





## A Technical Perspective on Essentially Derived Varieties

**Hedwich Teunissen – Naktuinbouw, Netherlands**  
Geneva: October 22, 2013. UPOV Seminar on Essentially Derived Varieties

## EDV- the Definition

**article 14 (5)(b) of the UPOV 1991 Act:**  
An essentially derived variety (EDV) shall be deemed to be essentially derived from another variety, the initial variety, when

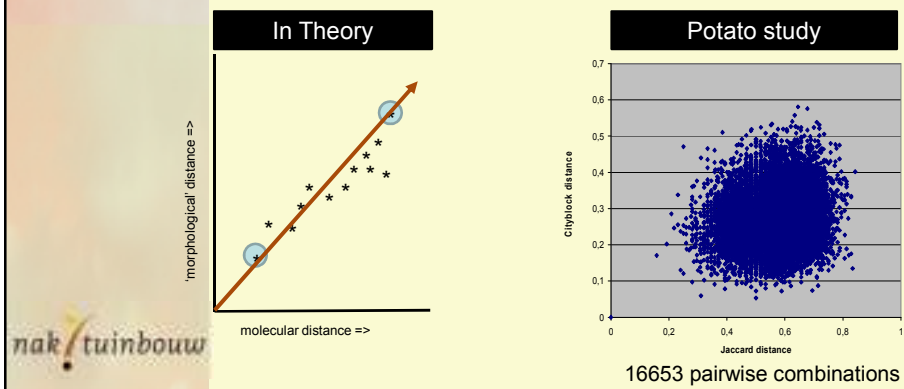
- a) It is predominantly derived from the initial variety, or from a variety that is itself predominantly derived from the initial variety, while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety and;
- b) It is clearly distinguishable from the initial variety and;
- c) Except for the differences which result from the act of derivation, it conforms to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety.

**Expression of the essential characteristics  
that results from the genotype  
or combination of genotypes**

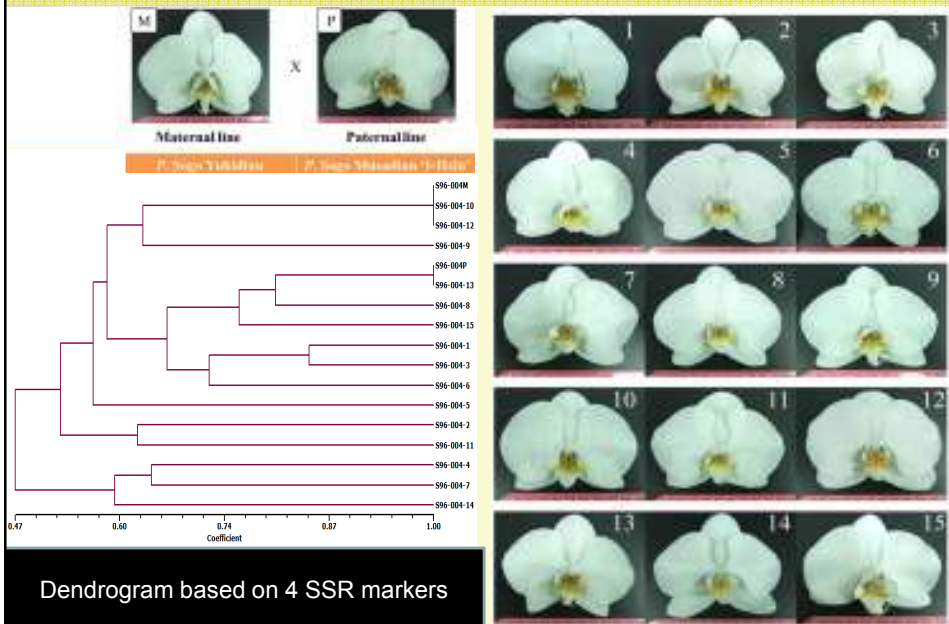
## Direct link between phenotype and genotype

*Expression of essential characteristics that results from the genotype or combination of genotypes*

### Direct correlation between genotype and phenotype



## Small phenotypic differences - significant genetic distance



## Hugh phenotypic differences - genetic conformity of ~100%

*Dtps. Younghome New York*



KA01801-1



KA01801-2



KA01801-3

AFLP 16 PCs  
No significant  
polymorphism



## Another example.....



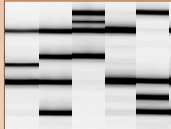
nak tuinbouw

More than one or a few characteristics were affected  
by spontaneous mutation event in *Dianthus*....EDV yes/no??

## Tool to predict EDV



Realizing that the correlation between phenotype and genotype is not waterproof.....



In many/most cases a strong genetic conformity between initial variety and putative EDV (especially mutants) is expected



Genetic conformity as a tool to predict essential derivation

Genetic conformity (EDV Threshold) is not decisive: shift of burden of proof

nak / tuinbouw

## Crop-by-crop



- Manner of multiplication:
  - ✓ Vegetatively propagated
  - ✓ Self/cross-pollination
  - ✓ Hybrids or OP
  - ✓ Genetic similarity within variety vs between varieties



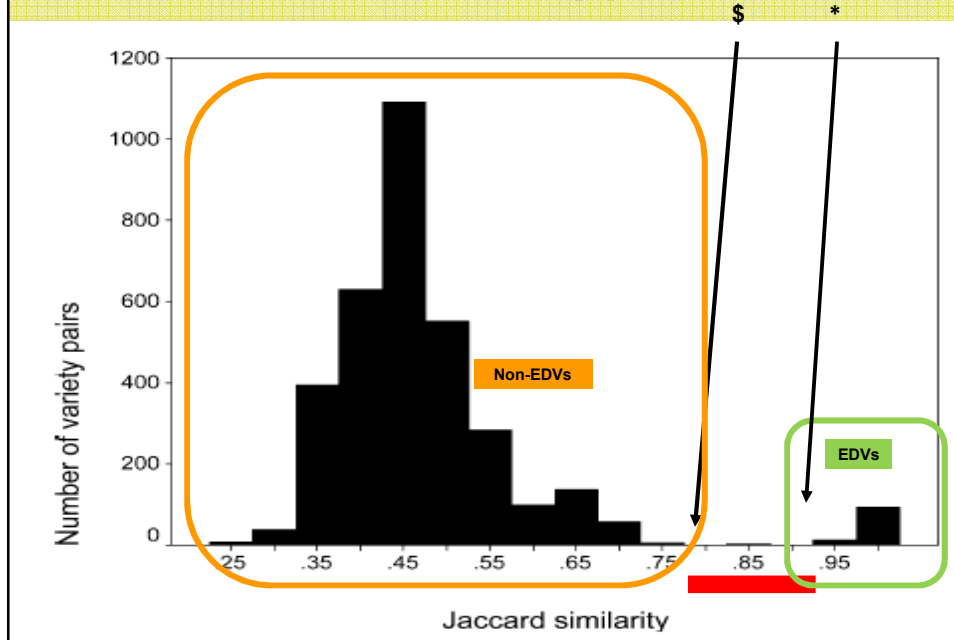
- Small or wide natural (botanic) genetic diversity within the species



- Ploidy level/genome size

nak / tuinbouw

## Harmonized approach



## Comparing is relative



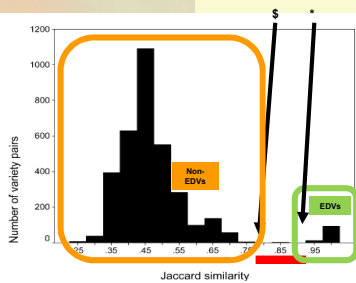
How deep?  
Choice of Marker Technology  
Number of markers



How wide?  
Choice of reference framework  
representative  
relevant

## Genetic width - choice of references

- A:** Varieties that are representative for the complete diversity within the species
- B:** Samples with known (close) genetic relationship (parents and progeny).
- C:** Varieties that are accepted EDVs and their initial varieties
- D:** Different origins, different generations of the same variety



Store DNA profiles  
in databases

## Comparing is relative



How deep?  
Choice of Marker Technology  
Number of markers



How wide?  
Choice of reference framework  
representative  
relevant

## Genetic depth - choice of technology

### AFLP:

Random  
Generally applicable  
Bi-allelic  
Dominant

### SNPs:

Targeted  
Crop specific  
Bi-allelic  
Co-dominant

### SSR:

Targeted  
Crop specific  
Multi-allelic  
Co-dominant

### NGS:

Random and Targeted  
Generally applicable  
Multi-allelic  
Co-dominant

nak / tuinbouw

## Advantages of NGS



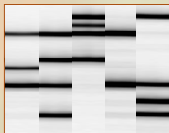
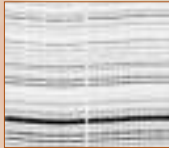
- Increased number of markers will give a more accurate representation of the genome
- Genome sequence *is* the genotype

When is the right moment to start investing in genetic conformity study and build up database?

nak / tuinbouw



## Comparing is relative (again)



nak / tuinbouw

- ✓ comparing whole genomes will reveal an increased number of differences between closely related varieties
- ✓ But... also the number of differences between non-related varieties will increase.
- ✓ The relative distances (and similarities) between these varieties will, however, not change.
- ✓ Choice of marker technology is **not** crucial
- ✓ In several cases analysis of the same dataset with different technologies let to identical conclusions
- ✓ Any DNA marker technology can do the job as long as the technology and performance have proven to be accurate

## Technology accuracy



nak / tuinbouw

### Discriminative capacity / informativeness:

- Such as....Polymorphism Information Content (PIC)-value.

### Representative sampling of the genome:

- Uniformly distributed and not linked.

### Reproducibility:

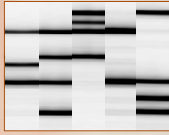
- Profiles in databases.

### Error rate:

- To distinguish the technically induced variation from the real genetic diversity.



## Concluding remarks



nak / tuinbouw

- Genetic conformity can be used as a tool to predict essential derivation
- On crop-by-crop basis using a harmonized approach
- Choice of well defined sets of varieties and relevant reference framework is crucial
- Choice of a DNA marker technology is not crucial as long it is proven to be accurate

*Quality in Horticulture*