Foods 2020

# Extraction, chemical characterization, and antioxidant activity of bioactive plant extracts

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# MOTIVATION

- Plant extracts have been proposed as alternative biocides and antioxidants to be included in food products
- There is scientific evidence of the antimicrobial and antioxidant properties of several plants
- Solid-liquid and Soxhlet extractions are often used in the food industry

Rosemary

Lemon balm

Basil

Tarragon

Sage

Spearmint

# OBJECTIVES

To study the phytochemical and antioxidant profile of plant extracts

(as obtained by distinct extraction methods and solvents)

To assess the potential of plant extracts to be used as food preservatives

# METHODOLOGY

Rosemary

Lemon balm

Basil

Tarragon

Sage

Spearmint

Solid-liquid Extraction

150 rpm, 60 °C, 90min
$dH_2O$ and Et70%

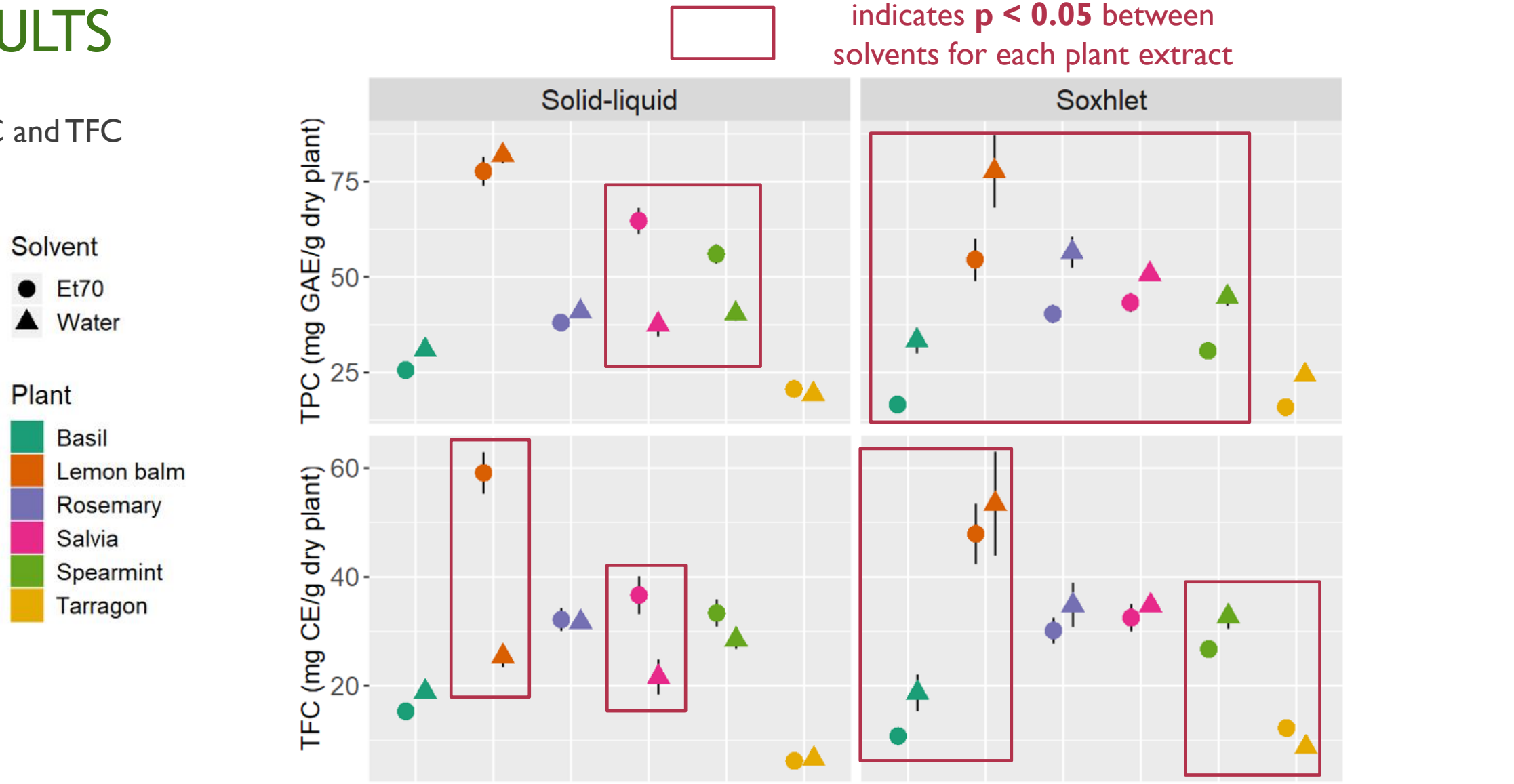
Soxhlet Extraction

7 recycles,
120 °C $dH_2O$;
80 °C Et70%

- Chemical characterization
  - Total Phenolic Content
  - Total Flavonoid Content
- Antioxidant activity
  - DPPH
  - ABTS
  - FRAP
- Identification and quantification of individual phenolic compounds
  - UPLC-DAD

# RESULTS

- TPC and TFC



# RESULTS

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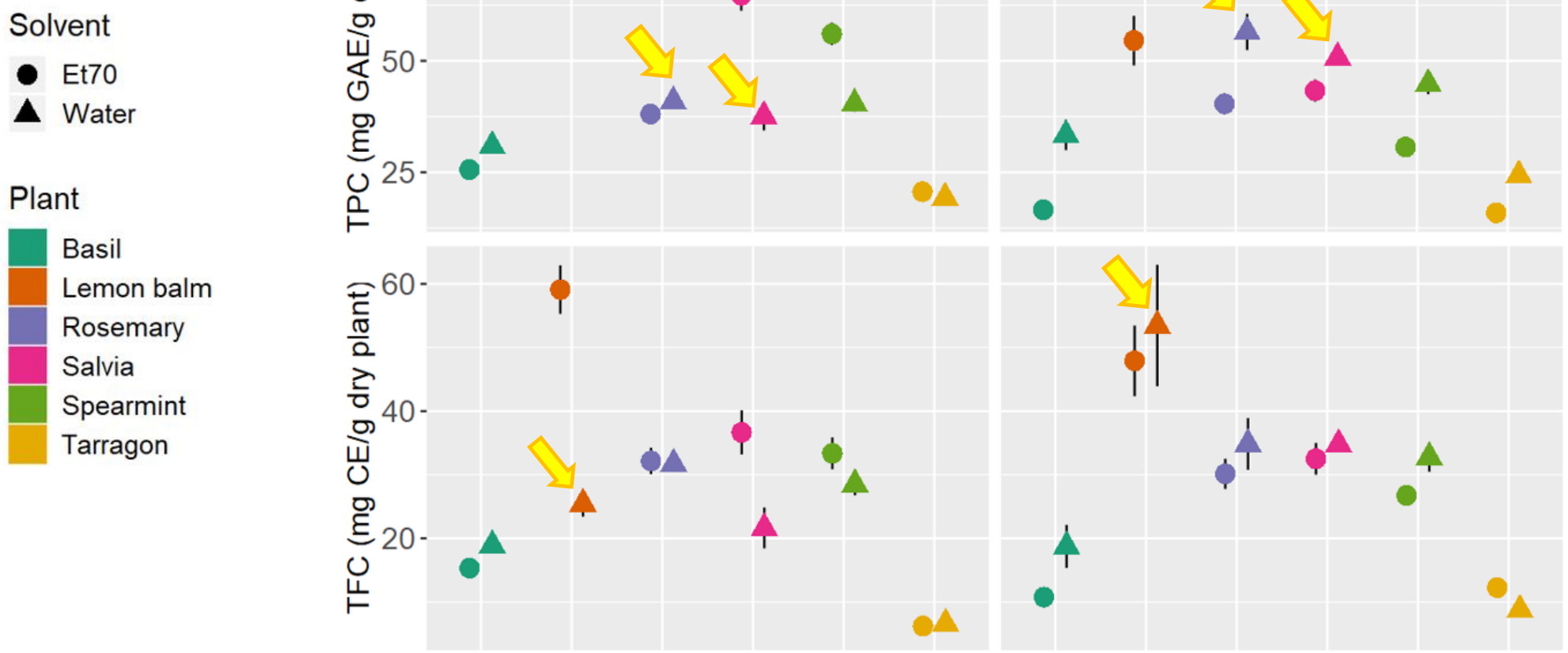
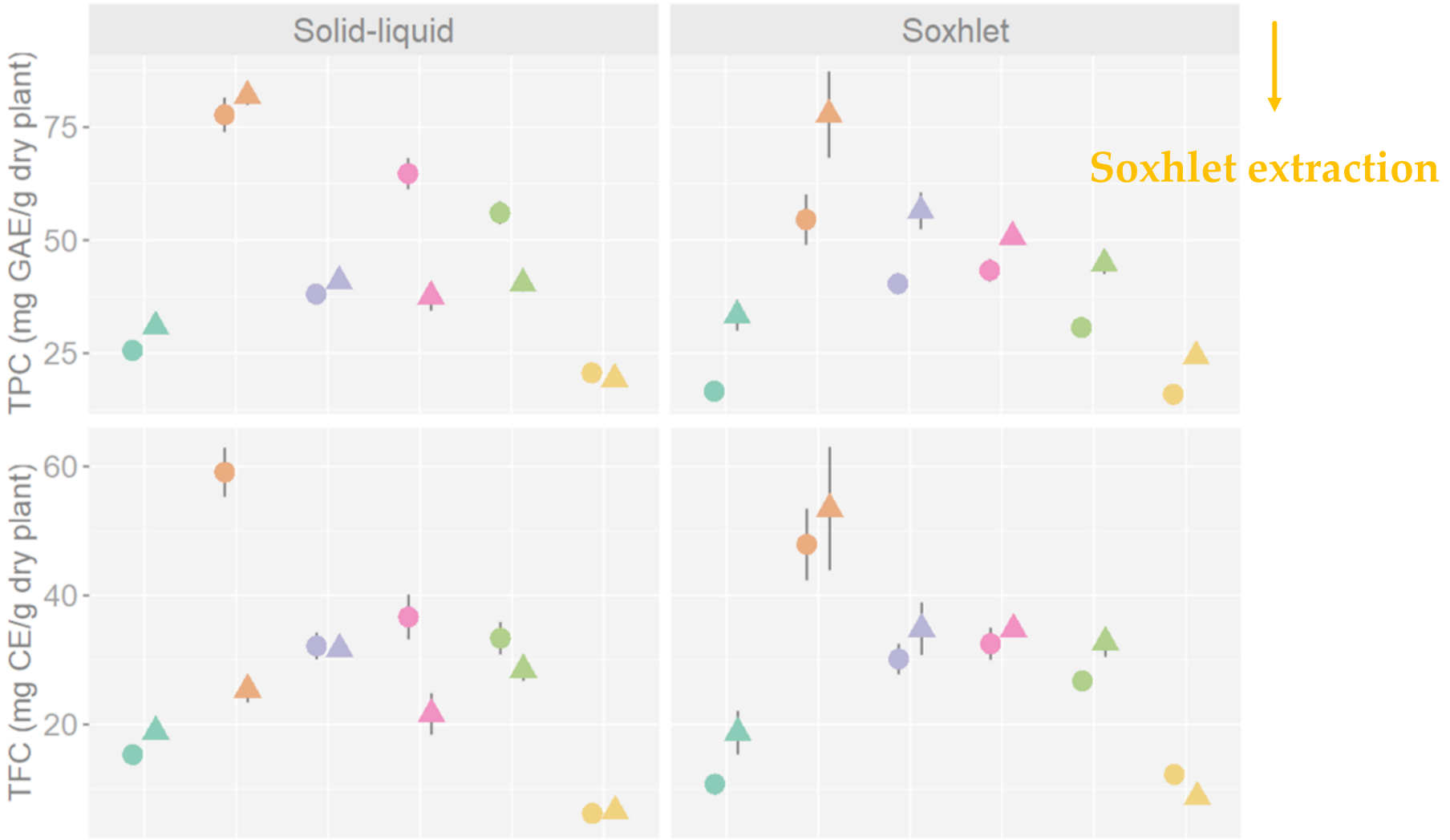


# RESULTS

- TPC and TFC

Higher TPC in aqueous extracts from

Soxhlet extraction



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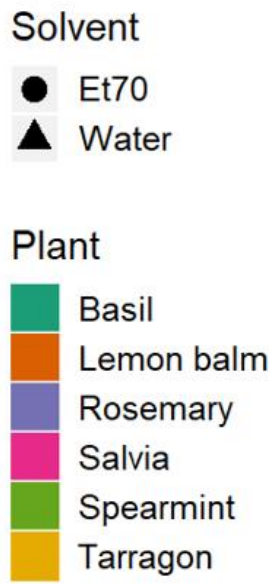
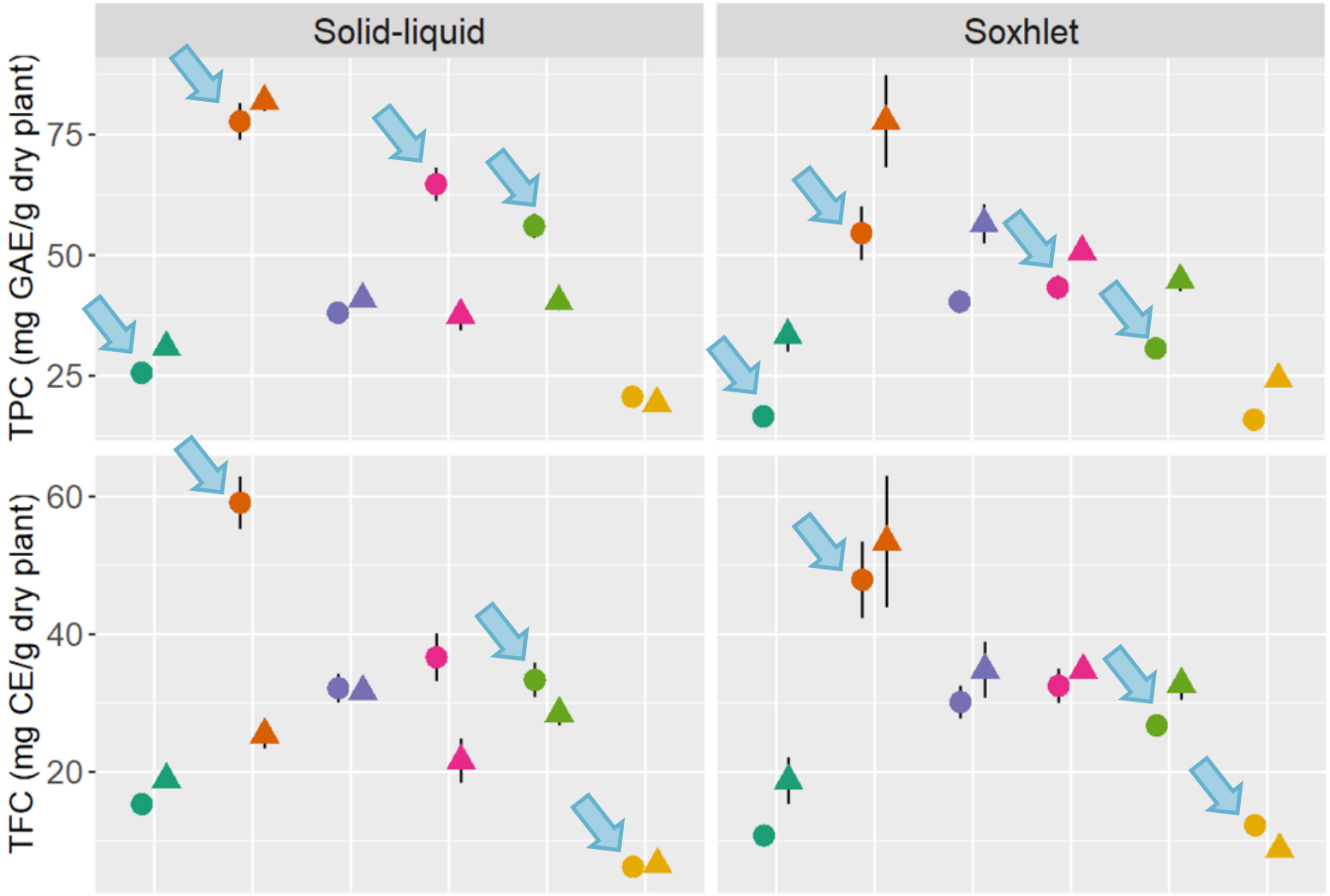
- TPC and TFC




indicates **p < 0.05** between extraction methods for each hydroethanolic plant extract



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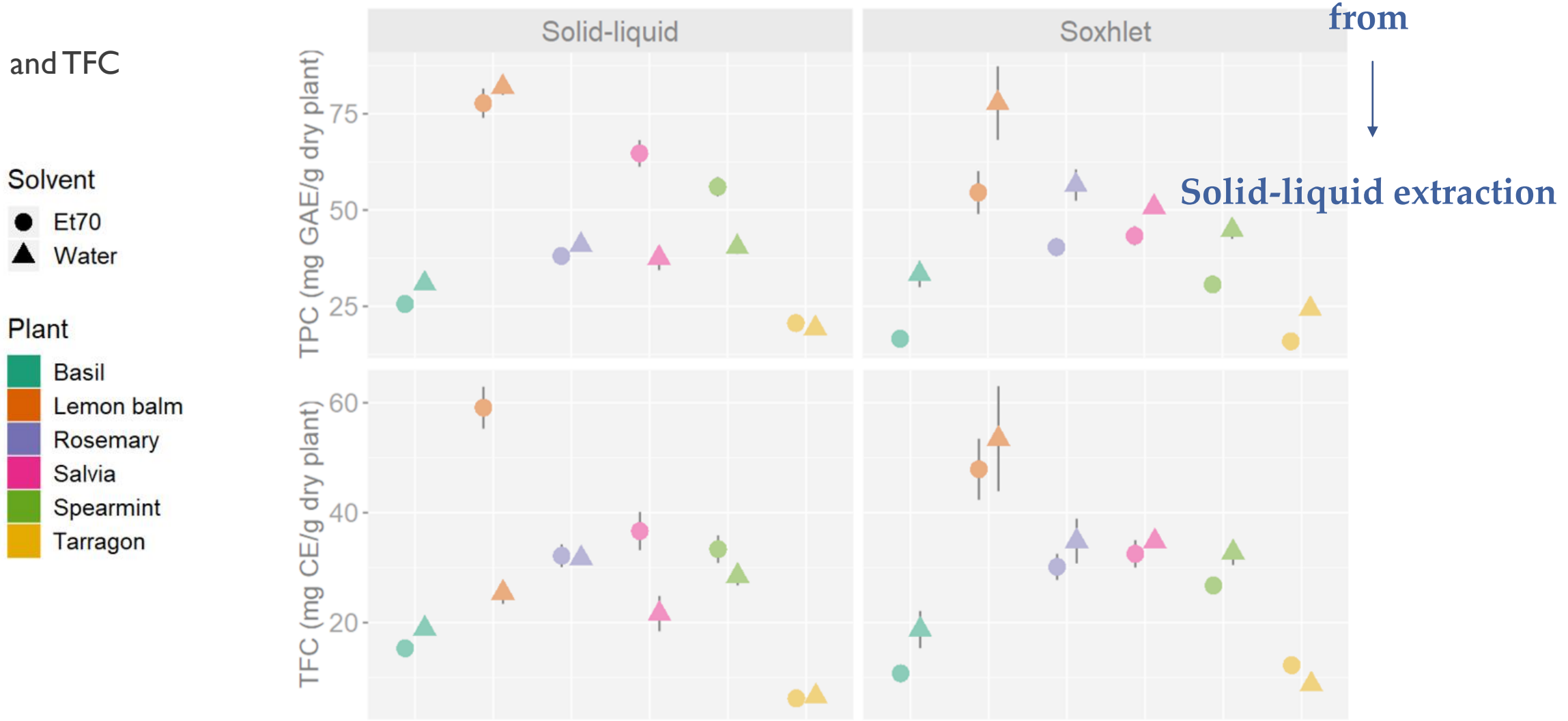
- TPC and TFC

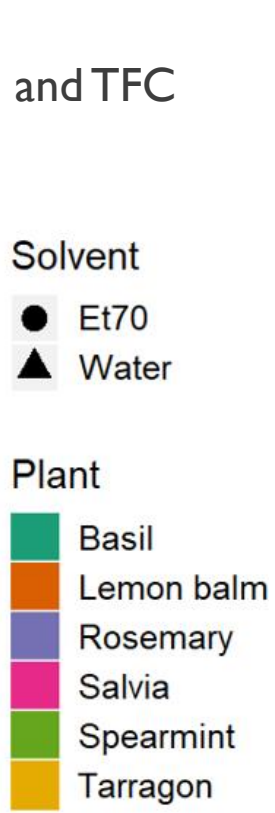


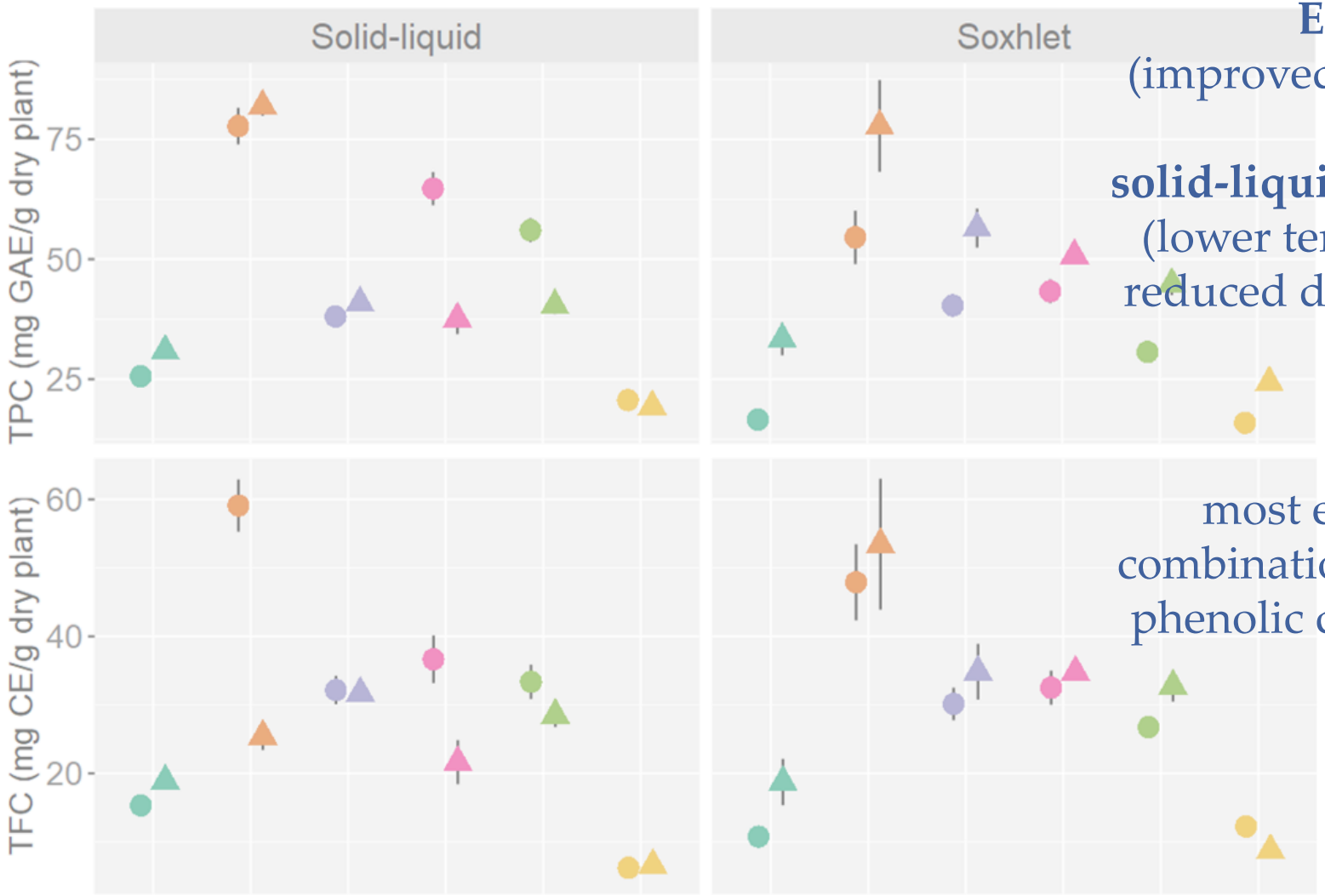

**Higher TPC in hydroethanolic extracts from**

**Solid-liquid extraction**

# RESULTS

- TPC and TFC




**Overall:**

**Et70**
(improved solubility)
+
**solid-liquid extraction**
(lower temperature, reduced degradation)

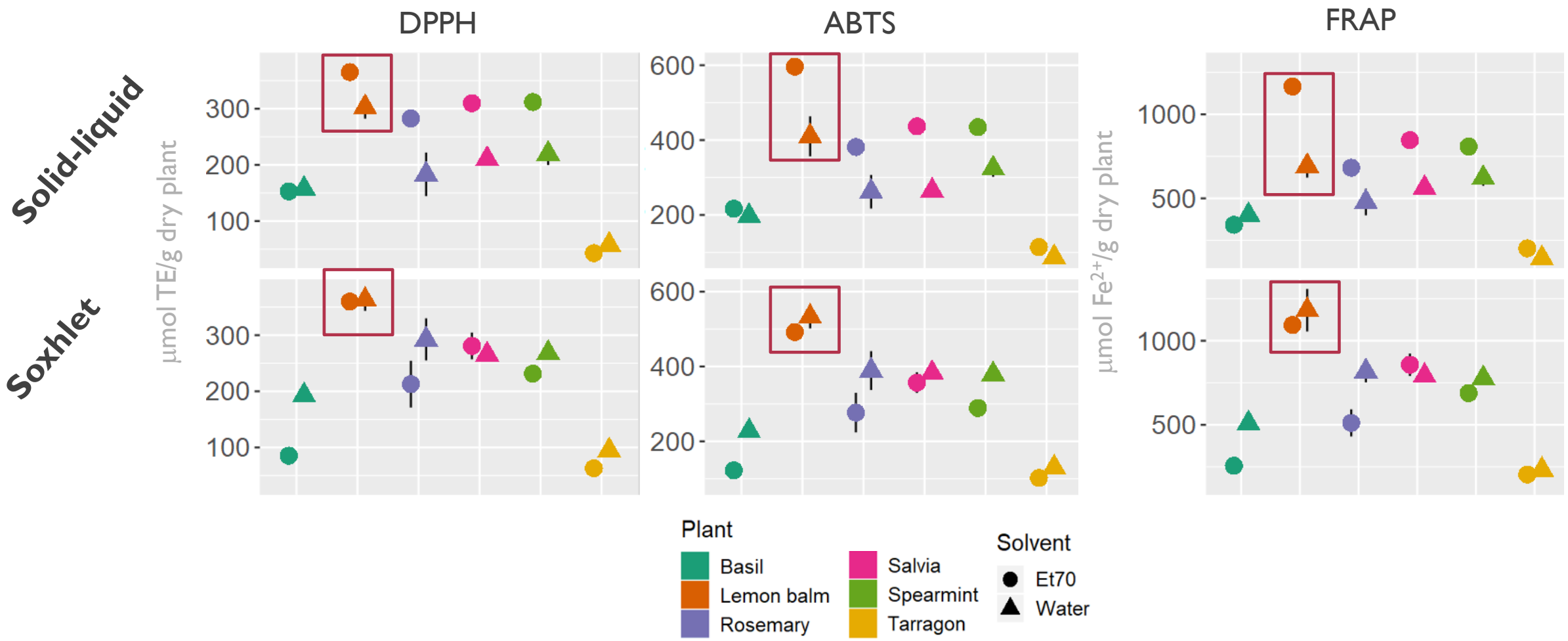
most effective combination to extract phenolic compounds

# RESULTS

- Antioxidant activity

Regardless of the extraction method or solvent:

- lemon balm extracts → highest antioxidant activities
- tarragon extracts → lowest antioxidant activities



# RESULTS

- Identification and Quantification of Individual Phenolic Compounds

**15 compounds identified**

- Rosmarinic acid
- Ferulic acid
- Ellagic acid
- Naringin
- Hesperidin
- Resveratrol
- Quercetin

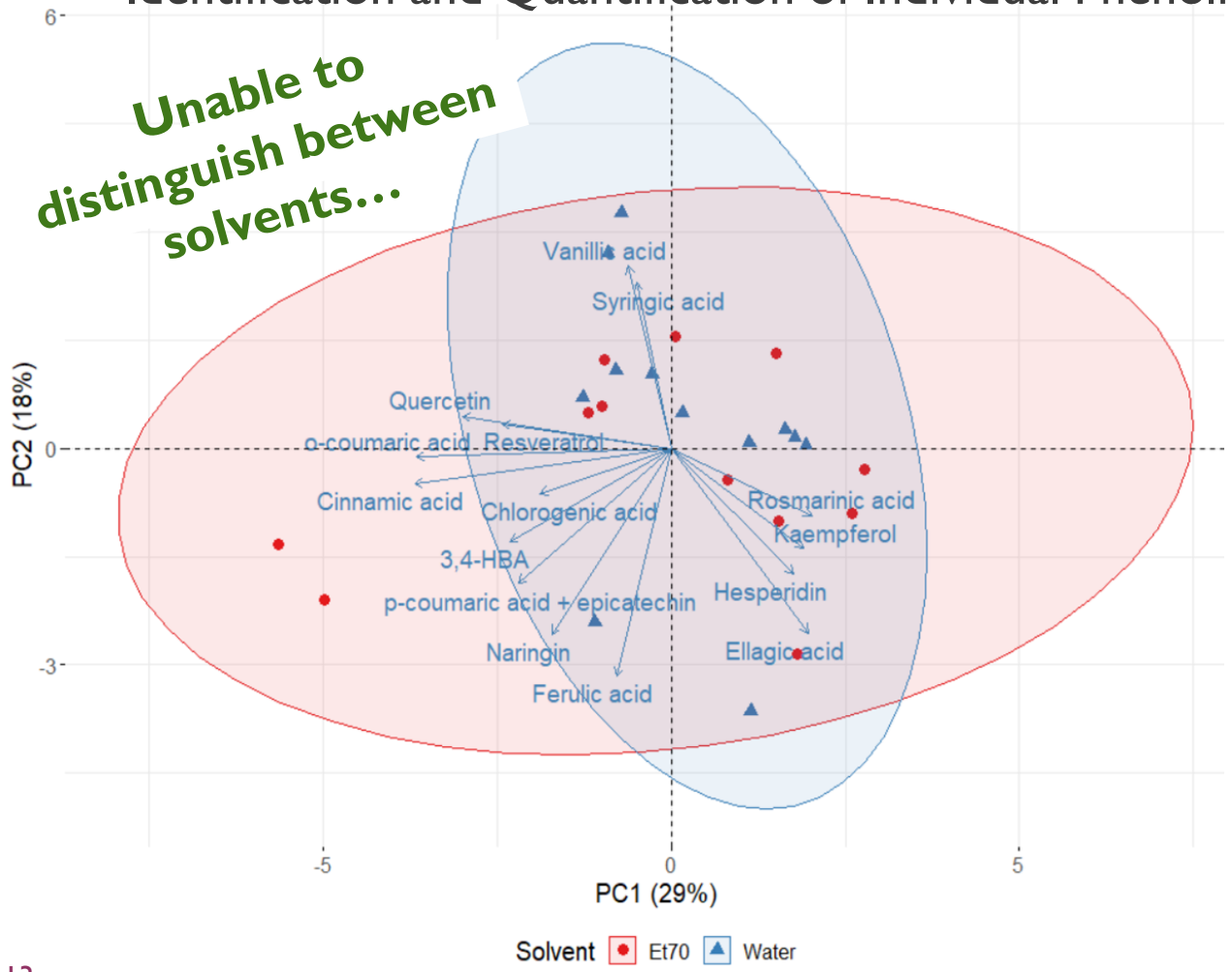
Present in all extracts

- p-coumaric acid + epicatechin
- o-coumaric acid
- Chlorogenic acid
- Cinnamic acid
- Syringic acid
- Vanillic acid
- Kaempferol
- 3,4-HBA

PCA was conducted to visualize the influence of phenolic compounds on extracts differentiation

# RESULTS

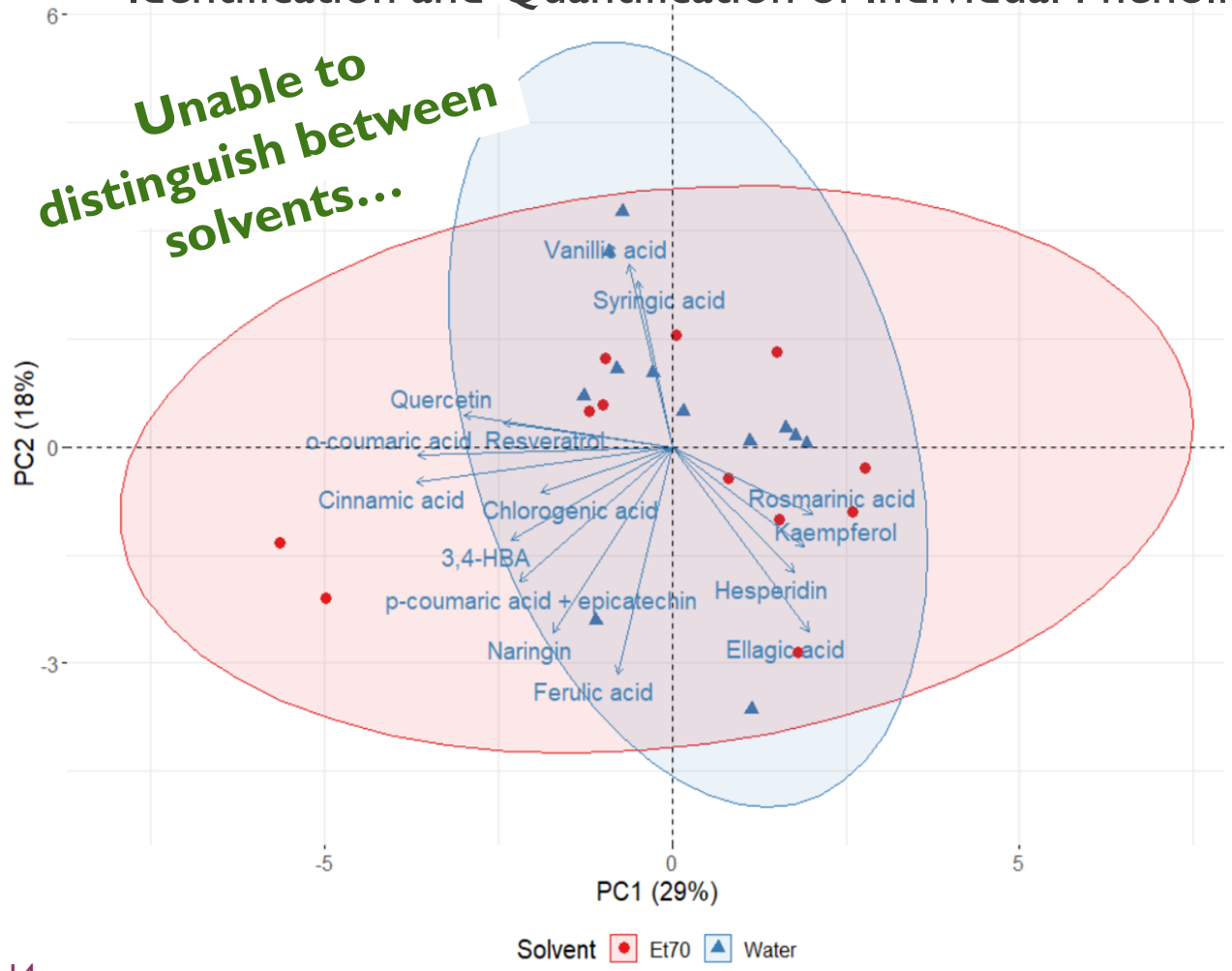
- Identification and Quantification of Individual Phenolic Compounds

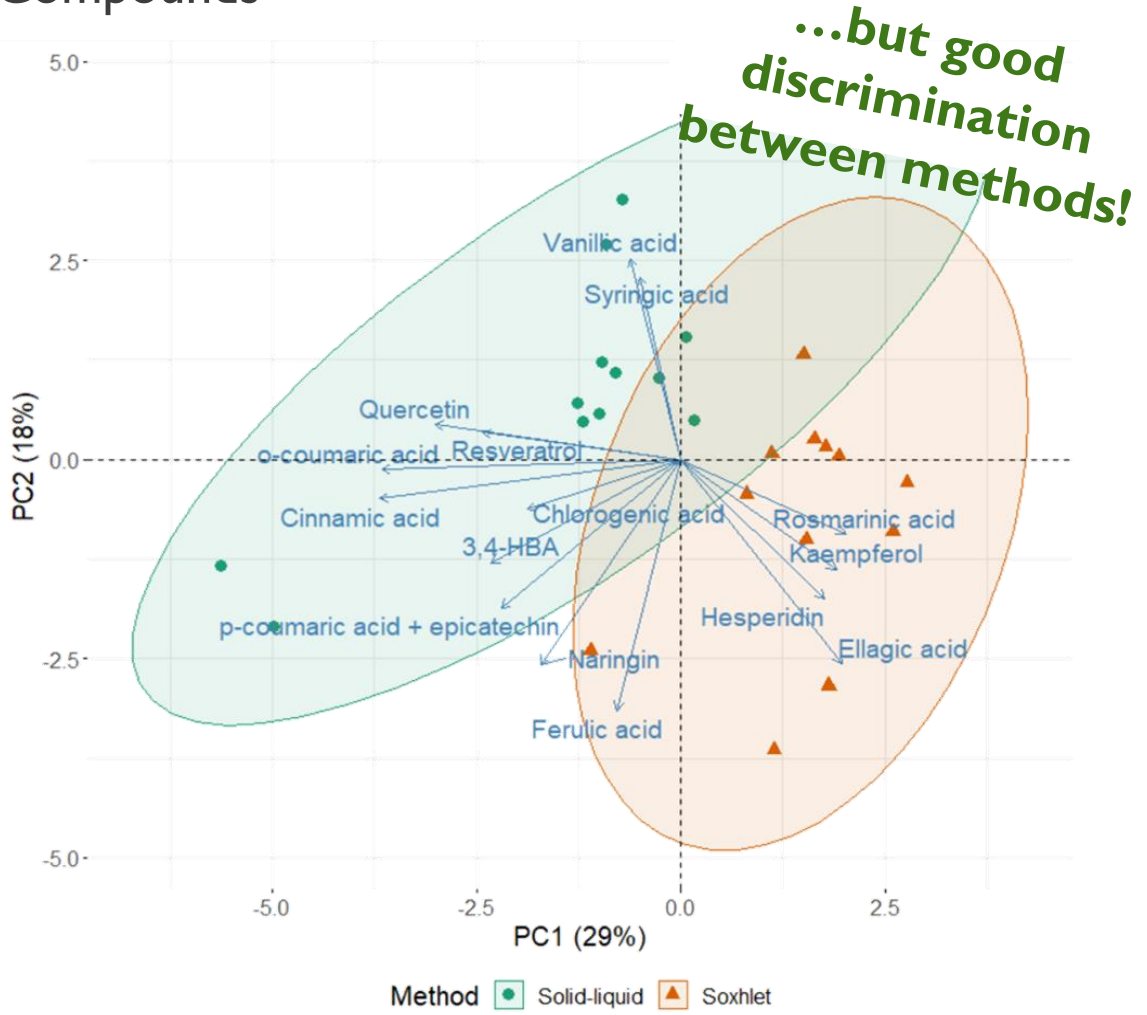



- Hydroethanolic extracts: higher concentrations of rosmarinic acid, resveratrol, and hesperidin
- Aqueous extracts: higher concentrations of vanillic and syringic acids

# RESULTS

- Identification and Quantification of Individual Phenolic Compounds



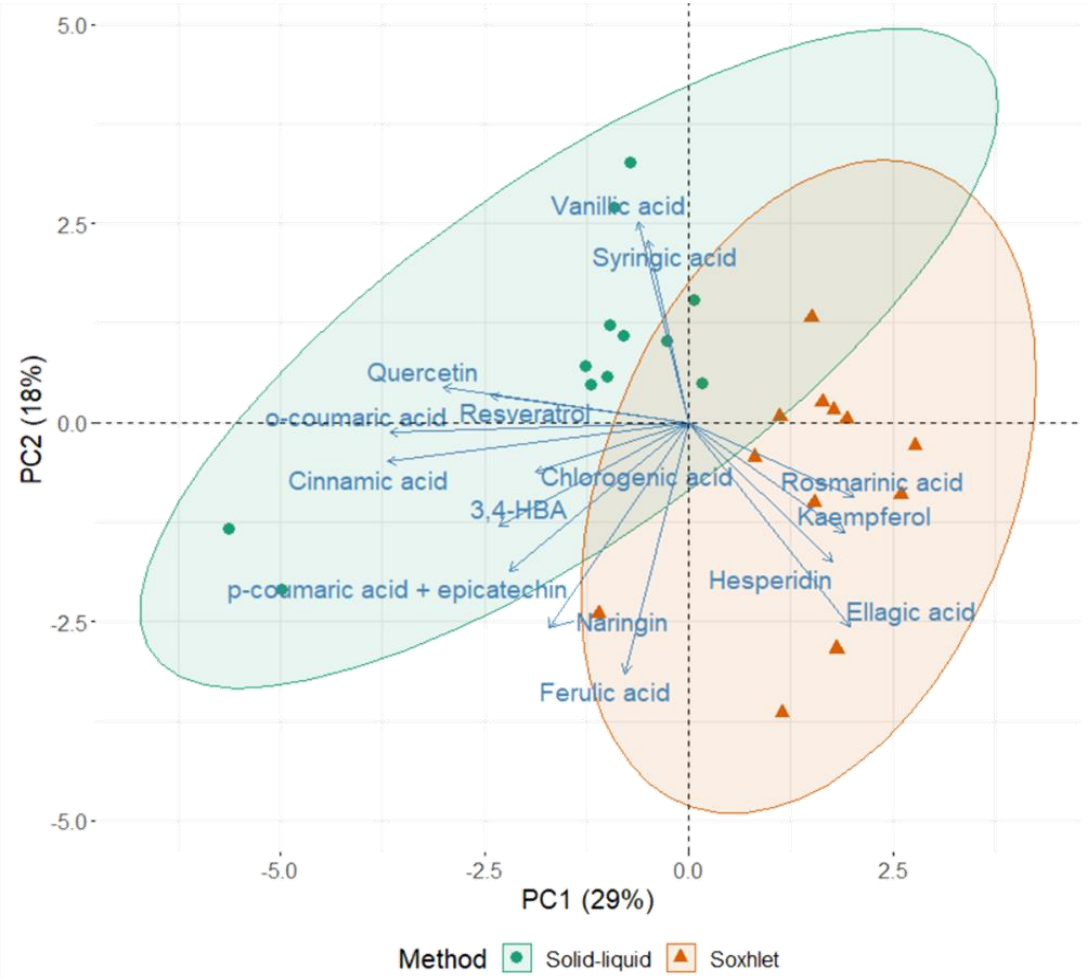



# RESULTS

- Identification and Quantification of Individual Phenolic Compounds

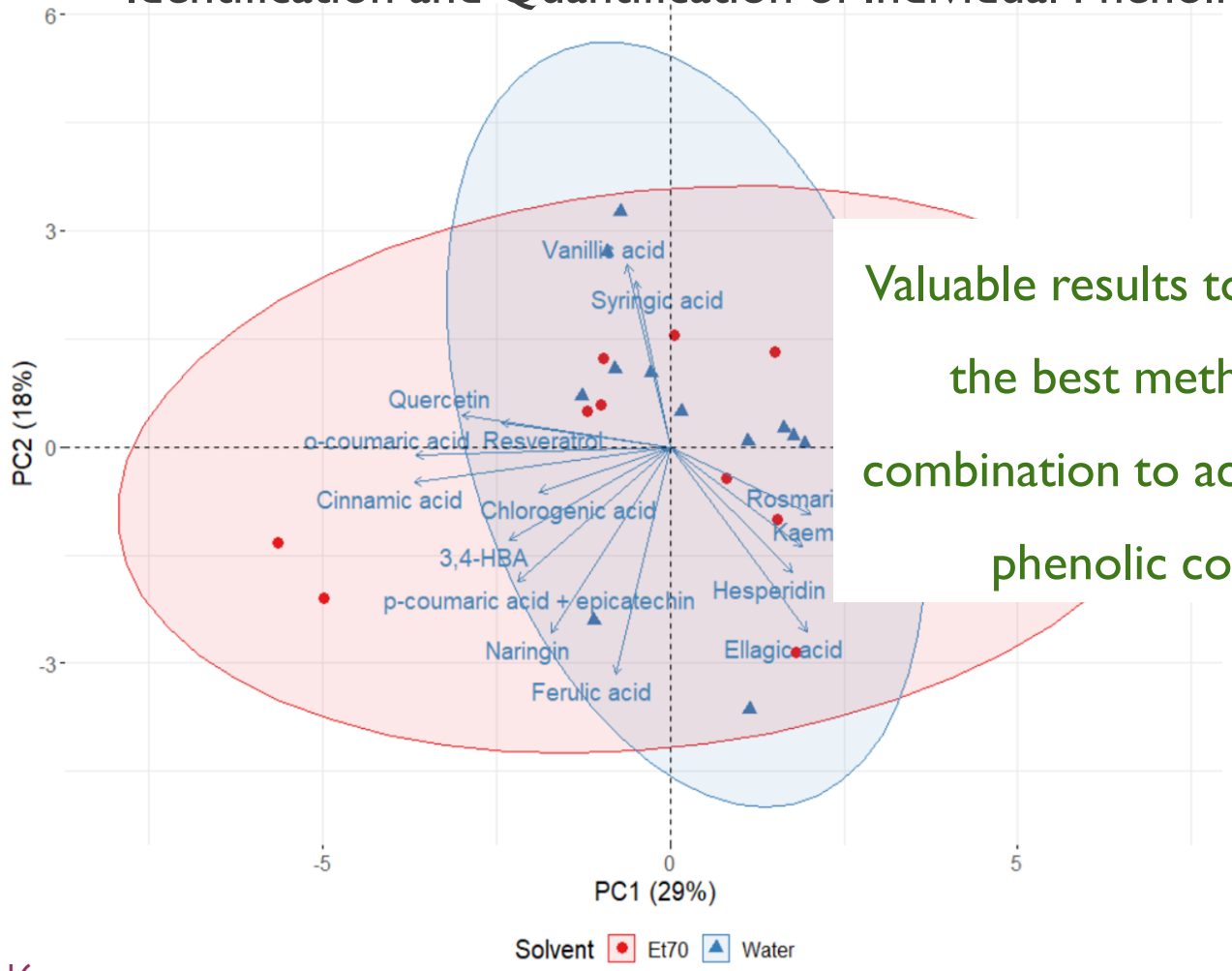
  - Soxhlet extracts: higher concentrations of rosmarinic acid, kaempferol, hesperidin and ellagic acid

  - Solid-liquid extracts: higher concentrations of vanillic and syringic acids, resveratrol, and quercetin

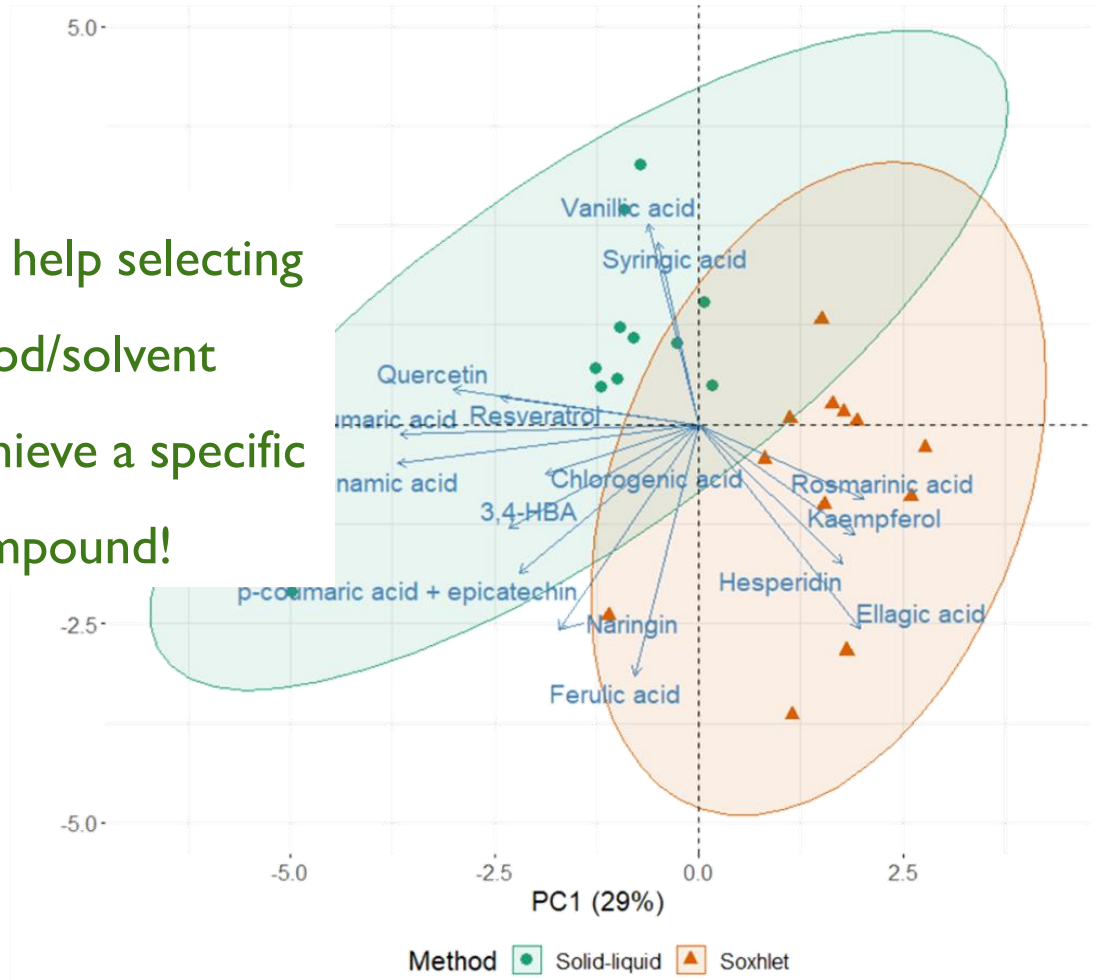


# RESULTS

- Identification and Quantification of Individual Phenolic Compounds




Valuable results to help selecting the best method/solvent combination to achieve a specific phenolic compound!



# CONCLUSIONS

- Insight on the phytochemical profile and antioxidant activity of plant extracts
- Evaluation of the effect of extraction methods and solvents
  - Differences between aqueous and ethanolic extracts
  - Differences between solid-liquid and Soxhlet techniques
- Overall higher phenolic content: solid-liquid hydroethanolic extracts
- Lemon balm extracts: highest TPC, TFC and antioxidant activities
- Tarragon: "worst" results in all assays

# ACKNOWLEDGEMENTS

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# Thank you!

Any questions: beatrizsilva@ceb.uminho.pt

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