

The use of a biological assay based on the growth parameters of the *Saccharomyces cerevisiae* $\Delta sod1$ mutant to assess the antioxidant properties of extracts of the aerial parts of dog rose (*Rosa canina* L.)

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INTRODUCTION

For many years dog rose (*Rosa canina* L.) has been used as a material rich in bioactive substances. The herbal materials are the fruits (pseudofruits), seeds (true fruits), leaves, flowers, petals, leaf and flower buds, shoots, and also the root, although the highest content of health-promoting substances is found in the aerial parts of the plant.

AIM

The aim of the study was to assess the antioxidant properties of water (W), ethanol + water (EW), and glycerol + water (GW) extracts of various organs of dog rose (obtained in their natural state and purchased at a herbalist's shop) using various methods: classic chemical methods (determination of the content of total phenolic (TP) and ascorbic acid (AA)), biochemical methods (determination of the capacity to scavenge artificial ABTS•+ and DPPH• radicals) and an innovative bioassay exploiting the phenomenon of restoration of growth to $\Delta sod1$ mutant *S. cerevisiae* yeast cells in a hypertonic medium and minimal YNB medium without the required additives (amino acids: lysine and methionine).

MATERIALS AND METHODS

The TAC (Total Antioxidant Capacity) was determined in the extracts by the ABTS•+ and DPPH• method (Re et al. 1999, Molyneux, 2004). The content of TP and the sum of AA and its oxidized form dehydroascorbic acid (DHA) in the extracts was determined according to Sanchez-Rangel et al. (2013). The TP results were expressed as chlorogenic acid equivalent (CHA) per 1mL of extract, corrected by subtracting the value for the AA reducing activity obtained in the same assay. The biological assay of antioxidant property of extracts relied on study their capacity for the stimulation of $\Delta sod1$ *S. cerevisiae* cells growth in liquid hypertonic and minimal YNB medium (Święciło et al. 2018). The density of the yeast culture was determined using a resazurin reduction assay (Święciło, Rybczyńska-Tkaczyk, 2019).

CONCLUSIONS

The results suggest that bioassays based on the growth parameters of the $\Delta sod1$ mutant of *S. cerevisiae* yeast can be used to assess the antioxidant properties of plant extracts *in vivo*, but their usefulness seems to depend mainly on the content of hydrophilic antioxidants.

RESULTS

The leaves, both young and mature, proved to be the richest sources of phenolic compounds. They contain from 128.29 to 159.14 mg phenolic compounds/mL expressed as CHA equivalent. The fruits and leaf buds are significantly poorer sources of these substances. On the other hand, vitamin C content was highest in the fruits of dog rose (whole fruits from Dary Nature and ground peel from Sanbios). It was much lower (by about 70%) in the extracts prepared from fruits obtained in their natural state in the previous growing season, and the lowest in extracts from the leaf buds and leaves. The extracts also had varied antioxidant properties as determined by the ABTS•+ and DPPH• assays. The extracts of leaf buds and leaves (young and mature) had a greater capacity to neutralize the DPPH radical than the ABTS radical cation, whereas the fruit extracts were more active against the ABTS radical than DPPH. The two biological assays, involving analysis of the growth of $\Delta sod1$ mutant cells in a hypertonic medium (test 1) and in YNB minimal medium, without essential amino acids lysine and methionine (test 2), produced similar results. The extracts of whole fruits from Dary Nature and the ground fruit skins from Sanbios showed the greatest capacity to restore growth to $\Delta sod1$ mutant cells. The highest OD values of the cultures were noted following the addition of glycerol + water extracts and the lowest in the case of water extracts, irrespective of the type of material used.

