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A Study on the Fruiting and Correlation between the Chemical Indicators and Antimicrobial Properties of *Hippophae rhamnoides* L.

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Abstract: Sea buckthorn is a promising species that, under the conditions of Eastern Europe, has shown high productivity and is also a good and possible source of a wide range of bioactive compounds that have a positive effect on the human body, especially polyphenols and carotenoids. Due to the content of biologically active substances in sea buckthorn (*Hippophae rhamnoides* L.), the species is of growing interest to scientists, the food industry, the pharmaceutical industry, the cosmetics industry and consumers. The aim of this study is to investigate the productivity and the correlation between the chemical composition and the antibacterial effect of four cultivars of sea buckthorn (Clara, Dora, Cora, Mara), cultivated in the Republic of Moldova. Sea buckthorn fruits were harvested at the stage of full ripening. Berry samples were frozen at minus 25 °C, stored for 6 months and whole fruits of sea buckthorn were studied. All quantitative characteristics were calculated in terms of absolutely dry raw material (dry weight). The sea buckthorn cultivars tested were found to have a different carotenoid contents (1.79–48.92 mg/100 g), ascorbic acid contents (74.36–373.38 mg/100 g), organic acids (malic acid 5.8–13.4 mg/100 g, citric acid 0.08–0.321 mg/100 g, succinic acid 0.03–1.1 mg/100 g), total dry matter contents (16.71–24.54%), titratable acidities (2.15–8.76%) and pH values (2.73–3.00). The antimicrobial activity of sea buckthorn, evaluated by the diameter of the inhibition zone, constituted for *Bacillus pumilus* 3.70–15.91 mm/g^{-1} for whole sea buckthorn fruits and 13.33–26.67 mm/g^{-1} for sea buckthorn purees.

Keywords: sea buckthorn; variety; productivity; *Hippophae rhamnoides* L.; carotenoids; antimicrobial activity; *Bacillus pumilus*

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1. Introduction

Due to its valuable nutritional benefits and therapeutic properties, sea buckthorn has gained a particular attention and interest compared with other species of flowering plants. Despite this, sea buckthorn has not known a widespread cultivation due to the low productivity of the plants and the presence of dense thorns, which represents a major impediment to manual harvesting. However, with the emergence of highly productive varieties (20 t/ha) and fruit harvesting machines, producers are showing an exceptional interest in sea buckthorn cultivation and the crop is in high demand (in unlimited quantities) on the international market.

Sea buckthorn is a relevant source of vitamins (the most important being vitamins C and E, but vitamins B_1, B_2 and K and bioflavonoids are also present), macro and microelements (nitrogen, phosphorus, iron, manganese, boron, calcium, aluminium, silicon and others) and antioxidants (catechin, myricetin, quercetin, p-coumaric acid, caffeic acid, L-ascorbic acid and gallic acid) [1–4]. Currently, papers containing experimental data

obtained by various international researchers supporting the consumption of sea buckthorn fruits as functional foods [5–7], the use of the fruit as therapeutic remedies [8–10] and their use as sources of natural antioxidants with antimicrobial properties by the food industry [11–14]. Sea buckthorn fruits have a great potential as antimicrobial compounds against microorganisms [15,16]. So, these berries can be used to control the stability of stored food [17,18].

The antioxidant and antimicrobial activity of sea buckthorn depends on the chemical composition of the berries [19,20]. Published experimental data [21,22] support the consumption of sea buckthorn fruits as functional foods and their use as sources of natural antioxidants by the food industry. The content of biologically active substances and the level of antioxidant activity of sea buckthorn depend on growing conditions, agricultural technology and climate [23,24].

The aim of this study was to determine the relationship between the antimicrobial properties of sea buckthorn fruits and the chemical parameters (ascorbic acid content (AAC), organic acids (OA), carotenoid content (CC), total dry matter (TDM), titratable acidity (TA) and pH) of the berries.

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