In silico screening and testing of new phytoeffectors to enhance drought stress tolerance in plants

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Biotic and particularly abiotic drought stress caused enormous loss in crop yield during the last years. Being a highly relevant problem for central Germany, there is a strong interest in finding new phytoeffectors which could help plants to overcome and survive drought periods. Several proteins (enzymes) could be identified as potential targets addressable by inhibition with phytoeffectors. Among others the plant alcohol dehydrogenases (ADH's) are believed to be such potential targets [1]. These enzymes are widely spread in many plants and are in the focus of drought stress research projects.

The X-ray structure (pdb: 4RQU) of the alcohol dehydrogenase (ADH) from *Arabidopsis thaliana* was used [2]. Within MOE, a pharmacophore was created consisting of nine features, one metal, six hydrophilic and two hydrophobic features, to search in several structural databases [3]. These databases include the lead like database delivered by MOE, an *in house* database of compounds available in our institute and some others containing agrochemicals and natural products.

The screening procedure led to the identification of more than 1500 first hits. Based on subsequent docking and scoring with GOLD, 130 promising compounds remained to pass for experimental studies [4].

Fast experimental screening in the lab was performed with a *Lemna minor* assay system [5].

From these first tests of 15 compounds, five provoked a considerable enhancement of drought stress tolerance. In comparison to the untreated duckweed, one compound added to the assay led to an increase in leaf area (related to the standard growth of *Lemna minor)* of more than 30% under drought stress conditions.

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[1] R. Dolferus *et al*., *Plant Physiol*, **1994**, 105, 1075-1087

[2] F. Chan *et al.*, *Biochemie*, **2015**, 108, 33-39.

[3] *Molecular Operating Environment (MOE)*, 2014.09; Chemical Computing Group Inc., 1010 Sherbooke St. West, Suite #910, Montreal, QC, Canada, H3A 2R7, **2014**.

[4] M. L. Verdonk *et al.*, *Proteins*, **2003**, 52, 609-632.

[5] T. Geissler, L. A. Wessjohann, *J Plant Growth Regul*, **2011**, 30, 504-511.