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LR characterization for identity assessment

Renzo Torricelli
Department of Applied Biology,
University of Perugia, (Italy)

Conservation strategies for European crop wild relative and landraces diversity,

Palanga, Lithuania,
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Outline

- **Landraces (LRs) - an important segment of diversity**
- **Morpho-phenological characterization: LR - case studies (*Apium graveolens* and *Vigna unguiculata*)**
- **Molecular characterization: LR - case studies (*Apium graveolens* and *Vigna unguiculata*)**
- **Conclusions**

Landraces

LRs are an important segment of diversity, that continues to disappear

They should be preserved because they are:

- an important source of useful genes for breeding work
- the base for new populations adapted to environmental changes
- The base for local profitable economies

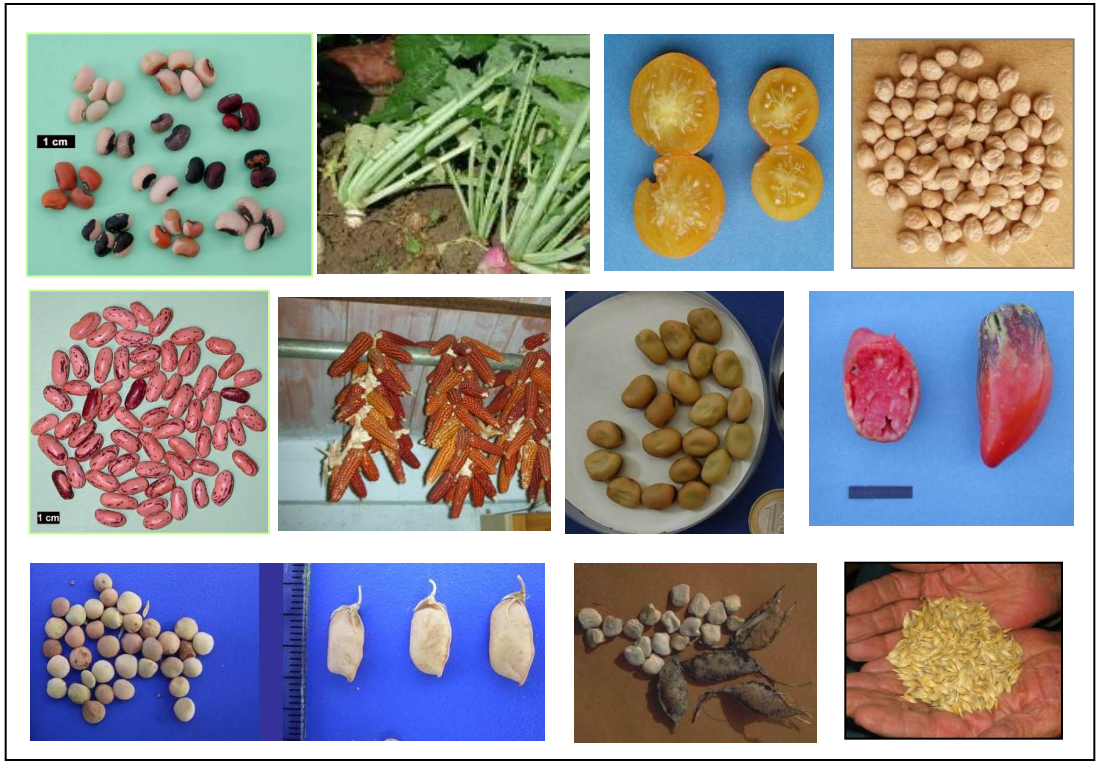
In Italy the most diffused LRs belong to the following species (herbaceous crops)

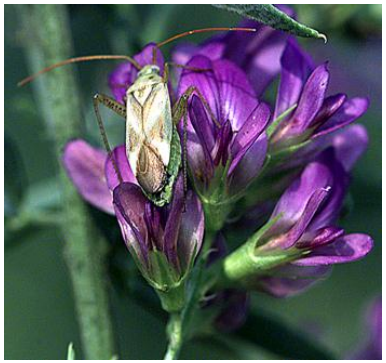
Garden crops
- *Apium graveolens*
- *Brassica rapa*
- *Lycopersicon esculentum*
- *Lactuca sativa*

Pulses
- *Lathyrus sativus*
- *Lens culinaris*
- *Cicer arietinum*
- *Vigna unguiculata*
- *Vicia faba*
- *Phaseolus vulgaris*

Cereals
- *Triticum aestivum*
- *Triticum dicoccum*
- *Zea mays*

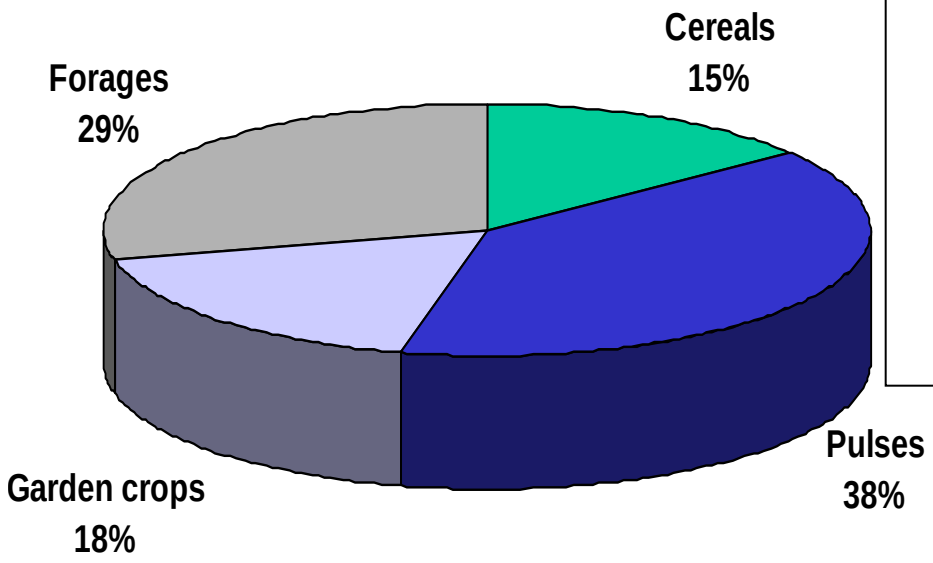
Forages
- *Medicago sativa*
- *Onobrychis viciifolia*

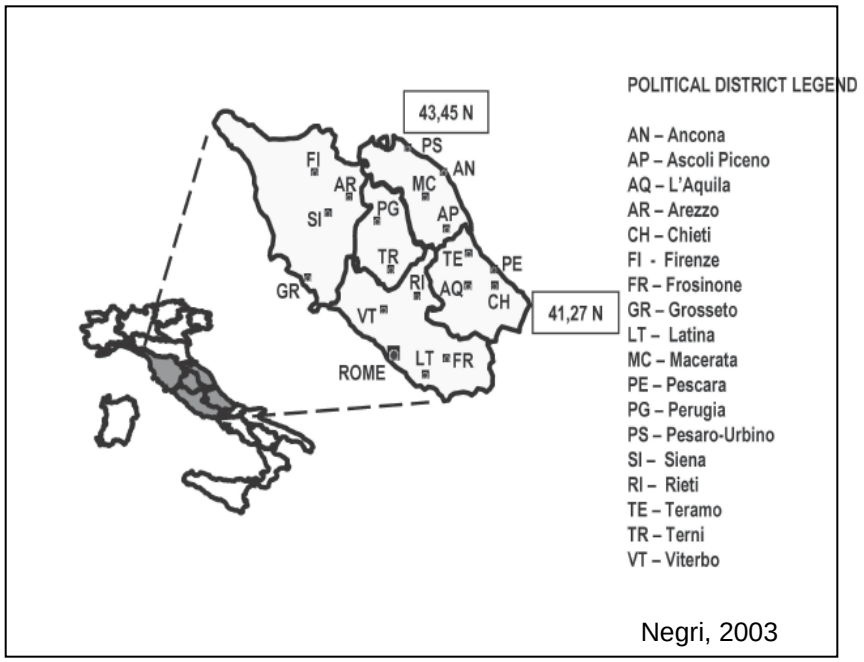




Twenty year collection in Central Italy showed that over 1300 landraces can be found

Percentages relative to different types of crops found





Negri, 2003

LRs are maintained because of:

- Better quality than commercial varieties
- Better performance (yield/persistence) under harsh pedoclimatic conditions
- Traditional reasons such as:

a) Particular traits appreciated by the farmer's family,

b) Ritual or religious use

Most of LRs, especially garden crops, are highly threatened because grown by aged farmers

In Italy some LRs are protected by National and Regional laws and other supportive measures

see my following ppt presentation

Morpho-phenological characterization useful to:

Plan actions to safeguard of individual LRs;

Identity & distinctiveness assessment (i.e. is it a true LR? Needed to protect a LR in Italy);

Enhance the value of product obtained from LRs;

Implement any actions to market the seed of conservation varieties (2008/62/EC, 2009/145/EC and 2010/60/EU Commission Directives);

The assessment of identity and distinctiveness of a certain LR from other LRs and commercial varieties: guidelines for propagated seed species

- ✓ ***in field trails;***
- ✓ ***with replicated and randomized designs;***
- ✓ ***spaced plants;***
- ✓ ***keeping distinct seed lots from different farmers;***
- ✓ ***use of control materials*** **(pure lines or F1 hybrids for autogamous or cross-pollinating species, respectively, including those recommended in the area);**
- ✓ ***use statistical tools***

Case Study n.1

'Black celery of Trevi' is grown in Umbria near the little town of Trevi. The cultivated area is small (2 ha).
The production is limited and mainly addressed to local market.

Morphological characterization was carried out in a farmer field using:
6 farmer populations,
64 plants per pops
4 replicates
4 èlite varieties (Controls)

3 hyb and 1 std

Black Celery of Trevi

Morphological variation: leaf, type……

Morphological characterization of was carried out according to the UPOV traits

Nine quantitative and four qualitative traits were recorded per plant:

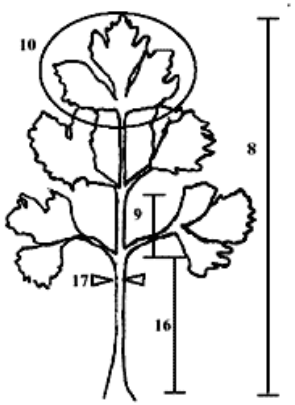
1. Green matter yield excluding lateral shoots (g);
2. Plant height (cm);
3. Number of leaves;
4. Intensity of leaves colour excluding petioles
5. Longest leaf length including petiole (cm);
6. Distance (cm) between 1st and 2nd leaflets ;
7. Size of the terminal leaflet of the longest leaf (cm);
8. Petiole length of the longest leaf (cm);
9. Petiole width of the longest leaf (cm);
10. Lobe spacing of leaflets
11. Ribs prominence of petiole
12. Inner side profile in cross section of petiole
13. Intensity of petioles colour .

Leaf: length (including petiole) (8)

Leaf: distance between 1st and 2nd pair of leaflets (9)

Leaf: size of the terminal leaflet (10)

Petiole: length (16) width (17)



Leaflet: shape of tips on margin

1

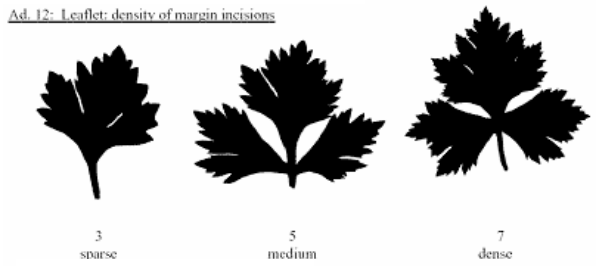
2
rounded

Petiole: profile of inner side in cross section

2
slightly concave

3
strongly concave

Leaflet: density of margin incision

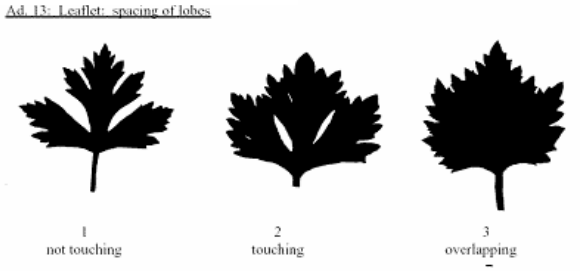


3
sparse

5
medium

7
dense

Leaflet: spacing of lobes



1
not touching

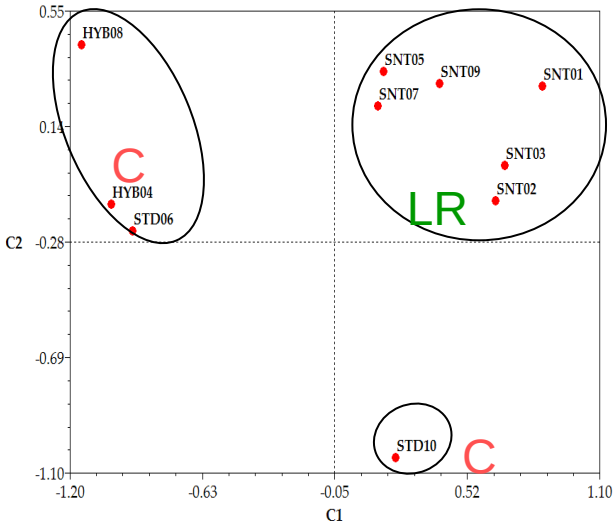
2
touching

3
overlapping

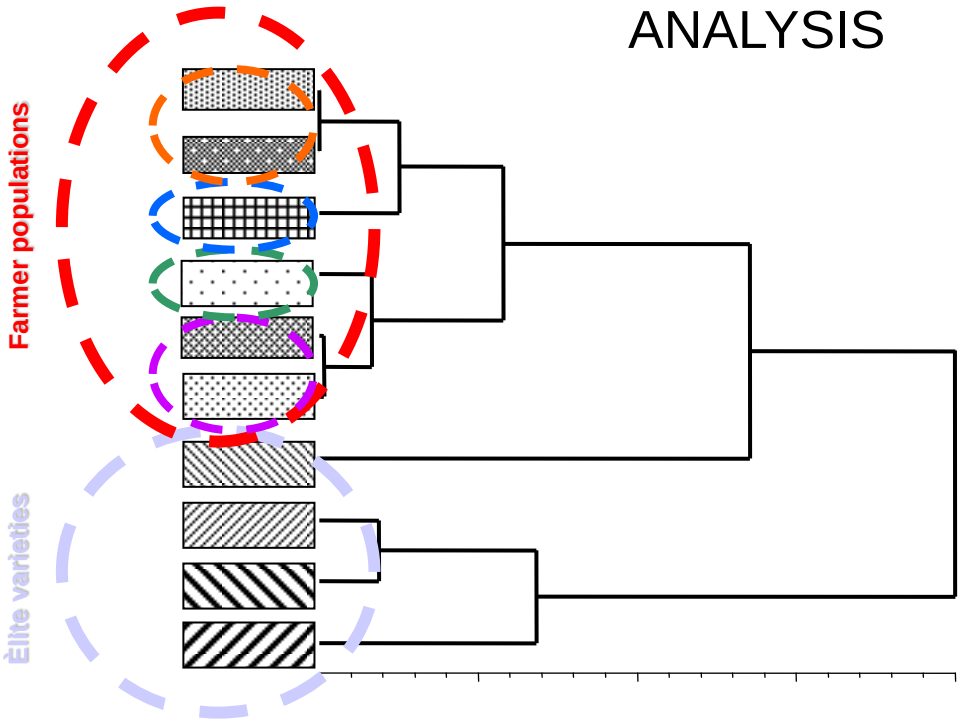
Morphological datasets were used to perform multivariate statistical analysis

'Black celery' LR from Trevi: morphological characterization results

PCA



CLUSTER ANALYSIS



Both cluster analysis of Euclidean genetic distance coefficients and principal component analysis showed that

Black celery farmer populations were clearly separated from cultivars

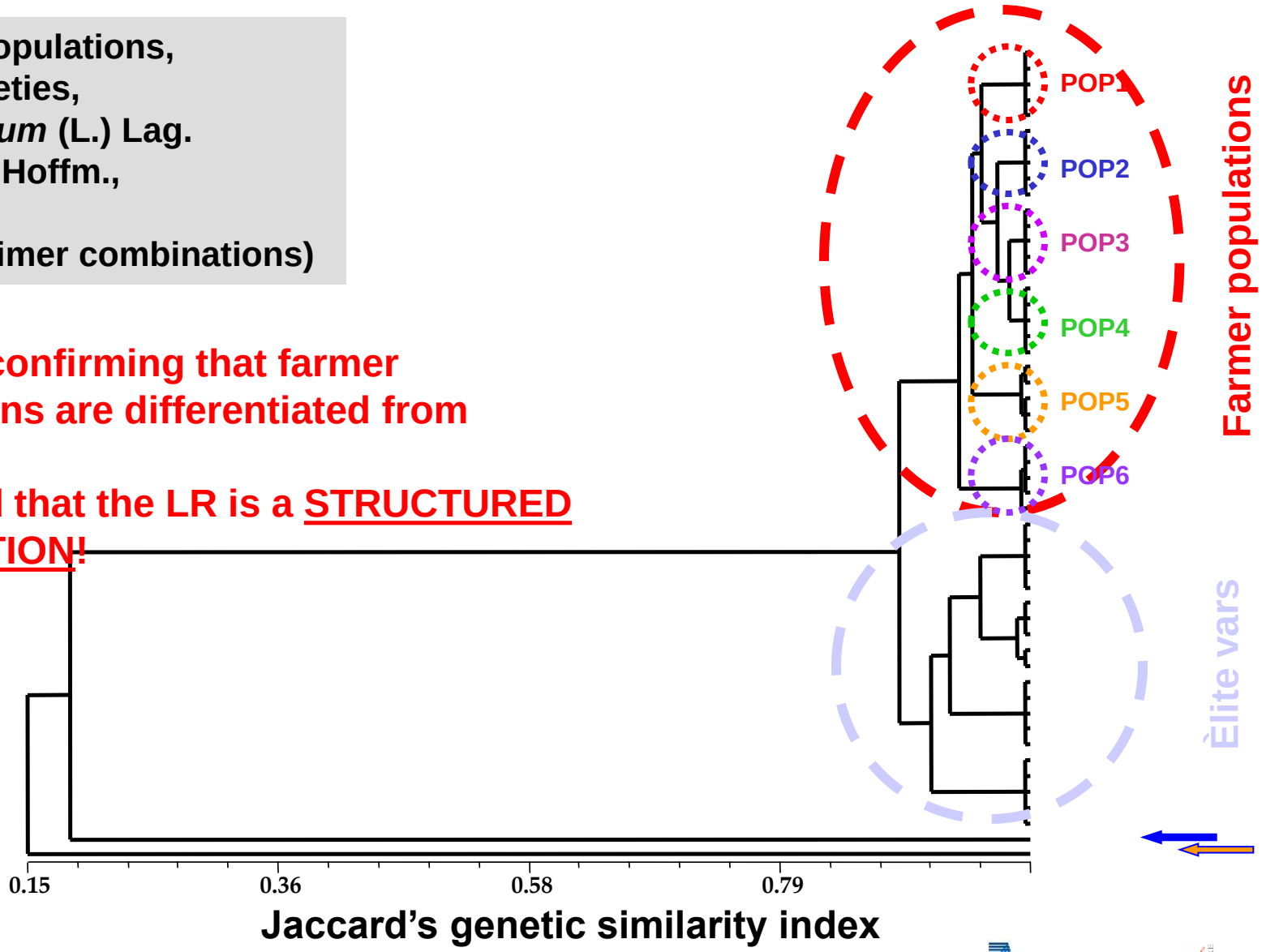
(although not always differentiated each other).

'Black celery' LR from Trevi: Molecular characterization (Case Study n.1)

6 farmer populations,
4 èlite varieties,
***A. nodiflorum* (L.) Lag.**
***P. sativum* Hoffm.,**

(9 AFLP primer combinations)

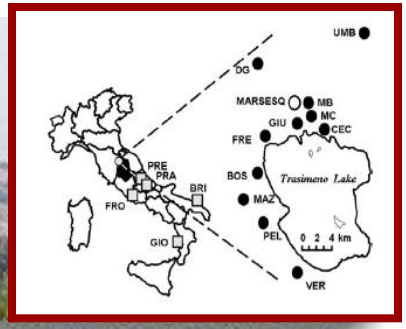
Besides confirming that farmer populations are differentiated from cultivars,
it showed that the LR is a STRUCTURED POPULATION!



Case Study n.2

"Fagiolina" (*Vigna unguiculata* subsp. *unguiculata* (L.) Walp)

From Trasimeno Lake (Umbria, central Italy)



The LR comes from the Trasimeno Lake area in Umbria (central Italy) where the plant (locally called ''fagiolina'') has been grown for centuries. The total area under cowpea cultivation was estimated to be less than 2 ha in1994; now is about 10 ha.

Consorzio Fagiolina del Trasimeno

Fagiolina® del Trasimeno

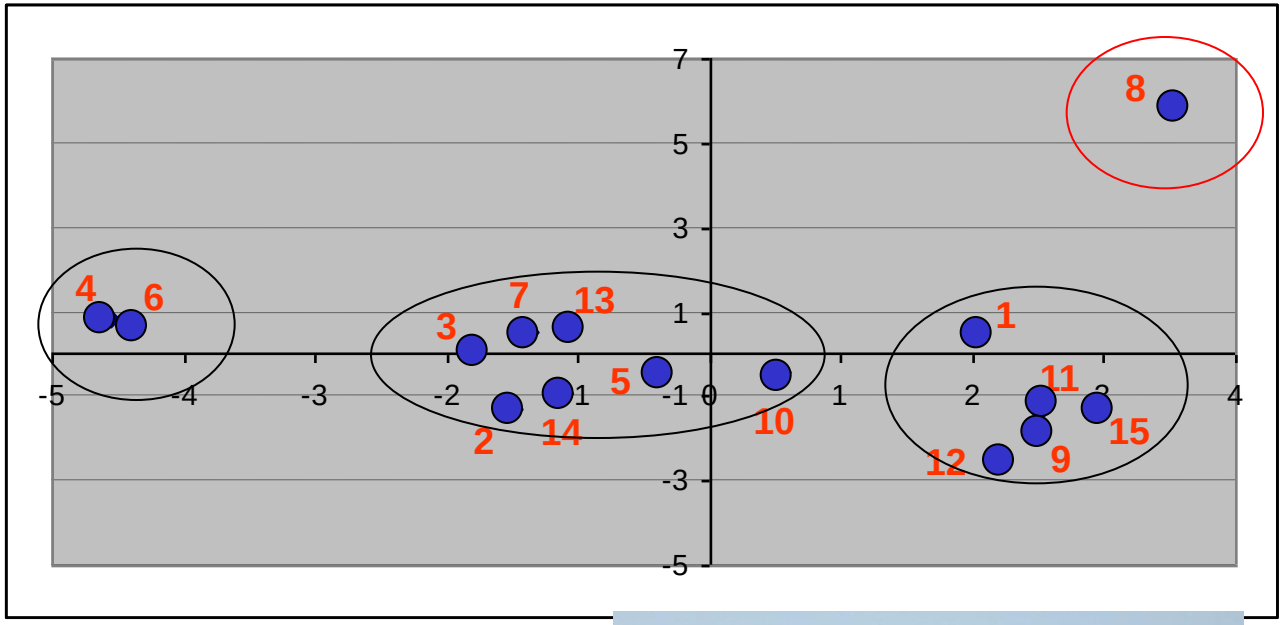
Morphological characterization, the following characters were recorded per plant:

Plant vigour;
Growth habit;
Flower colour;
Legume colour;
Days to flowering;
Days to first mature pod;
Pod length (mm);
Total number of pods produced;
Seed colour;
100 seed weight (g);
Total seed yield (g);
Virus susceptibility.

Variation in testa colour

Morphological data were used to perform PCA analysis.

The PCA analysis showed that there are some meta-populations of "Fagiolina" separated from the Control

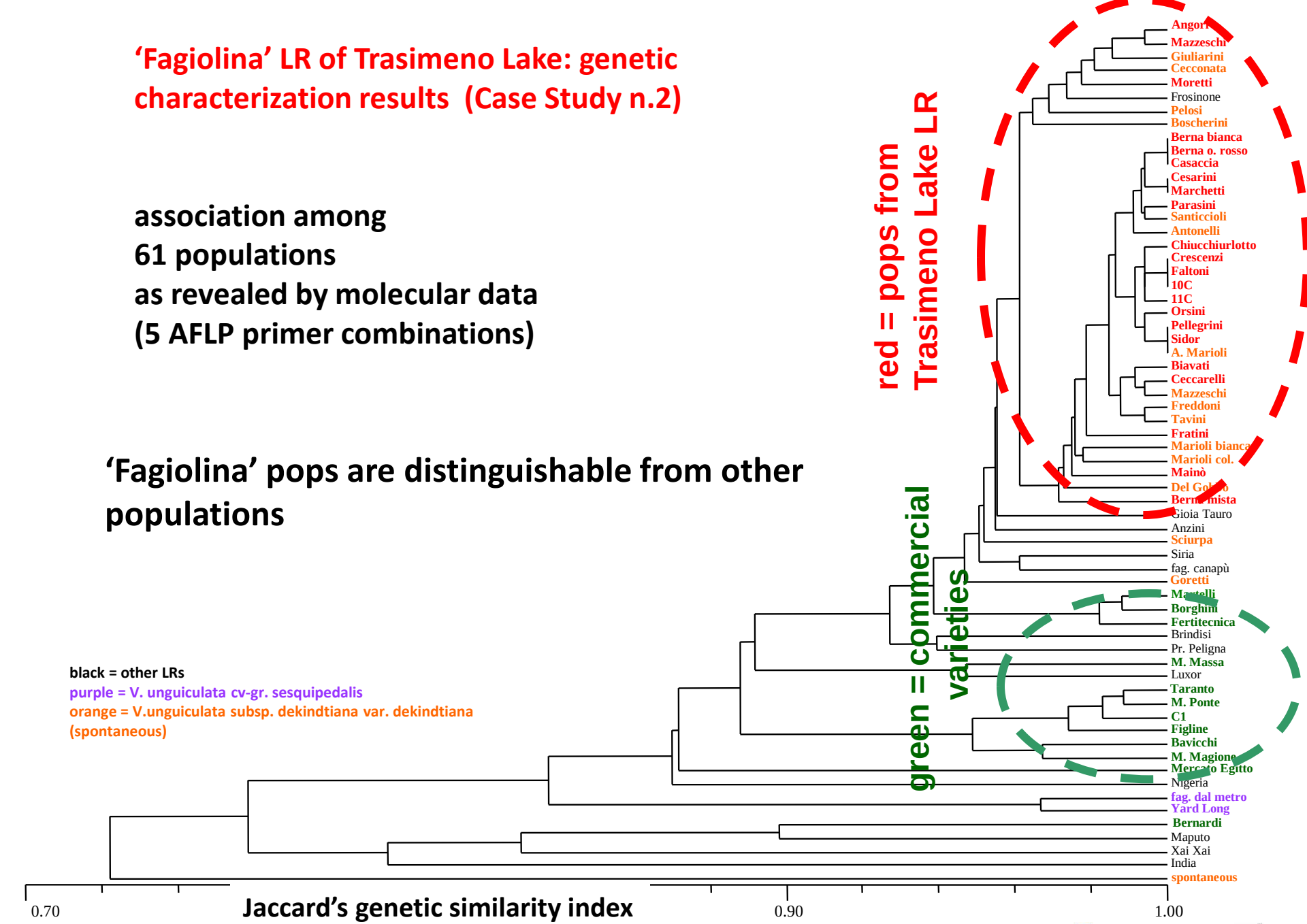


1 Bavicchi	9 Marioli F. occ.
2 Boscherini	10 Marioli Fag.
3 Cecconata	11 Mazzeschi
4 Del Gobbo	12 Pelosi Bian.
5 Freddoni	13 Pelosi Occ. N.
6 Ghezzi	14 Romizi
7 Giulianini	15 Veronesi
8 Ingegnoli (control)	

‘Fagiolina’ LR of Trasimeno Lake: genetic characterization results (Case Study n.2)

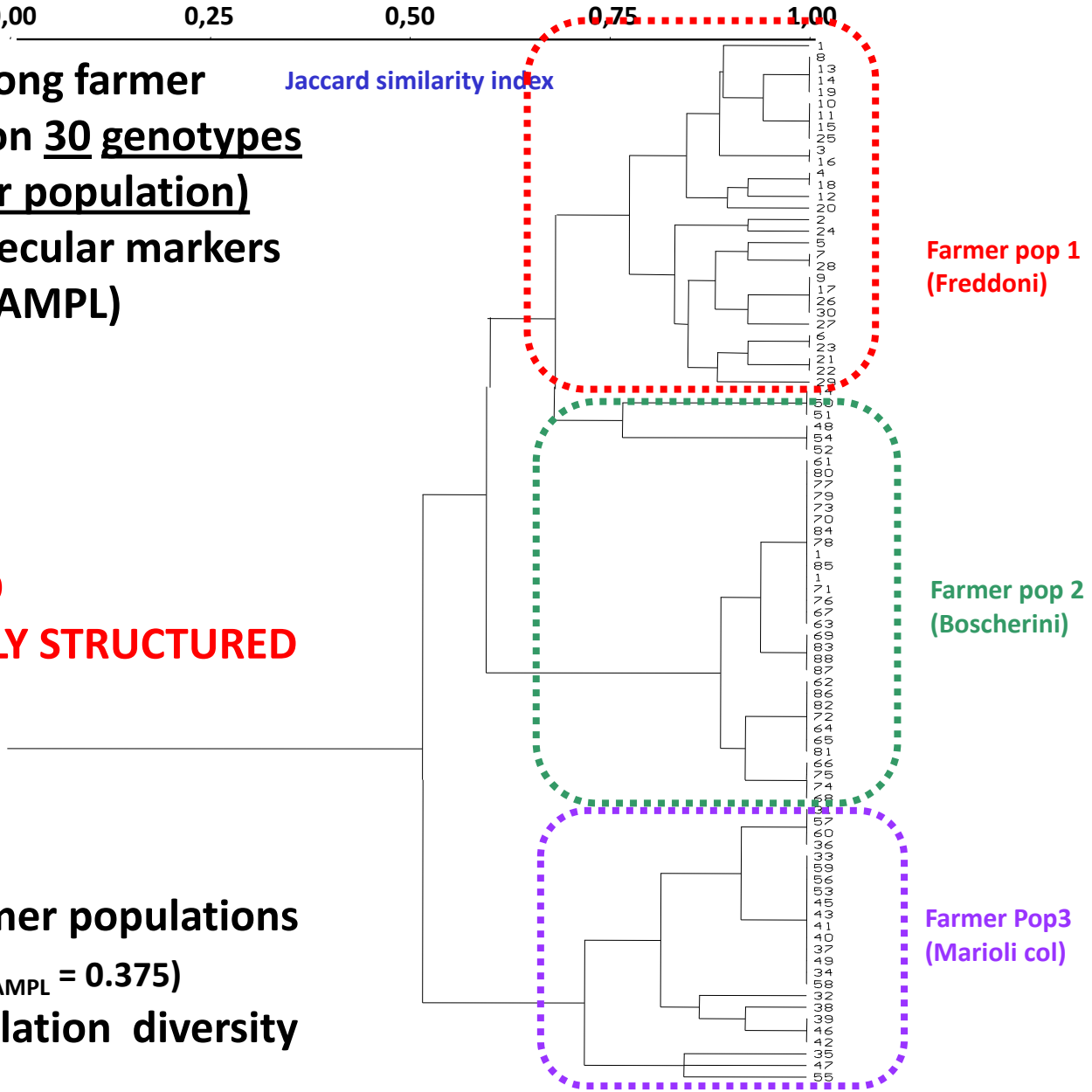
association among
61 populations
as revealed by molecular data
(5 AFLP primer combinations)

‘Fagiolina’ pops are distinguishable from other populations



‘Fagiolina’ LR of Trasimeno Lake: genetic characterization results

Association among farmer populations (based on 30 genotypes from single farmer population) as revealed by molecular markers (5AFLP+ 5SAMPL)



‘*Fagiolina*’ ALSO IS A GENETICALLY STRUCTURED LANDRACE

- **distinguishable farmer populations**
  ($G_{ST\ AFLP}$ = 0.557 and $G_{ST\ SAMPL}$ = 0.375)
- **within farmer population diversity**

CONCLUSIONS

LR (both morphological and molecular) characterization show that LRs have a:

- morphological and genetic identity;
- are distinguishable from other materials (LRs and CVs).

Thank you for attention