Concurrent exposure to drought and nonhost bacteria instigates novel and robust defenses in *Arabidopsis thaliana*

Aanchal Choudhary*, Aarti Gupta, Venkategowda Ramegowda and Muthappa Senthil-Kumar

National Institute of Plant Genome Research, Aruna Asaf Ali Road, New Delhi-110067

ICPDB2017 CONFERENCE *Presenting author : aanchal@nipgr.ac.in

Introduction

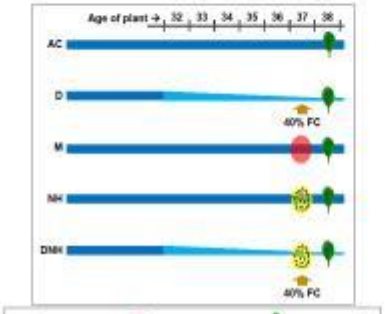
- Under field conditions, plants are often exposed to drought, while simultaneously being attacked by various pathogens
- Drought can significantly alter the plant defense response, either positively or negatively, depending on the timing, nature and severity of two stresses
- Broad spectrum **nonhost resistance** mechanism defends plants from a diverse array of potential pathogens

Rationale

- Host pathogen, owing to suppression of plant defenses and eventually plant death, limits its scope for combined stress studies
- Effector-mediated manipulation of host's transcriptomic machinery, makes it difficult to ascertain the changes under combined stress
- Employing nonhost pathogen facilitates the acourate documentation of the impact of drought on plant defense response over an extended duration

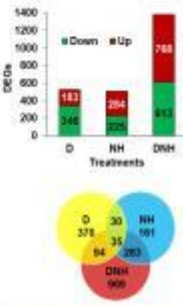
Can drought potentially influence plant's resistance against nonhost pathogens ??

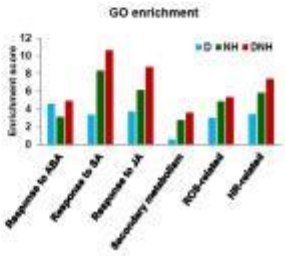
Methodology



AC, absolute control; M, mock inoculated;
D, drought (40% FC); FC – field capacity (soil moisture content)
NH, nonhost bacteria (*Pseudomonas syringae* pv. *tabaci*);
DNH, drought and nonhost bacterial infection imposed together

Parallel activation of multiple defense pathways imparts robustness to the overall plant immunity under combined stress



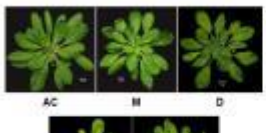


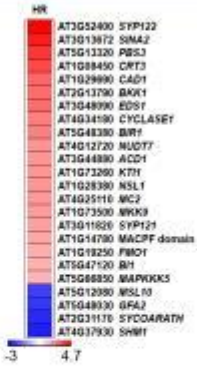
Differential expression of a large number of genes unique to DNH reflects the changes specifically evoked under DNH treatment

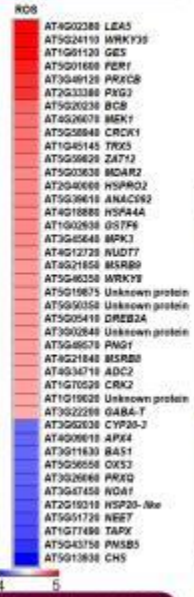
Biological processes associated with response to defense, oxidative stress and cell death were highly enriched under combined stress

Genes responsive to stress-related phytohormones, cell death and secondary metabolism were over-represented under combined stress

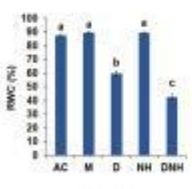
Combined stress treatment leads to early activation of a stronger hypersensitive response

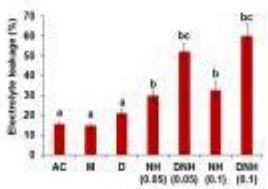






HR-mediated cell death was observed 24 hpi





- Hyperactivation of HR was concurrent with an increase in membrane leakage and enrichment of ROS- and HR-related transcripts in DNH transcriptome
- Majority of these genes were responsive to both drought and nonhost bacteria indicative of the plant's adaption for efficient utilization of limited resources under multiple stresses

Conclusions

- Response of plants to combined stress is significantly different from that of single stresses, involving several common and a large number of transcripts responding specifically to the stress combination
- Plant activates multiple defense pathways when simultaneously exposed to nonhost bacteria and drought, which strengthens its overall basal immunity
- Drought potentiates HR symptoms in combined stressed plants, accompanied by an increase in number and amplitude of genes responsive to ROS and HR-mediated cell death

Future perspectives

- Silencing of the selected genes in *A. thaliana* plants for assessing their role under combined drought and bacterial infection
- Detailed functional characterization of the genes to identify their role as potential targets for developing broad spectrum stress resistant plants

Acknowledgements

Authors thank National Institute of Plant Genome Research core funding, DBT-JRF and SERB N-PDF for the financial support

References

- Choudhary et al. Environ Exper Bot. 2017,139:152-164
- Gupta et al. Front. Plant Sc. 2016; 7: 686
- Bidzinski et al. Front. Plant Sci. 2016; 7, 1558,
- Dossa et al. Eur. J. Plant Pathol. 2016; 147, 115–127

Lab website link : http://www.nipgr.res.in/research/dr_skmuthappa.php

SCIPDb@2022

Citation: Choudhary A., Gupta A., Ramegowda V., and Senthil-Kumar M. (2017). Concurrent exposure to drought and nonhost bacteria instigates novel and robust defenses in Arabidopsis thaliana. Presented at 'International Conference on Plant Developmental Biology' held at Delhi. Organised by 'School of Biological Sciences, NISER' from 12 Dec 2017 to 16 Dec 2017.