



Understanding *Vitis vinifera*/Esca Interaction: A Metabolomic Approach



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GTDs in Portugal

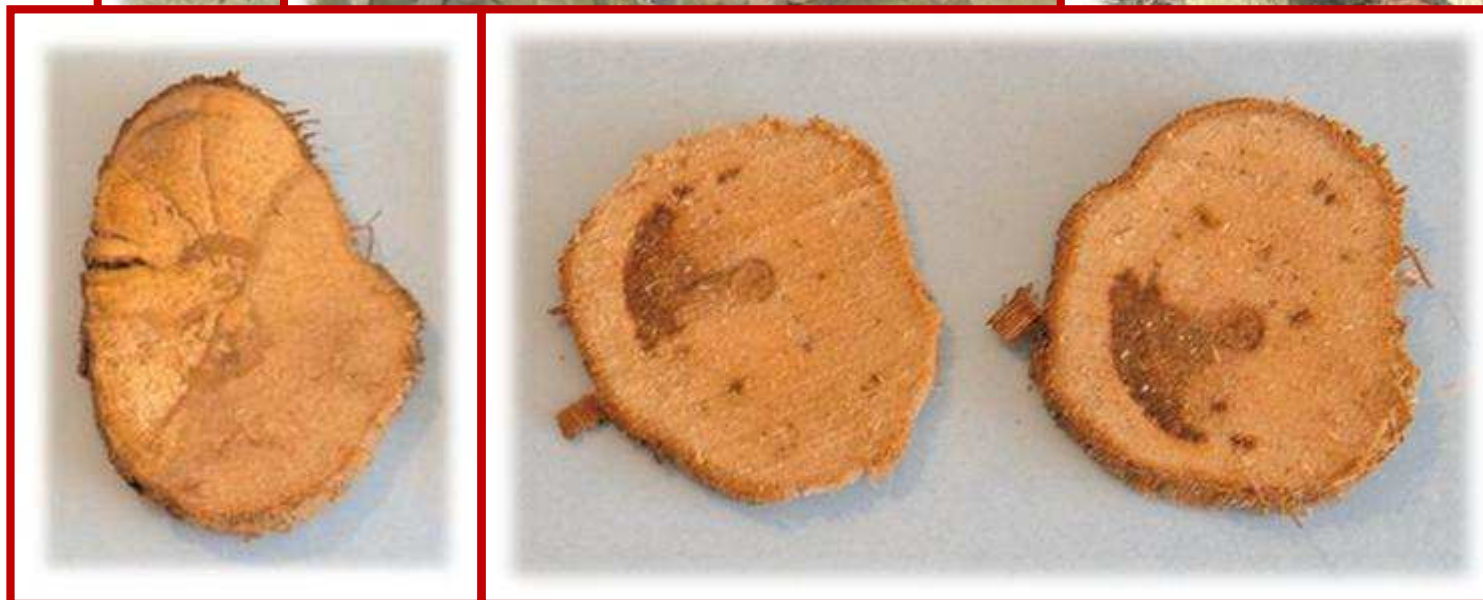
- Botryosphaeriaceae*-related infections
- Young grapevine decline
 - Petri disease
 - Black foot disease of grapevine
- Excoriosis
- Eutypiosis – very low relevance in Portugal

Esca in the *Vinho Verde* Demarcated Region (RDVV)



- ❑ The RDVV occupies *ca.* 10% of continental Portugal
 - ❑ Approximately 90% of the farmers in this region produce Vinho Verde
 - ❑ No completely effective treatment is available for esca
- ✓ **Economical importance**

Esca in the *Vinho Verde* Demarcated Region (RDVV)





Esca:

- ✓ Aetiology and epidemiology are not fully understood
- ✓ Complex disease believed to result from the association of several fungi
- ✓ Dramatic upsurge in the last years

Metabolomic approach:

- ✓ Broader overview of the disease effects
- ✓ Suggestion possible defense mechanisms
- ✓ Potential discovery of early infection biomarkers and mechanisms to be exploited for disease treatment



Proton Nuclear Magnetic Resonance (^1H NMR)

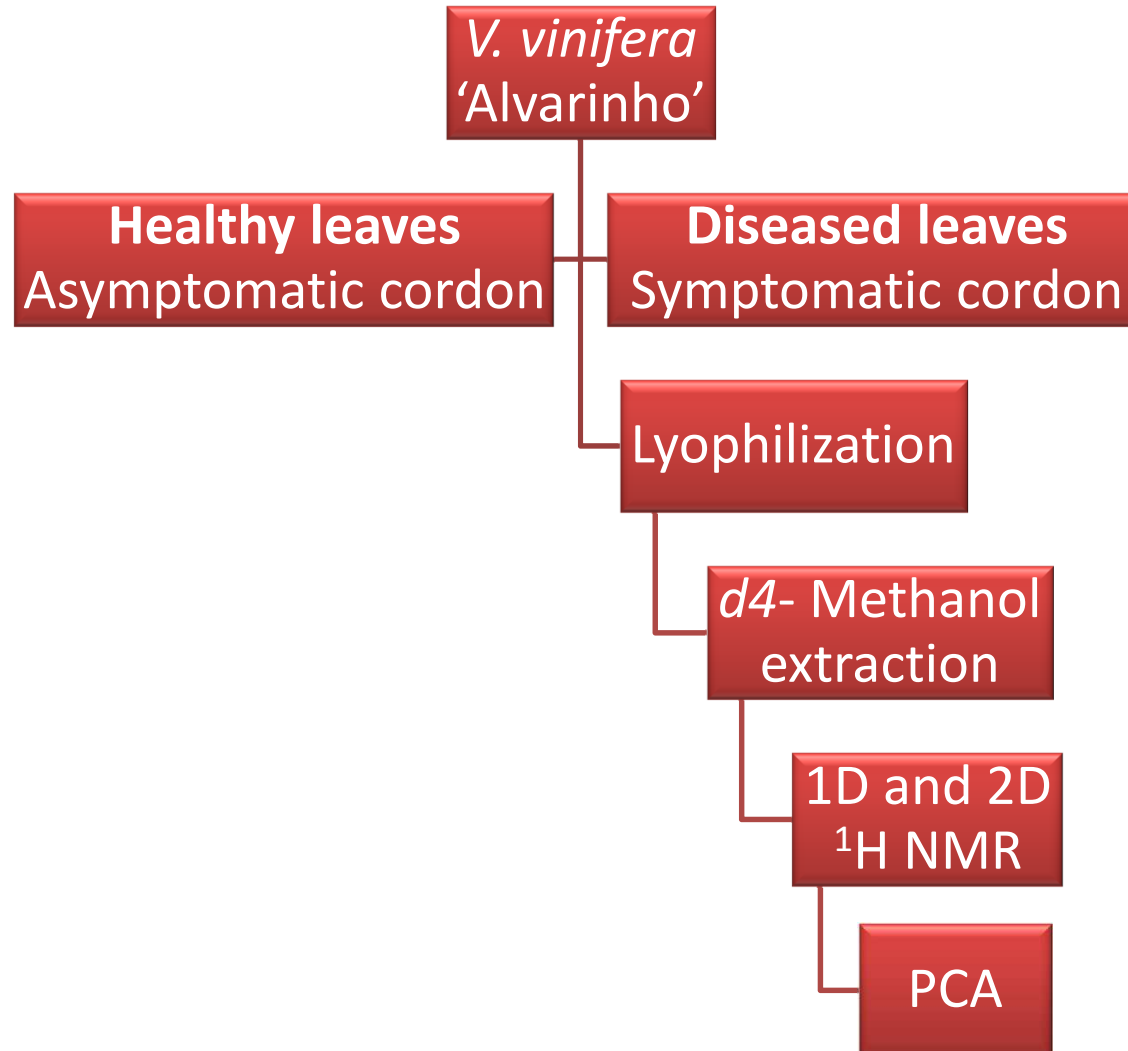
- Powerful technique to analyse plant extracts, given the universal abundance of protons in organic metabolites
- Sample preparation simple and rapid
- Measurement times are short and automated

Principal Components Analysis (PCA)

- Multivariate statistics analysis technique that reduces the dimensionality of multivariate data while preserving the variance within it
- Useful for observing groupings within large datasets (scores plot)
- Detects and displays the spectral areas responsible for the separation in the data (loadings plot)



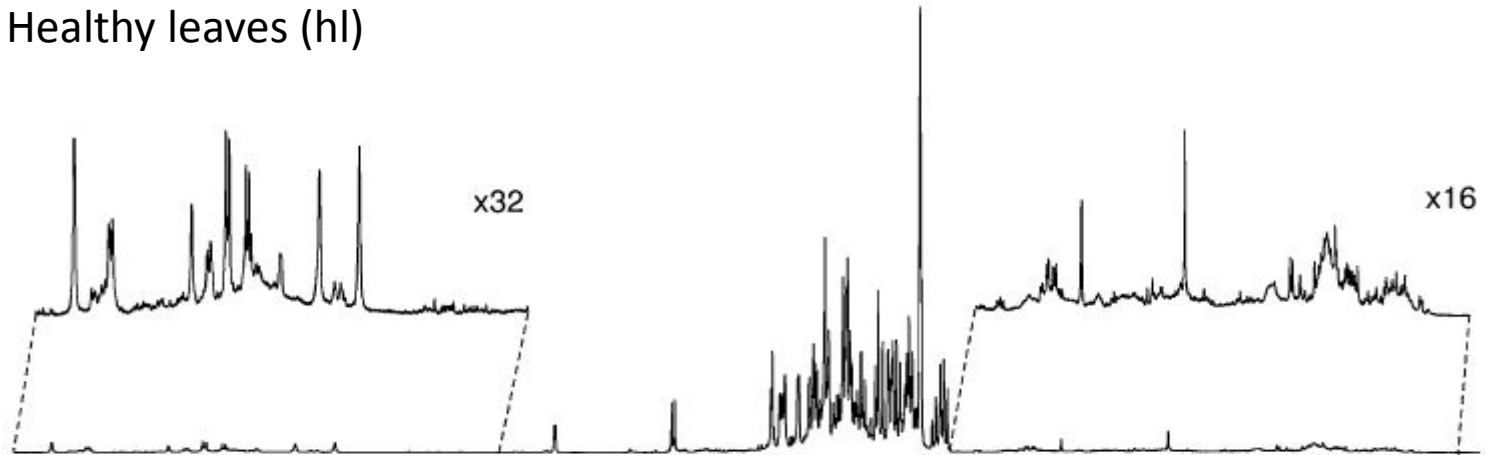
Experimental design



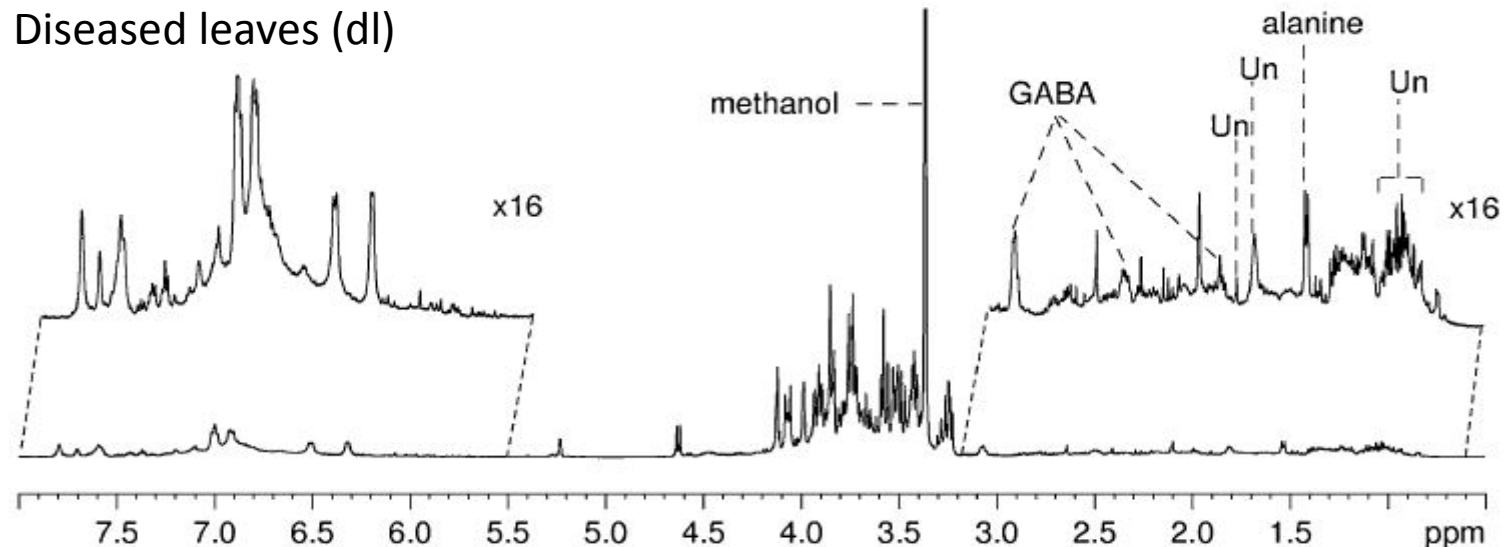


Typical 1D ^1H NMR spectra

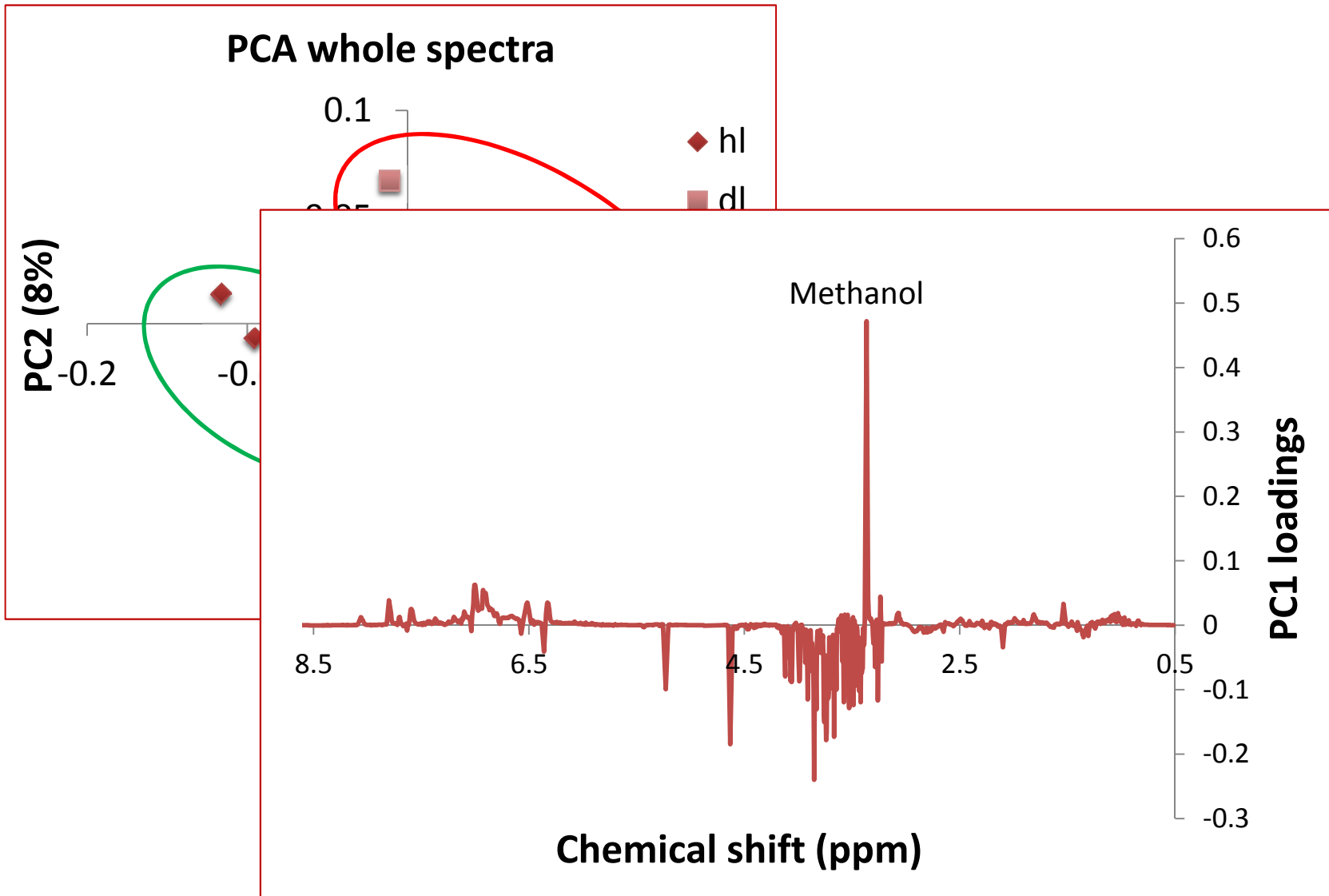
Healthy leaves (hl)



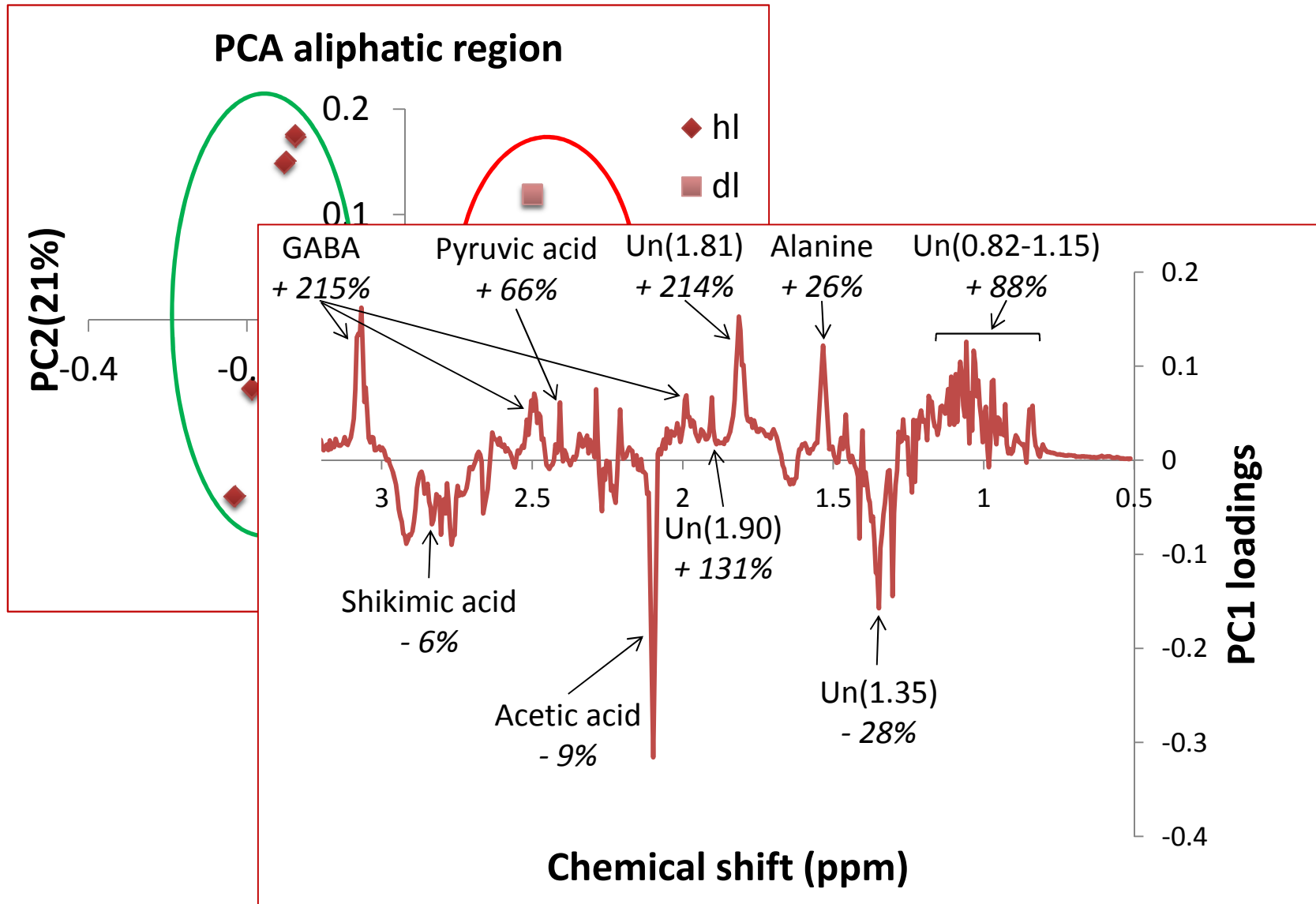
Diseased leaves (dl)



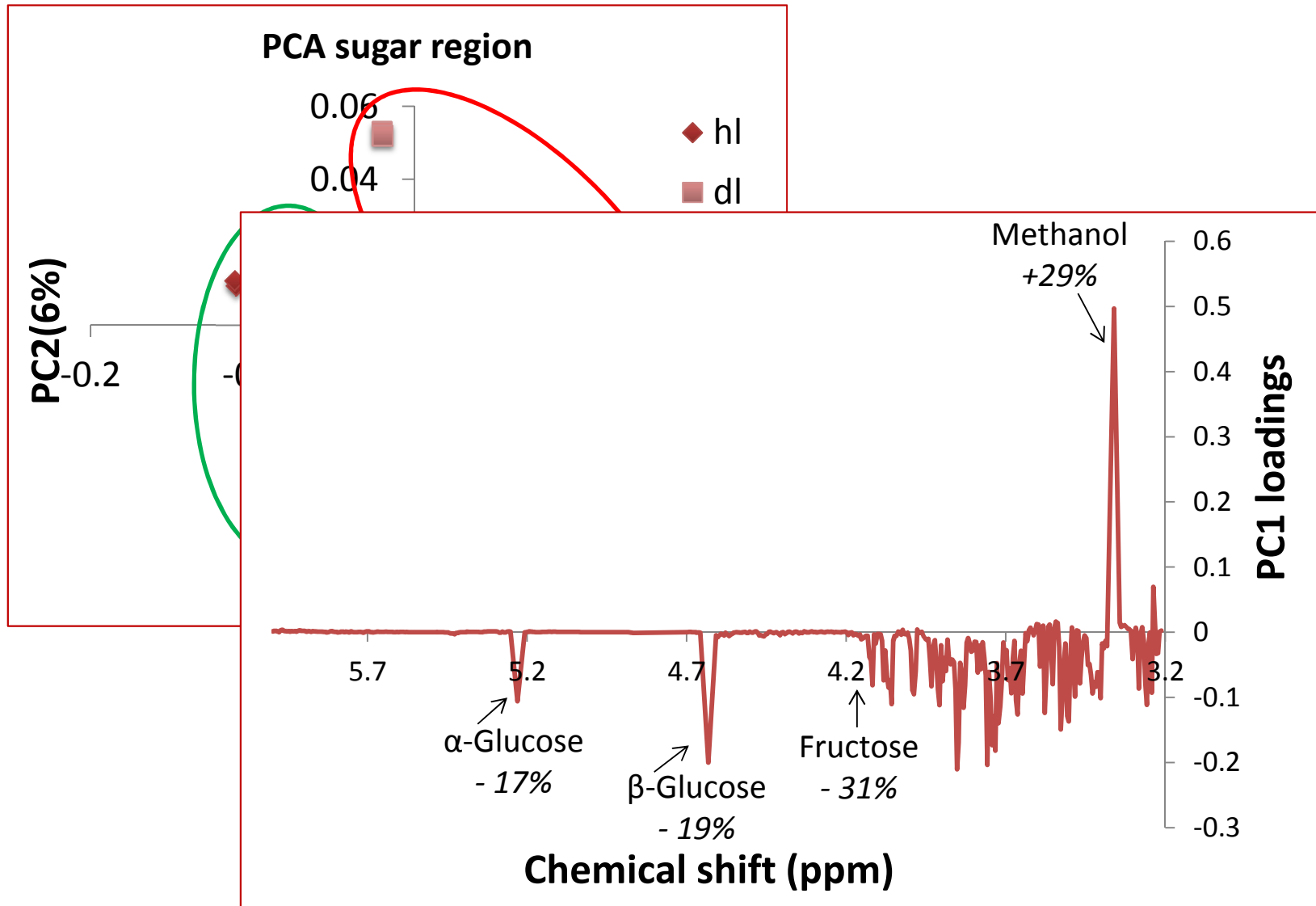
A metabolomic approach – RESULTS



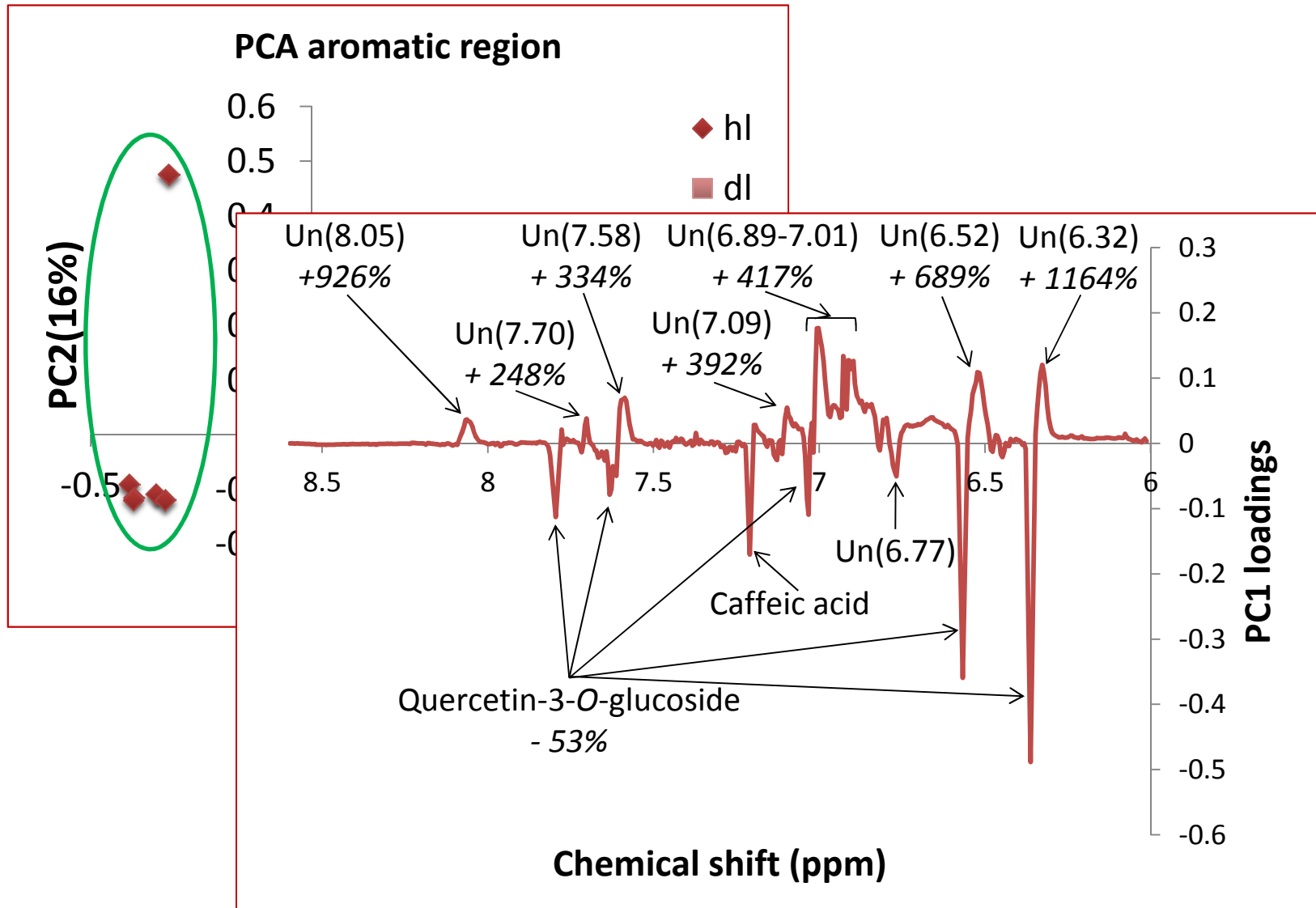
A metabolomic approach – RESULTS



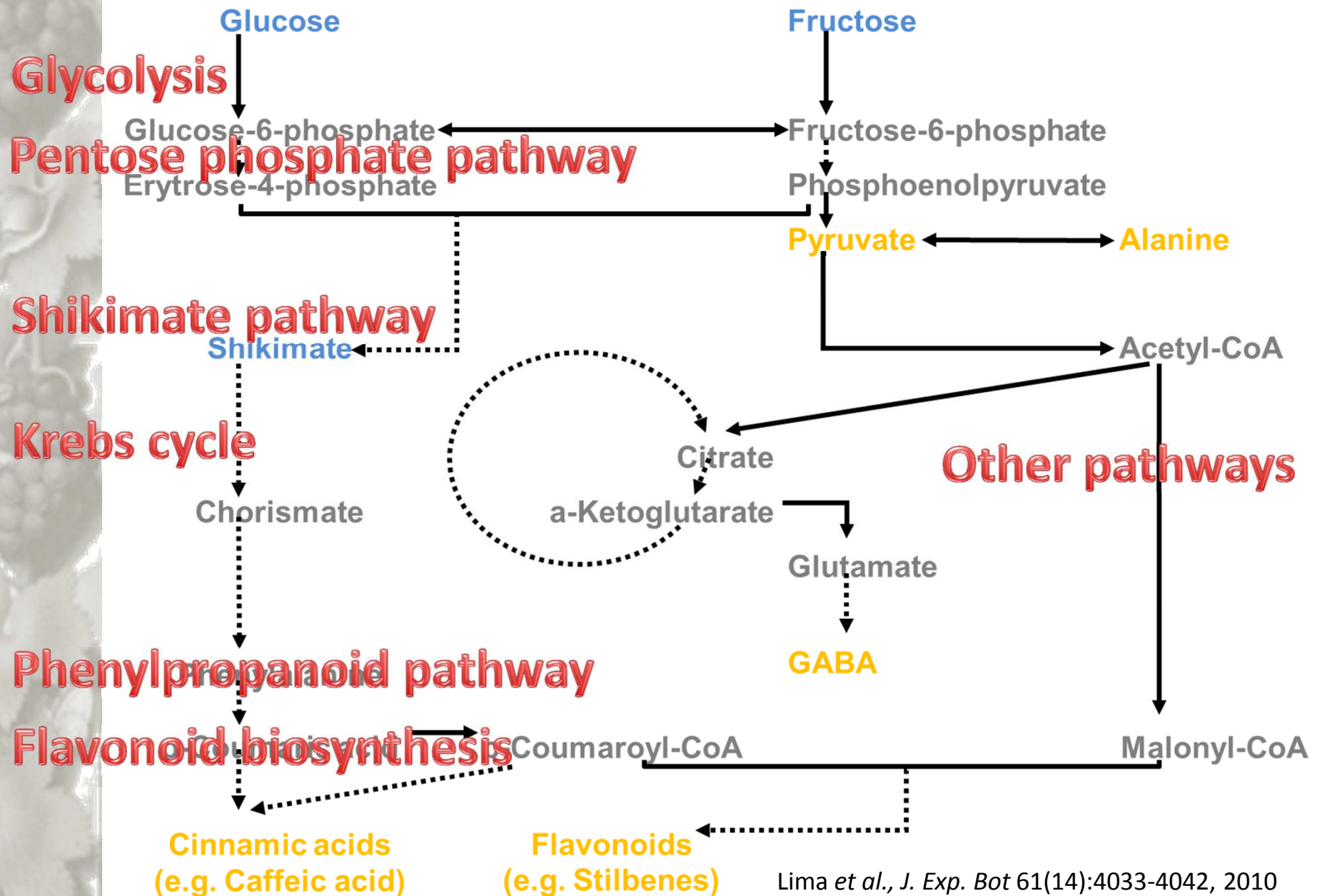
A metabolomic approach – RESULTS



A metabolomic approach – RESULTS



A metabolomic approach – RESULTS



A metabolomic approach – CONCLUSIONS



- ❑ The NMR/PCA approach shows that Esca impacts multiple metabolic pathways in leaves
- ❑ Decrease of glucose and fructose accompanied by increase in phenylpropanoid compounds → deviation of carbon and energy from primary to secondary metabolism in order to produce defensive compounds
- ❑ Other metabolic alterations include increased levels of alanine, GABA, pyruvate and methanol → might be involved in other defensive strategies
- ❑ The analytical approach used was very effective discriminating the metabolomic profiles of healthy and diseased leaves → great potential to study esca

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Thank you for your attention