Polyphenols from invasive *Reynoutria* species: extraction, characterisation, application

Linda Ansone-Bertina, Linards Klavins, Jorens Kviesis, Evelina Niedrite, Alise Zommere, Maris Klavins

University of Latvia, Department of Environmental Science

Contact information:

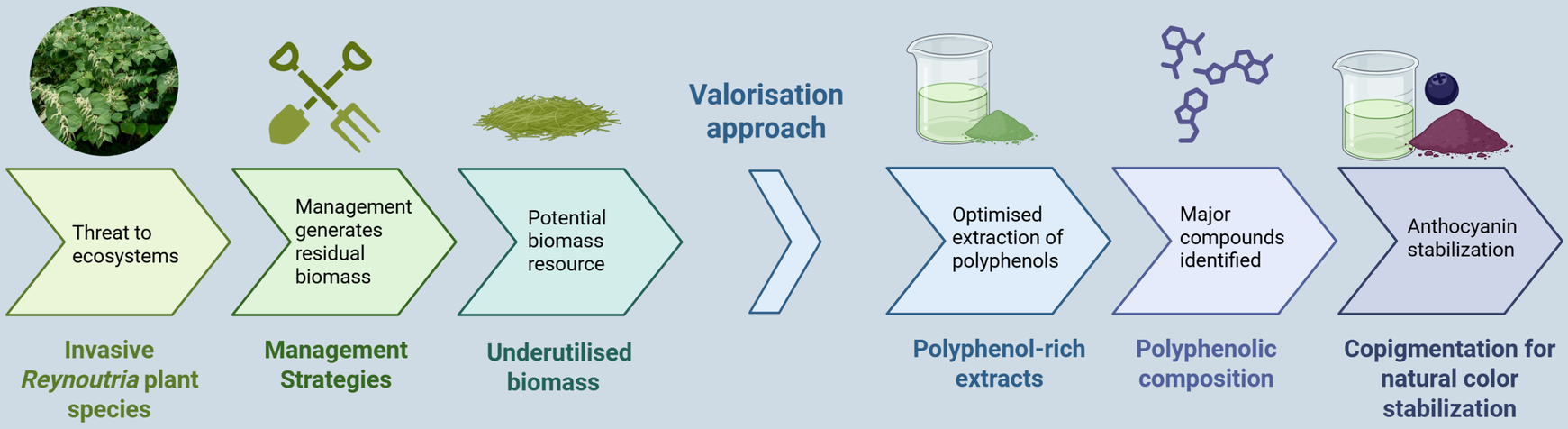
Jelgavas str. 1, Riga, Latvia

+371 27810677,

evelina.niedrite@lu.lv

maris.klavins@lu.lv

Invasive *Reynoutria* biomass can be valorised into polyphenol-rich extracts with functional potential for natural pigment stabilisation.



Introduction

Invasive *Reynoutria* species, including Japanese knotweed (*R. japonica*), Sakhalin knotweed (*R. sachalinensis*), and Bohemian knotweed (*R. × bohemica*), threaten biodiversity in Europe and generate large amounts of underutilised biomass during management. This biomass represents a promising source of polyphenols with antioxidant and copigmentation properties, offering potential for the stabilisation of natural pigments such as anthocyanins.

This study aimed to evaluate *Reynoutria* biomass as a source of polyphenol-rich extracts and assess their application for anthocyanin stabilisation.

Methods

The *Reynoutria* species samples were extracted using different solvents at varying concentrations (70–96%), temperatures (22–40°C), and extraction times (4–24 h). Conventional maceration, Soxhlet, ultrasound-assisted, and accelerated solvent extraction methods were compared. TPC (Folin–Ciocalteu) and DPPH activity were measured spectrophotometrically. Copigmentation was tested by mixing *Reynoutria* extracts (0.2–0.8 mg/mL) with aronia anthocyanins (0.5 mg/mL), stored at 4, 21, and 40°C for 10 days, and analysed by UV–Vis.

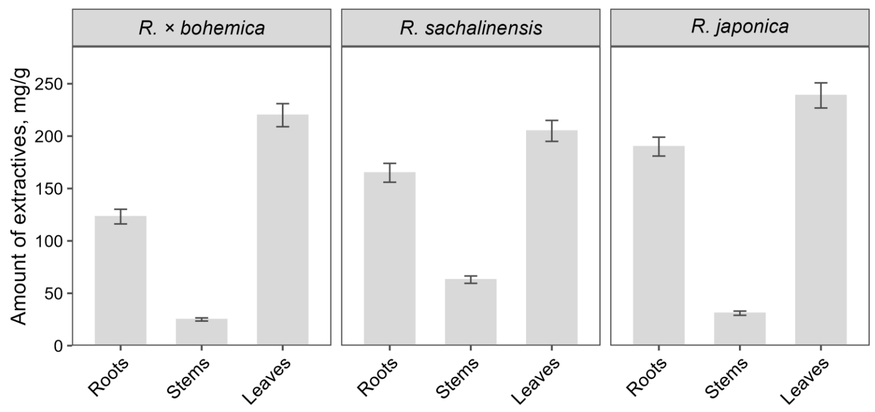


Fig. 1. Extractive yield in different plant parts of invasive *Reynoutria* species after Soxhlet extraction (~2 g biomass, 150 mL of 96% ethanol, 6 h, 108 °C).

Results

1. Extract yield

Polyphenol recovery depended on species, plant part, and extraction method. Leaves showed the highest extractive content, reaching **238.85 mg/g** in *R. japonica*, while stems had the lowest values in all tested samples (<65 mg/g) (**Fig. 1**). In the method comparison conducted only for *R. × bohemica* roots, Soxhlet extraction with 96% ethanol gave the highest extract yield (**123.19 mg/g**) compared with maceration, ultrasound-assisted extraction, and ASE.

2. Highest bioactivity

R. japonica leaves showed the highest total polyphenol content (**89 ± 2 mg GAE/g DW**) and strongest radical scavenging activity (**150 ± 4 mg Trolox/g DW**).

3. Best functional effect

Over 10 days, anthocyanin stability improved at higher polyphenol concentration and lower temperature, with minimal absorbance loss at 4 °C (**1.7%**) (**Fig. 2**).

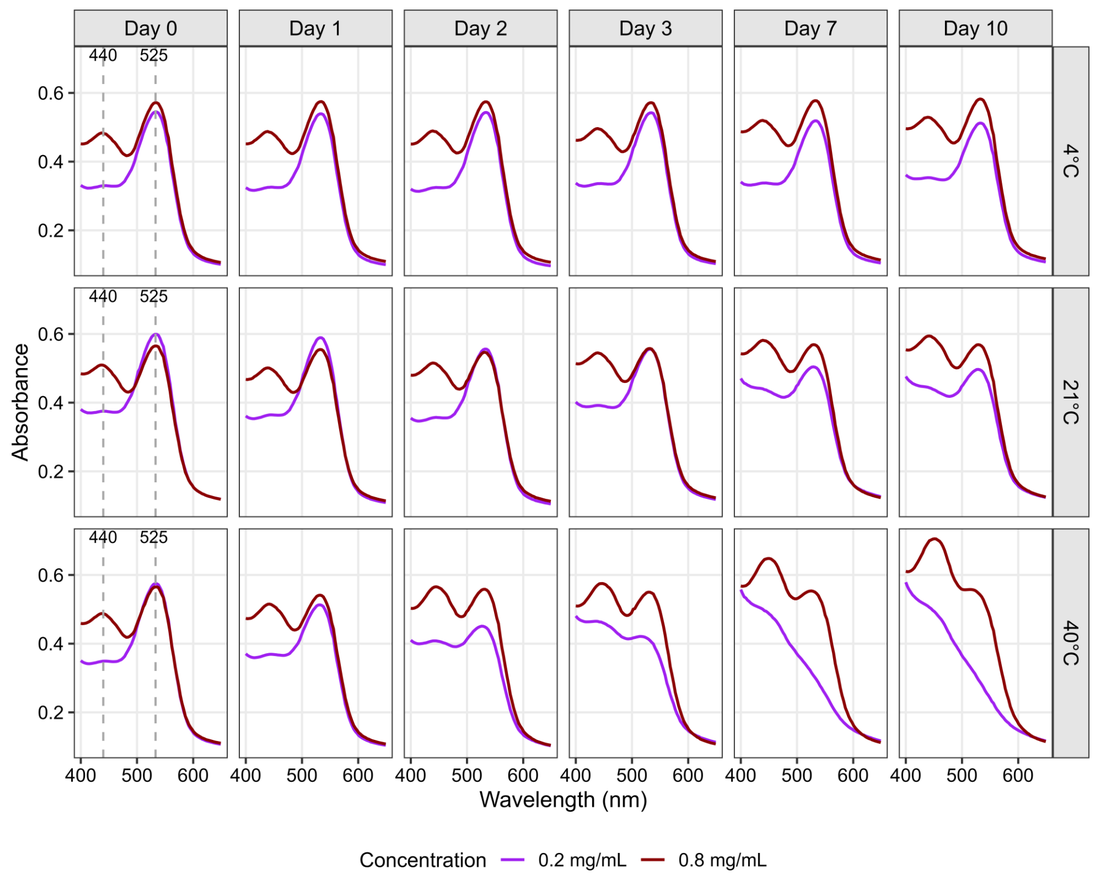


Fig. 2. UV–Vis absorption spectra of aronia anthocyanins in the presence of *R. japonica* polyphenol extract during storage at 4, 21, and 40 °C over 10 days.

Conclusion

Polyphenol-rich extracts recovered from invasive *Reynoutria* biomass could serve as value-added functional ingredients for stabilising natural anthocyanin colourants, for instance, in food and other liquid formulations.

Acknowledgement

This work has been supported by the Latvian Council of Science project “Biorefinery-derived Functional Ingredients for Enhanced Conjugate Stability of Natural Dyes through Co- pigmentation – ChromaQuest” (project No. lzp-2024/1–0066).