SUMMARY OF HABILITATION THESIS

DISTRIBUTION OF HEAVY METALS AND IZOTOPIC RATIO OF PB AND SR IN THE SOIL-WINE SYSTEM

i. Summary

The present habilitation thesis, entitled "*Distribution of heavy metals and isotopic ratios of Pb and Sr in the soil-wine system*" presents the most relevant personal achievements regarding the scientific research related to the after doctoral thesis period (Horticulture domain, 2015), up to present along with the scientific and didactic career development plans. The main field of research is the chemistry of the elements and the isotopic reports of Pb and Sr, but also their use for the zonal imprint of some wine assortments, as well as the establishment of quality parameters of the wines in order to promote them on the local and international market. During the period after the defense of the doctoral thesis, through the collaboration with the Research and Development Station for Viticulture and Vinification Bujoru, I acquired certain competences, especially in analytical chemistry, which helped me in further development of my own research direction. The thesis is structured on three parts, the first and the last one provide data regarding the professional training and, respectively, the main directions of my professional career development. The second part of the habilitation thesis presents the main research directions addressed, namely: (i) qualitative analysis of wines obtained from grape-vine varieties cultivated in well-established wine-growing centers; (ii) research on the evaluation of heavy metals concentration and of the isotopic ratios of Pb and Sr in the wine-growing soil; and (iii) research regarding the assessment of heavy metal concentration and isotopic ratios of Pb and Sr in wine.

The first line of research, namely the qualitative analysis of the wines obtained from vine varieties grown in established wine-growing centers, represents the starting point of the subsequent research. A first step was to exactly establish the eco climatic conditions in the Dealu Bujorului, Murfatlar, Târnava, Iași and Ștefănești-Argeș vineyards. Based on the weather data, the most important eco-climatic indices required for the growth and fruiting of vines were calculated: the global thermal balance, the active thermal balance, the useful thermal balance, the temperature coefficient, the solar radiation coefficient, the insulation coefficient. The three studies had as common conclusions the exceptional viticulture character of Romania. The qualitative assessment of the grapevine varieties for white and red wines revealed that the analyzed samples display the

special characteristics of variety. The studies offer new information on the quality of the white and red wines obtained in the main vineyards of Romania, useful for their advertising and marketing, both nationally and internationally.

The line of research entitled *Evaluation of heavy metals concentration and isotopic ratios of Pb and Sr in the wine and wine- growing soil* is the most consistent part of the habilitation thesis. The first study concerns the evaluation of heavy metals concentration and isotopic ratios of Pb and Sr from the soil. Heavy metals are of great concern in the industrial field, as well as in biological and ecological ones. One of the most important ways of transferring heavy metals into the human body is through the consumption of plant and animal foods produced in the contaminated area.

The research performed to determine the concentration of metals and the isotopic ratios of Pb and Sr were performed by the effective determination of the following metals: Cd, Pb, U, Hg, As, Sr, Co, Cu, Ni, Mn, Cr but also of the ^{206}Pb / ^{204}Pb ratios, $^{207}Pb/^{204}Pb$, $^{208}Pb/^{204}Pb$, $^{87}Sr/^{86}Sr$ on the depth of the soil profile from 0-120 cm ICP-MS technique. The wine centers that have been studied are Bujoru, Smulți and Oancea, part of the Dealu Bujorului vineyard. The studied areas have never been analyzed in terms of elemental composition concentration or distribution of Sr ($^{87}Sr/^{86}Sr$) and of Pb ($^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, $^{208}Pb/^{204}Pb$). The studies conducted on wine in order determine the mineral profile (Ca, Mg, K, Na, Li, Cu, Fe, Mn, Co, V, Ag, Al, As, Be, Bi, Cd, Ba, Cr, Cs, Ga, In, Sr, Ni, Rb, Se, Tl, U, Zn, Hg and Pb) but also to determine the isotopic ratios of Pb and Sr have used native varieties and also international varieties of vines, that were cultivated in the wine centers in Bujoru, Smulți and Oancea, part of the Dealu Bujorului vineyard.

The last line of research was the isotopic imprint of the vine varieties for the studied white and red wines. Following the research, it was established that elements such as Mn, Cd, Li, Ba, Ca, Bi, Rb, Mg, Al, Ag, Ni, Cr, Sr, Zn, Pb and Fe have a great discriminatory power for establishing the geographical origin of the analyzed wine samples, but, in addition to these elements other elements were discovered, such as: Hg, Ag, As, Al, Tl, U and which are characteristic of native vine varieties. Since 2015, I have been manager and project coordinator in 2 national research projects but also in 9 national research projects as a member through which about 110.000 euros were obtained, used to improve the infrastructure of research laboratories. The research activities led to the publication of 9 articles published in ISI journals with impact factor, 5 proceedings, 29 in journals in other databases and participation in numerous conferences and symposia in the country. Our plans include the continuation of studies to determine the concentration of metals, heavy metals and isotopic ratios of Pb and Sr, isotopic imprinting of different drinks and foods.