

Genetic bases of fruity and flora aroma of the Nacional cocoa variety

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AmazCacao



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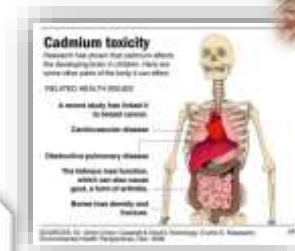
Total Budget total: 427K€

- MUSE
- Valrhona



AmazCacao

- History of past domestication of aromatic fine cocoa trees using paleogenomics
- Rescue and exploitation of new genetic resources related to fine cocoa
- **Study of genetic and biochemical determinants of fine cocoa aromas**
- Genetic basis of cadmium accumulation
- Study of dynamics of fine cocoa markets



Location of cultivation sites in Ecuador



The plant material were composed of a collection from Ecuador :

- Pichilingue experimental station of INIAP
- Coleccion de Cacao de Aroma Tenguel (CCAT) of Tenguel

This population (152) represents the Nacional variety currently grown in Ecuador

A second population of native cocoa trees (202) in the south of the Ecuadorian Amazon in the area of origin of Nacional

Phenotypes for Genome Wide Association Study (GWAS)



Fermentation
Turning at 24 et 72h



Solar drying



Liquor



Sensory analysis



GC-MS analysis

NIRS analysis

Methods

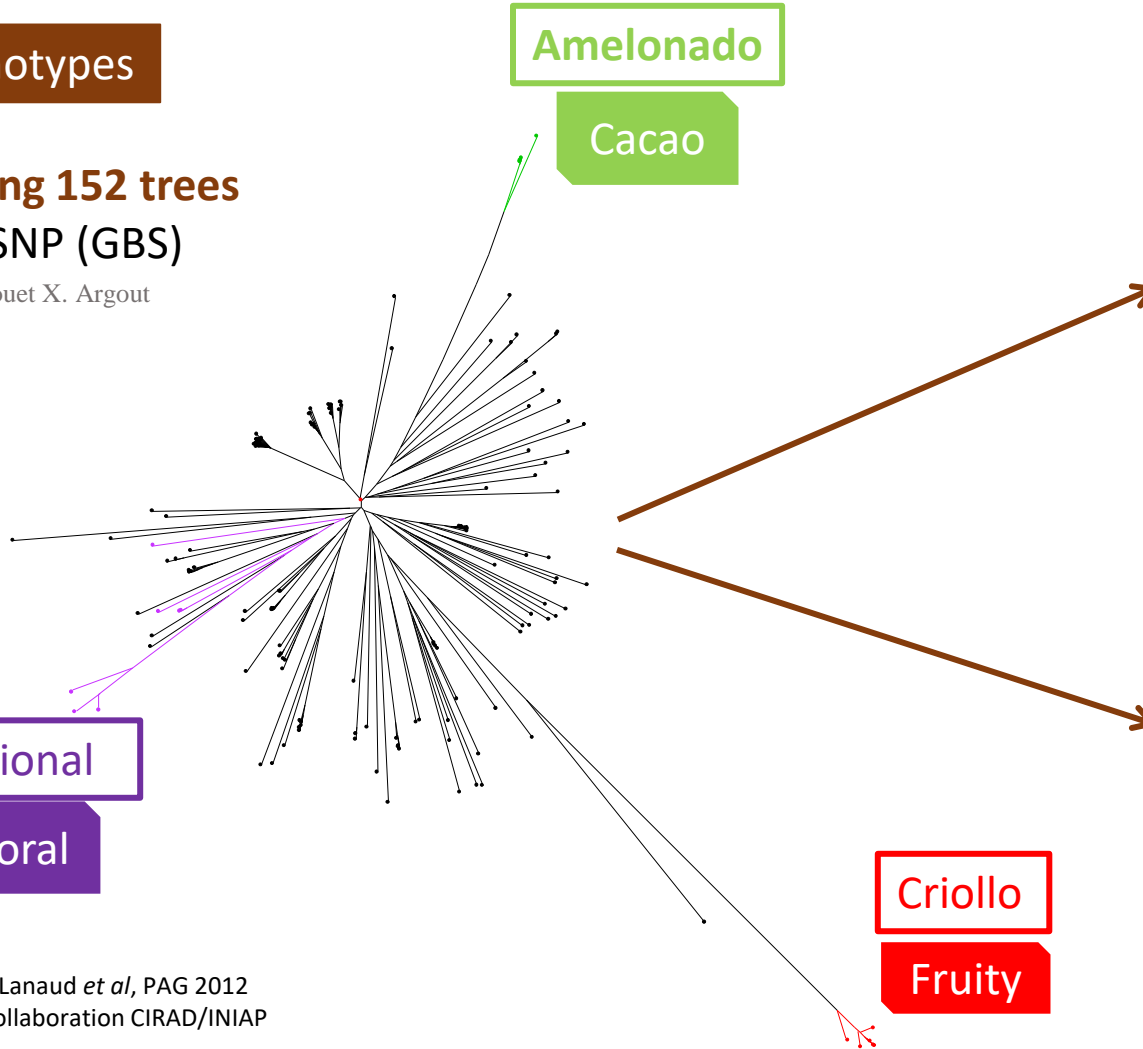
Genome Wide Association Study (GWAS)

Genotypes

Genotyping 152 trees

SSR + SNP (GBS)

O. Fouet X. Argout



Nacional

Floral

Amelonado

Cacao

Criollo

Fruity

Lanaud *et al*, PAG 2012
Collaboration CIRAD/INIAP

Phenotypes

Sensorial characterization

36 sensorial traits

(Fruity, Floral, Bitterness,
Astringency ...)

E. Seguine



Biochemical characterization

65 volatile compounds
unroasted beans

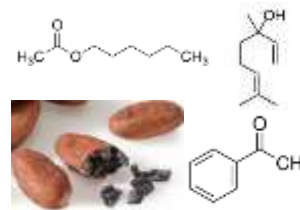
GC/MS R. Boulanger E. Cros J-C. Jimenez

87 volatile compounds
roasted beans

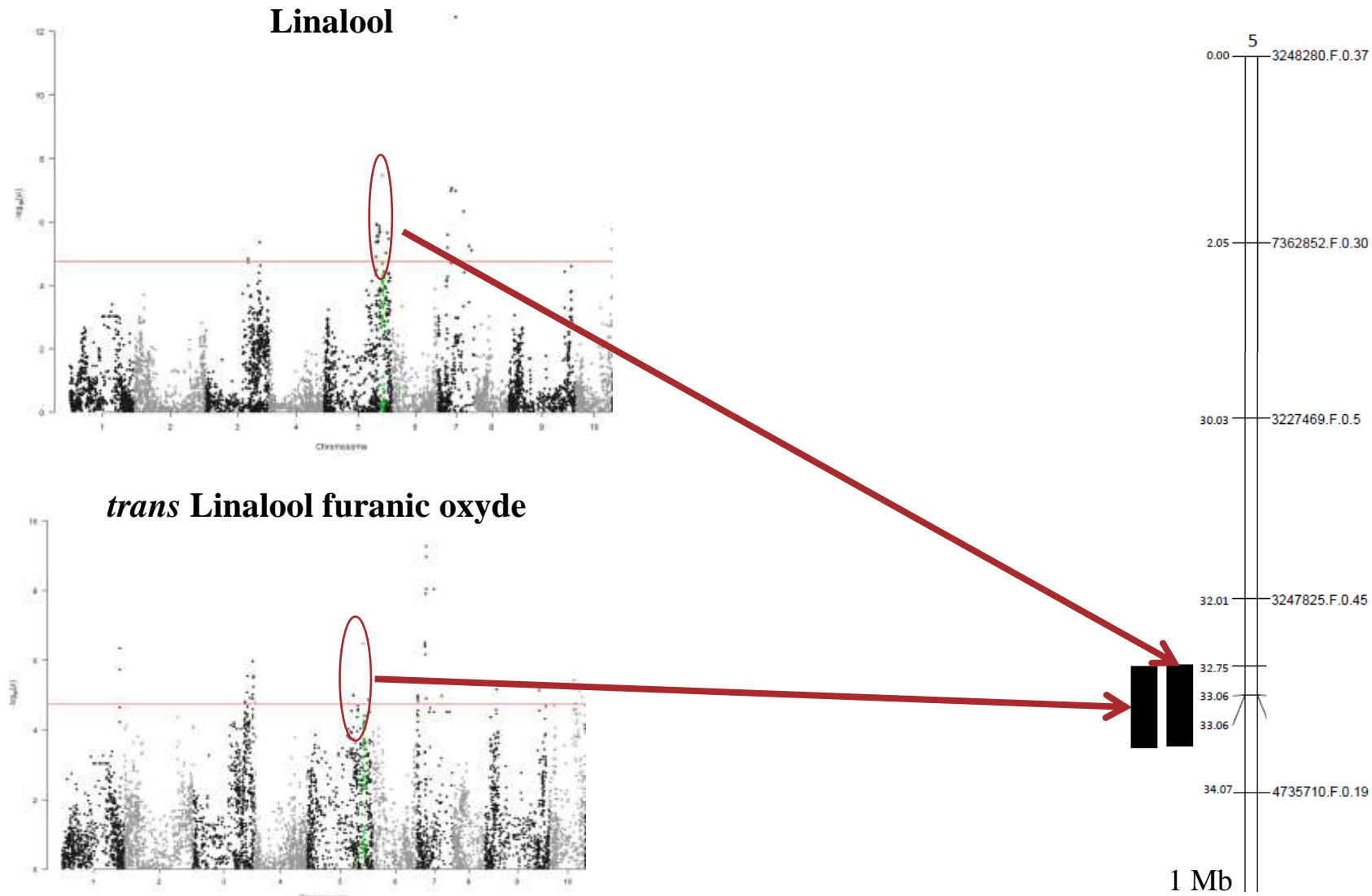
GC/MS R. Boulanger E. Cros A. Saltos

8 non volatile compounds
unroasted beans

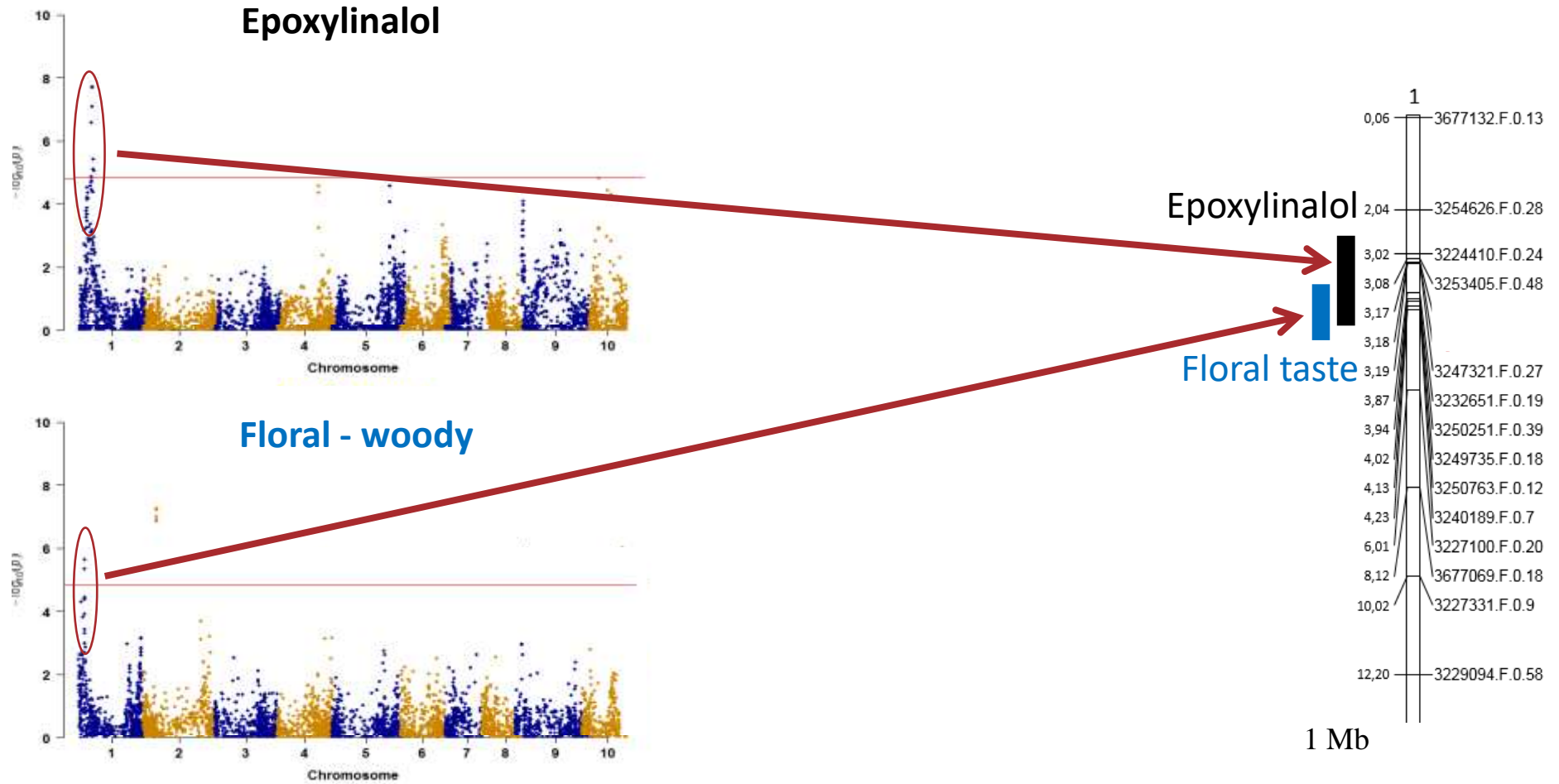
NIRS F. Davrieux A. Saltos



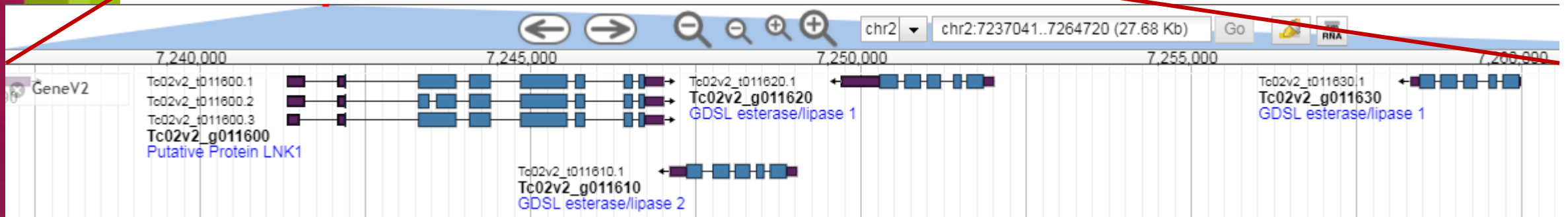
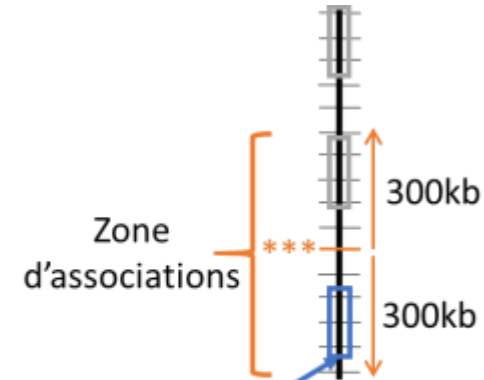
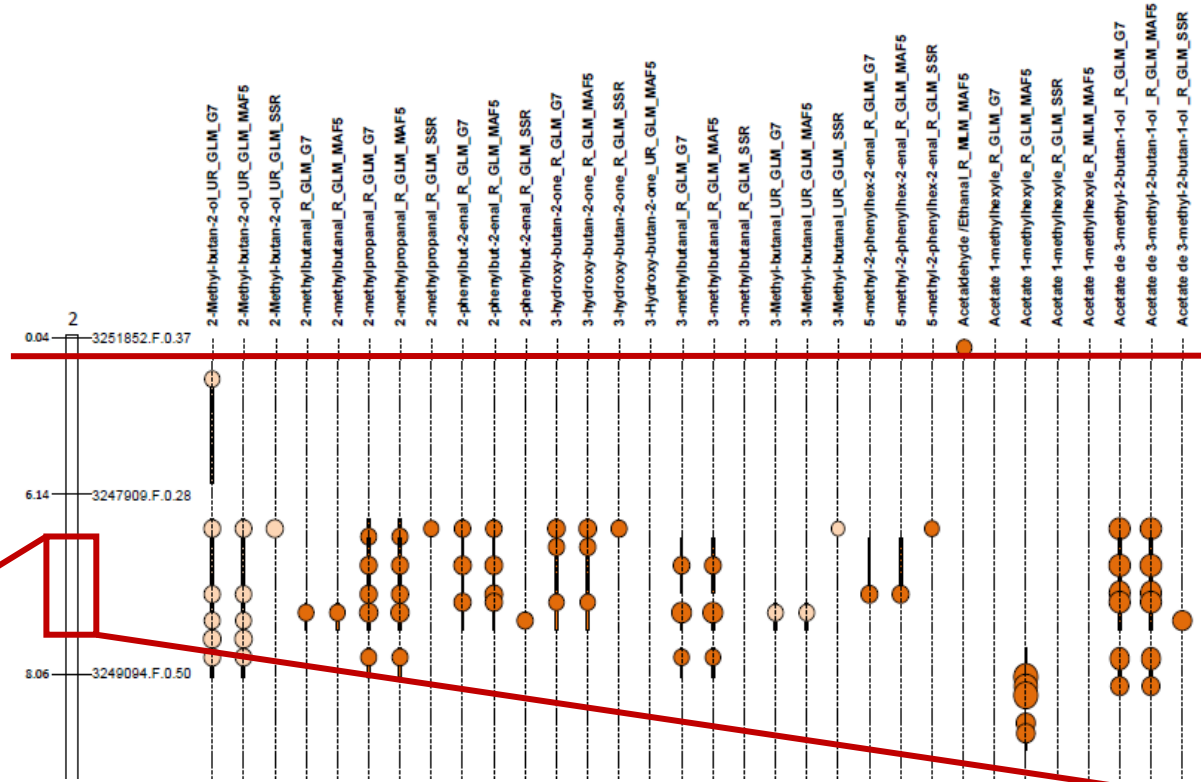
Association genetics (GWAS): example of results for aroma compounds



Association genetics (GWAS): example of results for floral notes



Candidates genes research in association areas



Determining the floral and fruity aromas of modern Nacional

Floral notes - 16 sensory descriptors, 27 VOCs

48 Association areas (9 sens.; 39 VOCs)

2 Main biosynthetic pathways:

- Monoterpene biosynthetic pathway (9 Candidate Genes)
- L-phenylalanine degradation pathway (19 Candidate Genes)



Fruity notes - 13 sensory notes and 35 VOCs

233 Association areas (39 sens.; 194 VOCs)

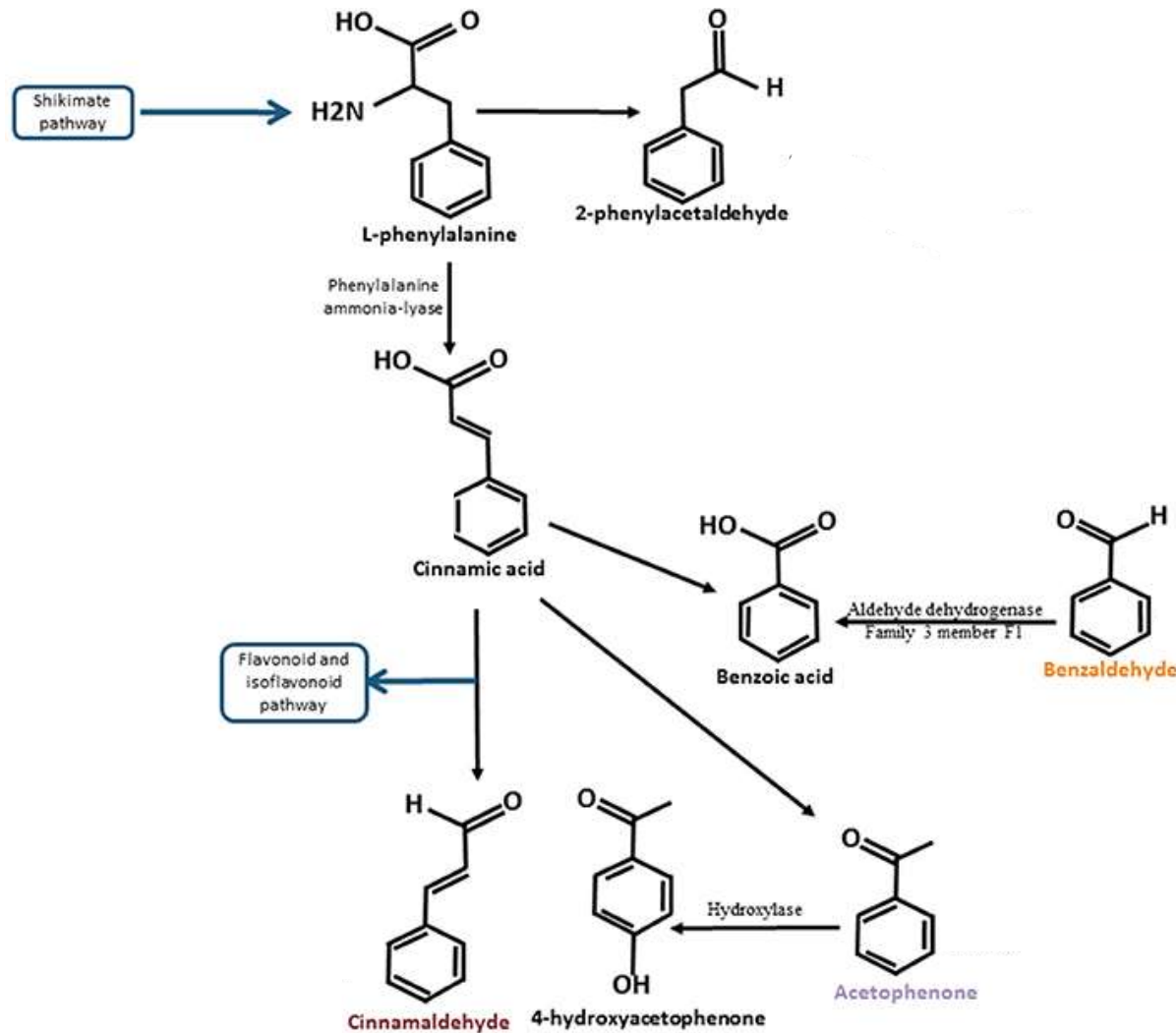
5 Biosynthetic pathways:

- Monoterpene biosynthetic pathway (514 Candidate Genes)
- Pathway of L-phenylalanine
- Degradation of proteins, sugars and fatty acids



Example for candidate genes, floral and fruity notes

L-phenylalanine pathway



58 gènes
candidats

Determining the floral and fruity aromas of National ancestral

A second population of native cocoa trees resulting from surveys carried out in the south of the Ecuadorian Amazon in the area of origin of Nacional

Floral notes – 16 sensory descriptors, 27 COVs

393 Zones d'associations (38 sens.; 355 COVs)

- monoterpene biosynthetic pathway (114 Candidate Genes)
- L-phenylalanine degradation pathway (41 Candidate Genes)



Fruity notes - 13 sensory descriptors and 35 COVs

502 Zones d'associations (22 sens.; 480 COVs)

- monoterpene biosynthetic pathway
- pathways of L-phenylalanine (1108 Candidate Genes)
- degradation of proteins, sugars and fatty acids



54 Common genes between the two populations

Determining the floral and fruity aromas of modern Nacional

➤ 5 biosynthetic pathways highlighted:

• 2 for the floral notes



• 5 for the fruity notes



➤ Characterization of genome zones in relation to aroma types

➤ Selection of areas of the genome favourable to the desired notes

Nest step

➤ Expression analyses at different stages



*Thanks for your
attention*



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