3	
	Euphorbia	Trạng nguyên	*Euphorbia pulcherima*	1		1	(-)	2	
Lamiaceae	Ocimum	Rau húng quế	*Ocimum basilicum*	1	4	4	2	3	(-)
Liliaceae	Lilium	Hoa huệ tây, bạch huệ,loa kèn trắng	*Lilium longiflorum*	3		4	4	1	
Lecythidaceae	Barringtonia	Lộc vừng	*Barringtonia acutangula*	3		1	2	1	

Table 2: Pollen identification keys (cont.)

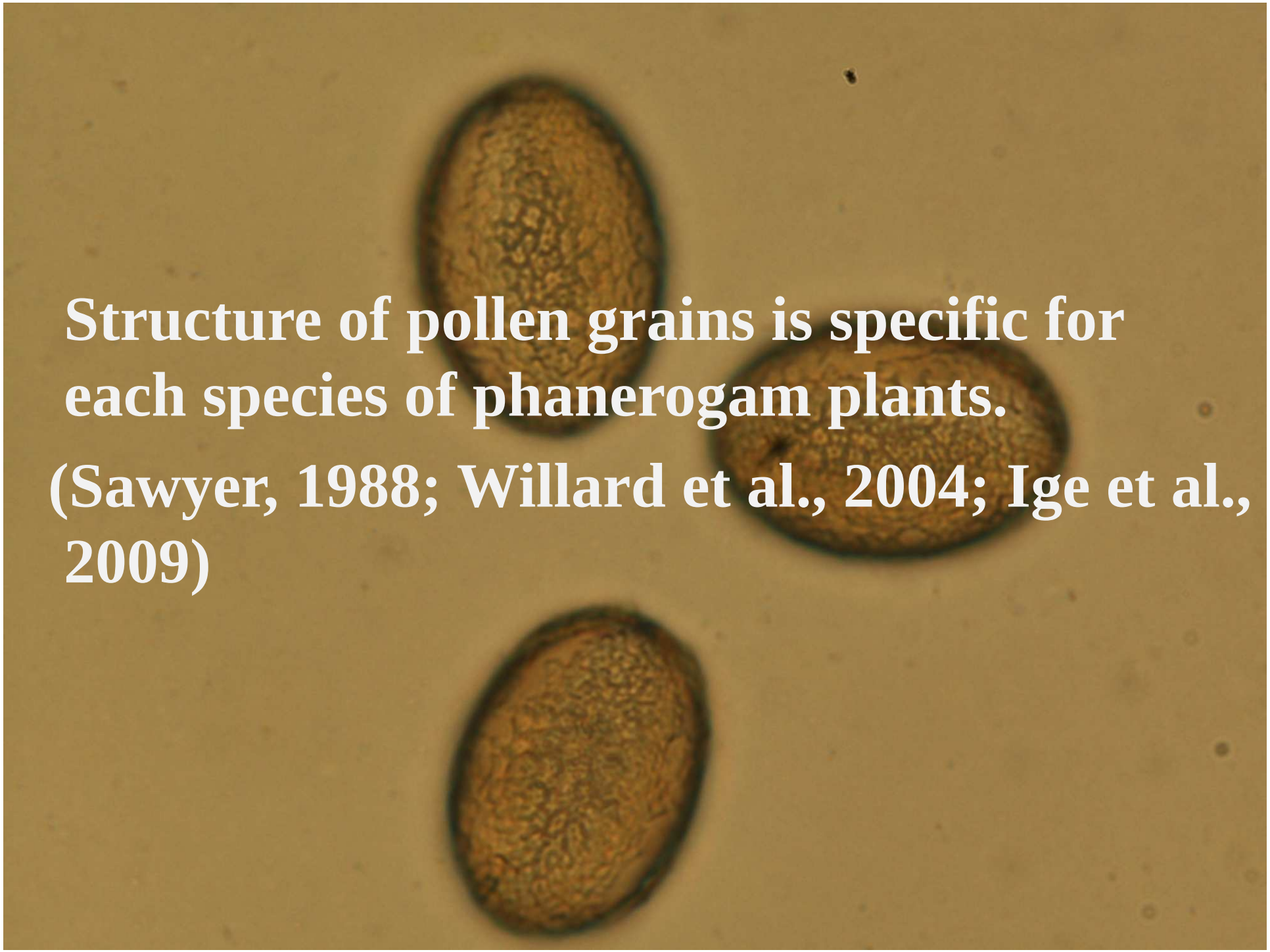
FAMILY NAME	GENUS NAME	VIETNAMESE NAME	LATIN NAME	Shape	Size	Surface	Aperture type	Exine, section	Other structure features
Lythraceae	Lagerstroemia	Bằng lăng	*Lagerstroemia speciosa*	1		1	4	1	
Magnoliaceae	Michelia	Ngọc lan	*Michelia alba*	3		5	4	8	
Malvaceae	Hibiscus	Dâm bụt	*Hibiscus rosa-sinensis*	1		6	4	6	(-)
Meliaceae	Khaya	Xà cừ	*Khaya senegalensis*	1		1	1	3	
	Melia	Xoan	*Melia azedarach*	4		4	4	1	
Mimosaceae	Mimosa	Trinh nữ (xấu hổ, cây buồn ngủ)	*Mimosa pudica*	6		4	(-)	4	2
Myrtaceae	Psidium	Ổi ta	*Psidium guajava*	5		1	4	2	
	Syzygium	Cây gioi	*Syzygium jambos*	3		1	2	1	
Nelumbonaceae	Nelumbo	Sen	*Nelumbo nucifera*	4		1	2	2	1
Nyctaginaceae	Bougainvillea	Hoa giấy	*Bougainvillea spectabilis*	1		3Or 4	(-)	1	(-)
Nymphaeaceae	Nymphaea	Hoa súng đỏ	*Nymphaea rubra*	1,5 or4		1	(-)	1	

Table 2: Pollen identification keys (cont.)

FAMILY NAME	GENUS NAME	VIETNAMESE NAME	LATIN NAME	Shape	Size	Surface	Aperture type	Exine, section	Other structure features
Oxalidaceae	Averrhoa	Khế	*Averrhoa carambola*	3		1	2	1	
	Oxalis	Chua me đất	*Oxalis violacea*	2		1	2	1	
Pedaliaceae	Sesamum	Vừng	*Sesamum indicum*	2		2	2	8	
Poaceae	Zea	Ngô	*Zea mays*	2		1	2	2	
Portulacaceae	Portulaca	Hoa mười giờ	*Portulaca grandiflora*	1		1	4	8	
Rosaceae	Prunus	Đào	*Prunus persica*						
Rhamnaceae	Ziziphus	Táo ta	*Ziziphus mauritiana*	5		1	4	2	
Rutaceae	Fortunelia	Quất	*Fortunella japonica*	2		2	2	2	
	Citrus	Bưởi	*Citrus maxima*						

Table 2: Pollen identification keys (cont.)

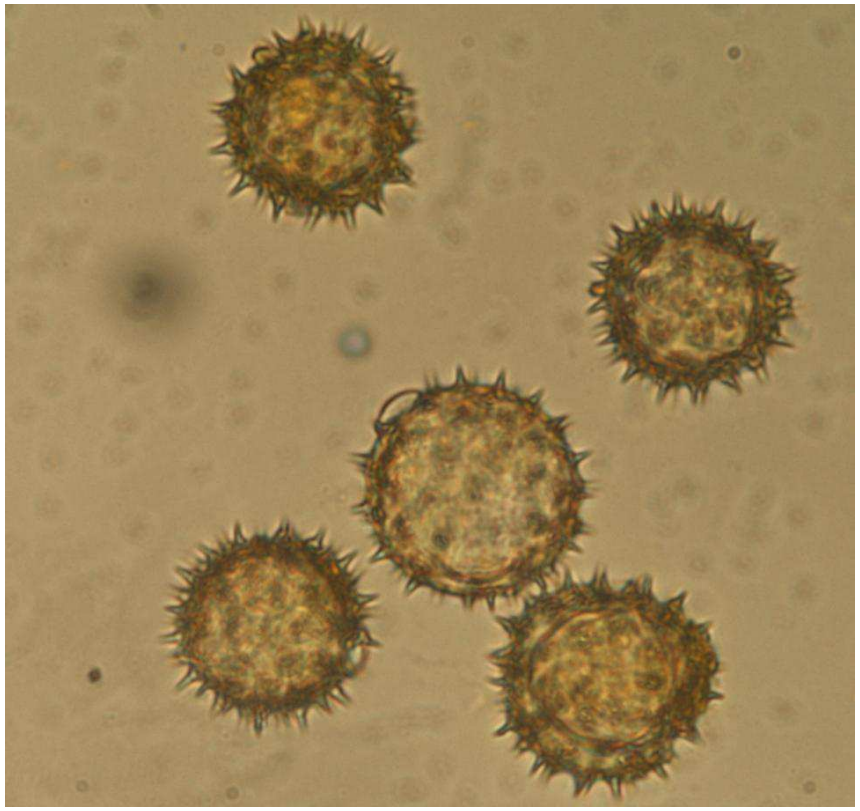
FAMILY NAME	GENUS NAME	VIETNAMESE NAME	LATIN NAME	Shape	Size	Surface	Aperture type	Exine, section	Other structure features
Solanaceae	Solanum	Cà tím	*Solanum melongena*	1		1	4	1	
Sapindaceae	Dimocarpus	Nhãn lồng	*Dimocarpus longan*	4		1	(-)	1	3
Sapotaceae	Manilkara	Hồng xiêm	*Manilkara zapota*	3		1	2	1	-
Theaceae	Thea	Chè	*Thea sinensis*	3		1	2	1	
Muntingiaceae	Muntingia	Trứng cá	*Muntingia calabura*	1		1	4	1	
Verbenaceae	Lantana	Thơm ổi	*Lantana camara*	1or 5		3	(-)	2	
Brassicaceae	Brassica	Cải xanh	*Brassica juncea*	3		4	4	2	



Structure of pollen grains is specific for each species of phanerogam plants.

(Sawyer, 1988; Willard et al., 2004; Ige et al., 2009)

Spanish Needle



Scientific name: ***Bidens pilosa*** **L.**
Common name: Spanish Needle
Oder: Asterales
Family: Asteraceae
Genus : **Bidens**

The pollen grain of Spanish Needle- (Mag. 100)
Shape: irregularly round
Size: medium
Surface: spines
Aperture type: Furrows only
Exine, section: long, thin spines

Jujube

The pollen of Sidr (mag.100)

•Shape: Triangular

•Size:

•Surface: indefinite

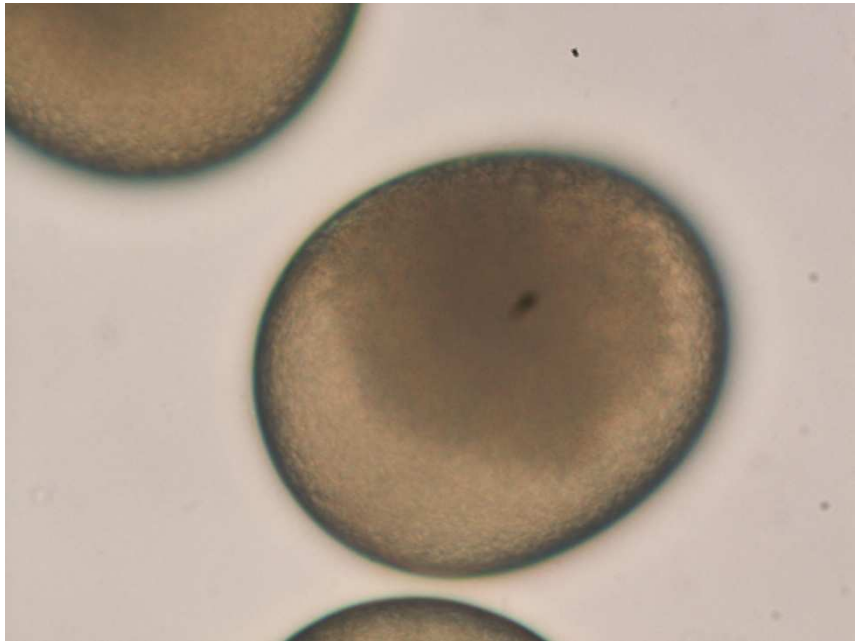
•Aperture type: United or irregular furrows may occur

•Exine, section : medium, no rod

•Other structure features :

- **Scientific name: *Ziziphus mauritiana* L.**
- **Common name: Jhar Berrie, Sidr, ...**
- **Oder: Rosales**
- **Family: Rhamnaceae**
- **Genus: Ziziphus**

Corn



- **Scientific name:** ***Zea mays*** **L.**
- **Common name:** **maize,corn**
- **Oder: Poales**
- **Family: Poaceae**
- **Genus: Zea**

The pollen grain of Zea mays.L(mag.100)

Shape: oval

Size:

Surface: Smooth or indefinite

•Aperture type: United or irregular furrows may occur

•Exine, section : thin

•Other structure: with granulesS

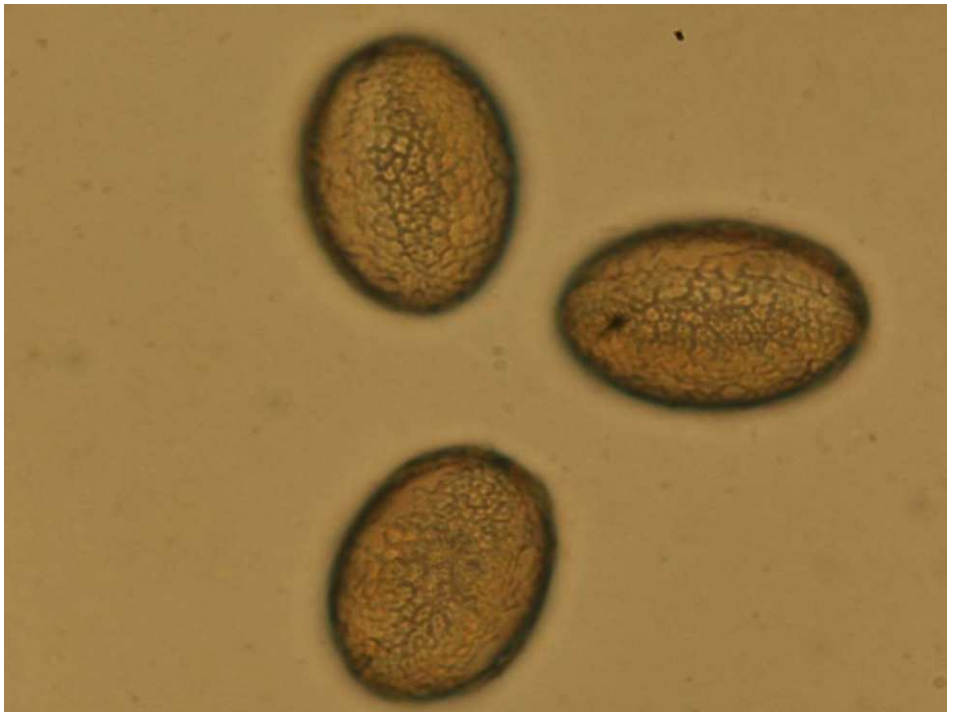
Gingilli

- **Scientific name: *Sesamum indicum* L.**
- **Common name: Gingilli, Sesame**
- **Oder: Lamiales**
- **Family: Pedaliaceae**
- **Genus: Sesamum**

The pollen grain of Sesame (mag. 40)

- **Shape: Oval , flattened**
- **Size:**
- **Surface: Granular**
- **Aperture type: Furrows**
- **Exine, section : medium, no rod**
- **Other structure features :**

Chinese cabbage



- **Scientific name: *Brassica juncea* L.**
- **Common name: Chinese cabbage**
- **Oder:Brassicales**
- **Family: Brassicaceae**
- **Genus: Brassca**

The pollen grain (mag. 100)

- **Shape: Oval elongated**
- **Size:**
- **Surface: Net**
- **Aperture type: United or irregular furrows may occur**
- **Exine, section : medium, no rod**
- **Other structure features :**

Sweet basil

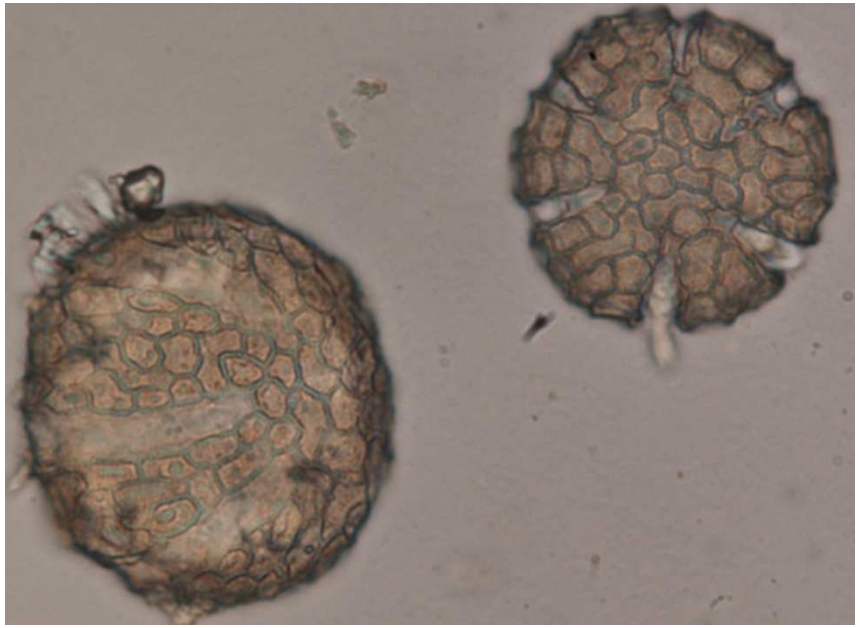
Scientific name: *Ocimum basilicum* L.

Common name: Sweet basil

Oder: Lamiales

Family: Lamiaceae

Genus: Ocimum



The pollen grain of sweet basil (mag.100)

Features: - shape: irregularly round

Size: large

Surface: net

Aperture type: Furrows only

Exine, section : beaded

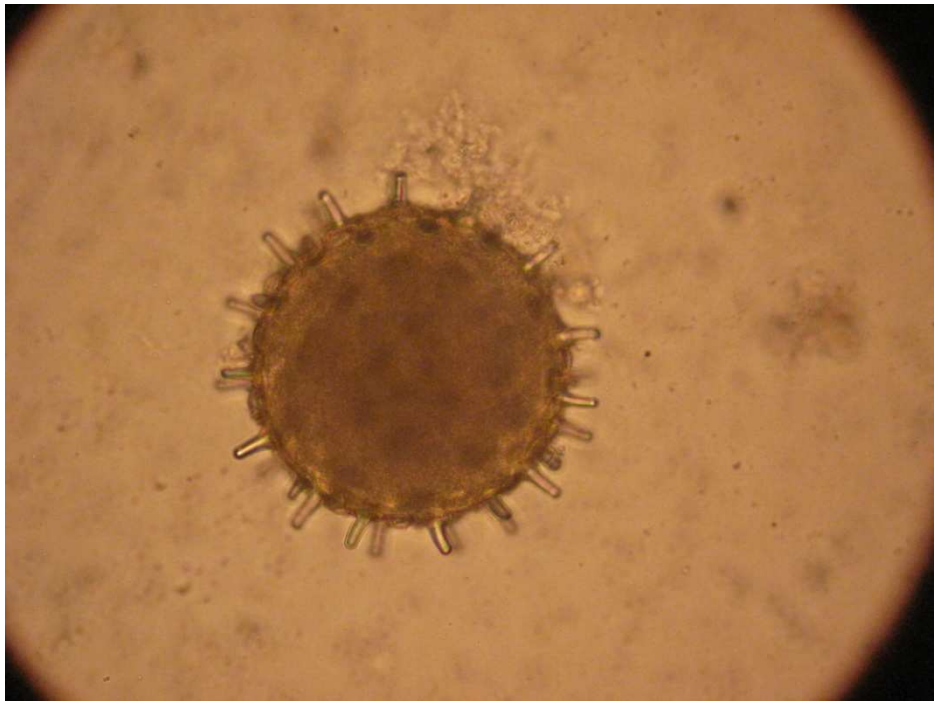
Coriander

The pollen grain of Coriande(mag.100)

- **Scientific name: *Coriandrum sativum* L.**
- **Common name: Coriander**
- **Oder: Apiales**
- **Family: Umbelliferae**
- **Genus: Coriandrum**

- **Shape: long**
- **Size: medium**
- **Surface: grannular**
- **Aperture type: United or irregular furrows may occur**
- **Exine, section : small projection**
- **Other structure features : cap on middle**

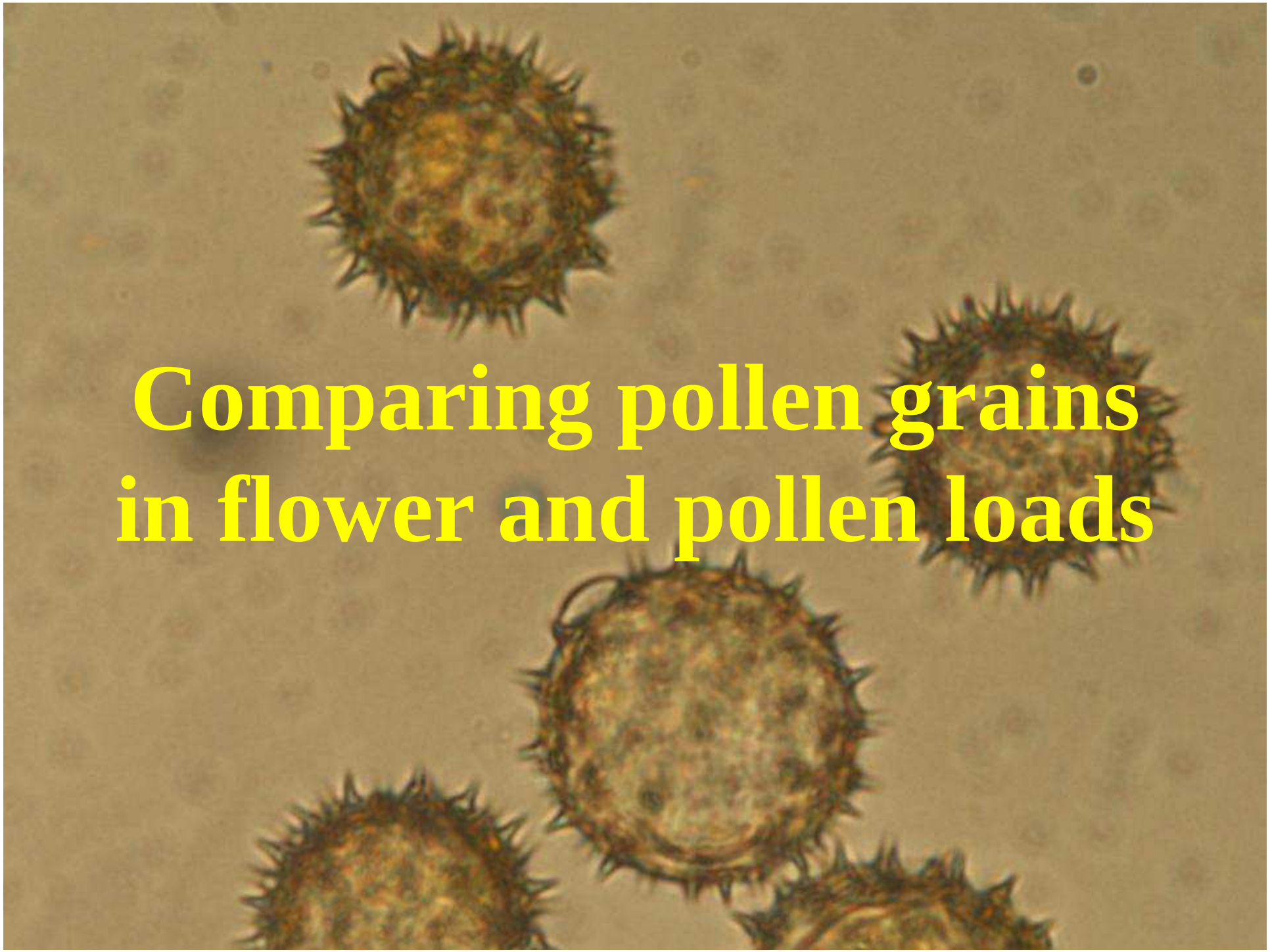
Hibiscus



- **Scientific name: *Hibiscus rosa-sinensis* L.**
- **Common name: Hibiscus**
- **Order: Malvales**
- **Family: Malvaceae**
- **Genus: Hibiscus**

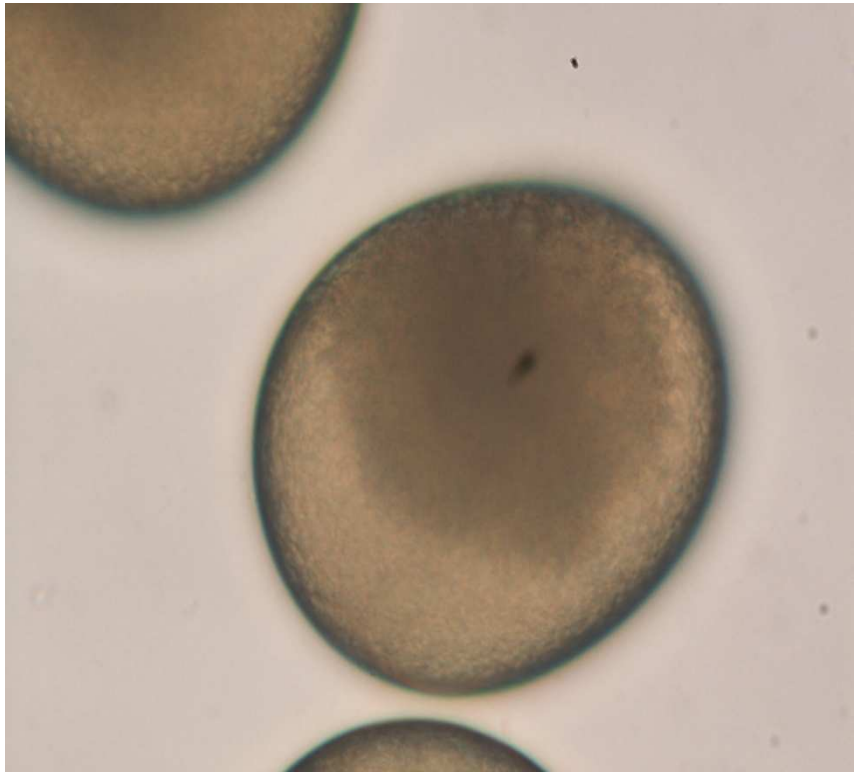
The pollen grain of Hibiscus (mag. 100)

- **Shape: round**
- **Size:**
- **Surface: Granular with dots**
- **Aperture type: United or irregular furrows may occur**
- **Exine, section : long, thin spines**
- **Other structure features :**


Comparing pollen grains
in flower and pollen loads

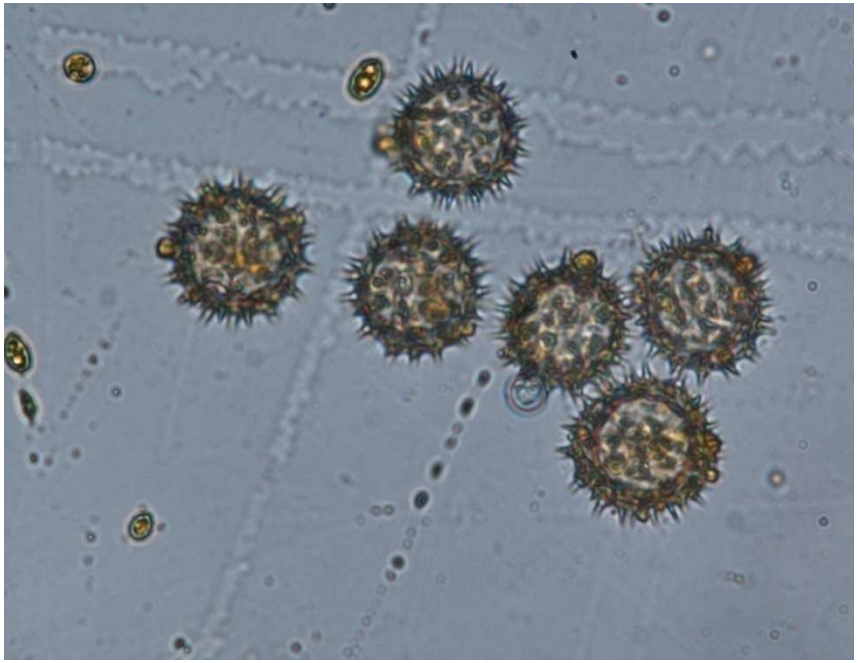
Comparing pollen grains in flower and pollen loads

Pollen grains on pollen load
(mag.40)

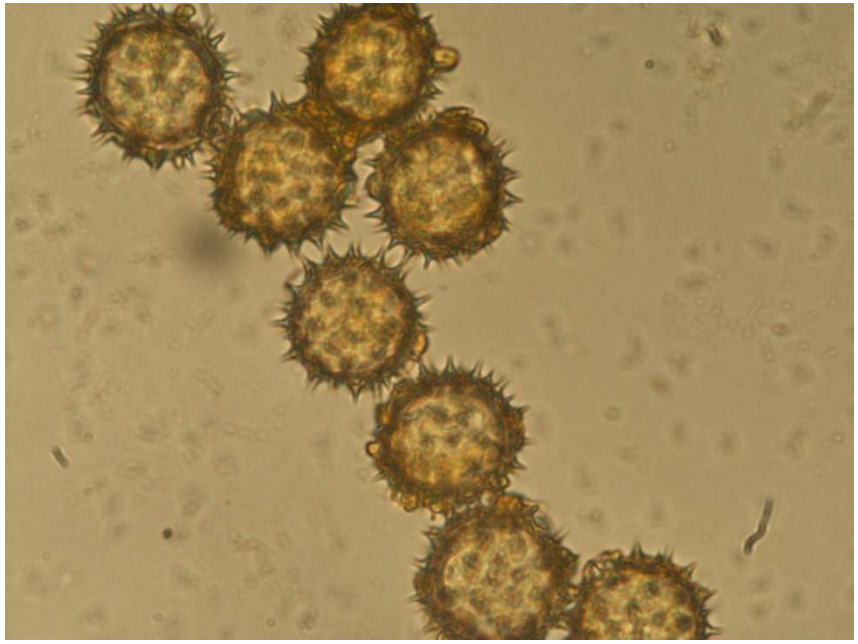


Zea mays L.
(Anther) Mag. 100

The pollen grains in anther and pollen loads



Pollen grains in a pollen load
(Mag. 40)



The pollen of Spanish Needle (Mag. 100)
(in flowers)

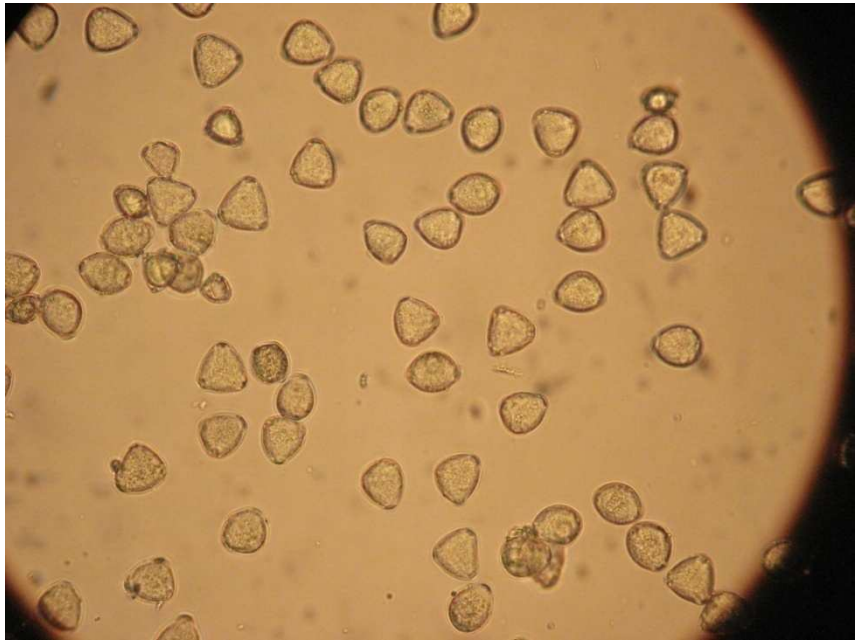
The pollen grains in anther and pollen loads

Pollen grains in a pollen load (mag.100)

The pollen grain of Coriander (Mag. 100)

(in flowers)

The pollen grains in anther and pollen loads



Pollen grains in a pollen load (mag.40)

The pollen grain of Sidr (mag.100) (anther)

- In pollen loads, often only one kinds of pollen present and specific for specie.
- Honey-bees do not collect all of flowering plants and some plants don’t have flower.

► Valuation for bee-keeping behavior and identify honeybee original.

THANKS FOR YOUR ATTENTION