

## ABSTRACT

### Phytochemistry and Biological Activity of *Rubus rosifolius* and an Associated Red Raspberry Variety

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Differences in the sensory and morphological properties of two plant varieties resembling *Rubus rosifolius* led to a comparative study of the plants in which their morphology, phytochemistry and biological activities were studied. Variation in the perceived colour of the fruits from each plant resulted in them being labelled 'red' (R) and 'wine red' (WR). Chapter 1 is a review of the secondary metabolites isolated from the *Rubus* genus and Chapter 2 details the morphological analysis of the plants, as only one variety was previously reported in literature. The findings indicate that the plants differ at the varietal level and this is the first time they are being differentiated. Phytochemical, physicochemical and sensory analyses of both plants were undertaken and these are detailed in Chapter 3. Among the parameters studied, the maturity index and total sugar contents of the juices from both varieties were found to be strongly correlated to sweetness, while pH and titratable acidity were strongly correlated to sourness.

The isolation and structure elucidation of compounds from the methanol and hexane extracts of the red variety ( $R_{MeOH}$  and  $R_{Hex}$ ) and the ethyl acetate extract of the wine red variety ( $WR_{EtOAc}$ ) are presented in Chapter 4. Nine compounds were isolated from  $R_{MeOH}$  and these include two malic acid derivatives: malic acid 4-methyl ester (**79**) and L-(-)-di-*n*-butyl malate (**80**), one furan: 5-hydroxymethyl-2-furaldehyde (**81**), two ursolic acid derivatives: nigaichigoside F1 (**62**) and trachelosperogenin B (**60**), one phytosterol: stigmasterol (**65**), and three sugars: glucose (**82**) maltose (**83**) and *n*-butyl- $\beta$ -D-fructopyranoside (**84**).

A triacylglycerol mixture (**85**), erucic acid (**86**) and  $\beta$ -sitosterol (**67**) resulted from  $R_{Hex}$ . Compounds **85** and **67** were also isolated from  $WR_{EtOAc}$  along with two derivatives of  $\beta$ -sitosterol: daucosterol (**65**) and  $\beta$ -sitosterol-3-*O*- $\beta$ -D-glucoside-6'-acetate (**87**), three triterpenes: euscaphic acid (**56**), pomolic acid (**88**) and trachelosperogenin A (**89**), two organic acids: malic acid (**90**) and pentanedioic acid, 2-hydroxy-1-methyl ester (**91**), a mixture of triacylglycerols (**92**) and two fatty acid mixtures (**93** and **94**). Compounds **79**, **80**, **84**, **87** and **89** are being reported in the *Rubus* genus for the first time.

Chapter 5 is a review of the biological activity of the phytochemicals previously reported in *Rubus*. The antioxidant, antimicrobial, brine shrimp lethality, cytochrome P450 enzyme inhibitory and hypoglycaemic activities of the crude extracts and isolated principles from the fruits of both varieties are presented in Chapter 6. The methanol extracts of the two *Rubus* plants exhibited the greatest antioxidant and anti-microbial activities. Compounds **80** and **89** and the mixture of fatty acids (**93**) exhibited the greatest CYP450 enzyme inhibitory activities against the isoenzymes CYP1A1 and CYP1B1. The autoxidation products of compound **85** displayed hypoglycaemic activity comparable to that of the positive control, metformin, for the first 150 minutes of the assay. Finally, Chapter 7 addresses the potential of research of this nature to impact the socioeconomic conditions of developing nations such as Fiji and Jamaica where the research was conducted.

Keywords: Theresa F. Campbell; *Rubus rosifolius*; red raspberry; bioactivity, antioxidant; antimicrobial; cytotoxicity; CYP450; hypoglycaemic.