



UNIVERSITÀ  
DEGLI STUDI  
DI TORINO



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**HCo**  
**FERRERO**  
Hazelnut Company

# Reproductive biology in hazelnut



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Amphacademy 2017 – September 15<sup>th</sup> 2017

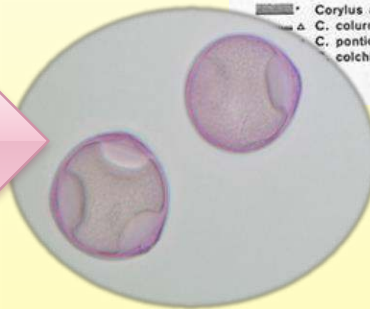
# Target species: *Corylus avellana*



Monoecious  
Dichogamous  
Self-incompatible



3 pores + oncus  
Bi-nucleate



Native range



[www.biologia.unipd.it](http://www.biologia.unipd.it)

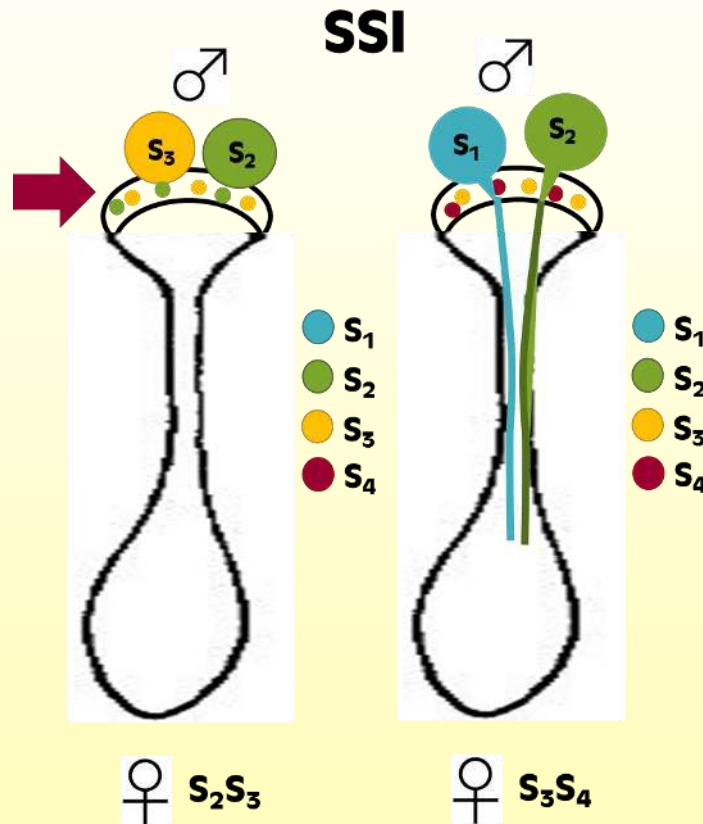
High genetic variability: **more than 400 cultivars and ecotypes**

Traditional cultivation in Europe, North America

# Mechanisms to insure cross-pollination

Single Locus Self-incompatibility:

## SPOROPHYTIC SELF-INCOMPATIBILITY

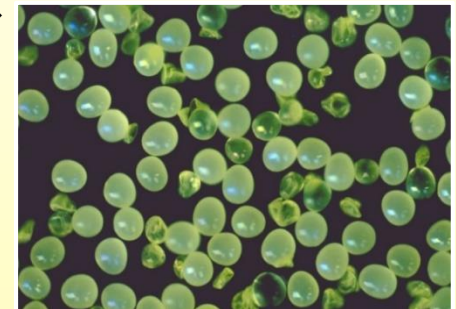


# Anomalous or sterile pollen grains



- Pollen without normal cell structures
- Higher percentage in commercial cultivars
- **High negative impact on final pollen viability**
- Probable **reciprocal-translocation heterozygote** (Salesses & Bonnet, 1988)
- **“Semisterility”**: an important diagnostic tool for identifying translocation heterozygotes in plants (Griffith et al., 2015)

Pollen of a semisterile corn plant, from Griffith et al., 2015 →



©1988 by Cytologia, Tokyo

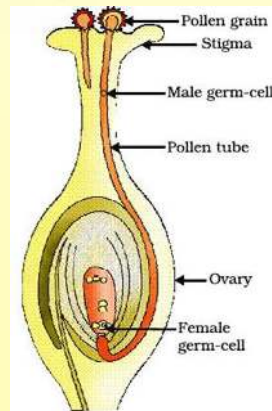
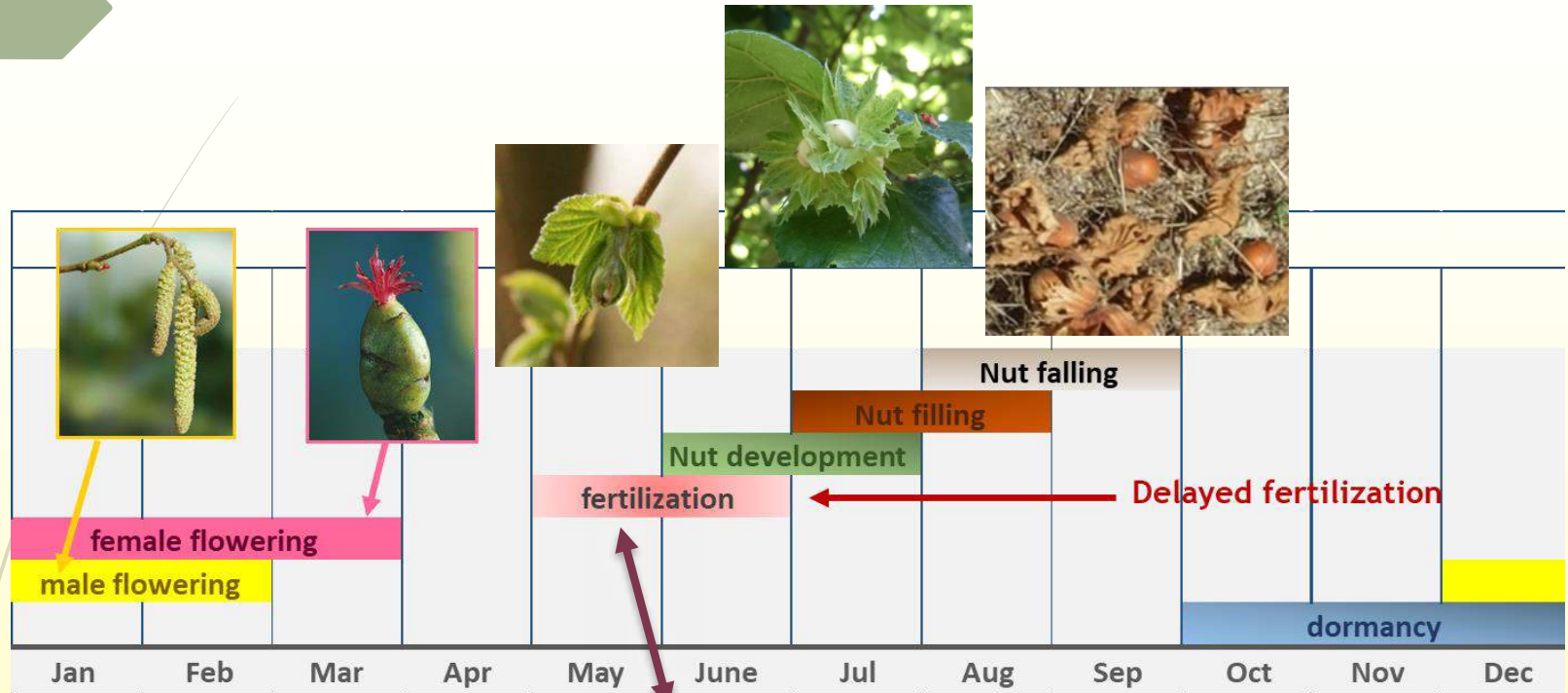
Cytologia 53: 407-413, 1988

Etude Cytogénétique d'Hybrides entre Variétés de Noisetier  
(*Corylus avellana*) Porteuses d'une Translocation  
à l'État Hétérozygote

G. Salesses et A. Bonnet

I.N.R.A., Centre de Recherches de Bordeaux,  
33140-Pont-de-la-Maye, France

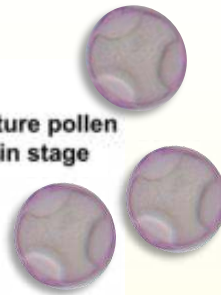
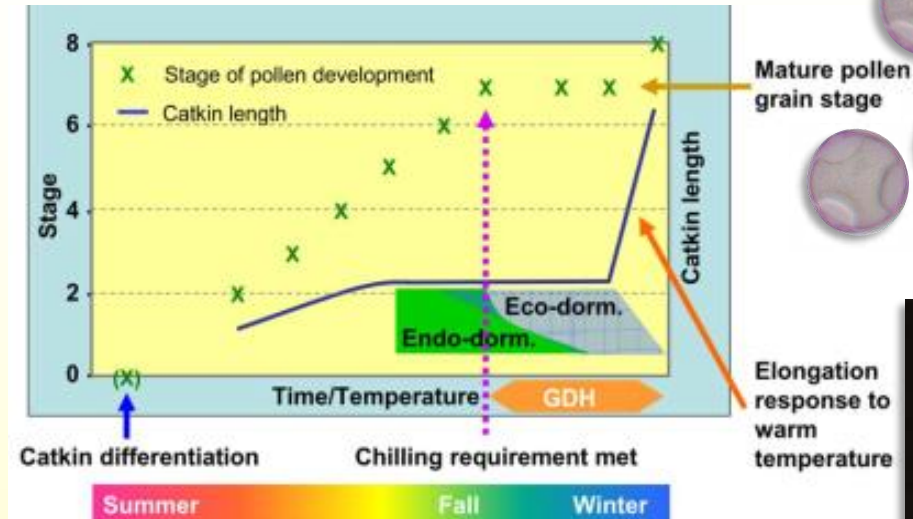
# Reproductive phenology



Temporal separation of pollination and fertilization

# Temperature-dependent process

The chilling hours requirement differs among cultivars and the different parts of the tree have a different chilling requirements



from Tiyyon and Azarenko, 2005

Amphacademy 2017 – September 17<sup>th</sup> 2017

# Pollination and fertilization

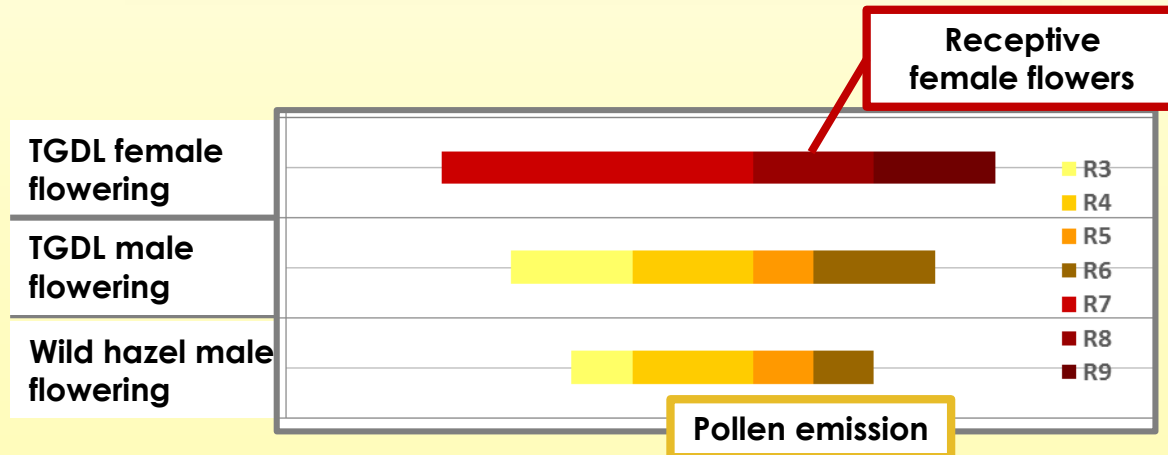
- Wild hazelnuts (naturally present in the woods) used as pollinizers in the native range



- Introduction of **cultivars useful as pollinizers** in the orchards, both in Europe and in new cultivation areas

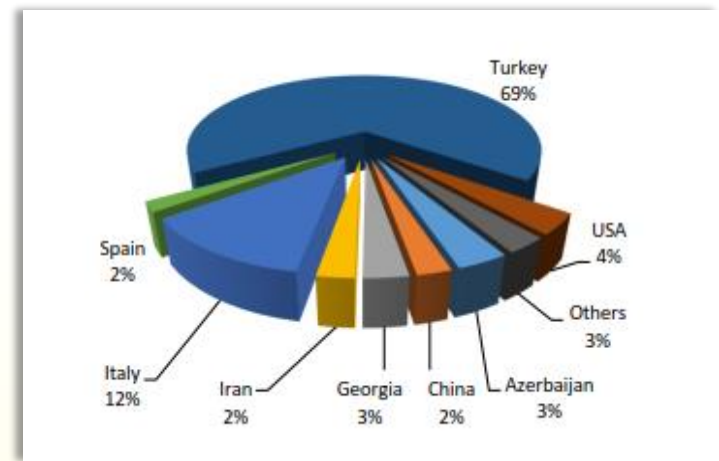


The pollinizers have to be **genetically** and **phenologically compatible**



# Nut production

The demand of hazelnuts is growing in all the world



→ Cultivation area is growing and rapidly expanding outside the native range





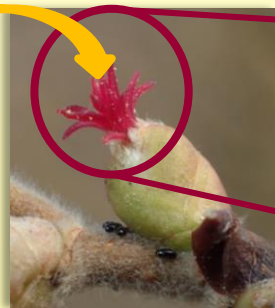
# Artificial and supplementary pollination

## 1. Pollen quantity and quality limits plant productivity:

- 63 % of 482 case studies of supplemental pollination showed significant pollen limitation (**Knight et al., 2005**).
- Higher quality pollen (cross-pollen) is thought to be responsible of the increase in seed-set observed in pollen supplementation experiments. **Aizen & Harder (2007)**

## 2. Pollen and resource limitation influence crop production and fruit quality

- Supplemental pollination has been adopted in agriculture either to increase fruit size in kiwifruit or to improve yield in avocado, pear, pistachio, and olive (**Pinillos & Quevas, 2008**)
- Different pollen types are able to influence fruit-set in *Prunus dulcis* (**Klein et al., 2015**) and even kernel nutritional composition in almond (**Brittain et al., 2014**).



Is fruit production pollen-limited in cultivation areas inside hazelnut native range?

Area of sampling



Catkins collection



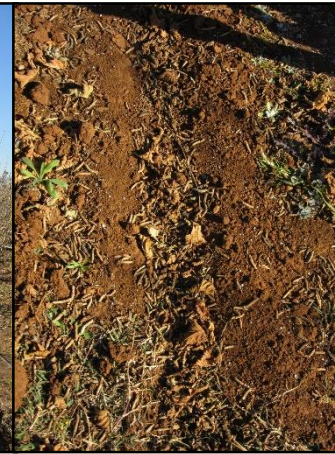
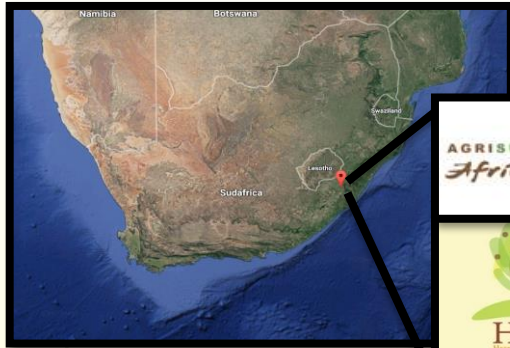
Application



Drying

# Is artificial pollination a feasible approach in areas where the natural process is compromised?

WINTER 2017

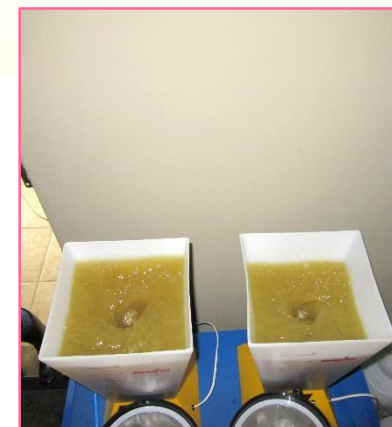
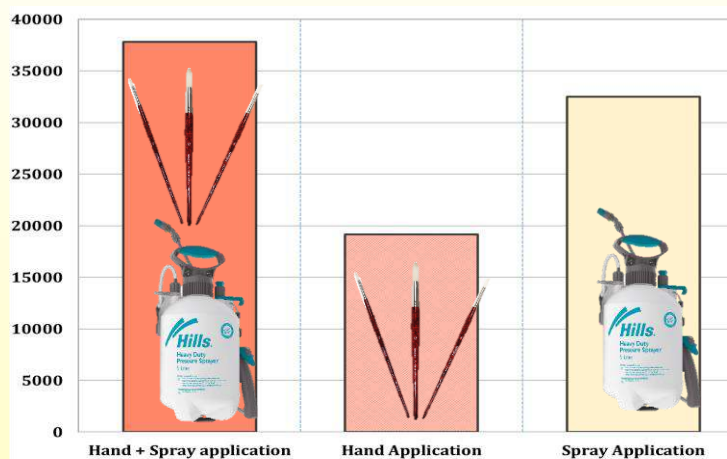
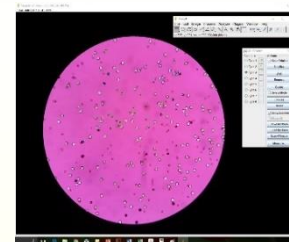


# Is artificial pollination a feasible approach in areas where the natural process is compromised?

## WINTER 2016 SOME RESULTS



**Kiwipollen**  
NEW ZEALAND



Fruit set  
(total weight/average  
nut weight)

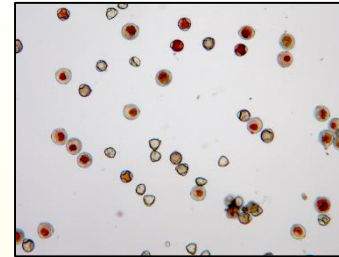
# Pollen viability

## Several tests to assay pollen viability

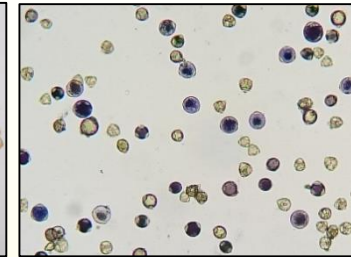
- Assays based on cell dehydrogenase activity
- Assays based on membrane integrity
- Analysis and classification of large biological image sets

→ **Impedance flow-cytometry applied to pollen viability analysis**

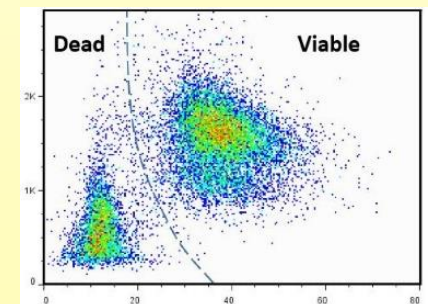
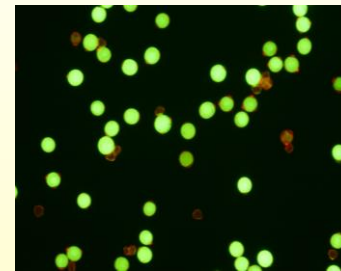
TTC



MTT



FCR



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***Thank you for your  
attention***

