

Spanish agri-food byproducts as potential sources of adaptogens for the development of functional foods and beverages

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INTRODUCTION & AIM

Adaptogens are compounds that **enhance the body's resilience** to physical, chemical, and biological stressors, supporting **homeostasis** and overall well-being.

Their beneficial effects are mediated through **modulation of key stress-response pathways** and are linked to their **chemical structure (Fig.1)**.

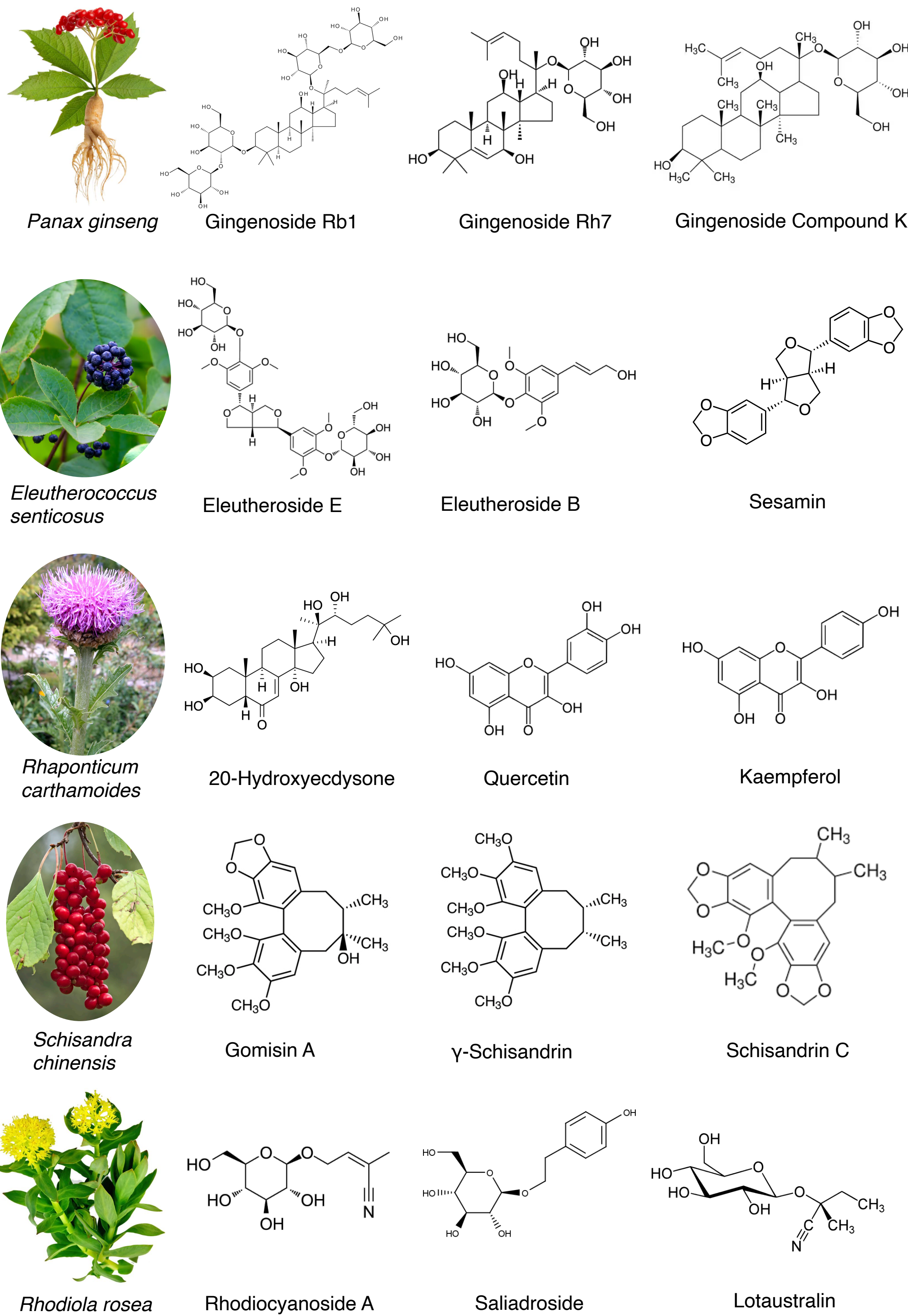


Figure 1. Traditional plants associated with adaptogens and the compound mainly associated to the adaptogenic effect.

CONCLUSIONS

FINDINGS

Compounds present in agri-food byproducts seem to show mechanisms of action linked to adaptogenic effect. These compounds can be incorporated in functional beverages which aim is to contribute to homeostasis.

LIMITATIONS

This hypothesis is based on bioactivity assays previously done and available in literature. However, it is necessary to perform specific analysis to underscore the pharmacokinetic and pharmacodynamic response of the selected compounds to underscore their adaptogenic activity.

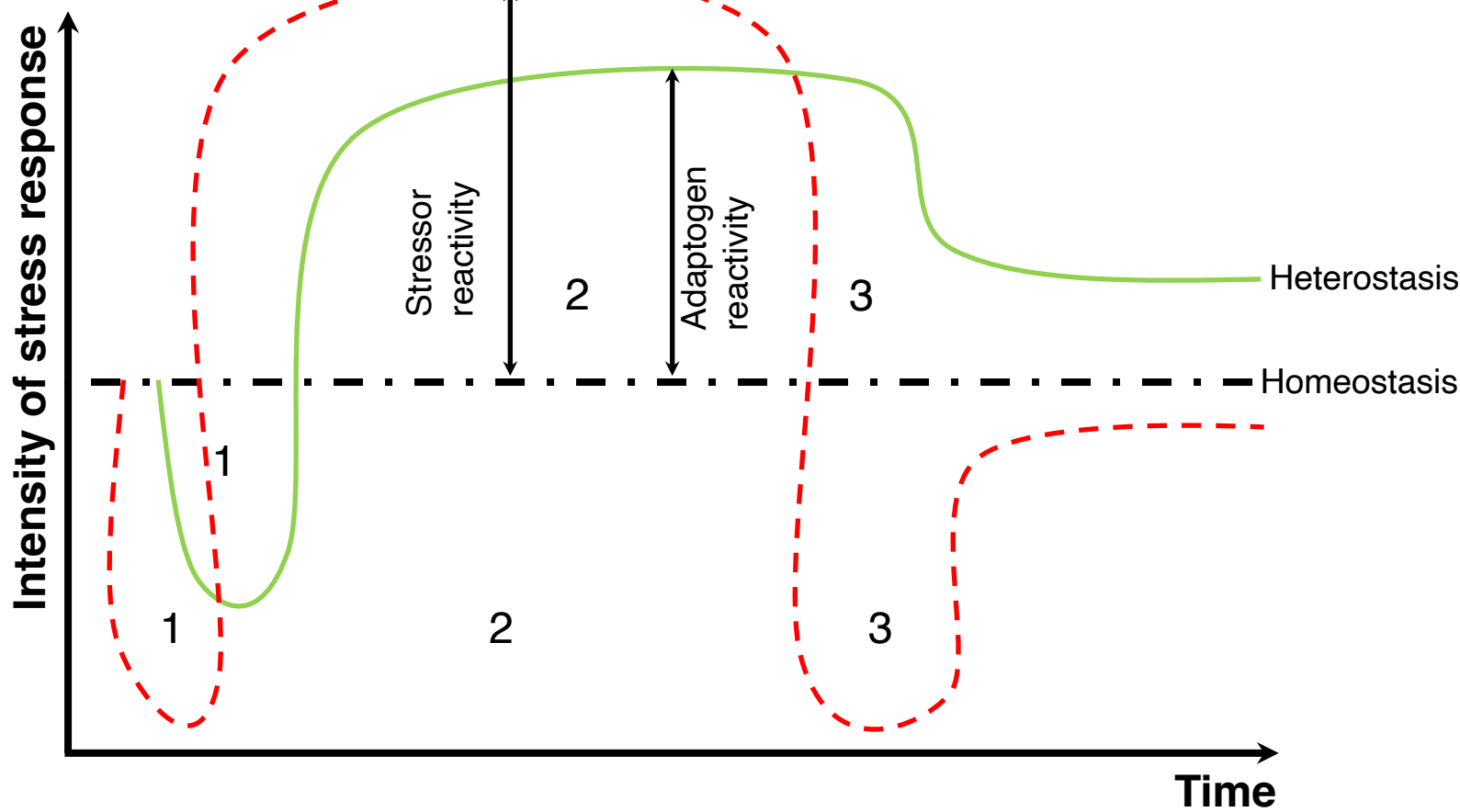


Figure 2. Comparison between stress response and adaptogens effect.
1.Alarm phase,
2.Resistance phase,
3.Exhaustion phase.

Several agri-food byproducts have shown a great composition of compounds showing different bioactivities, making them excellent sources for the formulation of functional food and beverages, while introducing a circular economy approach.

In Spain, there are several agri-food byproducts that have been studied, showing a great composition in compounds with antioxidant, anti-inflammatory, neuroprotective and anticancer activities (**Fig.2**).

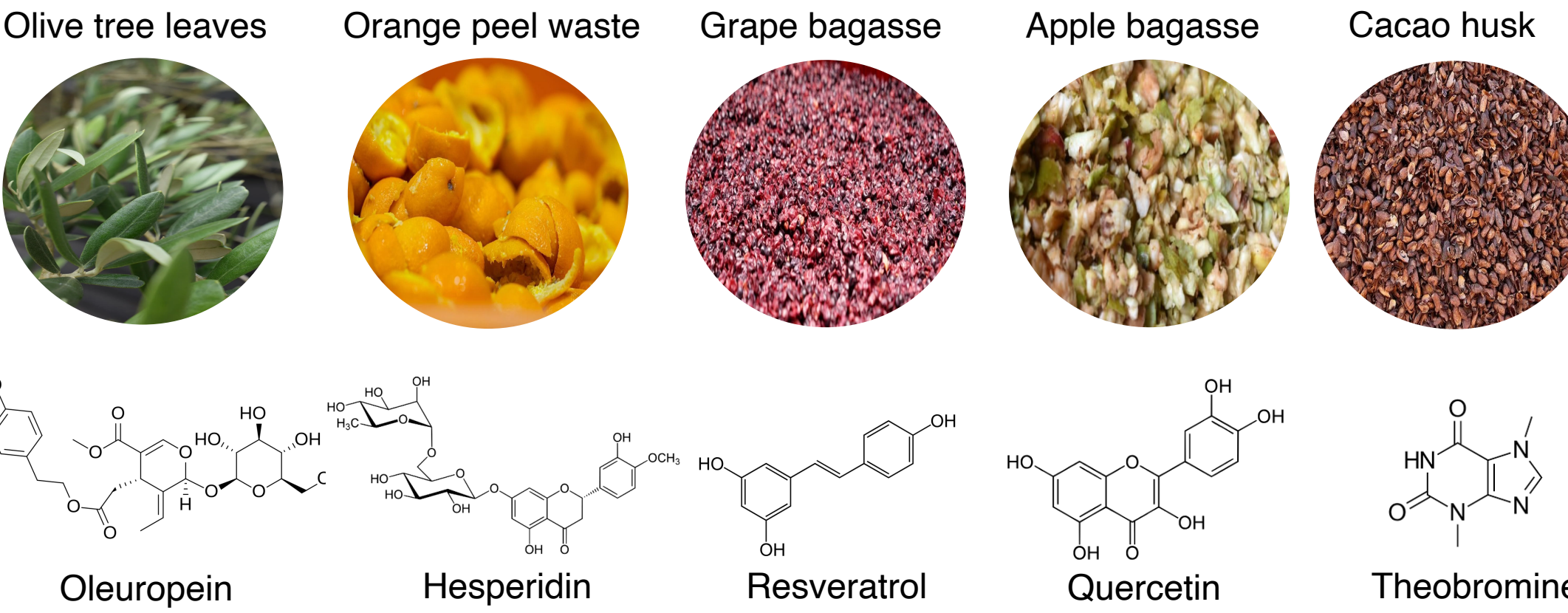


Figure 2. Agrifood byproducts and their compounds with potential adaptogenic effect.

RESULTS

Table 1. Characteristics of the compounds of interest from agri-food byproducts and their linkage to adaptogenic effect..

Compound	Chemical structure	Bioactivity	Main mode of action	Link to adaptogenic effect
Oleuropein	Secoiridoid glycoside	Antioxidant Anti-inflammatory Antineoplastic Antihypertensive Neuroprotector	Free radical stabilization through hydrogen bonding between phenoxyl radicals and hydroxyl groups	Activation of antioxidant defense system
Hesperidin	Aglycone	Antioxidant Anti-inflammatory Anticancer Antimicrobial	Suppression of MAPK kinase (MEK)-ERK phosphorylation in the MAPK signalling pathway	Attenuation of pro-inflammatory agents
Resveratrol	Stilbenol	Antioxidant Antihyperlipidemic Anticancer	Block topoisomerase-2 involved in overexpression of cancer cells	Attenuation of pro-inflammatory agents
Quercetin	Penta-hydroxy-flavone	Antioxidant Anti-inflammatory Antineoplastic Protein kinase inhibitor	Targets the catalytic sites of enzymes involed in signal transduction	Attenuation of pro-inflammatory agents
Theobromine	Dimetil-xanthine	Antioxidant Anti-inflammatory Anticancer Neuroprotector	Antagonize adenosine receptors, normalizing synaptic plasticity	Modulation of key stress response pathways

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