



ACCADEMIA DEI GEORGOFILI

“Il cloroplasto e la ricerca biologica per la produzione di cibo ed energia”

Sviluppo del cromoplasto e caratteristiche organolettiche del frutto in *Solanum* *Lycopersicum*

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Università di Verona

Dipartimento di Biotecnologie

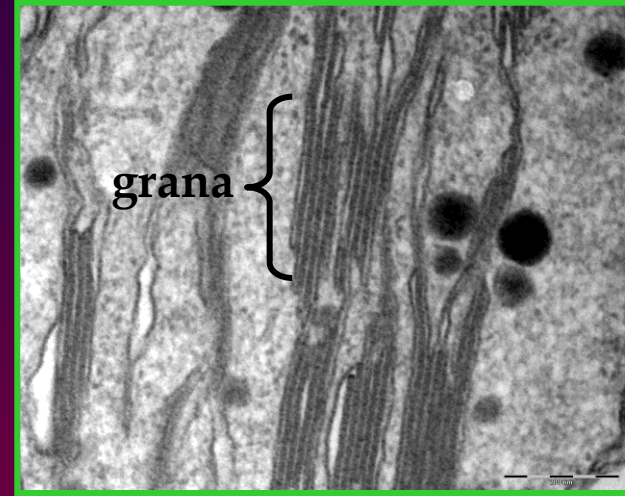
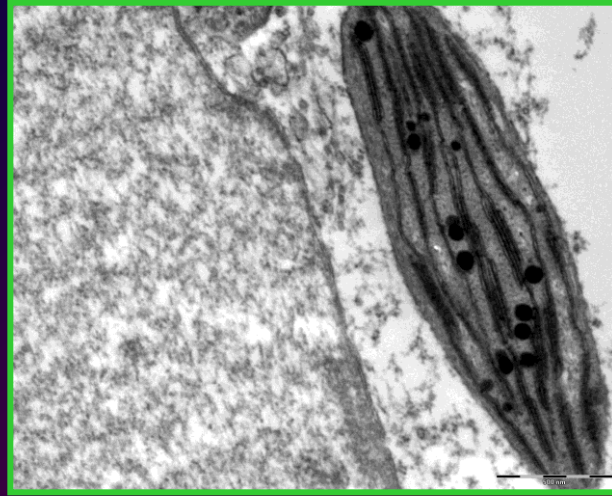
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Analysis of chloroplast-chromoplast transition by a proteomic and physiologic approach

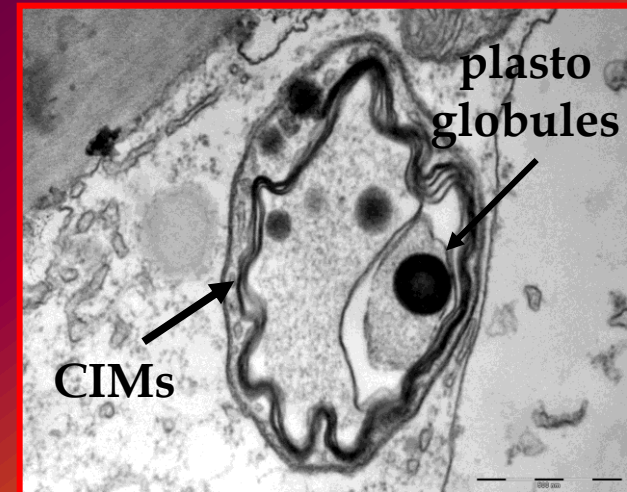
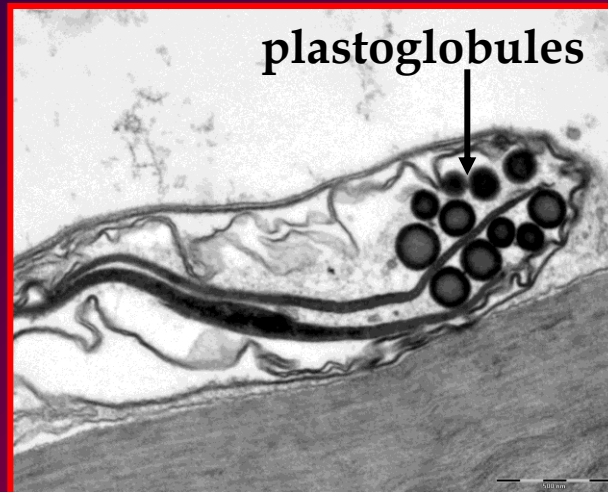
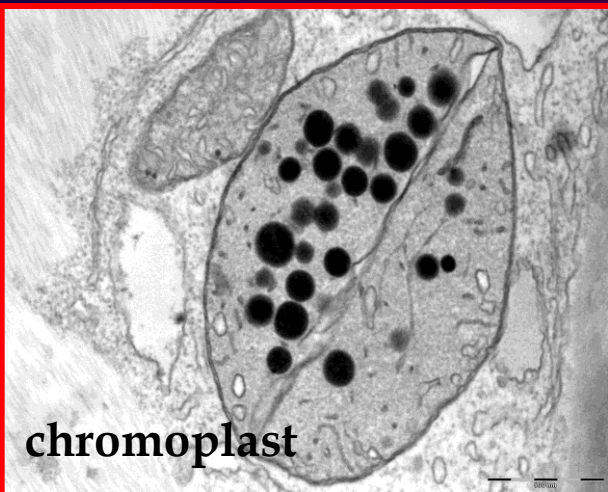


During Chloroplast - Chromoplast transition, thylakoids membranes are disassembled and substituted by lipid-carotenoids aggregated structure, as Plastoglobules.

CHLOROPLAST



CHROMOPLAST



Analysis of chloroplast-chromoplast transition by a proteomic and physiologic approach



SMALL GREEN

MATURE GREEN

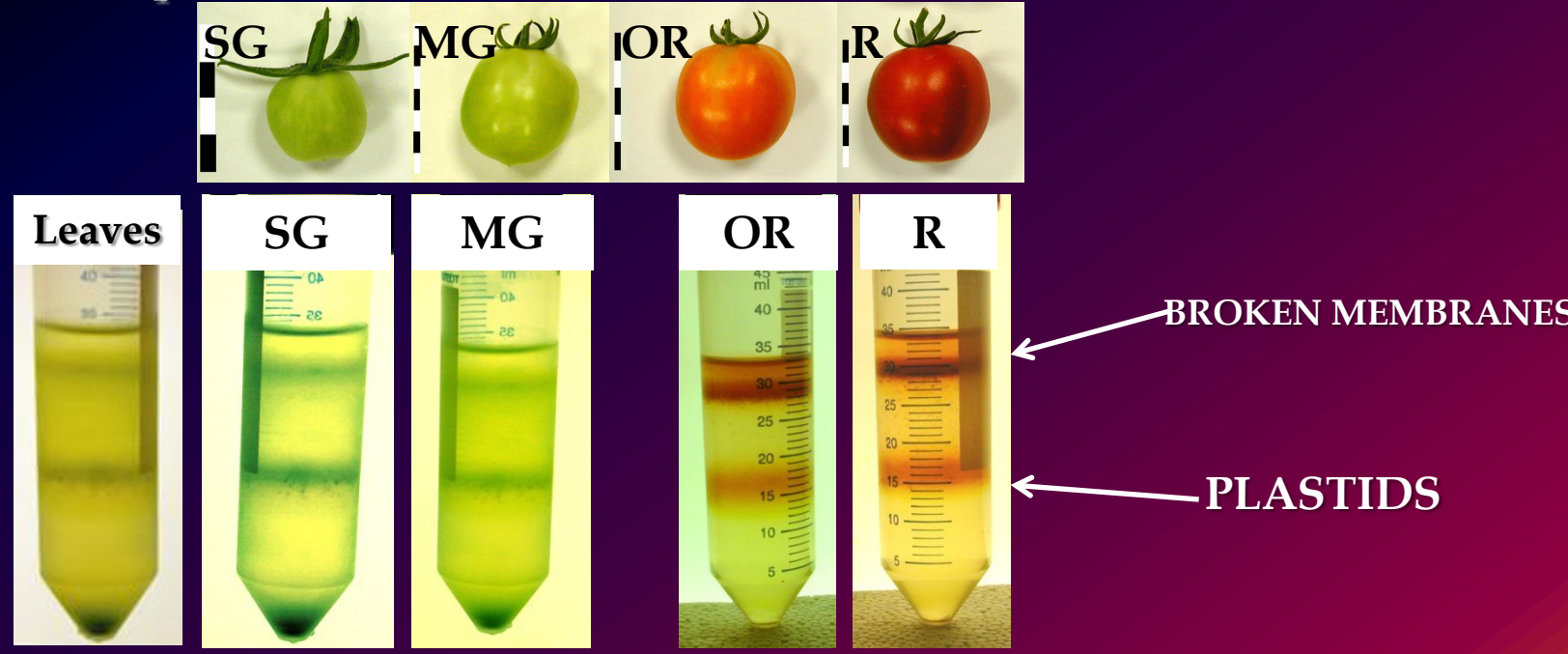
ORANGE

RED

4 DIFFERENT DEVELOPMENTAL STAGE CONDITIONS WERE SELECTED BY FRUIT AGE (dpa), VOLUME AND PIGMENT CONTENT

PROTEOMIC ANALYSIS OF CHLOROPLAST - CHROMOPLAST TRANSITION

Plastids were purified from different batches of fruit and leaves:

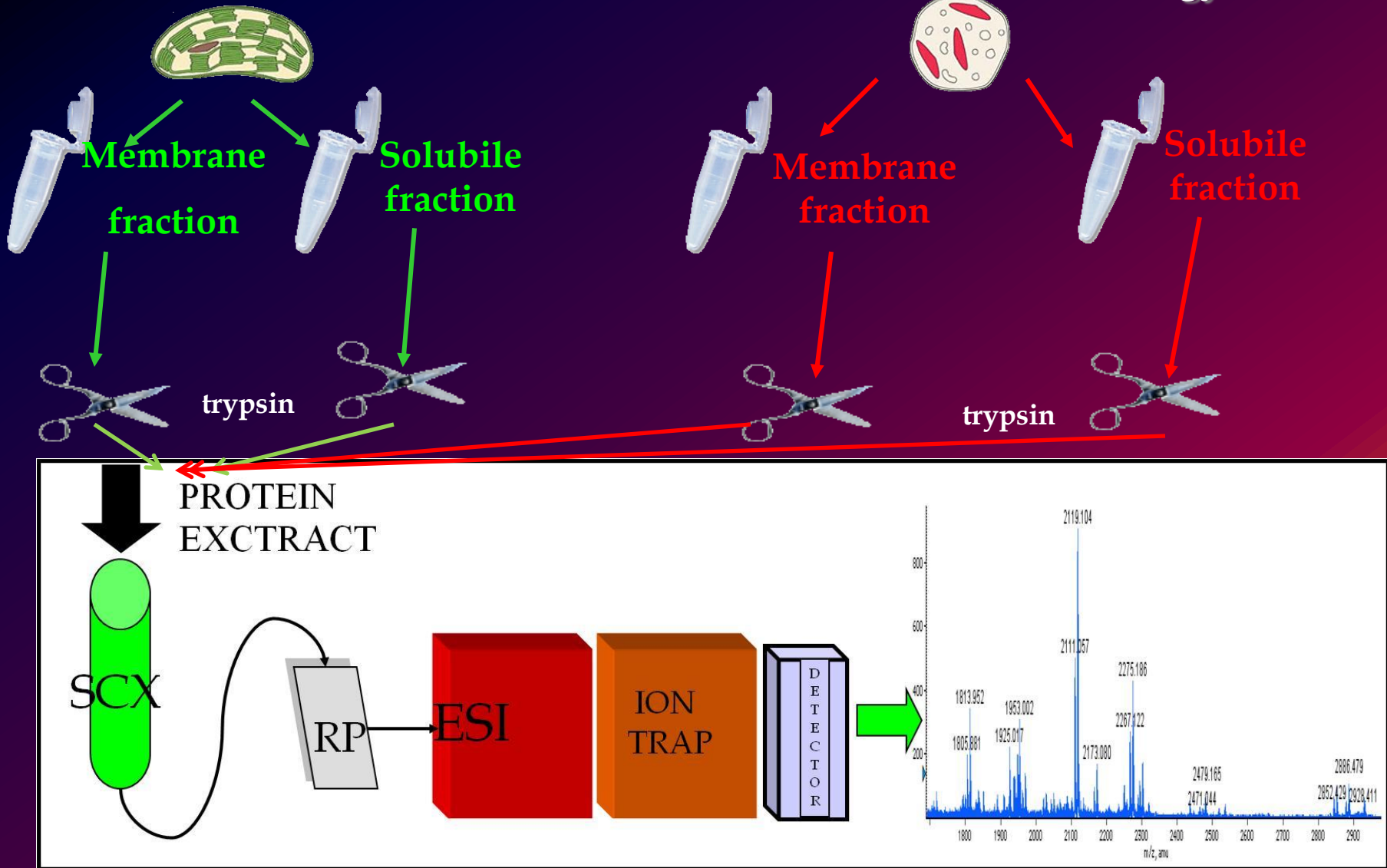


Almost no contamination
(Western blot analysis)

PROTEOMIC ANALYSIS OF CHLOROPLAST - CHROMOPLAST TRANSITION

Shotgun MudPIT analysis:

Multidimensional Protein Identification Tecnology

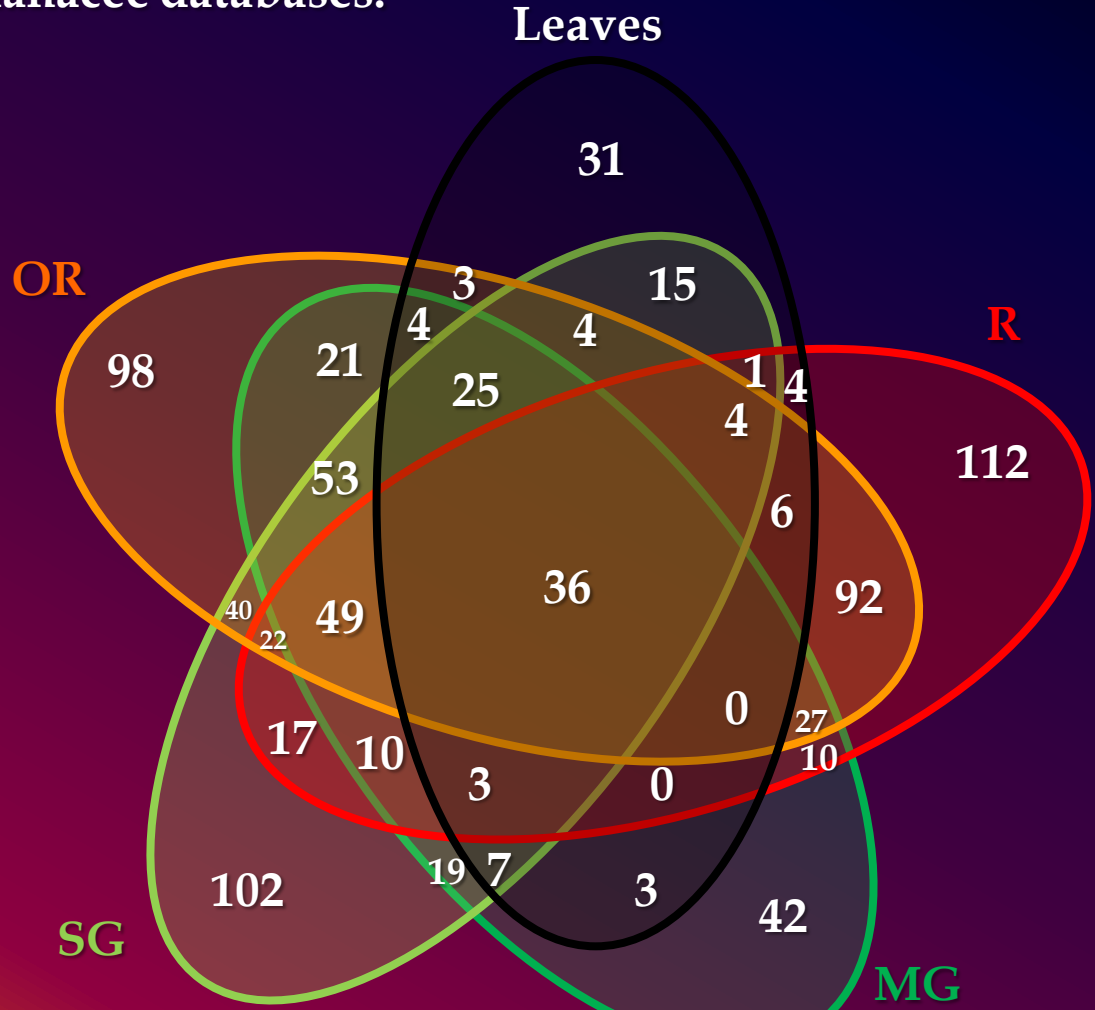


PROTEOMIC ANALYSIS OF CHLOROPLAST - CHROMOPLAST TRANSITION

1218 different polypeptides were identified using NCBI and TIGR-EST Solanaceae databases.

1206 identified proteins are homologous to **905** Arabidopsis proteins, corresponding to **863** Arabidopsis genes

Most of the proteins were differently expressed in the different developmental stages



PROTEOMIC ANALYSIS OF CHLOROPLAST - CHROMOPLAST TRANSITION

Cell sub-localization of identified proteins

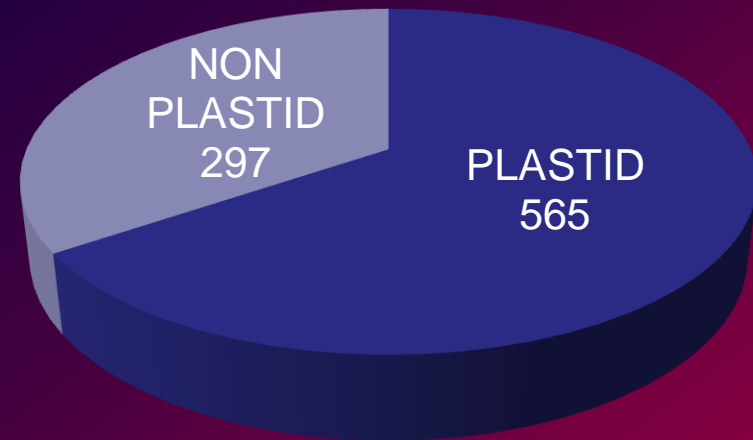
(combining data from Target-P; AT_chloro; Gene Ontology and Chromoplast proteome database)

<http://www.cbs.dtu.dk/services/TargetP/>

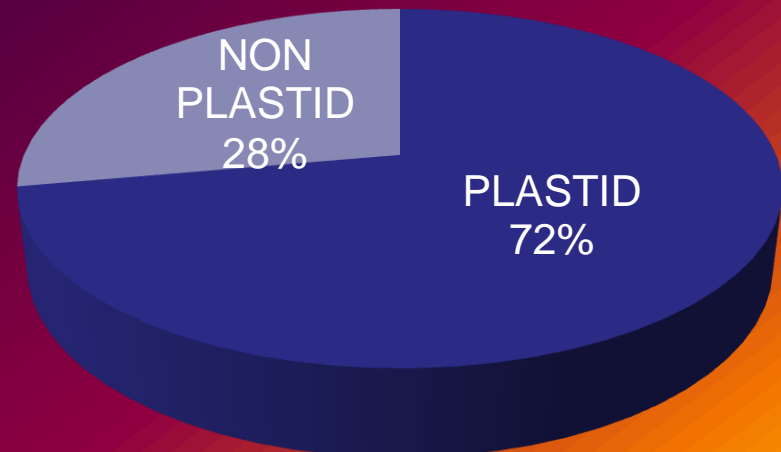
http://www.grenoble.prabi.fr/at_chloro/

Barsan et al J EXP BOT 2010

NUMBER OF PROTEINS

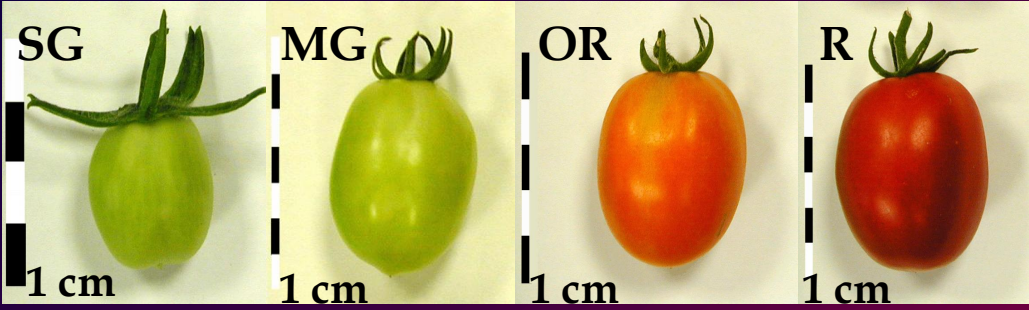


% PROTEIN QUANTITY



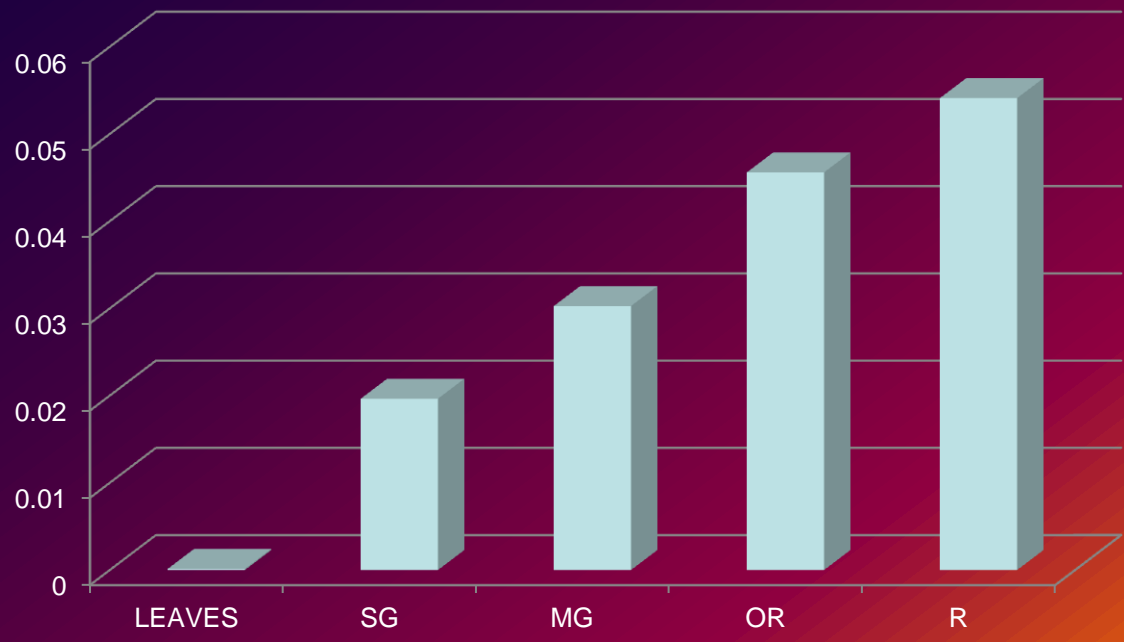
PROTEOMIC ANALYSIS OF CHLOROPLAST - CHROMOPLAST TRANSITION

MAP MAN Functional classification of the different proteins identified



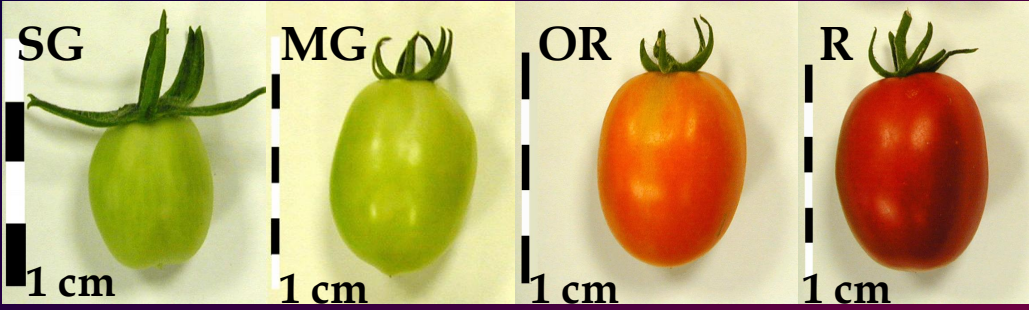
-heat shock proteins are accumulated in fruits and in particular in chromoplast :

HEAT SHOCK PROTEINS



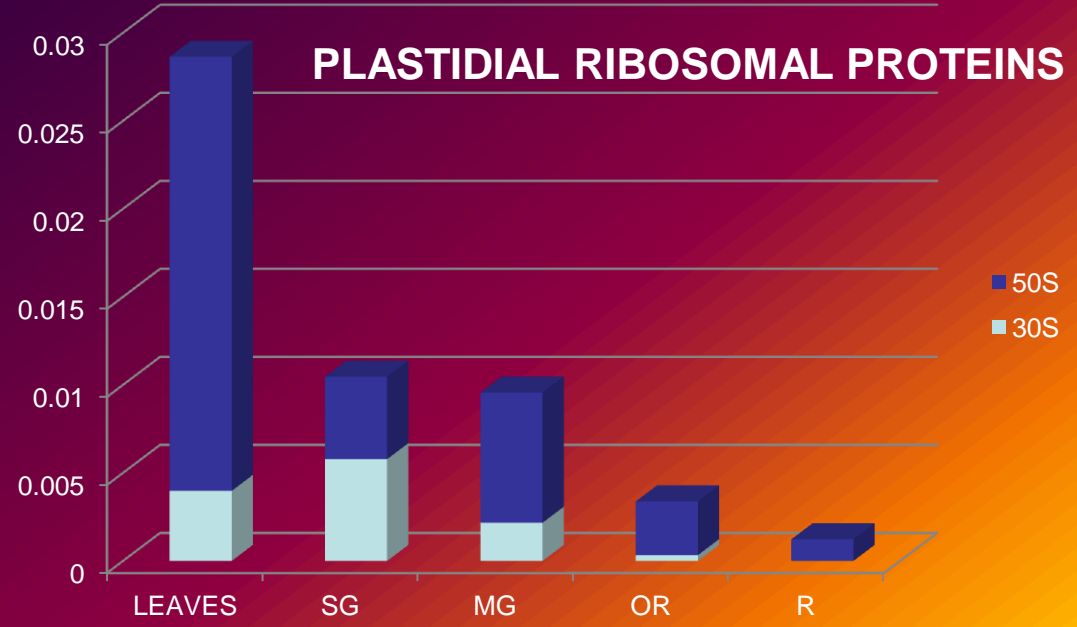
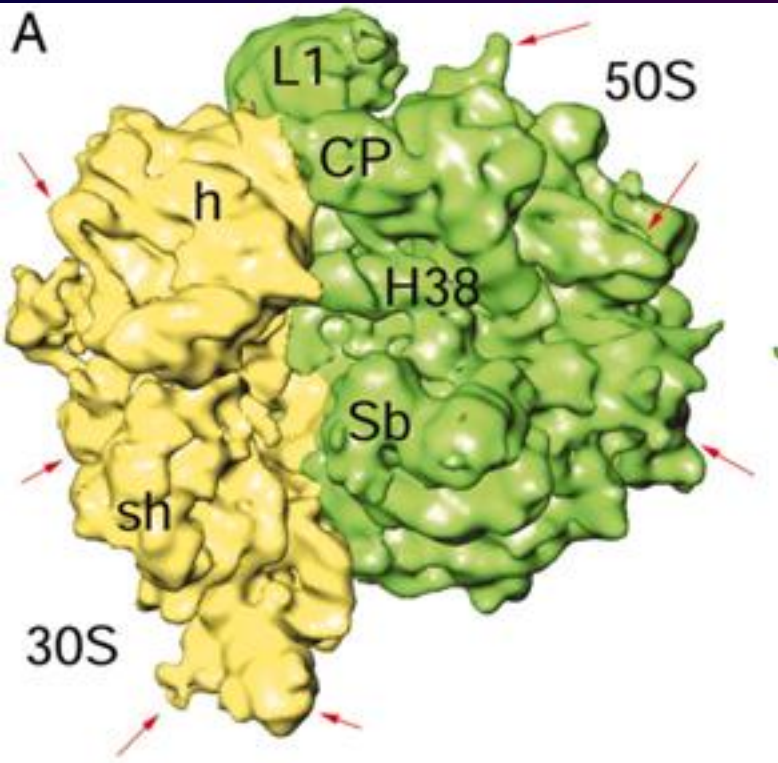
PROTEOMIC ANALYSIS OF CHLOROPLAST - CHROMOPLAST TRANSITION

MAP MAN Functional classification of the different proteins identified



-Plastid Ribosomal proteins in OR and R are strongly reduced.

Indeed in chromoplast transcription is strongly reduced (Marano and Carrillo 1992)



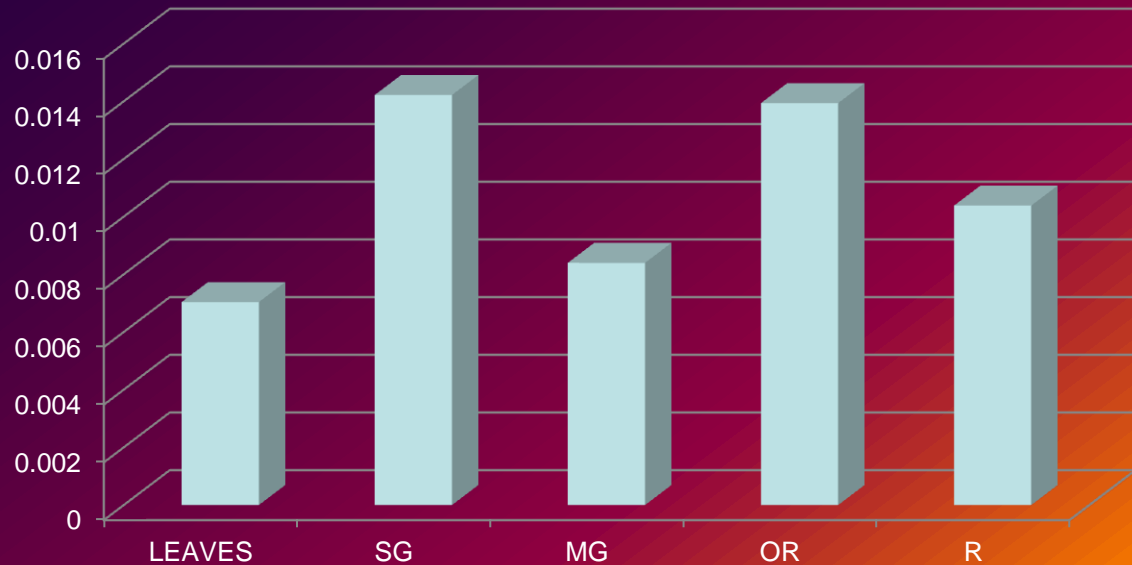
PROTEOMIC ANALYSIS OF CHLOROPLAST - CHROMOPLAST TRANSITION

MAP MAN Functional classification of the different proteins identified



-increase of proteases (serine proteases and Clp proteases) in SG and OR.

PROTEASES



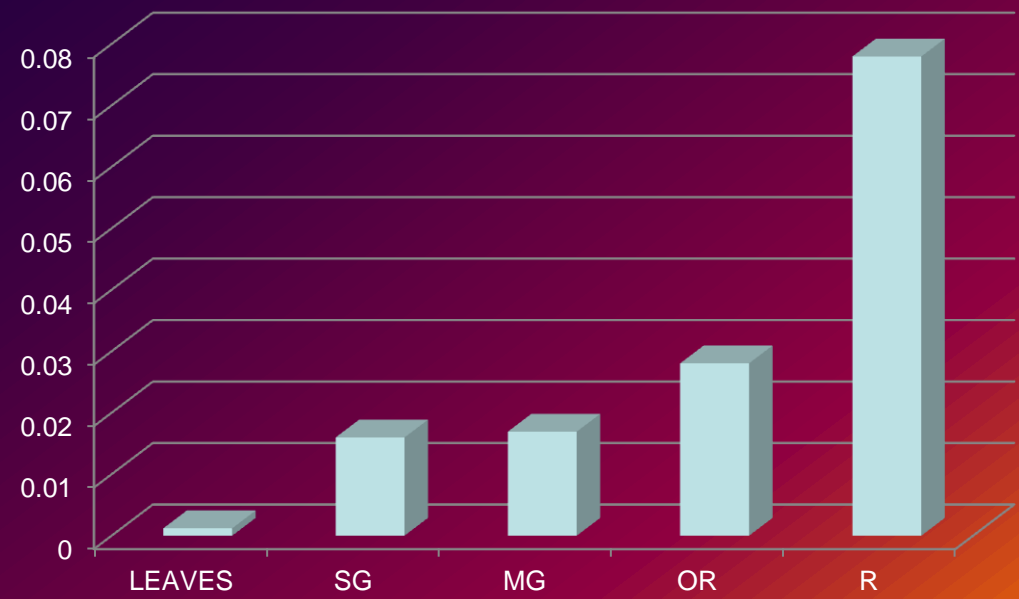
PROTEOMIC ANALYSIS OF CHLOROPLAST - CHROMOPLAST TRANSITION

MAP MAN Functional classification of the different proteins identified



-Increased amount of glycolytic enzymes in OR and R:

GLYCOLYTIC ENZYMES

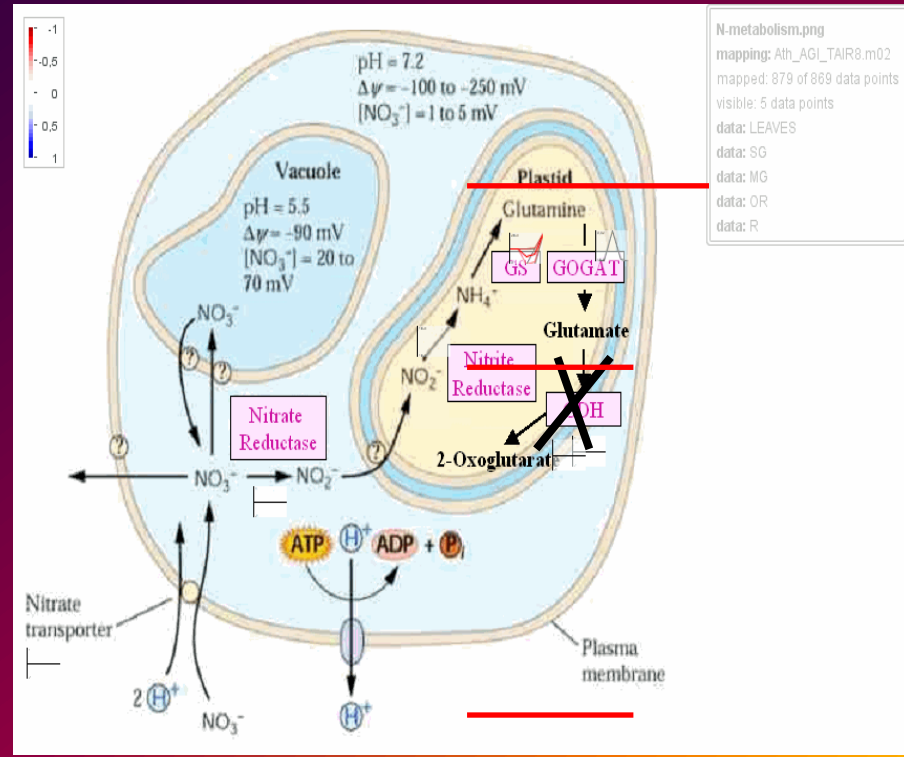
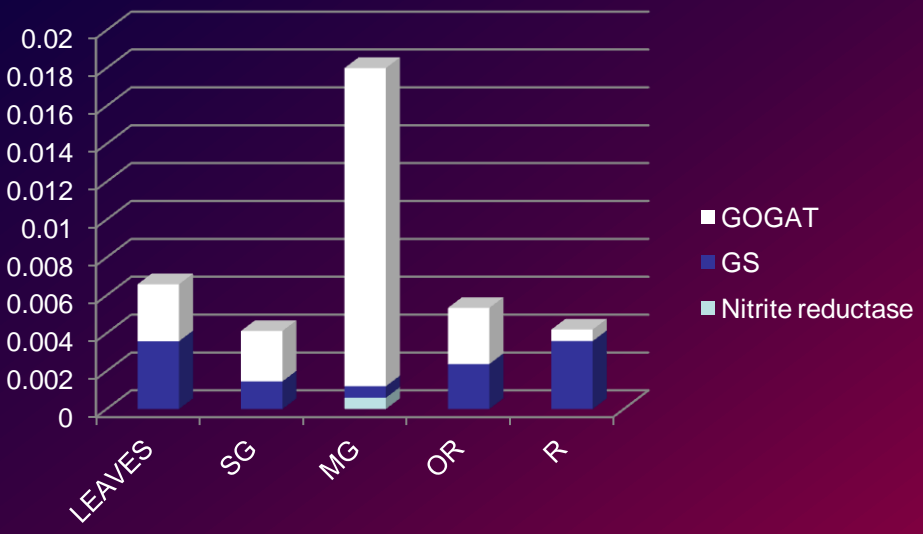


PROTEOMIC ANALYSIS OF CHLOROPLAST - CHROMOPLAST TRANSITION

MAP MAN Functional classification of the different proteins identified



- Nitrogen assimilation:

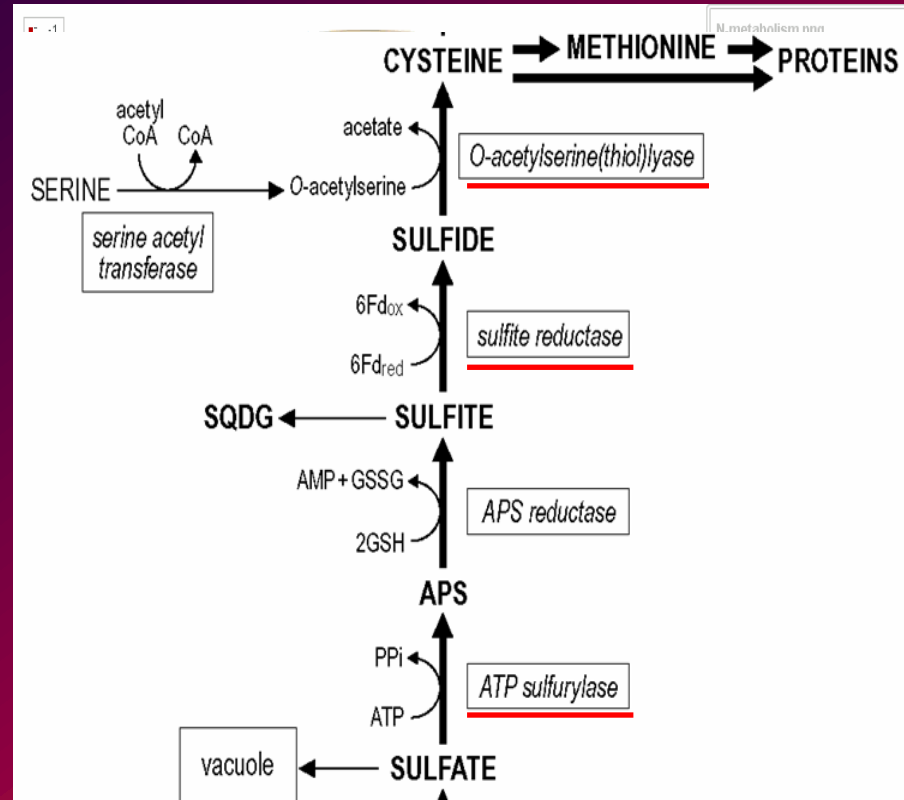
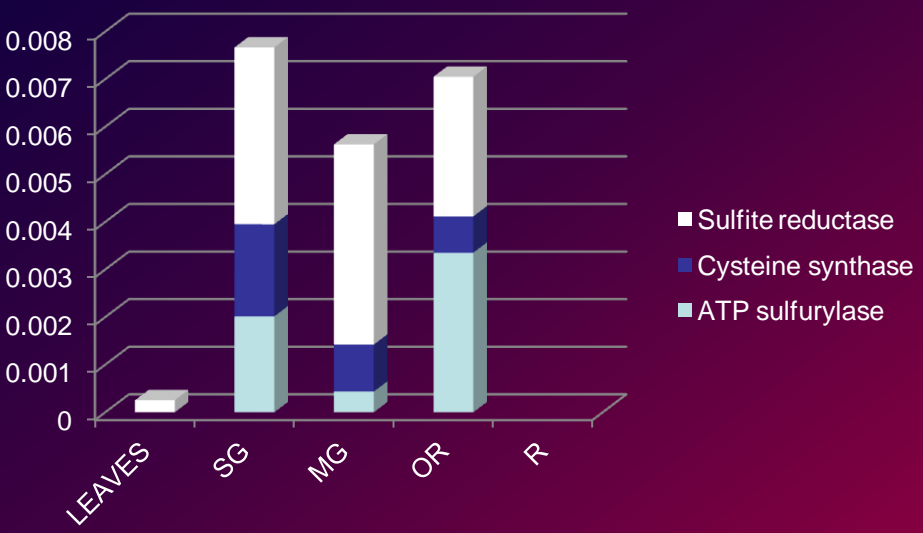


PROTEOMIC ANALYSIS OF CHLOROPLAST - CHROMOPLAST TRANSITION

MAP MAN Functional classification of the different proteins identified

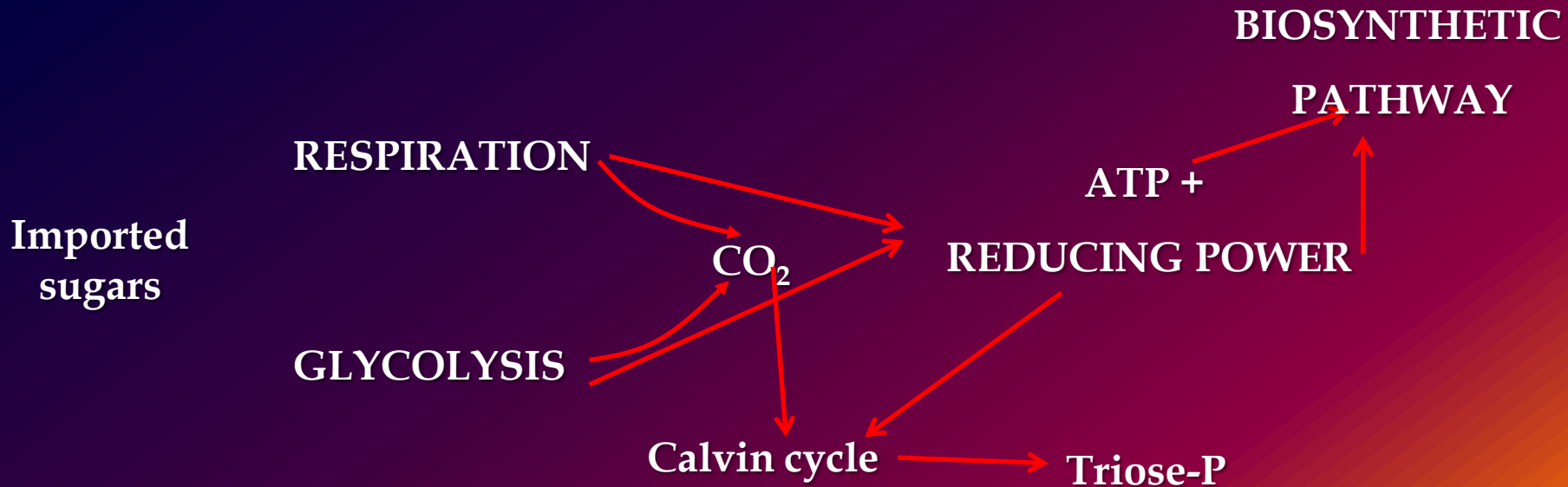


- Sulfur assimilation: ATP sulfurylase, sulfite reductase and cysteine synthase present until OR



ANALYSIS OF PHOTOSYNTHETIC APPARATUS DURING CHLOROPLAST - CHROMOPLAST TRANSITION

Being mature fruits mainly heterotrophic tissues, Calvin cycle enzyme in chromoplast may prevent lost of biomass by partial re-fixation of CO₂ produced by glycolysis and respiration



WHAT IS THE FUNCTION OF RUBISCO AND CALVIN CYCLE ENZYMES IN FRUITS AND IN CHROMOPLASTS?

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