



# Grant scheme presentation EUROPEPLAND

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CREA**

**Research Centre for Vegetable and Ornamental Crops**

*EUROPEPLAND– Implementing a trans-EUROpean  
PEPper LANDrace collection for resilient agriculture*

*March 4, 2026, Meeting ECPGR WGC, Spain*



# The Project



The EUROPEPLAND Activity, submitted by the Solanaceae Working Group for funding under the First Call of the Phase XI ECPGR Activity Grant Scheme, was selected by the Executive Committee and approved in March 2024 - € 29 947.50

*1<sup>st</sup> September 2024 – 31<sup>st</sup> August 2026*

## Grant Scheme Activities

### Phase XI

- First Call (2023)**
- Implementing a trans-EUROpean PEPper LANDrace collection for resilient agriculture (EUROPEPLAND)

## Working Group activities and related events

### March 2024

The EUROPEPLAND Activity, submitted by the Solanaceae Working Group for funding under the First Call of the Phase XI ECPGR Activity Grant Scheme, was selected by the Executive Committee and approved in March 2024.

The screenshot shows the ECPGR website interface. At the top left is the ECPGR logo (European Cooperative Programme for Plant Genetic Resources). To the right are navigation buttons for AEGIS, EVA, EURISCO, and a search bar. Below the logo is a menu with links: HOME, ABOUT, WORKING GROUPS, MEETINGS, RESOURCES, GRANT SCHEME, and CONTACTS IN ECPGR. The main content area has a green header with 'EUROPEPLAND' and social media icons for Facebook, YouTube, and Email. Below the header is the breadcrumb: 'ECPGR Homepage / ECPGR Working Groups / ECPGR Solanaceae Working Group'. The main text area contains the title 'Implementing a trans-EUROpean PEPper LANDrace collection for resilient agriculture' and the text: 'The EUROPEPLAND Activity, submitted by the Solanaceae Working Group for funding under the First Call of the Phase XI ECPGR Activity Grant Scheme, was selected by the Executive Committee and approved in March 2024.' A list of documents includes 'Activity proposal (895.8 KB)'. On the right side, there is a box for 'ECPGR SOLANACEAE WORKING GROUP' with the subtext 'Solanaceae'.

### Implementing a trans-EUROpean PEPper LANDrace collection for resilient agriculture

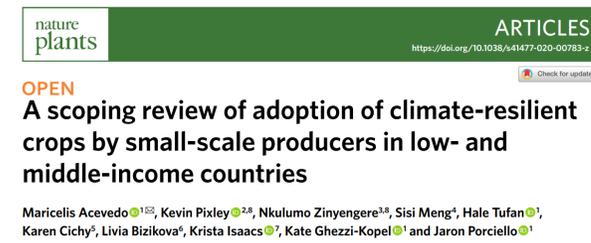
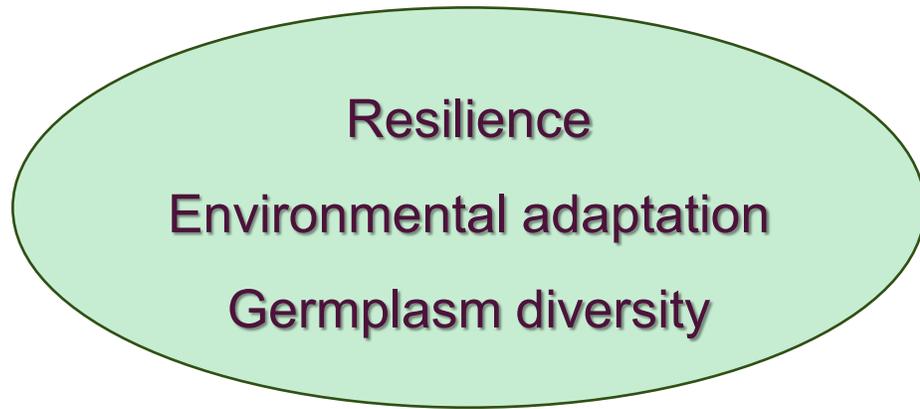
Activity Coordinator: Pasquale Tripodi

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- Activity proposal (895.8 KB)

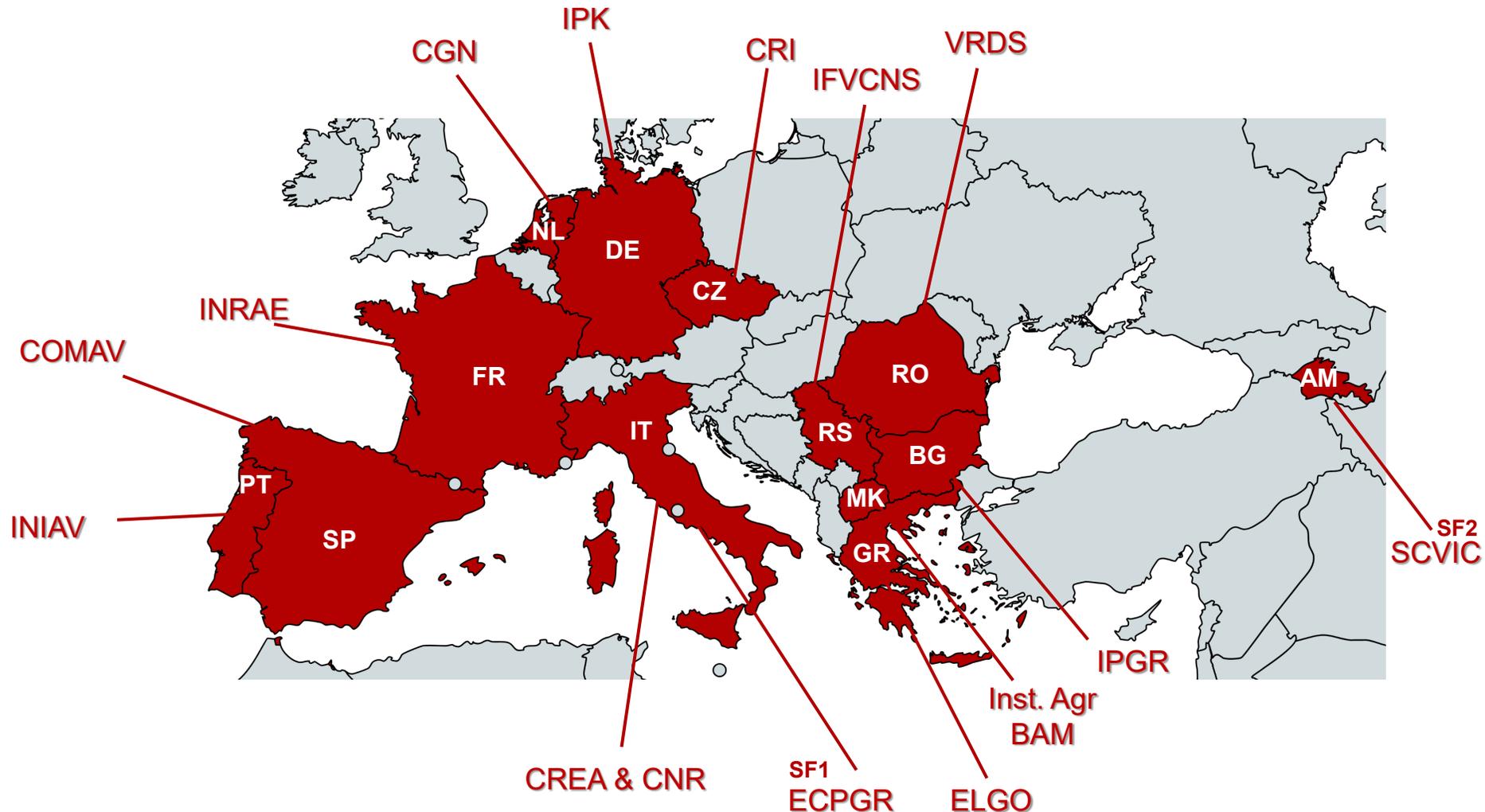
ECPGR SOLANACEAE WORKING GROUP  
Solanaceae

# Rationale



- Landraces represent a valuable resource for breeding cultivars better adapted to diverse environments and more resilient to climate change
- Mediterranean basin of Europe is a Centre of secondary diversification for pepper
- No availability of pepper core collection for European local varieties
- Need to implement genomics to existing passport data (Milner et al 2019 Nat Gen, Tripodi et al PNAS, 2021)

# The EuroPepland Network



*19 Partners, 13 Countries -Valorization of European genetic resources promoting their use for breeding purposes facilitating the use of pepper germplasm for sustainable use*

# Aim of the project

- ❑ **Establishment of a European Core Collection** Create a novel, representative collection of local pepper varieties to map and preserve European genetic diversity.
- ❑ **Genomic & Phenotypic Characterization:** Perform high-throughput genotyping using **Next-Generation Sequencing (NGS)** Assess agricultural traits using standardized crop phenotyping descriptors.
- ❑ **Data Integration & Open Access:** Strengthen the plant genetic resource information system by making data available through the **EURISCO** database and expanding the **EVA pepper** project.
- ❑ **Support for Sustainable Breeding:** Facilitate the identification of candidate genes to promote the use of pepper germplasm in developing sustainable crop varieties.
- ❑ **Conservation & Safety Duplication:** Establish a strategic safety duplication protocol across partner genebanks and integrate all germplasm into the **AEGIS** system.
- ❑ **Strategic Collaboration:** Foster synergy among ECPGR Solanaceae Working Group members to meet the priority targets of **ECPGR Phase XI**.

# Project Work Plan & Task Overview



## **Task 1: Core Collection Development (M1–M6)**

- Selection: Establish a representative collection of 400 individuals based on origin, fruit morphology, and flavor profiles (sweet vs. hot).
- Regeneration: Partners will regenerate seeds following phytosanitary standards.
- Conservation: Define a safety duplication strategy across European genebanks.

## **Task 2: Phenotyping & Genotyping (M6–M18)**

- Phenotyping: Use standardized EVA protocols to assess crop descriptors, bioactive compounds (flavor), and salt stress tolerance.
- Genotyping: Centralized DNA isolation and analysis using the 10 K pepper array (SGS Trait Genetics) for consistency with existing EVA data.

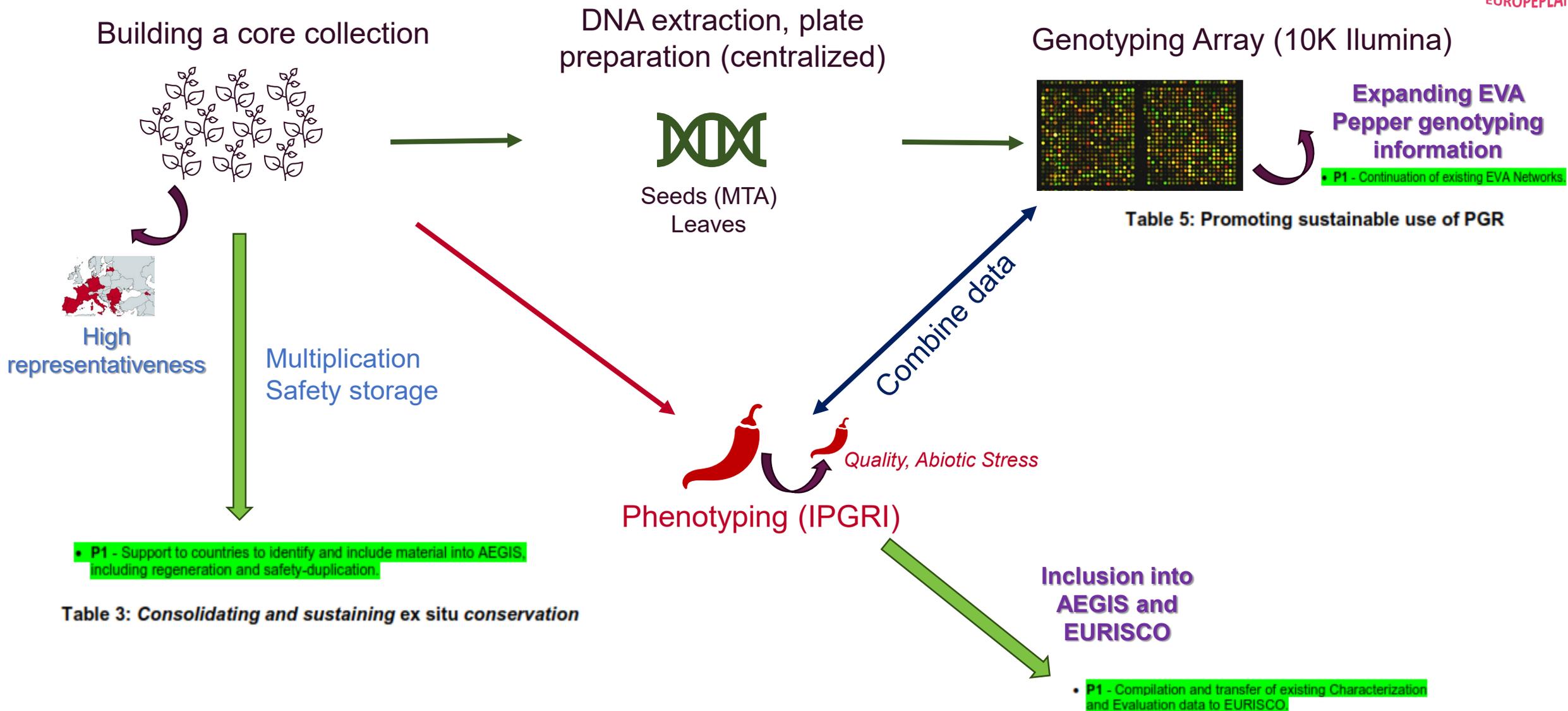
## **Task 3: Data Analysis & Integration (M19–M24)**

- Bioinformatics: Investigate genetic diversity, population structure, and identify candidate genes.
- Proof-of-Concept: Select top <10 accessions for advanced metabolic and abiotic stress trials.
- Open Data: Assign DOIs and upload results to EURISCO (phenotypic), Zenodo (genotypic), and AEGIS systems.

## **Task 4: Management & Dissemination (M1–M24)**

- Meetings: Conduct Kick-off, Interim, and Final virtual meetings.
- Outreach: Present findings at international conferences (e.g., EUCARPIA) and publish in peer-reviewed journals.
- Synergy: Feed materials and data directly into the EVA Pepper network for long-term exploitation.

# Diagram of project activities



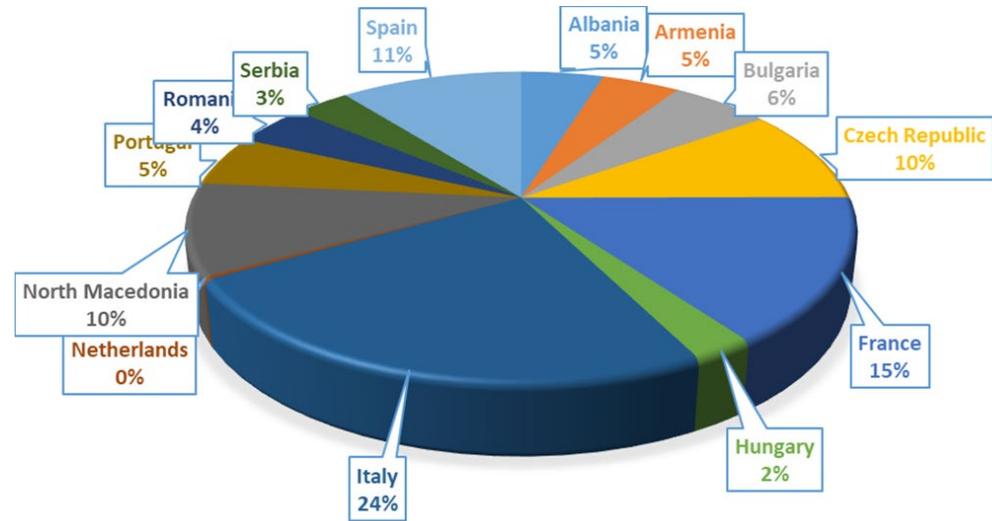
**Table 4: Strengthening a comprehensive information system for plant genetic resources for food and agriculture (Documentation)**

# Gantt chart of project proposal

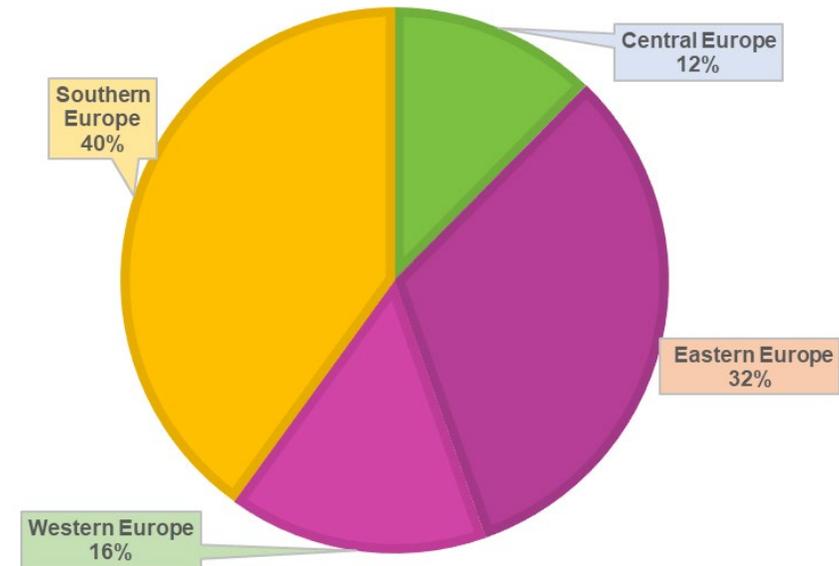
Task	Year	2024				2025												2026							
	Main activity/Month	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
<b>T1</b>	<b>Core collection establishment</b>	█	█	█	█	█	█																		
<b>T2</b>	<b>Seeds/Leaf exchange</b>						█	█																	
<b>T2</b>	<b>DNA extraction</b>								█	█	█	█													
<b>T2</b>	<b>Genotyping</b>												█	█	█	█									
<b>T2</b>	<b>Plant grown and phenotyping</b>							█	█	█	█	█	█	█	█										
<b>T3</b>	<b>Data integration/analysis</b>																█	█	█	█	█	█	█	█	
<b>T4</b>	<b>Meetings</b>	█	█																						



# Collection Establishment



Institute	N°
SCDL (Romania)	17
UPV (Spain)	30
FVCNS (Serbia)	13
BPGV (Portugal)	20
CNR (Italy)	90
CRI (Czech Republic)	38
CREA (Italy)	41
INRAE (France)	61
Faculty of Agric (N. Macedonia)*	38
IPK(Germany)	23
IPGR (Bulgaria)	20
CGN (Netherlands)	29
*seeds provided via CGN	



# Collection Data



Accession Name	Accession N°	Country	Location (Region or coordinates)	Biological status (if in EURISCO)	DOI
Papaccella	21-PT-41	Italy	Campania region		
Sigaretta	21-PT-163	Italy	Calabria region		
Peperone di Senise	22-PT-101	Italy	40°08'N 16°17'E		

Accession Name	Accession N°	Shape	Color at Maturity	Color at Immature stage	Fruit size	Pungency
Papaccella	21-PT-41	Round	Red	Medium Green	Large	Sweet
Sigaretta	21-PT-163	elongated	Red	Medium Green	Small	Pungent
Peperone di Senise	22-PT-101	conical	Red	Light green	Intermediate	Sweet

- ↑
- 1 Oblate
  - 2 Circular
  - 3 Cordate/heart-shape
  - 4 Blocky
  - 5 Rectangular
  - 6 Trapezoidal
  - 7 Conical
  - 8 Elongated
  - 9 Hornshaped

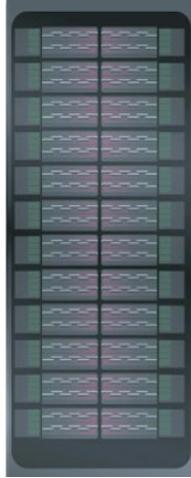
- ↑
- 1 White
  - 2 Lemon-yellow
  - 3 Pale orange-yellow
  - 4 Orange-yellow
  - 5 Pale orange
  - 6 Orange
  - 7 Light red
  - 8 Red
  - 9 Dark red
  - 10 Purple
  - 11 Brown
  - 12 Black

- ↑
- Before ripening*
- 1 White
  - 2 Cream
  - 3 Light Green
  - 4 Medium Green
  - 5 Dark Green
  - 6 Purple
  7. Other (e.g. orange)

- ↑
- 1 Large > 100 g
  - 2 Intermediate 20g – 100g
  - 3 Small < 20 g



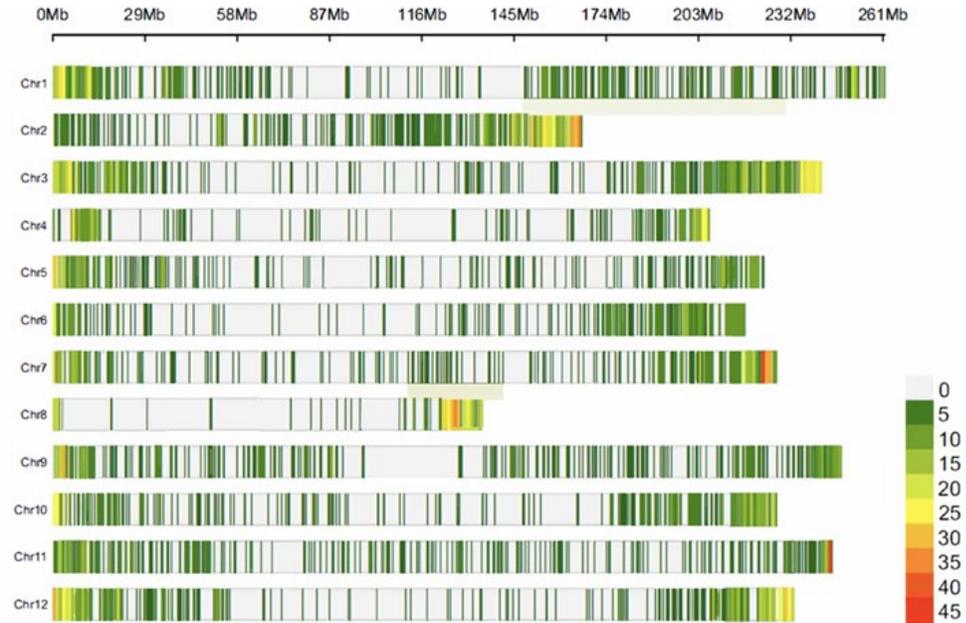
## 10K array SGS trait Genetics



**9,928 SNPs**  
genome wide  
distributed

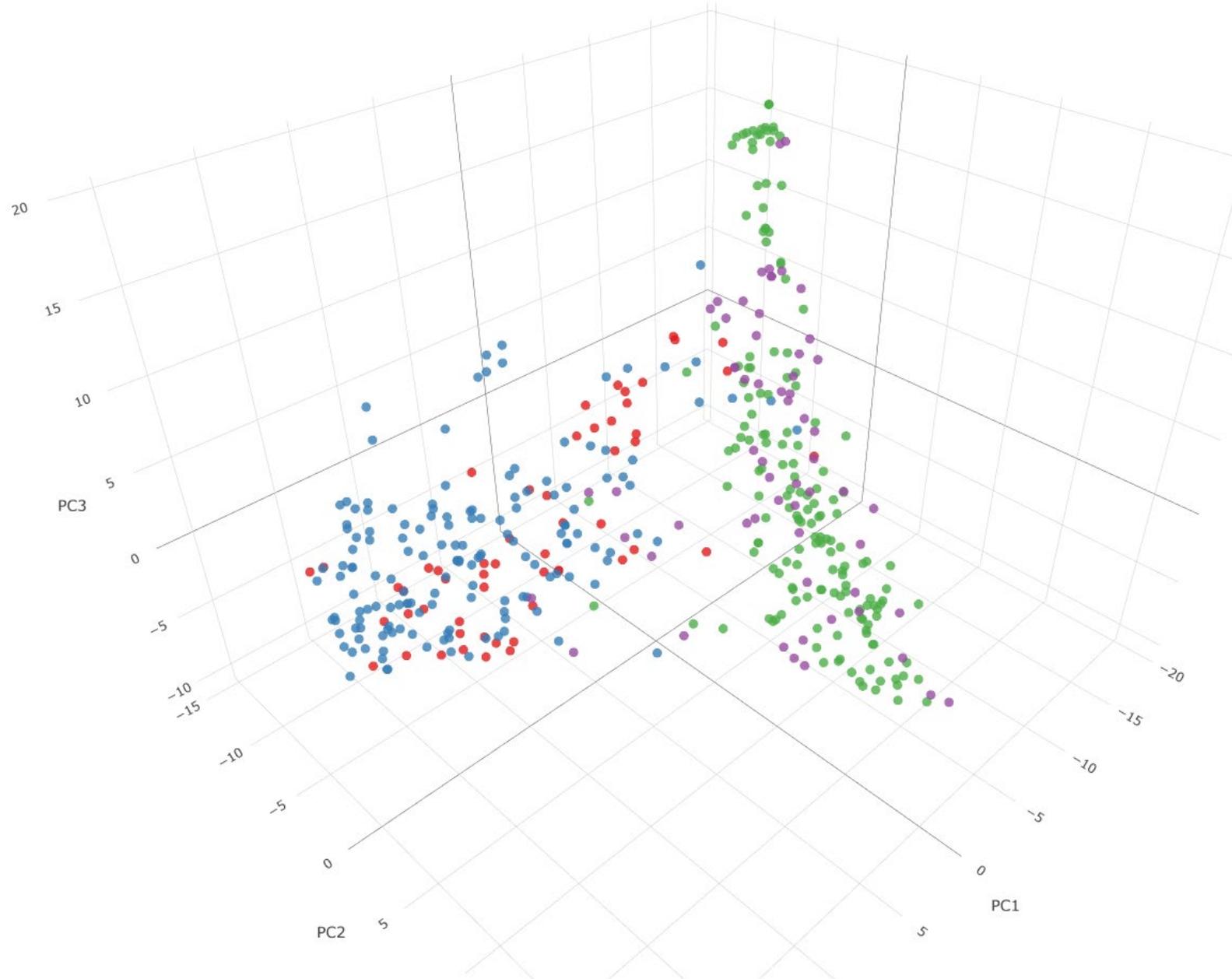


*Filtering with MAF 0.05 and max missing 0.9*



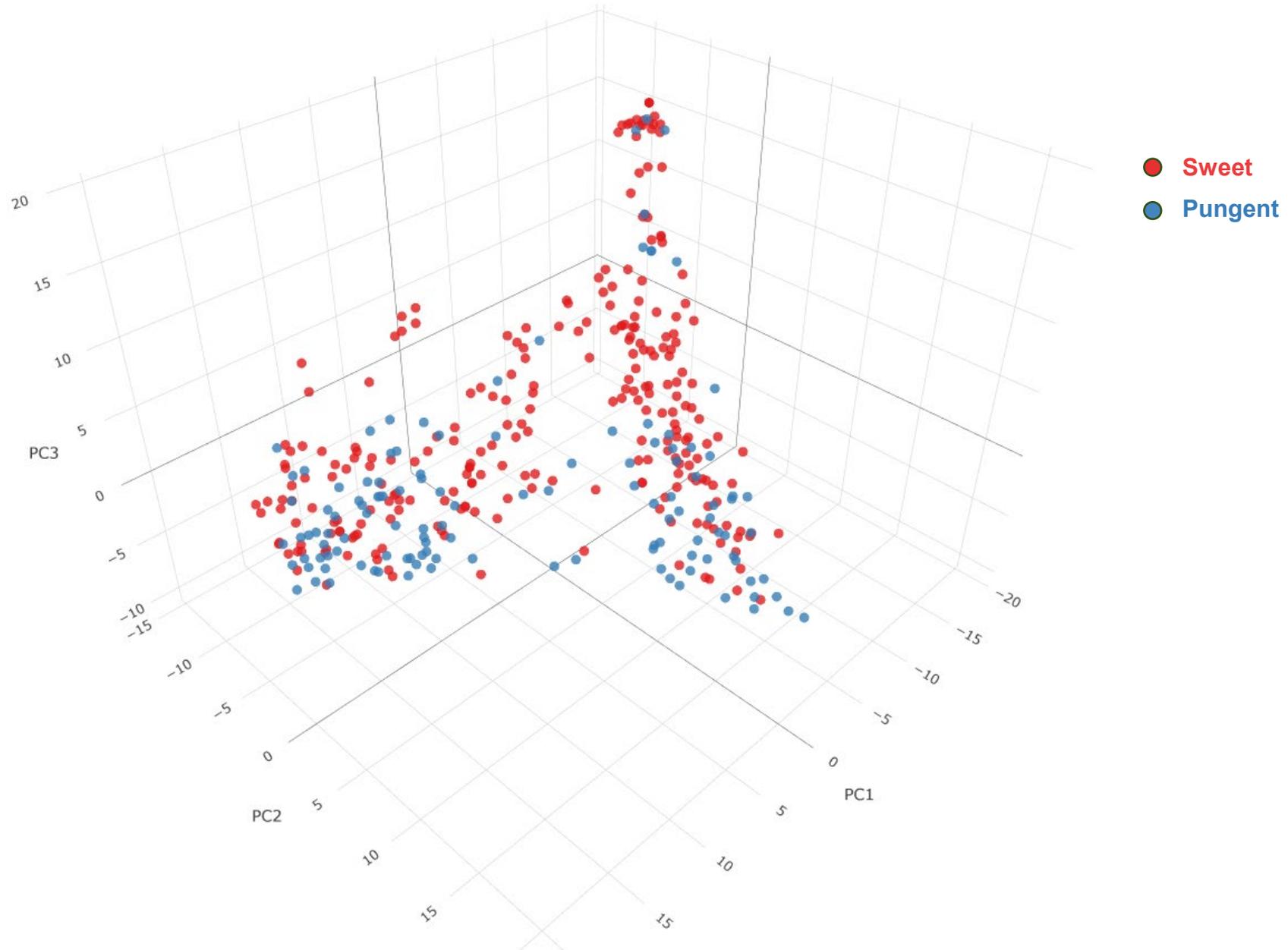
**7,246** SNP density plot/chromosome wise representing number of SNPs within 1 Mb window size. The horizontal axis shows the chromosome length (Mb); the different color depicts SNP density.

# Geographical distribution based on SNP data

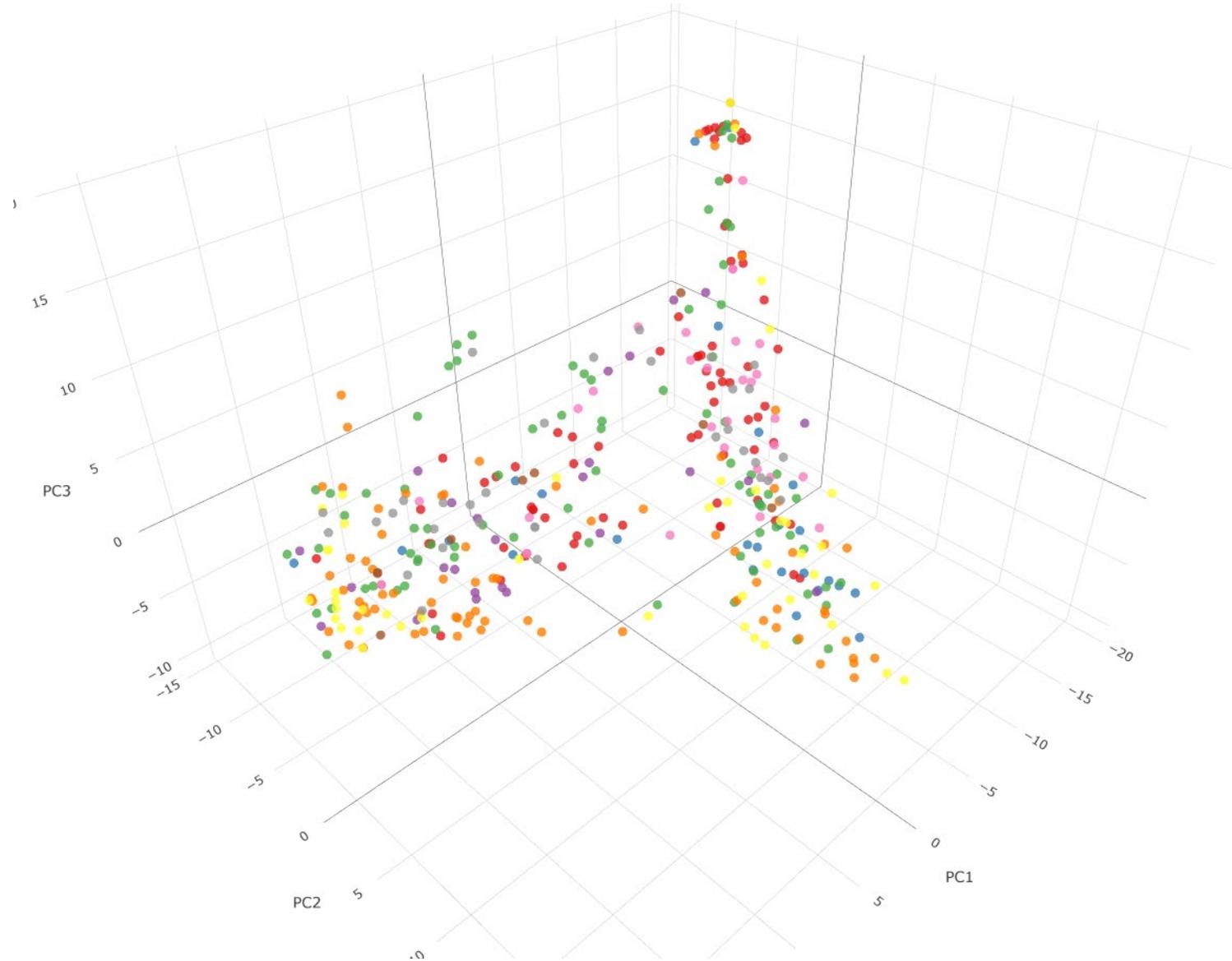


- Central and Eastern Europe
- Eastern Europe
- Southern Europe
- Western Europe

# Pungency-based distribution based on SNP data



# Shape distribution based on SNP data

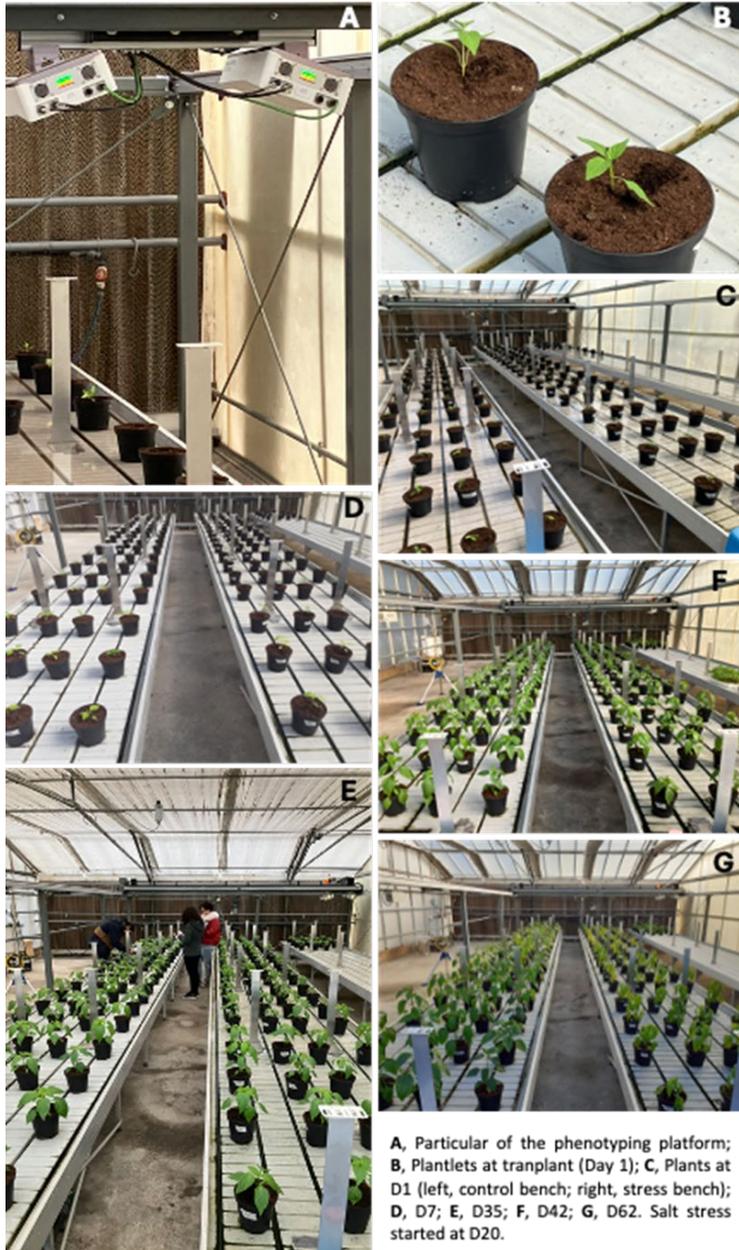


- Blocky
- Circular
- Conical
- Cordate/heart-shape
- Elongated
- Hornshaped
- Oblate
- Rectangular
- Trapezoidal

# Phenotyping experiment - salt



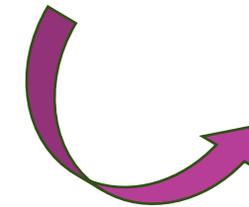
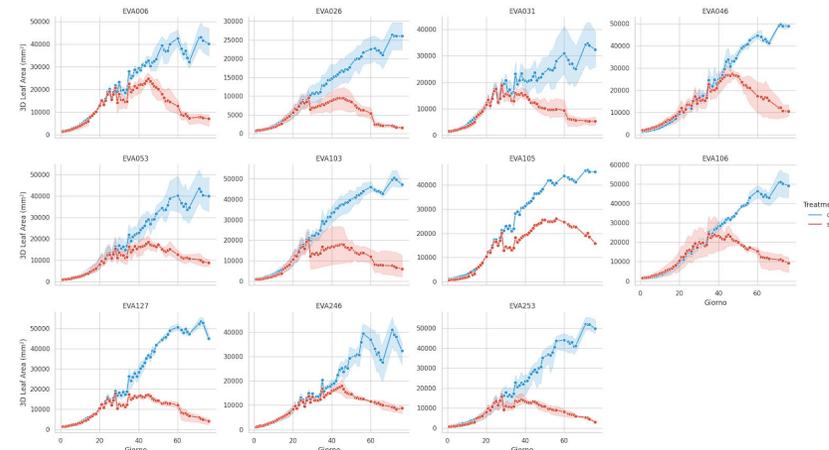
EUROPEPLAND



A, Particular of the phenotyping platform; B, Plantlets at transplant (Day 1); C, Plants at D1 (left, control bench; right, stress bench); D, D7; E, D35; F, D42; G, D62. Salt stress started at D20.



- ❑ Time horizon: 11 weeks (77 days, continuous monitoring)
- ❑ Genotypes = 11
- ❑ Conditions: Control and Salt Stress 150 nM
- ❑ 20 morpho-physiological parameters analyzed.
- ❑ 82,540 data points



Leaf sampled for biochemical analysis

## Conclusions & Future activities

- ❑ Established the "Europepland" collection, consisting of 397 European landrace accessions and later expanded to 440 genotypes through the inclusion of accessions from the EVA project.
- ❑ Generated a genotyping matrix consisting of 9,928 SNP markers, yielding a total of 149,272 polymorphic sites.
- ❑ Developed a multi-resource genetic panel to pinpoint novel candidate genes for enhanced quality and resilience.
- ❑ Conducted a phenotyping experiment to evaluate salt stress tolerance across 11 specific pepper genotypes.
- ❑ Further data analysis (Genomic STRUCTURE, Phylogenesis, Integration of phenotypic data, GWA, genomic regions under selection, etc)

# Link with other projects



# Thanks for your attention



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