Accumulation of Glycoconjugates of 3-Methyl-4-hydroxyoctanoic Acid in Fruits, Leaves, and Shoots of Vitis vinifera cv. Monastrell following Foliar Applications of Oak Extract or Oak Lactone

Ana I. Pardo-Garcia,† Kerry L. Wilkinson,§ Julie A. Culbert,§ Natoiya D. R. Lloyd,‡ Gonzalo L. Alonso,† and M. Rosario Salinas*†

†Cátedra de Química Agrícola, E.T.S.I. Agrónomos y Montes, Universidad de Castilla-La Mancha, Campus Universitario, 02071 Albacete, Spain
§School of Agriculture, Food and Wine, The University of Adelaide, Waite Campus, PMB 1, Glen Osmond, South Australia 5064, Australia
‡Metabolomics Australia, The Australian Wine Research Institute, P.O. Box 197, Glen Osmond, South Australia 5064, Australia

ABSTRACT: Grapevines are capable of absorbing volatile compounds present in the vineyard during the growing season, and in some cases, volatiles have been found to accumulate in fruits or leaves in glycoconjugate forms, that is, with one or more sugar moieties attached. The presence of oak lactone in wine is usually attributable to oak maturation, but oak lactone has been detected in wines made with fruit from grapevines treated with oak extract or oak lactone. This study investigated the accumulation of glycoconjugates of 3-methyl-4-hydroxyoctanoic acid (i.e., the ring-opened form of oak lactone) in the fruits, leaves, and shoots of Monastrell grapevines following foliar application of either oak extract or oak lactone at approximately 7 days postveraison. Fruits, leaves, and shoots were collected at three different time points, including at maturity. The oak lactone content of fruit was determined by gas chromatography–mass spectrometry, with declining concentrations observed in fruit from grapevines treated with oak lactone with ripening. The concentrations of a β-D-glucopyranoside of 3-methyl-4-hydroxyoctanoic acid in fruits, leaves, and shoots was determined by liquid chromatography–tandem mass spectrometry, with the highest oak lactone glucoside levels observed in leaves of grapevines treated with oak lactone. A glucose–glucose disaccharide was also tentatively identified. These results demonstrate both ring-opening and glycosylation of oak lactone occurred after experimental treatments were imposed.

KEYWORDS: GC-MS, glycoconjugates, grapevines, UHPLC-MS/MS, oak extract, oak lactone