

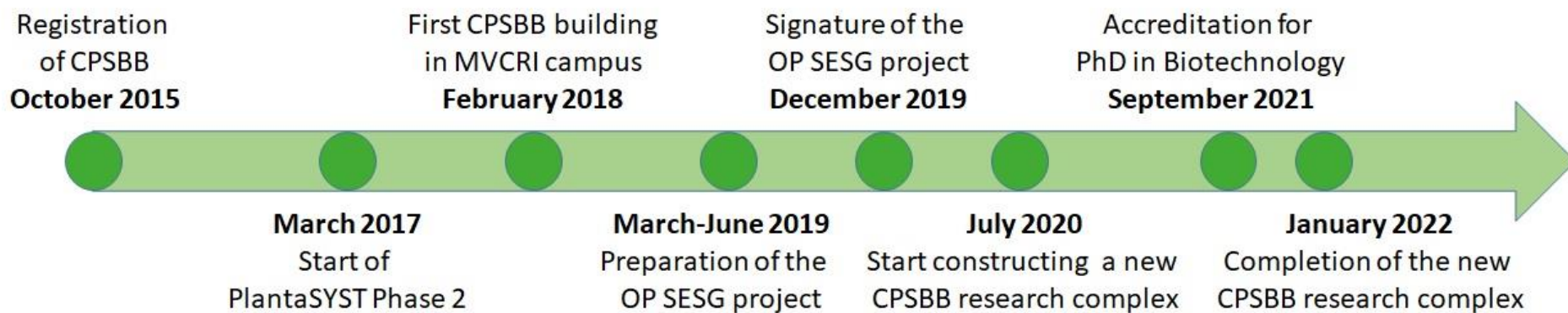
# Център по Растителна Системна Биология и Биотехнология (ЦРСББ)

## РЕГИОНАЛНА СРЕЩА „ОТ НАУКА КЪМ ИНОВАЦИИ“

ТУ Габрово, 15 юни 2023

Цанко Гечев

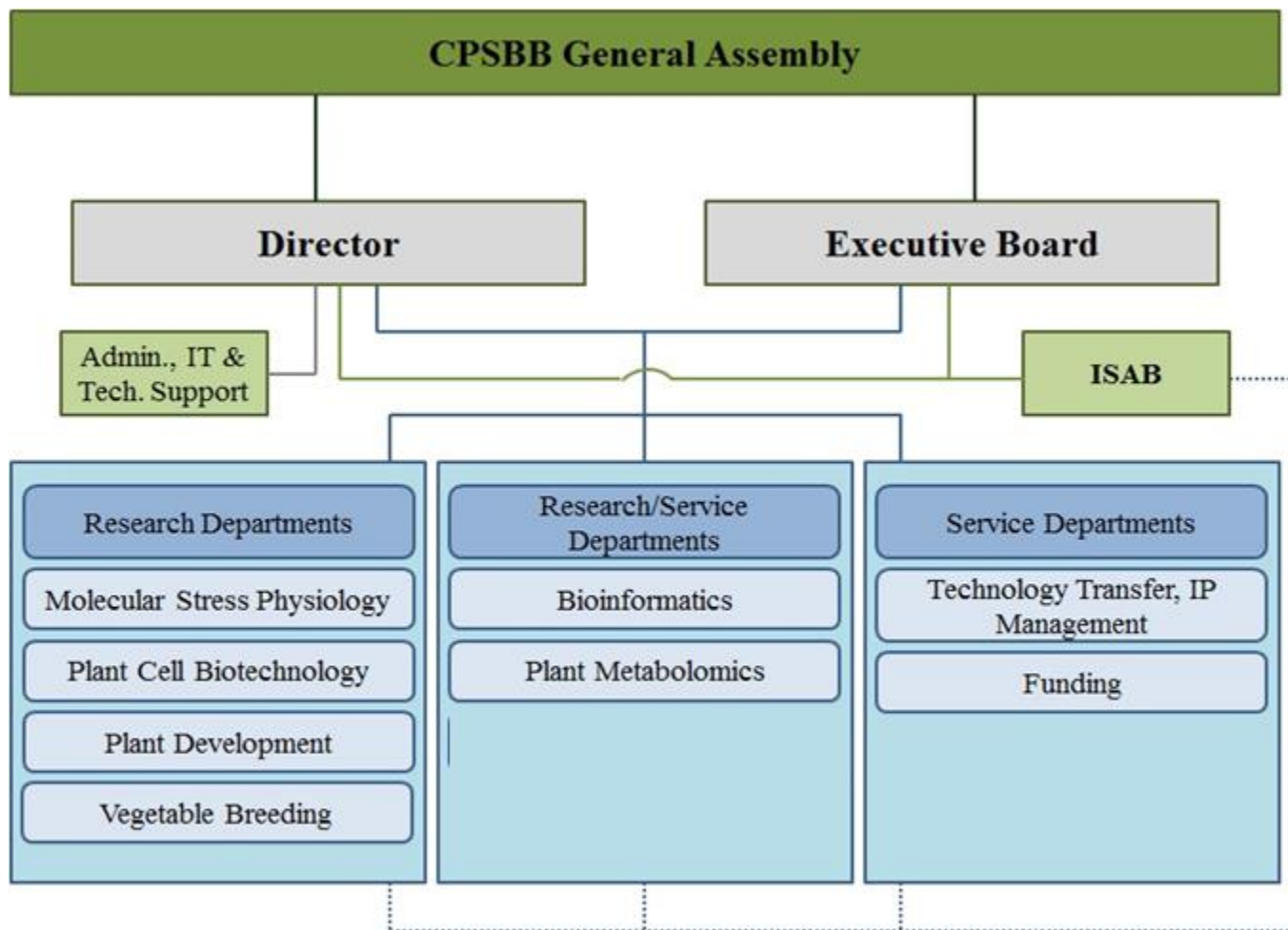
# Кратка история на ЦРСББ



## Стратегически цели на ЦРСББ:

- **Basic Science: Highest research quality and productivity** in the field of plant systems biology and biotechnology (high-impact publications, collaborative research projects)
- **Applied Science: New products for the European market** (tools and technologies for plant breeding, cultivars of vegetable crops with improved qualities, and plant-derived products with new pharmaceutical properties for medical applications).
- **Retaining and gaining the best specialists** in the fields of plant science, in coherence with the goal of the Bulgarian S3 to secure skilled labour, as well as attraction of excellent foreign researchers.
- **Services** (metabolomics, bioinformatics)
- **Link between the academia and industry**

# Структура на ЦРСББ



## Инфраструктура на ЦРСББ





# Infrastructure of CPSBB







## Примери за научна дейност

**Bioinformatics and Mathematical Modelling:** Sequencing and analysis of plant genomes, GWAS, RNA-seq, integration of large transcriptomic and metabolomic datasets. Providing services to other CPSBB departments and external organizations.

**Molecular Stress Physiology:** Analysis of the physiological and metabolic responses of plants, including vegetable crops, to various stresses and how the knowledge gained from these studies can be employed to enhance stress tolerance.

**Plant Cell Biotechnology:** Understanding of plant biochemical machinery and development of new means for sustainable of mass bioproduction of value-added plant-derived metabolites (“green factories” concept) using bioreactors.

**Plant Development:** Analysis of genes and proteins (transcription factors) and their regulatory networks to unravel the crosstalk between developmental, hormonal and stress-related signalling pathways.

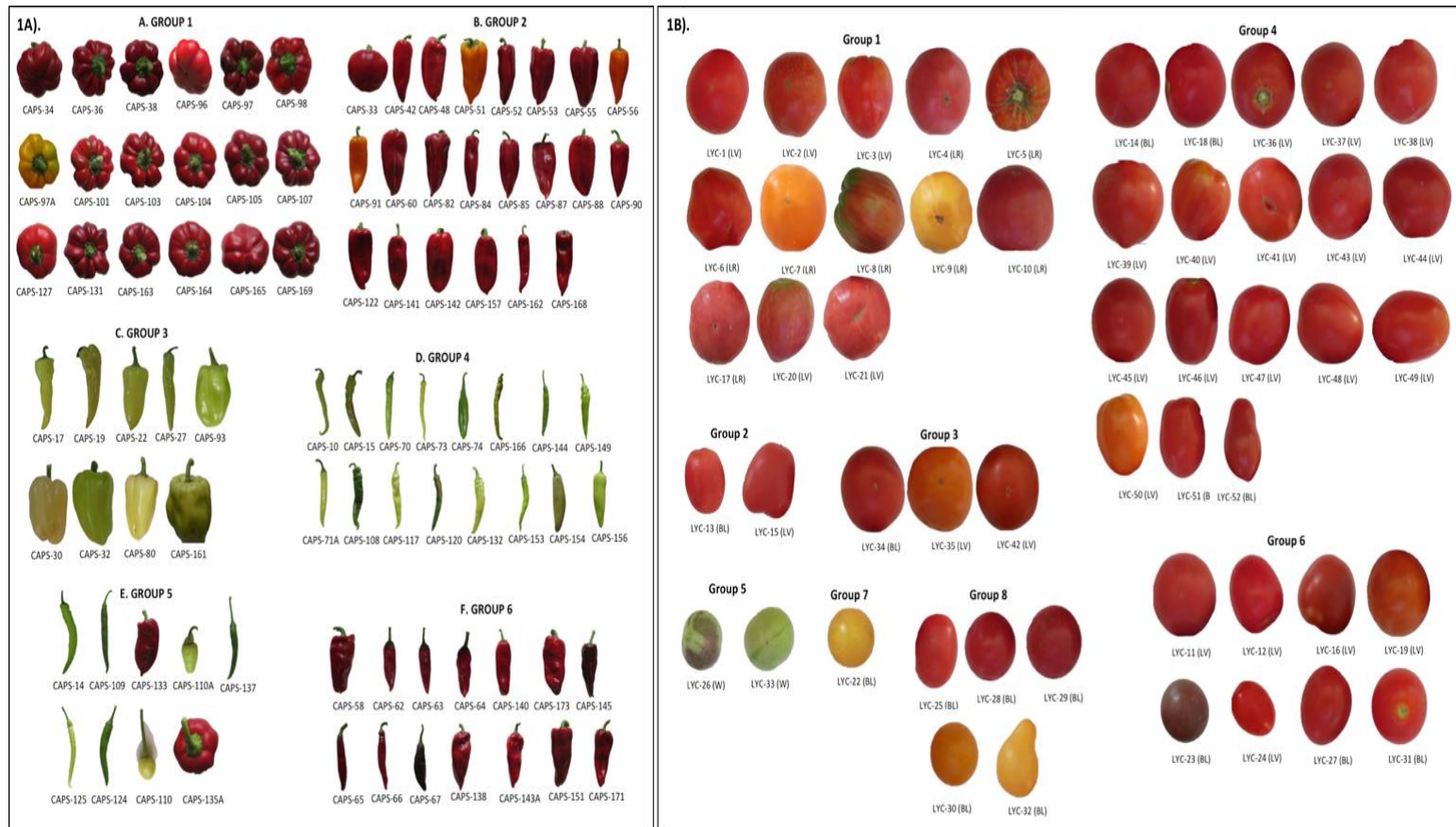
**Plant Metabolomics:** Unravelling the metabolic profiles and pathways and their regulatory control in harvestable organs (e.g., fruits) of vegetable crops. Studying nutritious compounds (vitamins, antioxidants) which promote human health.

**Vegetable Breeding:** Assessing valuable vegetable germplasm for resistance to stresses. Genetic investigations to establish the type of resistance etc. Creation of breeding lines, F<sub>1</sub> hybrids and direct varieties with valuable traits.



# Приложна наука

GWAS analysis of genes determining abiotic stress tolerance, disease resistance, fruit shape, size, and color in pepper and tomato



Phenotypic variability of pepper and tomato collections

# Сортове и линии пипер и домати на разположение на ЦРСББ

pepper



tomato



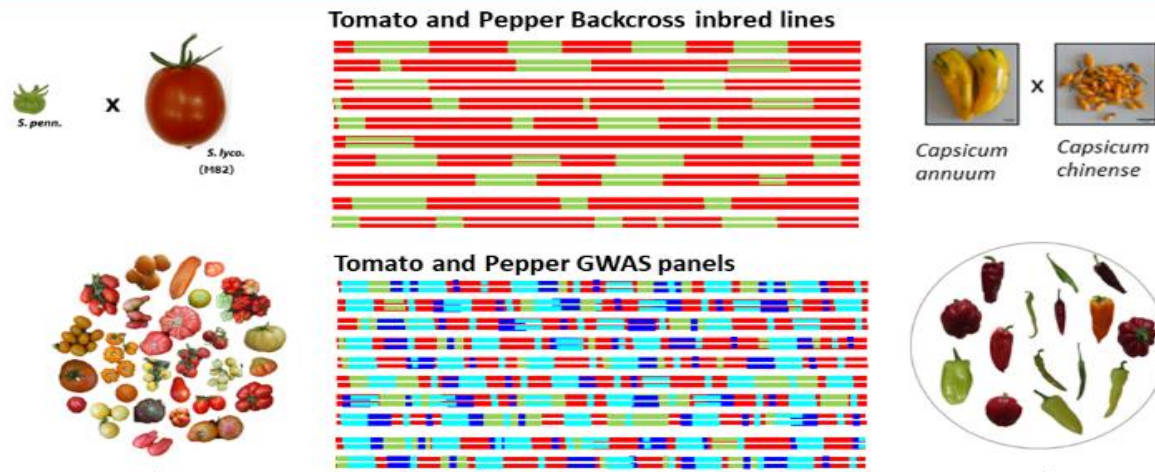
Group	Vitamin·C·(mg/100g·FW)		
	Minimum	Average	Maximum
Pungent	105.8	250.7	356.3
Green	110.4	199.5	325.9
Kapia	141.4	203.2	331.0
Pumpkin	110.7	202.6	286.3
For powder	143.0	218.9	255.2

Group	Vitamin·C·(mg/100g·FW)		
	minimum	average	maximum
Very small	8.3	32.1	59.6
Small	16.7	33.7	45.8
Medium	14.5	25.9	45.4
Big	12.9	24.9	38.9
Very big	12.0	24.0	34.6



# Технология за идентифициране на гени от интерес

Genetic Resources

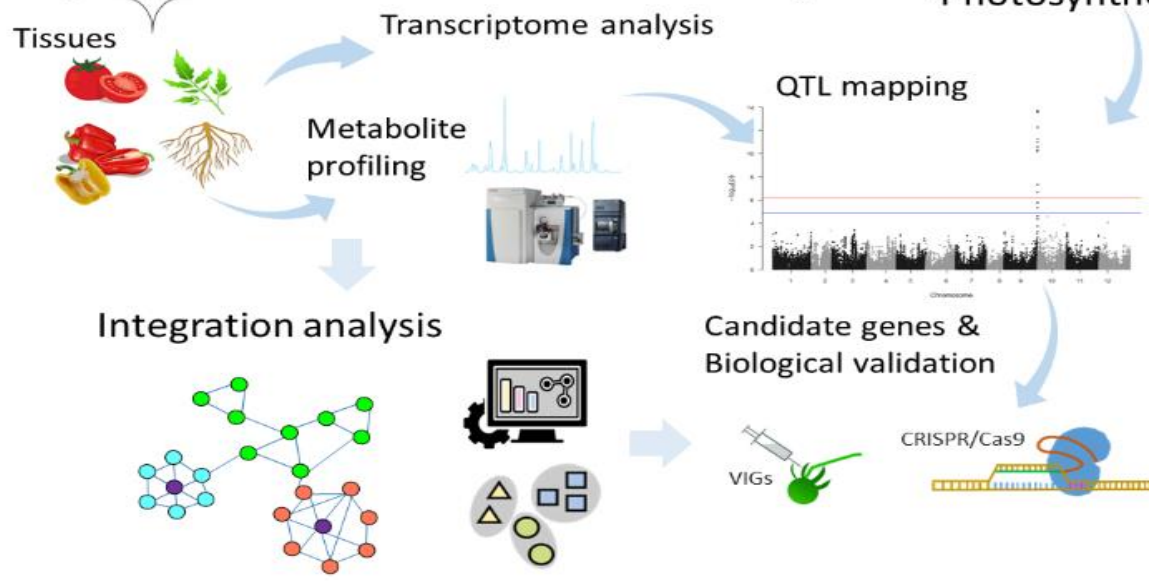


Data a Production

Phenotyping under different environmental conditions



Integration & Validation



# Нови сортове, регистрирани от ЦРСББ



Дара



Розово сияние



Мини мис



Сълзица



## Нови сортове, въведени от ЦРСББ

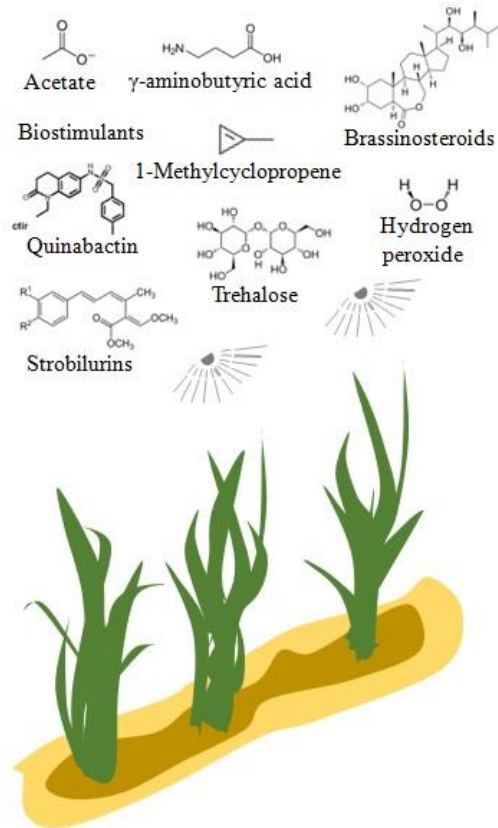


Балтовска Капия

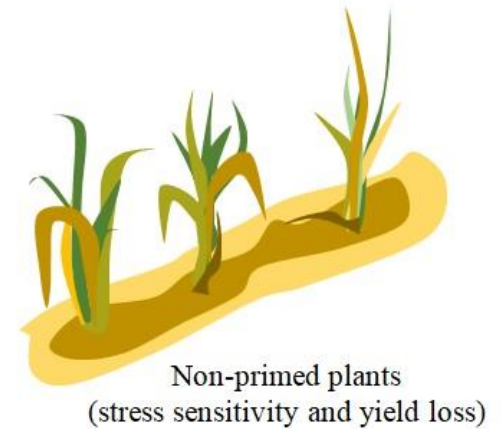
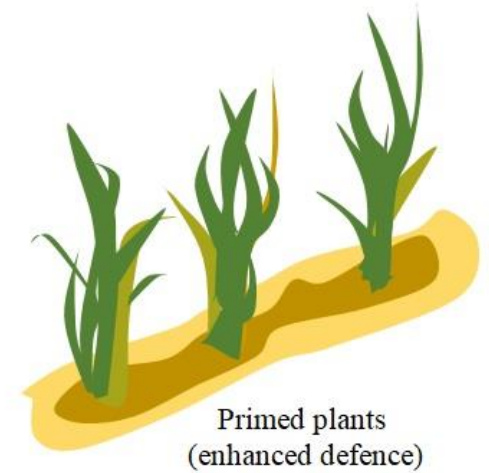
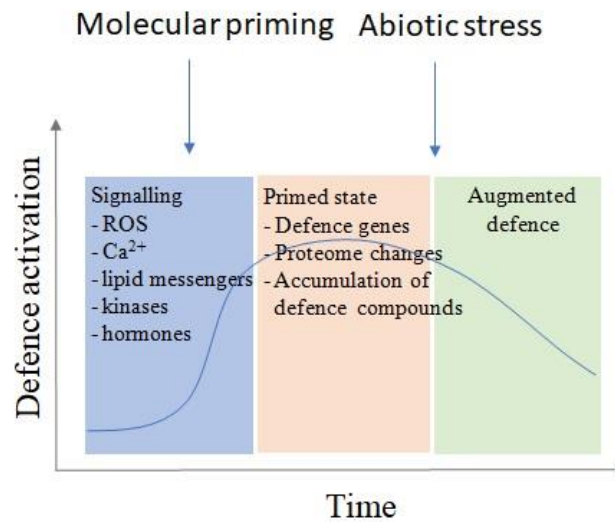


Руевит

# Молекулен прайминг за предпазване от стрес

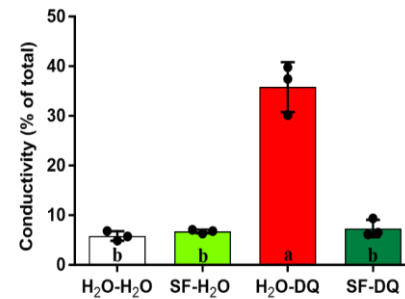
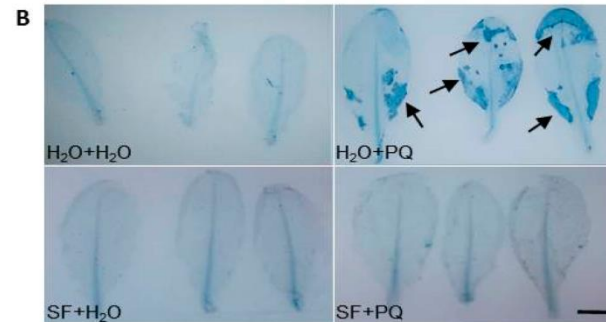
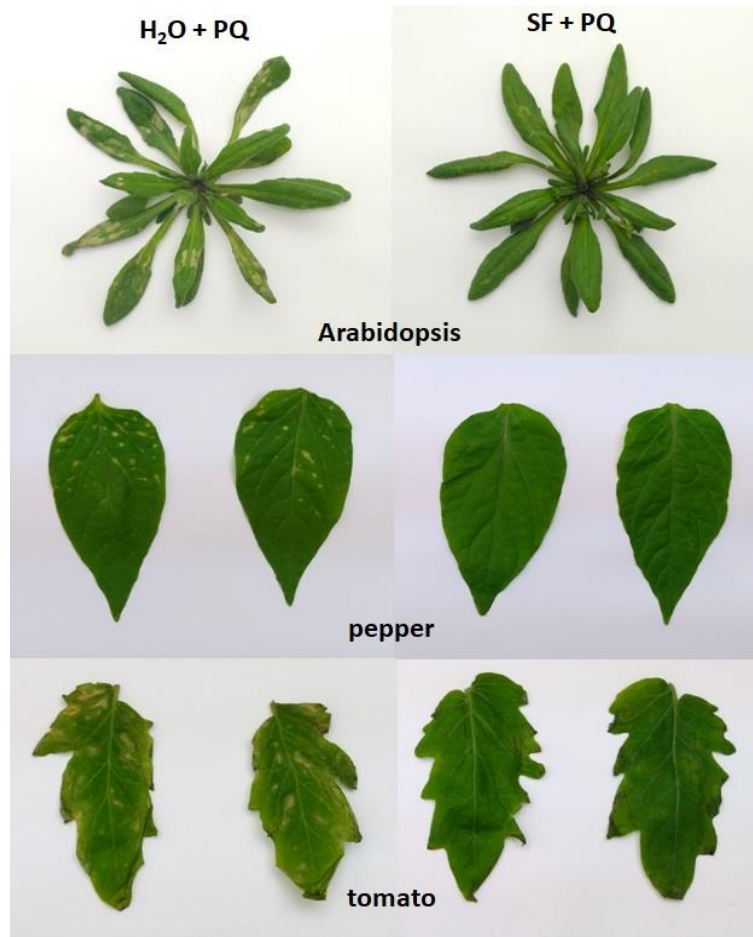


## Molecular priming



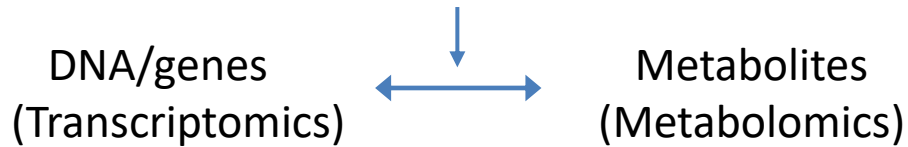
# Молекулен прайминг за предпазване от стрес

SuperFifty<sup>®</sup> protects *A. thaliana*, pepper, and tomato from oxidative stress



# Молекулен прайминг за предпазване от стрес

## Plant 'Omics technologies'



## Transcriptomics & Bioinformatics

- RNA-seq using NGS
- Differential gene expression analysis (DGE)



Unstressed

Drought stress

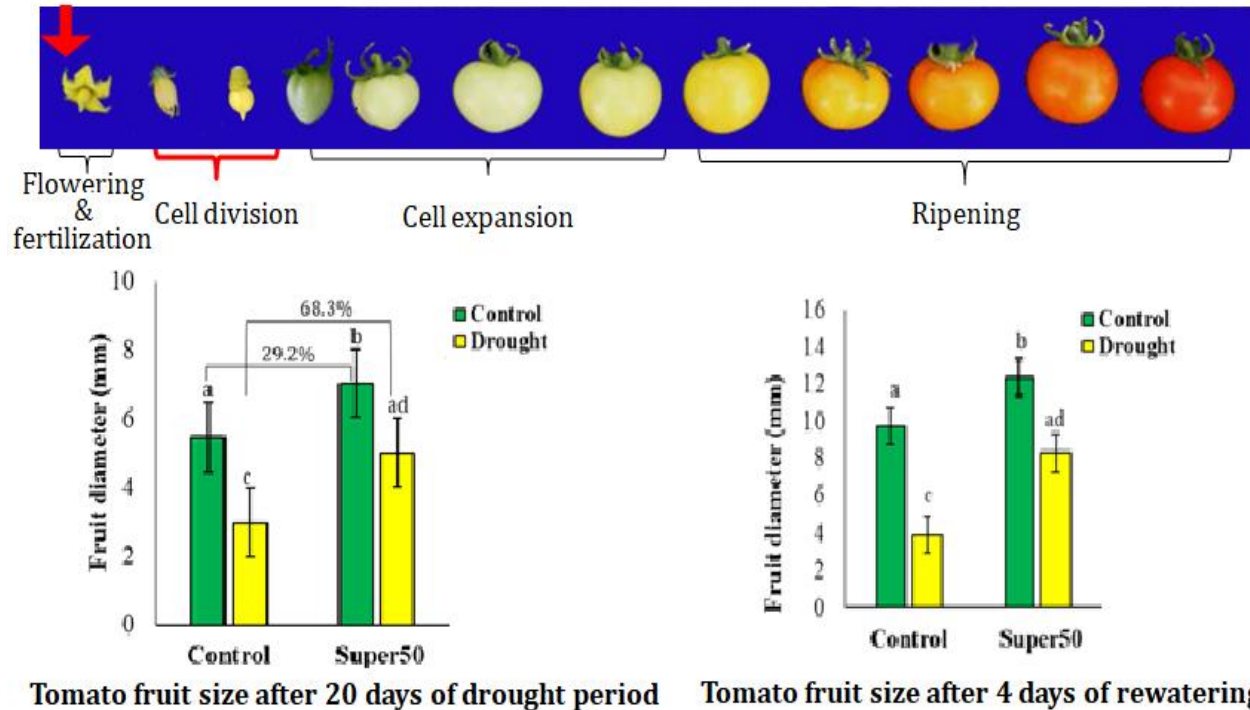
Primed+drought

Sampling dates	Differential gene expression (Treatment comparison)			No. of genes modulated $\log_2FC \geq 1$ ; $FDR \leq 0.001$			Process
				Total	Up	Down	
7 days after drought	Stressed	Vs	Untreated	3038	1370	1668	Stress
	SF Primed + stressed	Vs	Stressed	164	135	29	Tolerance













# Department Molecular Stress Physiology

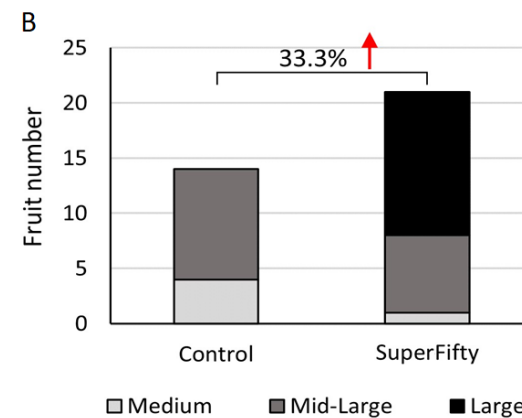
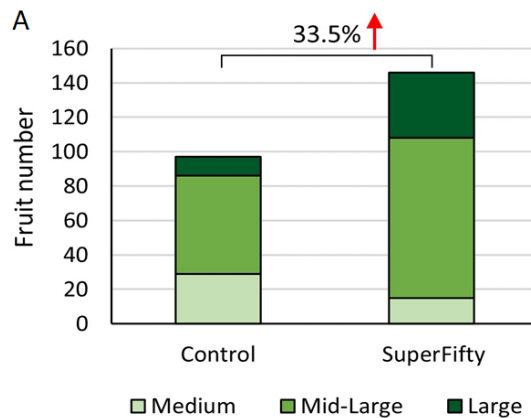
## Molecular priming protects tomato from drought stress and increases fruit size



**Molecular priming by SuperFifty increases fruit size and protects from drought**

# Повишаване на добивите при зеленчукови култури

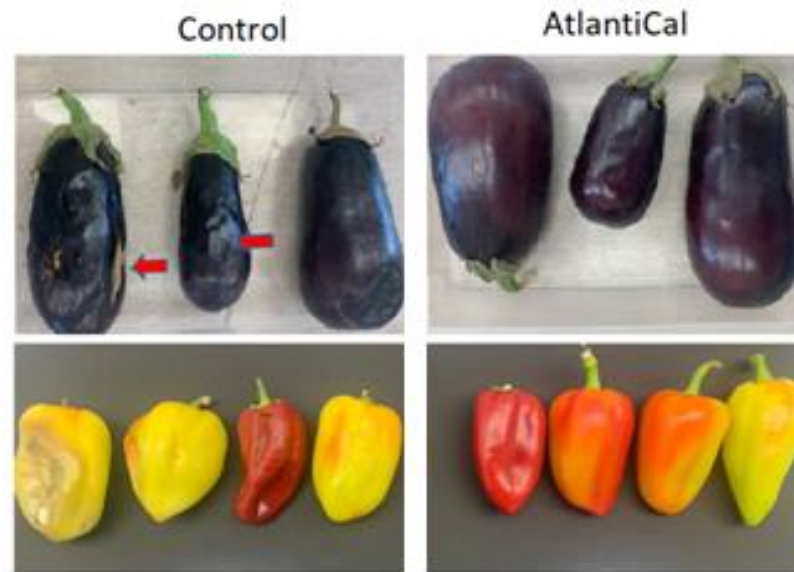
	Flowering & fertilization		Cell division	Cell expansion	Fruit ripening
Egg plant					
Pepper					
	First SFP spray	Second SFP spray	Measure fruit diameter Count total number of fruits Harvest samples for multi-omics	Measure fruit diameter Count total number of fruits Harvest samples for multi-omics	Final harvest Measure fruit diameter Count total number of fruits Harvest samples for multi-omics



**SuperFifty increases yield and improves markeable grade in eggplant (A) and pepper (B).**

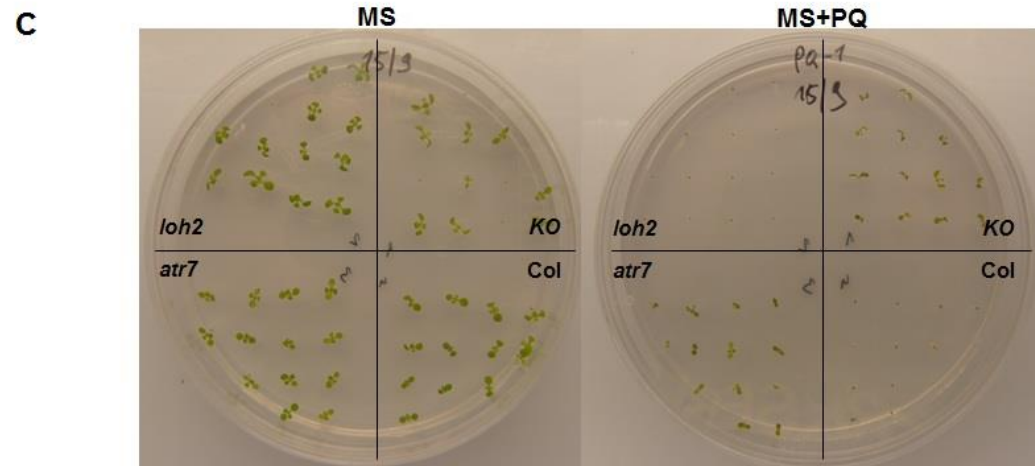
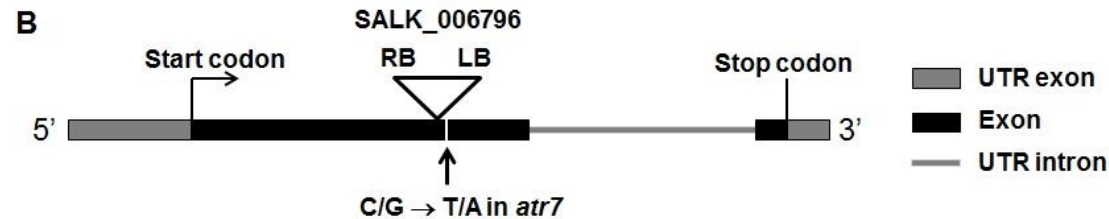
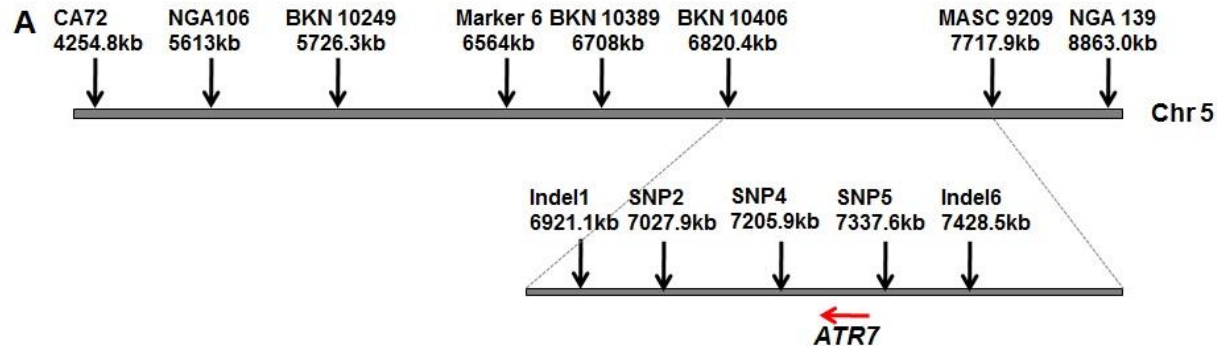
# Удължаване трайността на плодове и зеленчуци

Technology applicable to berry crops (e.g. raspberries, strawberries) and vegetable crops (eggplants, pepper, tomatoes)



# Идентифициране на гени, влияещи на стресустойчивостта

Identification of a new flowering plant specific gene, *ATR7*, with roles in stress responses

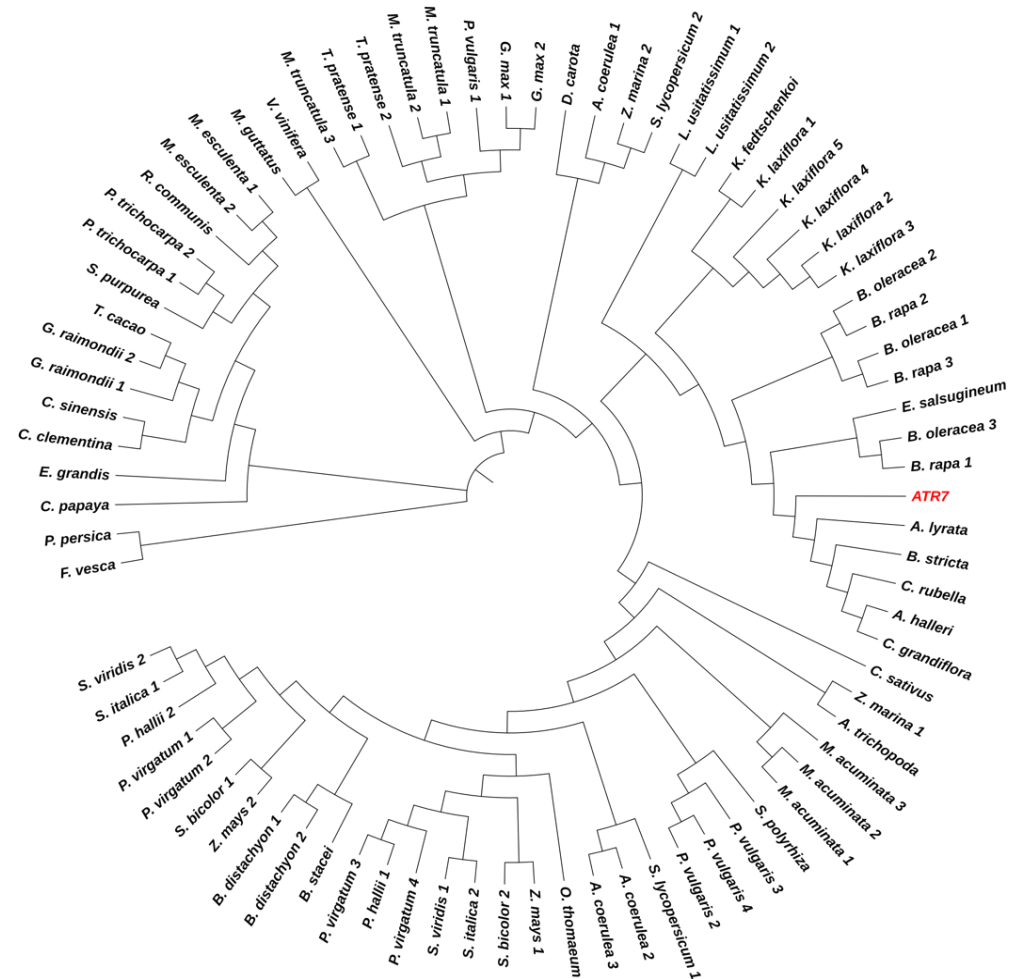
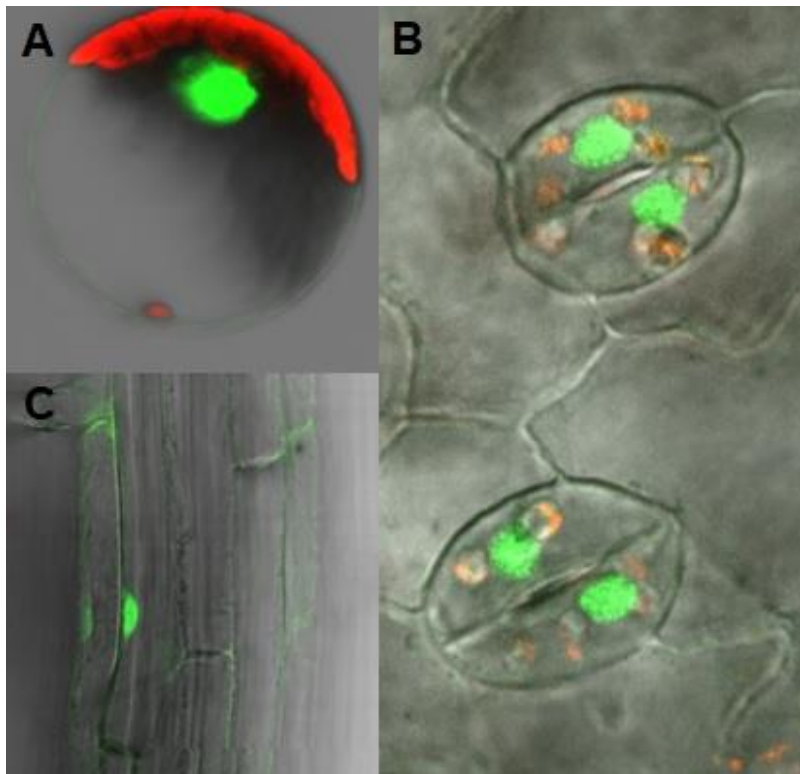




## Идентифициране на гени, влияещи на стресоустойчивостта

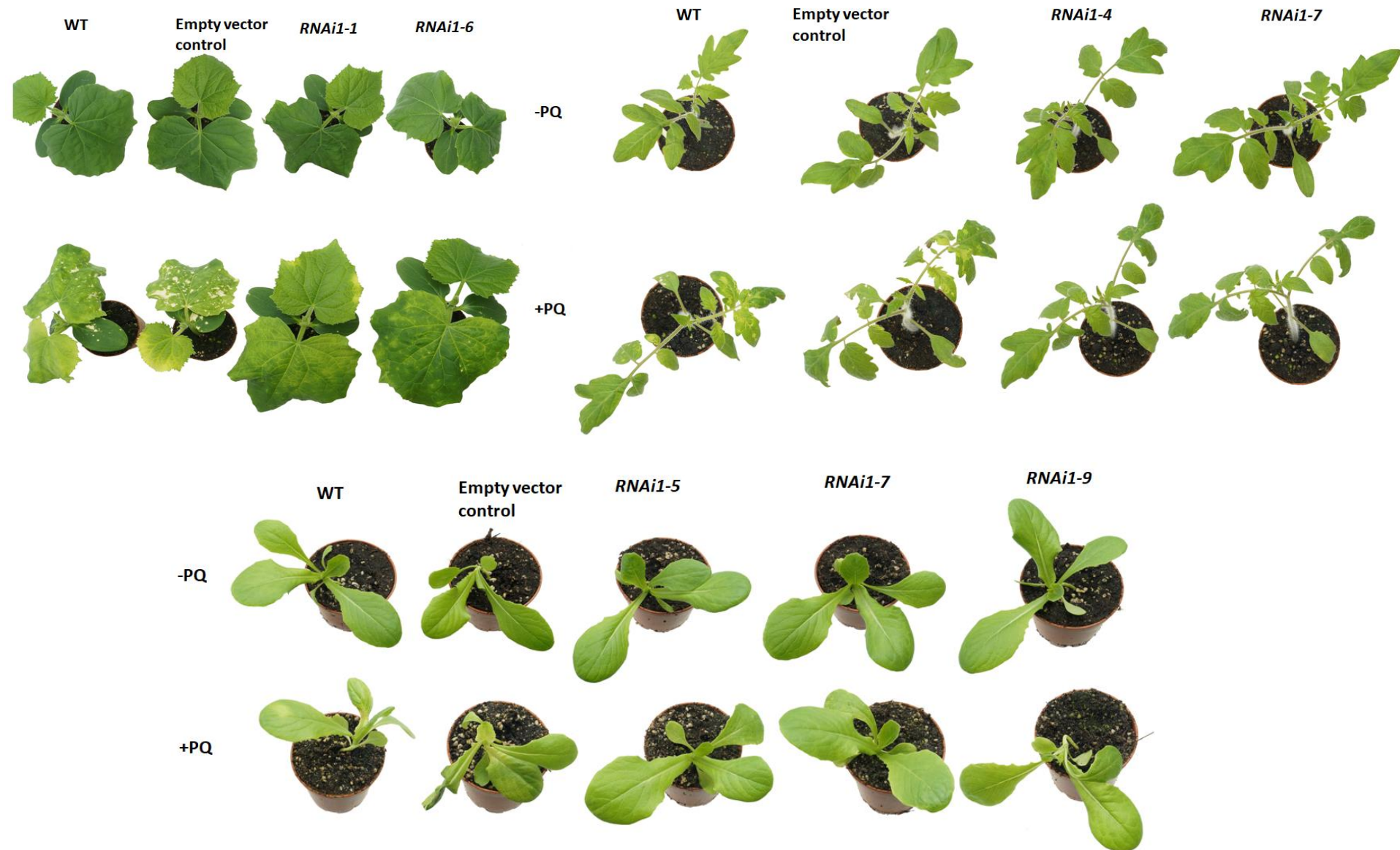
## Nuclear localization of ATR7

homologs in flowering plants



# Идентифициране на гени, влияещи на стресустойчивостта

ATR7 functions in a similar manner in crops (cucumber, lettuce, tomato)



## Проекти на ЦРСББ

<b>Project title/acronym</b>	<b>Funding body</b>	<b>Duration</b>	<b>Role of CPSBB</b>
PlantaSYST	Horizon 2020	2017 - 2025	Coordinator
BG05M2OP001-1.003-0001-C01	OP SESG	2019 - 2023	Coordinator
RESIST	Horizon 2020	2019 - 2024	Coordinator
ScienceAgainstInfodemic	ACF	2021 - 2023	Beneficiary
AgroDigiRise	Horizon Europe	2022 - 2025	Beneficiary
CAFTA	NSF of Bulgaria	2022 - 2027	Coordinator
K-TRIO	Horizon Europe	2023 - 2024	Beneficiary
CropPrime	Horizon Europe	2023 - 2027	Beneficiary
NatGenCrop	Horizon Europe	2023 - 2027	Coordinator
Motivation	NSF of Bulgaria	2023 - 2025	Coordinator
AbioStressTolerance	NSF of Bulgaria	2023 - 2025	Coordonator
EpiFlowScen	NSF of Bulgaria	2023 - 2025	Coordinator
ChARomics	NSF of Bulgaria	2023 - 2025	Coordonator
PlantMetals	NSF of Bulgaria	2022 - 2024	Coordonator
BenBedPhar	NSF of Bulgaria	2023 - 2025	Coordonator
BOOSTER	Horizon Europe	2023 - 2028	Beneficiary
BELIS	Horizon Europe	2023 - 2028	Beneficiary
BG-175467353	NSF of Bulgaria	2023	Coordinator
HelthyDiets4Africa	Horizon Europe	2023 - 2029	Beneficiary

# Сътрудничество с академични организации и с бизнеса

**Сътрудничество с университети и изследователски организации в Пловдив**

**Пловдивски Университет (метаболомен анализ)**

**Аграрен Университет (съвместен проект)**

**Медицински Университет (метаболомен анализ)**

**Институт по зеленчукови култури Марица (съвместни проекти)**

**Сътрудничество с фирми:**

**Arhea.Bio (Белгия) (съвместен проект)**

**BetterSeeds (Израел) (съвместни изследвания)**

**BGI (Китай) (съвместни изследвания)**

**BioAtlantis (Ирландия) (съвместни проекти)**

**Biovet (България) (договор )**

**Ondo Solutions (България) (съвместен проект)**

**Opora Zaden (България) (съвместни изследвания)**



# Благодарности:

ОП НОИР

Европейска Комисия (Хоризонт 2020)

ИЗК Марица

Община Пловдив

ФНИ

Партньорски организации:

PlantaSYST (6)

RESIST (6)

AgroDigiRise (12)

CropPrime (8)

BOOSTER (10)

PlantMetals (40)

BELIS (24)

HD4A (21)

# ICPSBB 2023, Пловдив, ЦРСББ, 25-27.09.2023



## 2ND INTERNATIONAL CONFERENCE ON PLANT SYSTEMS BIOLOGY AND BIOTECHNOLOGY (ICPSBB)

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## VENUE

### Center of Plant Systems Biology and Biotechnology

The venue of ICPSBB 2023 is the Center of Plant Systems Biology and Biotechnology (CPSBB) Plovdiv, Bulgaria. CPSBB is a new plant institute with the aim to perform world class fundamental and applied research in the fields of plant systems biology and biotechnology. The new research complex of CPSBB was awarded the prize "Building of the year 2022" in Bulgaria.

