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INFLUENCE OF SELENIUM ON GLUCOSINOLATE PROFILE IN ROCKET SPROUTS

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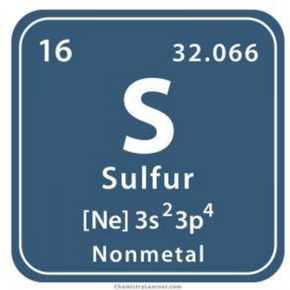
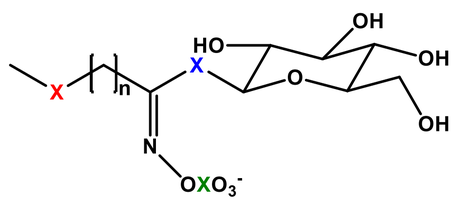
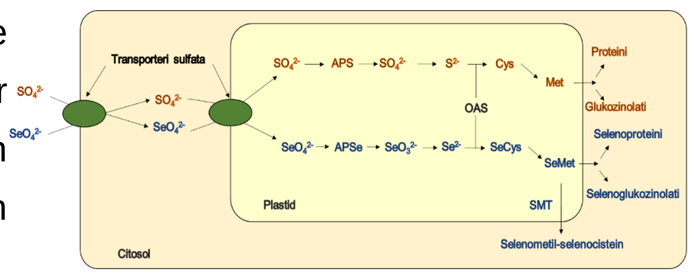
INTRODUCTION

Glucosinolates (*β*-thioglucoside-*N*-hydroxysulfates) are a large group of specialised metabolites that give a characteristic bitter and pungent taste to cabbages and their degradation products are biologically active compounds. They are involved in plant response to biotic stress but can be significantly influenced by abiotic factors as well. [1] Rocket sprouts are nutritionally rich, and their advantage is very easy cultivation. Also they are rich in vitamins whose content increases with germination, essential fatty acids and fibres. Plants generally do not tolerate selenium concentrations higher than 10-100 μg/g dry weight in tissues, but species belonging to the Brassicaceae family can accumulate selenium in tissues and tolerate concentrations up to 1000 μg/g dry weight [2]. In this way, plants can produce various selenium metabolites that can play a role as a means of preventing cancer. Studies have shown that a selenium atom can be incorporated into the side chain of glucosinolates instead of sulfur (Scheme 1). The development of bioaccumulation strategies for nutraceutical compounds in plants, in any of their growth phases, has become a focus of attention in improving the health-benefits of foods and for the design and production of functional ingredients that can potentially be included in various food matrices or even some cosmetics.







Scheme 1. Sulfate and selenate transport

MATERIALS AND METHODS

The rocket sprouts were grown hydroponically and watered with selenium solutions of different concentrations (1; 2.5; 5; 7.5; 10 ppm). The development of the plants was monitored for 7 days and only at the highest concentration of selenium the plant did not develop. After collection, glucosinolates were extracted using 70% methanol and qualitatively and quantitatively analysed by UHPLC-DAD-MS/MS. Volatile glucosinolate degradation products were isolated by CH_2Cl_2 extraction and isolates were analyzed by GC-MS.

RESULTS

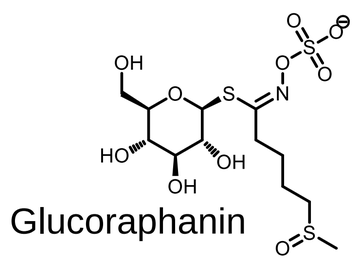
Table 1. Glucosinolate (GSL) content in rocket sprouts grown hydroponically.

Identified glucosinolates	Glucosinolate content (μmol g^{-1})						
	Seeds	Reference	Se 1 ppm	Se 2.5 ppm	Se 5 ppm	Se 7.5 ppm	Se 10 ppm
Glucoraphanin	3.57	9.83	6.60	8.76	4.59	7.10	1.42
Glucoerucin	220.79	84.17	38.59	44.36	30.53	38.61	22.85
Dimeric 4-mercaptobutyl GSL	n.d.	1.83	2.83	2.79	0.57	0.30	n.d
4-Methoxy glucobrassicin	n.d.	1.13	0.93	1.55	0.34	0.47	n.d

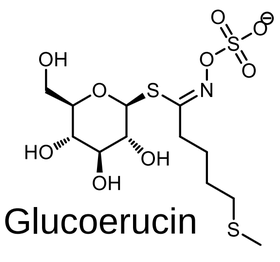
n.d. – not detected

Identified glucosinolates

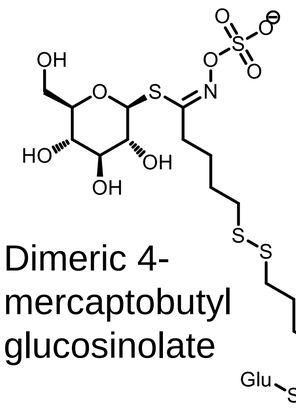
Met derived



Glucoraphanin

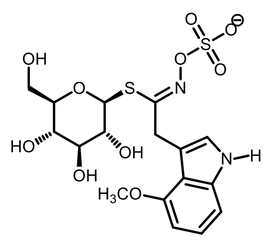


Glucoerucin



Dimeric 4-mercaptobutyl glucosinolate

Trp derived



4-Methoxyglucobrassicin

CONCLUSION

Four (4) glucosinolates were identified: glucoraphanin, glucoerucin, dimeric 4-mercaptobutyl GSL and 4-methoxyglucobrasicin, while GC-MS technique identified erucin which originated from degradation of glucoerucin. The amount of glucoerucin was significantly higher in sprouts treated with selenium concentrations than the concentrations of other identified glucosinolates. No selenoglucosinolate was detected in the analysed samples.

REFERENCES

[1] I. Blažević, S. Montaut, F. Burčul, C. E. Olsen, M. Burow, P. Rollin, N. Agerbirk, Phytochemistry 169 (2020) 112100

[2] R. S. Boyd, Plant Soil (2007) 293, 153–176.