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BIOMARKERS OF LIPID AND PROTEIN OXIDATION IN THE MUSCLE TISSUE OF ATLANTIC SALMON (SALMO SALAR L.) INCUBATED WITH EXTRACTS OF GREATER CELANDINE (CHELIDONIUM MAJUS L.)

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Better knowledge of oxidative balance in fish tissues and its application to fisheries and aquaculture science (i.e., breeding fit fish) is needed in the face of global environmental change, high fishing pressure, increased aquaculture production, as well as increased concern for fish welfare (Johnston, 1999; Palstra and Planas, 2011). Oxidative stress-related diseases can contribute to increased fish mortality (Bisht et al., 2017). Therefore, there is a need to search for measurements to prevent oxidative imbalance in fish. It is suggested that medicinal plants containing secondary metabolites such as alkaloids, polyphenols, and vitamins, among others, can contribute to eliminating the harmfulness of oxidative stress (Koleva et al., 2018). Recent scientific reports have demonstrated that plants belonging to the Papaveraceae family contain several compounds possessing antioxidant properties. Great celandine Chelidonium majus L. (CM) (Papaveraceae) has a long history of being useful for the treatment of many diseases. This plant is of great interest for its use also in Chinese herbal medicine (Zielińska et al., 2018). The plant contains as major secondary metabolites isoquinoline alkaloids, such as sanguinarine, chelidonine, chelerythrine, berberine, and coptisine. Other compounds structurally unrelated to the alkaloids have been isolated from the aerial parts: several flavonoids and phenolic acids. CM extracts and their purified compounds exhibit antiviral, antitumor, antimicrobial, and antioxidative properties in both in vitro and in vivo studies (Arora and Sharma, 2013).

Consistent with our previous studies, we continue to evaluate the antioxidant potential of representatives belonging to the Papaveraceae family collected from the northern part of Poland using a muscle tissue model of Atlantic salmon (Salmo salar L.). Therefore, in the present study, oxidative stress biomarkers [2-thiobarbituric acid

reactive substances (TBARS), aldehydic and ketonic derivatives of oxidatively modified proteins (OMP), total antioxidant capacity (TAC)] and also activity of antioxidant enzymes (catalase, superoxide dismutase, glutathione peroxidase) were used for evaluating the in vitro antioxidant activity of root and stalk extracts derived from great celandine Chelidonium majus L. (CM) collected in urban and rural agglomerations of Kartuzy district (Pomeranian province, northern part of Poland). Freshly collected roots and stalks were washed, weighed, crushed, and homogenized in 0.1M phosphate buffer (pH 7.4) (in the proportion of 1:19, w/w) at room temperature. Incubation of salmon muscle tissue with extracts derived from both the stalks and roots of CM harvested from rural areas resulted in a decrease in lipid peroxidation. The incubation of salmon muscle tissue with extracts derived from both the stems and roots of CM harvested from rural areas resulted in a decrease in lipid peroxidation. Similarly, the use of extracts derived from the roots of CM collected from urban areas resulted in a decrease in TBARS levels. These results suggest that it can be argued that the presence of secondary plant metabolites in CM extracts protects structures of cell membranes against the damaging effects of free radicals. On the other hand, analysis of levels of protein oxidation after incubation of muscle tissue with CM extracts showed that extracts derived from both roots and stalks of CM harvested from urban areas reduced levels of ketonic derivatives of oxidatively modified proteins. Analyzing the total antioxidant capacity after the incubation with CM extracts under in vitro conditions, we concluded that extracts mainly derived from the stalks of CM harvested from both urban and rural areas effectively increase TAC levels. These results are reflected after analysis of antioxidant enzyme activity, where we observed statistically significant increases in superoxide dismutase and catalase activity. On the other hand, the incubation of CM extracts with muscle tissue resulted in a statistically significant decrease in glutathione peroxidase activity compared to the control samples.

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