Evaluation of interactions between arabidopsides and plant plasma membrane lipids

Manon Genva[1], Magali Deleu[1], Mats X. Andersson[2], Marie-Laure Fauconnier[1], Laurence Lins[1]

[1]*Gembloux Agro-Bio Tech, Université de Liège, Passage des déportés, 2, 5030 Gembloux/Belgique*

[2]*University of Gothenburg, Box 461, SE-405 30, Göteborg, Suède*

Introduction

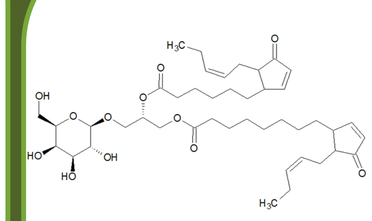
Context

Plant oxylipins produced by the oxidation of unsaturated fatty acids play important roles in plant metabolism and protection against pathogens. Recently, it has been discovered that *Arabidopsis thaliana L.* produces high quantities of oxylipins esterified to galactolipids under stress. Those molecules are called arabidopsides and are produced following oxidation of monogalactosyldiacylglycerol and digalactosyldiacylglycerol found in high quantities in thylakoid membranes. Moreover, arabidopsides pattern is different depending on the nature of the stress, suggesting an involvement of those molecules in plant protection responses. However, the mechanisms of biological activities of arabidopsides remain largely unknown.

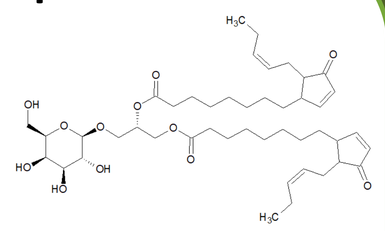
Objectives

Folowing stress, arabidopsides could be released and interact with plant plasma membranes. In the present work, arabidopsides ability to interact with plant plasma membrane lipids was evaluated by molecular modelling methods.

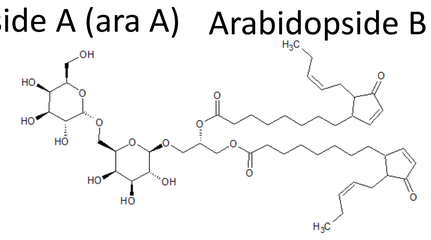
Arabidopsides



Arabidopside A (ara A)



Arabidopside B (ara B)



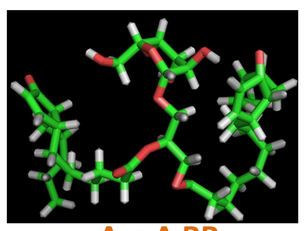
Arabidopside D (ara D)

Diversity

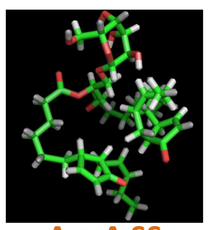
Results

Determination of arabidopside 3D structures

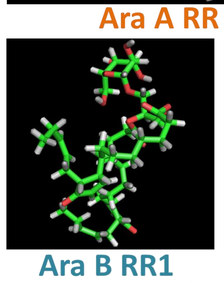
Structure tree is an informatic tool that calculates biomolecules lowest energy structure(s) based on its major torsion axis.



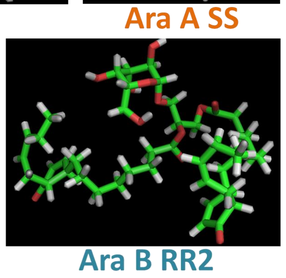
Ara A RR



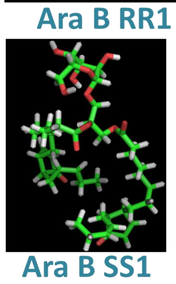
Ara A SS



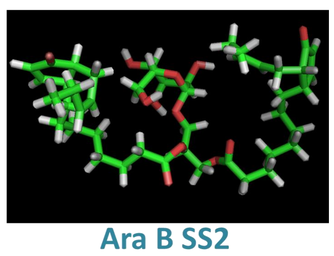
Ara B RR1



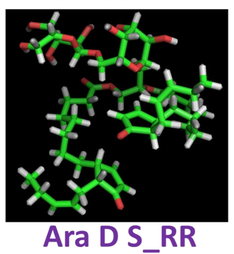
Ara B RR2



Ara B SS1



Ara B SS2

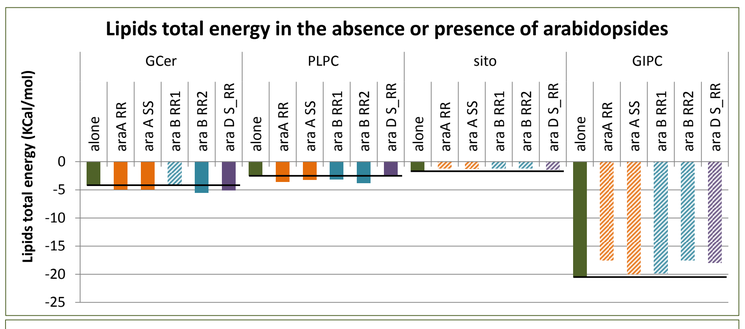


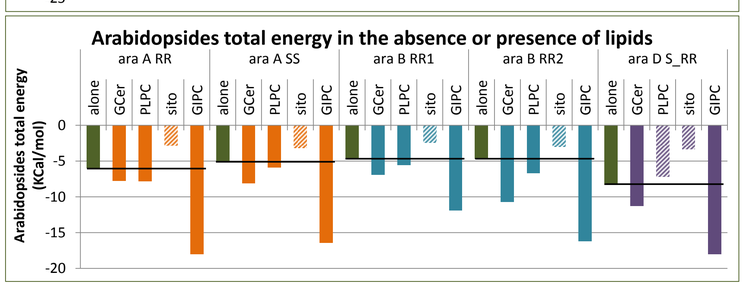
Ara D S_RR

Ara D S_SS

Arabidopsides affinities with plant plasma membrane lipids

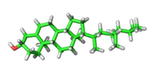
The docking method Hypermatrix allow to calculate the interaction between lipids and a biomolecule positioned at an hydrophobic/hydrophilic interface. Interaction energies are calculated and more stables positions for each lipid are determined. This method allow to predict if interactions between different molecules is favorable.



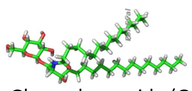


Favorable

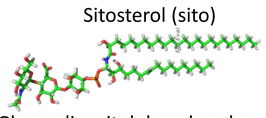
Favorable



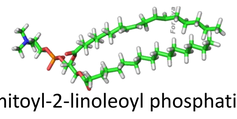
Sitosterol (sito)



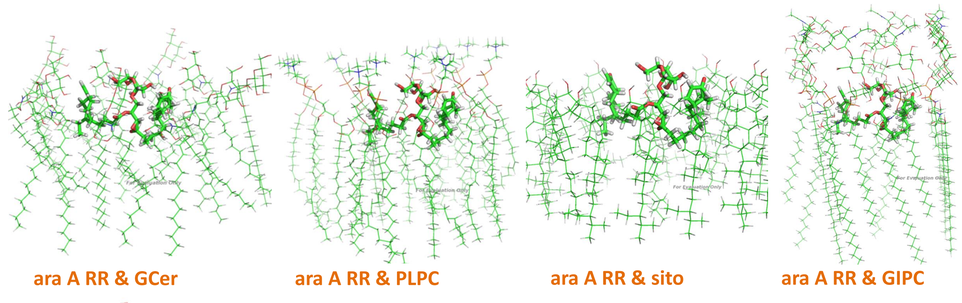
Glucosylceramide (GCer)



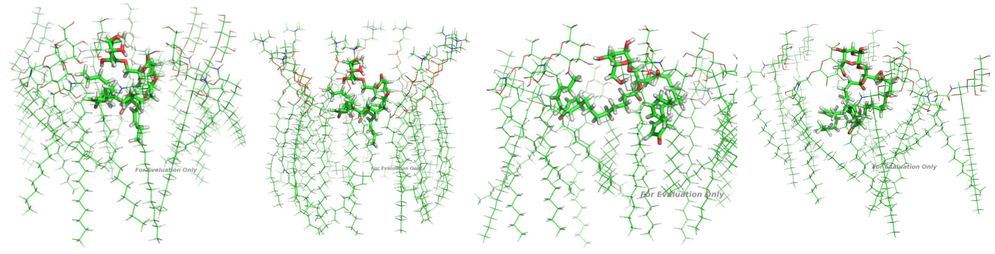
Glucosylinositolphosphorylceramide (GIPC)



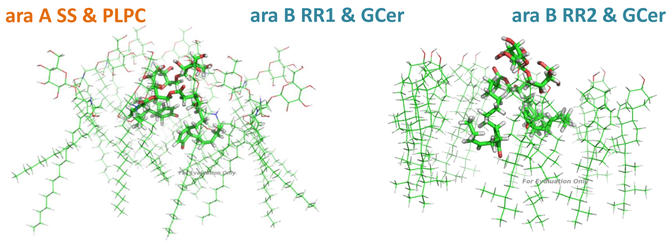
1-Palmitoyl-2-linoleoyl phosphatidylcholine (PLPC)



ara A RR & GCer | ara A RR & PLPC | ara A RR & sito | ara A RR & GIPC



ara A SS & GCer | ara A SS & PLPC | ara B RR1 & GCer | ara B RR2 & GCer



ara D S_RR & GCer | ara D S_RR & sito

Arabidopsides abilities to insert within a membrane

The method Impala allow to simulate biomolecules insertion in an implicit membrane

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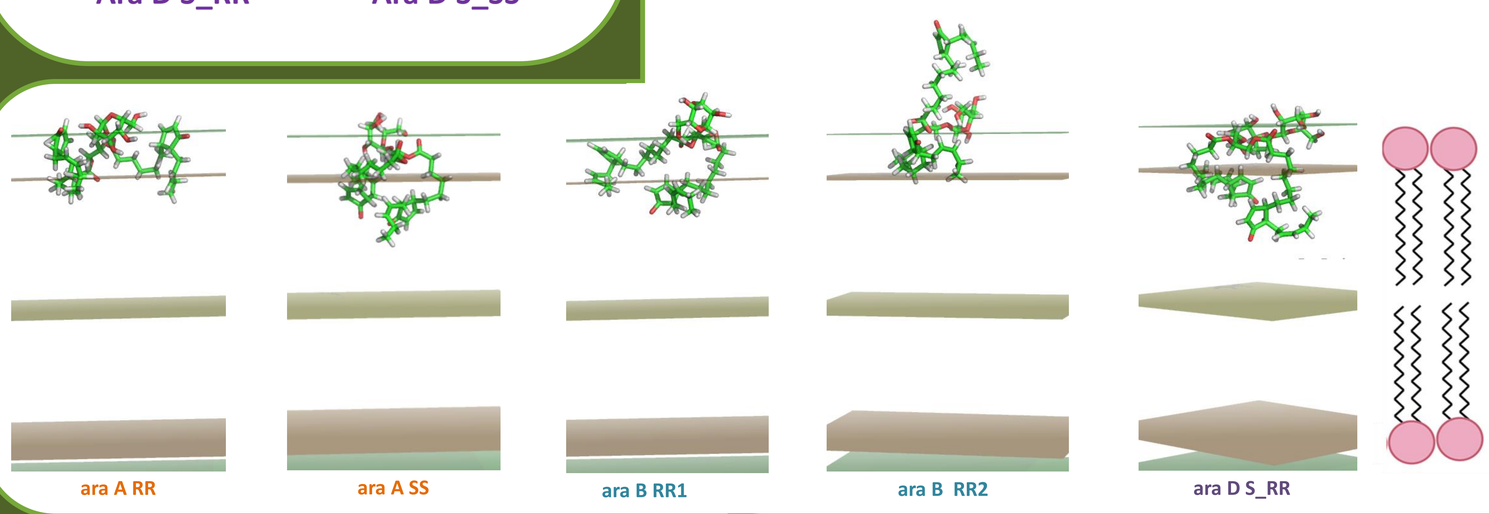
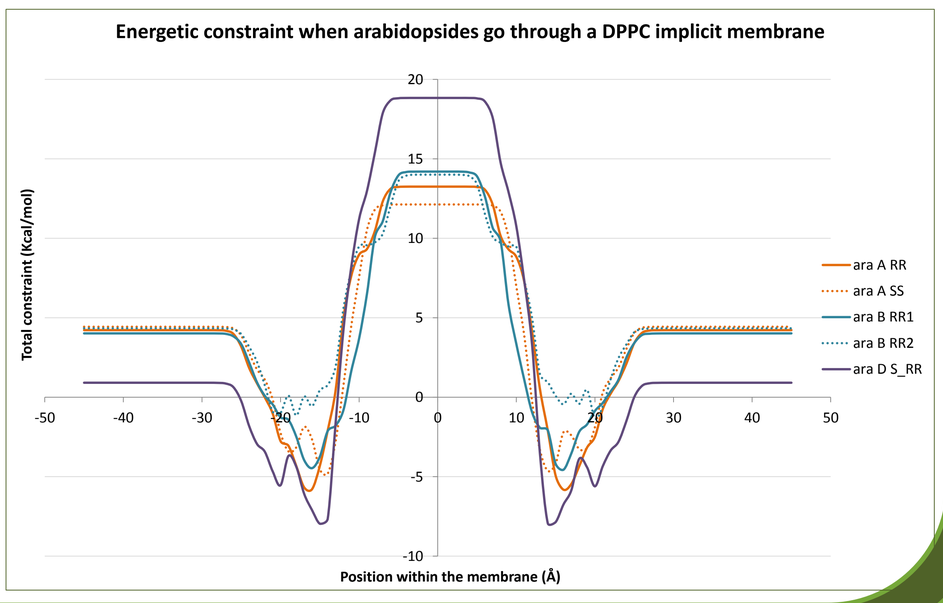


ara A RR | ara A SS | ara B RR1 | ara B RR2 | ara D S_RR



Conclusion

Results suggest that the interaction between arabidopsides and some plant plasma membrane lipids, such as GIPC, is favorable. Arabidopsides could also be able to get inserted within plant plasma membranes. Consequently, arabidopsides could modify plant plasma membrane organization and such change could be a signal for defense mechanisms activation. As a perspective, *in-vitro* studies will be performed in order to study interactions between arabidopsides and models of membranes.

Literature

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For further informations

Please contact m.genva@ulg.ac.be

Acknowledgments

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