Review of the habilitation thesis „Conditional and developmental remodeling of the plant cytoskeleton" submitted by Georgios Komis, PhD

Due to specific mechano-developmental features of plant growth and differentiation imposed by the presence of the cell wall, also plant cytoskeleton shows features evolutionary constrained by overall plant tissue mechanics. In his habilitation thesis Georgios Komis addresses some of important aspects of plant cytoskeleton regulation and function.

His thesis is logically split into two main parts – one related to the changing environment effects (specifically hyperosmotic shock) on the plant cytoskeleton and the other more focused on the ontogenetic, developmental functions of cytoskeleton and molecular mechanisms of their regulation. This division is also characterized by to switch from non-model species at the beginning to Arabidopsis thaliana later on. Thesis is based on 15 publications which Georgios Komis published either as a first author (13x) or co-author (2x).

First seven reports are outcome of his research activity at his homeland Greece addressing function and dynamics of microtubular and actin cytoskeleton during hyper osmotic stress treatment of two monocot plant species – also in relation to MAP kinases and lipid signalling by phospholipases. Specific paracrystalline storage form of collapsed microtubular cytoskeleton after the hyperosmotic challenge and plasmolysis called macrotubule is shown to be essential for the following recovery cell/tissue swelling phase and cell survival. Actin cytoskeleton is implied mostly in volume control of the cell, feature linked with cell growth/expansion. Regulation and function of actin dynamics in hyperosmotic shock seem to be less understood as compared to microtubules. Suspected activation of MAP kinases during hyperosmotic stress treatment was proven and concomitant activation of phospholipase C (PLC) activity in reciprocal regulatory correlation to microtubules ; activity of PLD was also implied in the regulation of plasmolysis, cytoskeleton and cell survival.

While first round of reports done with non-model species is implemented mainly using pharmacological approaches (inhibitors of cytoskeleton, PLC/PLD, MAP kinases) and immunostaining of cytoskeleton combined with EM, when Georgios Komis joined team of Prof. Josef Šamaj he switched to the genetically amenable model plant Arabidopsis thaliana and made first productive use of combination of cytological (also first use of in vivo GFP cytoskeleton labelling) and genetic analyses. This is also a time when his attention is shifted from the hyperosmotic stress reaction analysis to the developmentally regulated processes using hypocotyl/root/root hairs and embryo development as a major stages and relation between MAP kinases signalling and cytoskeletal dynamics as a major molecular mechanism of interest. In this period he also put emphasis on the development of advanced microscopy techniques in the newly established research centre "Centre of the region Haná". Methodological efforts of this team lead to the first successful application of SIM high resolution microscopy on cortical microtubules in plants and further microscopy applications advancements. He stepwise deepened insights into the specific functions of MAP kinases in cortical microtubule array organization/dynamics and its rearrangement at the onset of mitosis and during cytokinesis. In specific MAP kinases loss of function Arabidopsis mutants multinucleated cells with array of cell

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division aberrations was described implying these kinases and one of their targets MAP65 (microtubules associated protein) as essential regulators of cell division in plants including cell division plane establishment and maintenance.

All results are well discussed not only in the context of published knowledge on plant cells but compared to known mechanisms in animal cells. At the end author provides a condensed summary and his personal view of future necessary inquiries into the integration of cytoskeleton dynamics with the cellular signalling especially with emphasis on the identification of candidate specific proteins fosforylation / dephosphorylation as important regulatory switches. Text of thesis is overall well written and lacks typos. The only comment I have to the language is that word "conditional" in the title of thesis does not very well fit the meaning/content and possibly also does not fit usage in English language. Word "environment/-al" would be in my opinion more appropriate in this context. Minor criticism – pity that the list of attached papers is not provided at the beginning of thesis and absence of page numbering in this Suppl. part of thesis makes search in attached reports real pain. For the sake of paper saving (and reviewers back pack overloading avoidance) printing on both sides would be welcome.

Few question:

1) Why Triticum forms less macrotubular aggregates than Chlorophytum and how similar or different would be reaction of eudicot plant cells to hyperosmotic shock as compared to Chlorophytum and Triticum (partially addressed on p.14)?

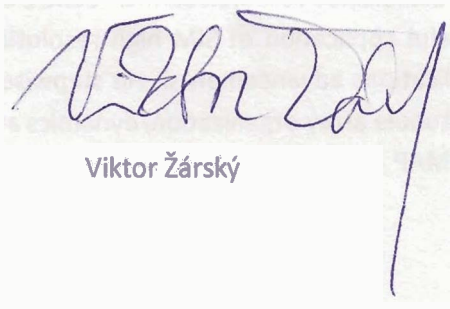
2) How far interrelated are microtubular vs. actin cytoskeletons in hyperosmotic stress and recovery, but also during the ontogenesis?

3) How do you plan to proceed with the analysis of specific kinase – substrate regulatory relations in your future research?

4) Which proteins apart from KATANIN1 you would like to study?

I am looking forward for further discussion during presentation of thesis.

Habilitation thesis submitted by Georgios Komis well documents that he already distinctly contributed to the advancement of plant cell biology and became a respected creative expert in the field of plant cytoskeleton regulation, moving forward his field of interest on the international level. Very welcomed contribution of originally Greek scholar to the progress and future of the Czech plant science. Therefore I endorse his thesis and support decision to award Georgios Komis habilitation.



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Viktor Žárský