Arbuscular Mycorrhizal Symbiosis-Induced Expression Changes in *Solanum lycopersicum* Leaves Revealed by RNA-seq Analysis

Plant Molecular Biology Reporter

February 2016, Volume 34, Issue 1, pp 89–102 | Cite as

- Rocío Guadalupe Cervantes-Gámez (1)
- Mario Alonso Bueno-Ibarra (1)
- Abraham Cruz-Mendívil (2)
- Carlos Ligné Calderón-Vázquez (1)
- Claudia María Ramírez-Douriet (1)
- Ignacio Eduardo Maldonado-Mendoza (1)
- Miguel Ángel Villalobos-López (3)
- Ángel Valdez-Ortíz (2)
- Melina López-Meyer (1) Email author (mlopez@ipn.mx)

1. Departamento de Biotecnología Agrícola, Instituto Politécnico Nacional CIIDIR-Sinaloa, , Guasave, México
2. Facultad de Ciencias Químico-Biológicas, Universidad Autónoma de Sinaloa, , Culiacán, México
3. Instituto Politécnico Nacional CIBA-Tlaxcala, , Tlaxcala, México

Original Paper
First Online: 18 June 2015

Abstract

Arbuscular mycorrhizal symbiosis is a beneficial association between plant roots and fungi that occurs in approximately 80 % of terrestrial plants and which confers different benefits including mineral nutrient acquisition and enhanced defense capacity. Although mycorrhizal colonization takes place in roots, the symbiosis establishment has systemic effects in other parts of the plant, in processes such as nutrient translocation and systemic resistance. In order to understand the transcriptional changes that occur in leaves of mycorrhizal plants, we used RNA-seq technology to obtain the transcriptomes of leaves from mycorrhizal and non-mycorrhizal tomato plants (*Solanum lycopersicum*). Four weeks after inoculation with the fungus *Rhizophagus irregularis*, leaves from mycorrhizal and non-mycorrhizal tomato plants were used for transcriptome sequencing. Of the 21,113 genes expressed in tomato leaves, 742 genes displayed differential expression between the mycorrhizal and non-mycorrhizal conditions. Most of the transcriptional changes occurred in the “protein,” “RNA,” “signaling,” “transport,” “biotic and abiotic stresses,” and “hormone metabolism” categories. Some transcriptional changes also occurred in P, N, and sugar transporters, as would be expected for mycorrhizal colonization. Finally, several differentially expressed genes may be related to systemic defense priming, in agreement with our demonstration that symbiotic plants exhibited mycorrhiza-induced resistance against the foliar pathogen *Xanthomonas campestris* pv. *vesicatoria*. This is the first study to take on a genome-wide analysis aimed at understanding the expression changes in leaves of mycorrhiza-colonized plants. The results will therefore be valuable to future analyses focused on specific genes, as well as detailed studies of the expression profiles of certain gene families.

Keywords

Rhizophagus irregularis Transcriptome sequencing Mycorrhiza-induced defense RNA-seq technology

Electronic supplementary material

The online version of this article (doi: 10.1007/s11105-015-0903-9 (https://doi.org/10.1007/s11105-015-0903-9)) contains supplementary material, which is available to authorized users.

Notes

Acknowledgments

MLM acknowledges support from CONACyT (project no. 102237) and SIP-IPN (project no. 20131537) grants. RGCG acknowledges CONACyT (219635) and PIFI-IPN graduate fellowships. The authors thank Dr. Dagoberto Armenta for his assistance with the statistical analyses and Brandon Loveall of Improvence for English proofreading of the manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

Author contributions

RGCG participated in the experimental design, performed most of the experiments, participated in the sequencing analysis, and drafted the manuscript. MABI, ACM, and CLCV participated in the sequence analysis and drafted the manuscript. CMRD, IEMM, and MAVL participated in the experimental design and drafted the manuscript. AVO assisted in drafting the manuscript. MLM conceived the study and participated in its design and coordination, as well as the manuscript writing. All authors read and approved the final manuscript.

Supplementary material

11105_2015_903_MOESM1_ESM.xls (34 kb)
Supplementary Table 1 Primers used in q-PCR to validate RNA-seq results (XLS 34 kb)
11105_2015_903_MOESM2_ESM.xls (145 kb)
Supplementary Table 2 Functional classification of significant differentially expressed mycorrhiza-responsive genes in leaves of tomato plants, according to RNA-seq fold changes (XLS 145 kb)
11105_2015_903_MOESM3_ESM.xls (84 kb)
Supplementary Table 3 Mycorrhiza-responsive genes with significant different expression but less than 10 unique gene reads in one or both treatments (XLS 84 kb)
11105_2015_903_MOESM4_ESM.xls (34 kb)
Supplementary Table 4 Mycorrhiza-responsive genes involved in more than one biological process according to MAPMAN classification (XLS 34 kb)

References

Antolín-Llovera M, Ried MK, Binder A, Parniske M (2012) Receptor kinase signaling pathways in plant-microbe interactions. Annu Rev Phytopathol 50:451–473
CrossRef (https://doi.org/10.1146/annurev-phyto-081211-173002)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=22920561)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Receptor%20kinase%20signaling%20pathways%20in%20plant-microbe%20interactions&author=M.%20Antol%C3%ADn-Llovera&author=MK.%20Ried&author=A.%20Binder&author=M.%20Parniske&journal=Annu%20Rev%20Phytopathol&volume=50&pages=451-473&publication_year=2012)

Aoki K et al (2010) Large-scale analysis of full-length cDNAs from the tomato (Solanum lycopersicum) cultivar Micro-Tom, a reference system for the Solanaceae genomics. BMC Genomics 11:210
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2859864)
CrossRef (https://doi.org/10.1186/1471-2164-11-210)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=20350329)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Large-scale%20analysis%20of%20full-length%20cDNAs%20from%20the%20tomato%20%28Solanum%20lycopersicum%29%20cultivar%20Micro-Tom%2C%20a%20reference%20system%20for%20the%20Solanaceae%20genomics&author=K.%20Aoki&journal=BMC%20Genomics&volume=11&pages=210&publication_year=2010)

Aroca R, Porcel R, Ruiz-Lozano JM (2007) How does arbuscular mycorrhizal symbiosis regulate root hydraulic properties and plasma membrane aquaporins in Phaseolus vulgaris under drought, cold or salinity stresses? New Phytol 173:808–816
CrossRef (https://doi.org/10.1111/j.1469-8137.2006.01961.x)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=17286829)
Google Scholar (http://scholar.google.com/scholar_lookup?title=How%20does%20arbuscular%20mycorrhizal%20symbiosis%20regulate%20root%20hydraulic%20properties%20and%20plasma%20membrane%20aquaporins%20in%20Phaseolus%20vulgaris%20under%20drought%2C%20cold%20or%20salinity%20stresses%3F&author=R.%20Aroca&author=R.%20Porcel&author=JM.%20Ruiz-Lozano&journal=New%20Phytol&volume=173&pages=808-816&publication_year=2007)

Baggerly K, Deng L, Morris J, Aldaz C (2003) Differential expression in SAGE: accounting for normal between-library variation. Bioinformatics 19:1477–1483
CrossRef (https://doi.org/10.1093/bioinformatics/btg173)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=12912827)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Differential%20expression%20in%20SAGE%3A%20accounting%20for%20normal%20between-library%20variation&author=K.%20Baggerly&author=L.%20Deng&author=J.%20Morris&author=C.%20Aldaz&journal=Bioinformatics&volume=19&pages=1477-1483&publication_year=2003)

Barry CS, Blume B, Bouzayen M, Cooper W, Hamilton AJ, Grierson D (1996) Differential expression of the 1-aminocyclopropane-1-carboxylate oxidase gene family of tomato. Plant J 9:525–535
CrossRef (https://doi.org/10.1046/j.1365-313X.1996.09040525.x)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=8624515)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Differential%20expression%20of%20the%201-aminocyclopropane-1-carboxylate%20oxidase%20gene%20family%20of%20tomato&author=CS.%20Barry&author=B.%20Blume&author=M.%2

oBouzayen&author=W.%20Cooper&author=AJ.%20Hamilton&author=D.%20Grierson&journal=Plant%20J&volume=9&pages=525-535&publication_year=1996)

Benjamini Y, Hochberg Y (1995) Controlling the false discovery rate: a practical and powerful approach to multiple testing. J R Stat Soc Ser B 57:289
Google Scholar (http://scholar.google.com/scholar_lookup?title=Controlling%20the%20false%20discovery%20rate%3A%20a%20practical%20and%20powerful%20approach%20to%20multiple%20testing&author=Y.%20Benjamini&author=Y.%20Hochberg&journal=J%20R%20Stat%20Soc%20Ser%20B&volume=57&pages=289&publication_year=1995)

Bolstad B, Irizarry R, Astrand M, Speed T (2003) A comparison of normalization methods for high density oligonucleotide array data based on variance and bias. Bioinformatics 19:185–193
CrossRef (https://doi.org/10.1093/bioinformatics/19.2.185)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=12538238)
Google Scholar (http://scholar.google.com/scholar_lookup?title=A%20comparison%20of%20normalization%20methods%20for%20high%20density%20oligonucleotide%20array%20data%20based%20on%20variance%20and%20bias&author=B.%20Bolstad&author=R.%20Irizarry&author=M.%20Astrand&author=T.%20Speed&journal=Bioinformatics&volume=19&pages=185-193&publication_year=2003)

Breuillin-Sessomsa F., Floss DS, Gomez K, Pumplin N, Ding Y, Levesque-Tremblay V, Noar RD, Daniels DA, Bravo A, Eagleshama JB, Beneditob VA, Udvardib MK, Harrison MJ (2015) Suppression of arbuscule degeneration in Medicago truncatula phosphate transporter4 mutants is dependent on the ammonium transporter 2 family protein AMT2;3. Plant Cell tpc.114.131144. doi: 10.1105/tpc.114.131144 (https://doi.org/10.1105/tpc.114.131144)

Campos-Soriano L, García-Martínez J, Segundo BS (2012) The arbuscular mycorrhizal symbiosis promotes the systemic induction of regulatory defence-related genes in rice leaves and confers resistance to pathogen infection. Mol Plant Pathol 13:579–592. doi: 10.1111/j.1364-3703.2011.00773.x (https://doi.org/10.1111/j.1364-3703.2011.00773.x)
CrossRef (https://doi.org/10.1111/j.1364-3703.2011.00773.x)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=22212404)
Google Scholar (http://scholar.google.com/scholar_lookup?title=The%20arbuscular%20mycorrhizal%20symbiosis%20promotes%20the%20systemic%20induction%20of%20regulatory%20defence-related%20genes%20in%20rice%20leaves%20and%20confers%20resistance%20to%20pathogen%20infection&author=L.%20Campos-Soriano&author=J.%20Garc%C3%ADa-Mart%C3%ADnez&author=BS.%20Segundo&journal=Mol%20Plant%20Pathol&volume=13&pages=579-592&publication_year=2012&doi=10.1111%2Fj.1364-3703.2011.00773.x)

Cartieaux F et al (2008) Simultaneous interaction of Arabidopsis thaliana with Bradyrhizobium Sp. strain ORS278 and Pseudomonas syringae pv. tomato DC3000 leads to complex transcriptome changes. Mol Plant-Microbe Interact 21:244–259. doi: 10.1094/MPMI-21-2-0244 (https://doi.org/10.1094/MPMI-21-2-0244)
CrossRef (https://doi.org/10.1094/MPMI-21-2-0244)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=18184068)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Simultaneous%20interaction%20of%20Arabidopsis%20thaliana%20with%20Bradyrhizobium%20Sp.%20strain%20ORS278%20and%20Pseudomonas%20syringae%20pv.%20tomato%20DC3000%20leads%20to%20complex%20transcriptome%20changes&author=F.%20Cartieaux&journal=Mol%20Plant-Microbe%20Interact&volume=21&pages=244-259&publication_year=2008&doi=10.1094%2FMPMI-21-2-0244)

Chabot S, Becard G, Piche Y (1992) Life cycle of Glomus intraradix in root organ culture. Mycologia 84:315–321
CrossRef (https://doi.org/10.2307/3760183)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Life%20cycle%20of%20Glomus%20intraradix%20in%20root%20organ%20culture&author=S.%20Chabot&author=G.%20Becard&author=Y.%20Piche&journal=Mycologia&volume=84&pages=315-321&publication_year=1992)

Conrath U (2011) Molecular aspects of defence priming. Trends Plant Sci 16:524–531
CrossRef (https://doi.org/10.1016/j.tplants.2011.06.004)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=21782492)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Molecular%20aspects%20of%20defence%20priming&author=U.%20Conrath&journal=Trends%20Plant%20Sci&volume=16&pages=524-531&publication_year=2011)

Davies KM, Grierson D (1989) Identification of cDNA clones for tomato (Lycopersicon esculentum Mill.) mRNAs that accumulate during fruit ripening and leaf senescence in response to ethylene. Planta 179:73–80
CrossRef (https://doi.org/10.1007/BF00395773)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=24201424)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Identification%20of%20cDNA%20clones%20for%20tomato%20%28Lycopersicon%20esculentum%20Mill.%29%20mRNAs%20that%20accumulate%20during%20fruit%20ripening%20and%20leaf%20senescence%20in%20response%20to%20ethylene&author=KM.%20Davies&author=D.%20Grierson&journal=Planta&volume=179&pages=73-80&publication_year=1989)

De Smet I, Voß U, Jürgens G, Beeckman T (2009) Receptor-like kinases shape the plant. Nat Cell Biol 11:1166–1173
CrossRef (https://doi.org/10.1038/ncb1009-1166)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=19794500)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Receptor-like%20kinases%20shape%20the%20plant&author=I.%20Smet&author=U.%20Vo%C3%9F&author=G.%20J%C3%BCrgens&author=T.%20Beeckman&journal=Nat%20Cell%20Biol&volume=11&pages=1166-1173&publication_year=2009)

Fiorilli V, Catoni M, Miozzi L, Novero M, Accotto GP, Lanfranco L (2009) Global and cell-type gene expression profiles in tomato plants colonized by an arbuscular mycorrhizal fungus. New Phytol 184:975–987. doi: 10.1111/j.1469-

8137.2009.03031.x (https://doi.org/10.1111/j.1469-8137.2009.03031.x)
CrossRef (https://doi.org/10.1111/j.1469-8137.2009.03031.x)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=19765230)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Global%20and%20cell-type%20gene%20expression%20profiles%20in%20tomato%20plants%20colonized%20by%20an%20arbuscular%20mycorrhizal%20fungus&author=V.%20Fiorilli&author=M.%20Catoni&author=L.%20Miozzi&author=M.%20Novero&author=GP.%20Accotto&author=L.%20Lanfranco&journal=New%20Phytol&volume=184&pages=975-987&publication_year=2009&doi=10.1111%2Fj.1469-8137.2009.03031.x)

Fotopoulos V (2005) Plant invertases: structure, function and regulation of a diverse enzyme family. J Biol Res 4:127–137
Google Scholar (http://scholar.google.com/scholar_lookup?title=Plant%20invertases%3A%20structure%2C%20function%20and%20regulation%20of%20a%20diverse%20enzyme%20family&author=V.%20Fotopoulos&journal=J%20Biol%20Res&volume=4&pages=127-137&publication_year=2005)

Gallou A, Declerck S, Cranenbrouck S (2012) Transcriptional regulation of defence genes and involvement of the WRKY transcription factor in arbuscular mycorrhizal potato root colonization. Funct Integr Genomics 12:183–198
CrossRef (https://doi.org/10.1007/s10142-011-0241-4)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=21811781)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Transcriptional%20regulation%20of%20defence%20genes%20and%20involvement%20of%20the%20WRKY%20transcription%20factor%20in%20arbuscular%20mycorrhizal%20potato%20root%20colonization&author=A.%20Gallou&author=S.%20Declerck&author=S.%20Cranenbrouck&journal=Funct%20Integr%20Genomics&volume=12&pages=183-198&publication_year=2012)

Giovannetti M, Mosse B (1980) An evaluation of techniques for measuring vesicular–arbuscular Mycorrhizal infection in roots. New Phytol 84:489–500. doi: 10.1111/j.1469-8137.1980.tb04556.x (https://doi.org/10.1111/j.1469-8137.1980.tb04556.x)
CrossRef (https://doi.org/10.1111/j.1469-8137.1980.tb04556.x)
Google Scholar (http://scholar.google.com/scholar_lookup?title=An%20evaluation%20of%20techniques%20for%20measuring%20vesicular%E2%80%93arbuscular%20Mycorrhizal%20infection%20in%20roots&author=M.%20Giovannetti&author=B.%20Mosse&journal=New%20Phytol&volume=84&pages=489-500&publication_year=1980&doi=10.1111%2Fj.1469-8137.1980.tb04556.x)

Govindarajulu M et al (2005) Nitrogen transfer in the arbuscular mycorrhizal symbiosis. Nature 435:819–823. doi: 10.1038/nature03610 (https://doi.org/10.1038/nature03610)
CrossRef (https://doi.org/10.1038/nature03610)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=15944705)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Nitrogen%20transfer%20in%20the%20arbuscular%20mycorrhizal%20symbiosis&author=M.%20Govindarajulu&journal=Nature&volume=435&pages=819-823&publication_year=2005&doi=10.1038%2Fnature03610)

Guether M, Balestrini R, Hannah M, He J, Udvardi MK, Bonfante P (2009) Genome-wide reprogramming of regulatory networks, transport, cell wall and membrane biogenesis during arbuscular mycorrhizal symbiosis in Lotus japonicus. The New phytologist 182:200–212. doi: 10.1111/j.1469-8137.2008.02725.x (https://doi.org/10.1111/j.1469-8137.2008.02725.x)
CrossRef (https://doi.org/10.1111/j.1469-8137.2008.02725.x)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=19192192)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Genome-wide%20reprogramming%20of%20regulatory%20networks%2C%20transport%2C%20cell%20wall%20and%20membrane%20biogenesis%20during%20arbuscular%20mycorrhizal%20symbiosis%20in%20Lotus%20japonicus&author=M.%20Guether&author=R.%20Balestrini&author=M.%20Hannah&author=J.%20He&author=MK.%20Udvardi&author=P.%20Bonfante&journal=The%20New%20phytologist&volume=182&pages=200-212&publication_year=2009&doi=10.1111%2Fj.1469-8137.2008.02725.x)

Güimil S et al (2005) Comparative transcriptomics of rice reveals an ancient pattern of response to microbial colonization. Proc Natl Acad Sci U S A 102:8066–8070. doi: 10.1073/pnas.0502999102 (https://doi.org/10.1073/pnas.0502999102)
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1142390)
CrossRef (https://doi.org/10.1073/pnas.0502999102)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=15905328)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Comparative%20transcriptomics%20of%20rice%20reveals%20an%20ancient%20pattern%20of%20response%20to%20microbial%20colonization&author=S.%20G%C3%BCimil&journal=Proc%20Natl%20Acad%20Sci%20U%20S%20A&volume=102&pages=8066-8070&publication_year=2005&doi=10.1073%2Fpnas.0502999102)

Hao Z, Fayolle L, van Tuinen D, Chatagnier O, Li X, Gianinazzi S, Gianinazzi-Pearson V (2012) Local and systemic mycorrhiza-induced protection against the ectoparasitic nematode Xiphinema index involves priming of defence gene responses in grapevine. J Exp Bot 63:3657–3672. doi: 10.1093/jxb/ers046 (https://doi.org/10.1093/jxb/ers046)
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3388824)
CrossRef (https://doi.org/10.1093/jxb/ers046)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=22407649)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Local%20and%20systemic%20mycorrhiza-induced%20protection%20against%20the%20ectoparasitic%20nematode%20Xiphinema%20index%20involves%20priming%20of%20defence%20gene%20responses%20in%20grapevine&author=Z.%20Hao&author=L.%20Fayolle&author=D.%20Tuinen&author=O.%20Chatagnier&author=X.%20Li&author=S.%20Gianinazzi&author=V.%20Gianinazzi-Pearson&journal=J%20Exp%20Bot&volume=63&pages=3657-3672&publication_year=2012&doi=10.1093%2Fjxb%2Fers046)

Harrison MJ (2012) Cellular programs for arbuscular mycorrhizal symbiosis. Curr Opin Plant Biol 15:691–698. doi: 10.1016/j.pbi.2012.08.010 (https://doi.org/10.1016/j.pbi.2012.08.010)

CrossRef (https://doi.org/10.1016/j.pbi.2012.08.010)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=23036821)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Cellular%20programs%20for%20arbuscular%20mycorrhizal%20symbiosis&author=MJ.%20Harrison&journal=Curr%20Opin%20Plant%20Biol&volume=15&pages=691-698&publication_year=2012&doi=10.1016%2Fj.pbi.2012.08.010)

Hause B, Fester T (2005) Molecular and cell biology of arbuscular mycorrhizal symbiosis. Planta 221:184–196. doi: 10.1007/s00425-004-1436-x (https://doi.org/10.1007/s00425-004-1436-x)
CrossRef (https://doi.org/10.1007/s00425-004-1436-x)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=15871030)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Molecular%20and%20cell%20biology%20of%20arbuscular%20mycorrhizal%20symbiosis&author=B.%20Hause&author=T.%20Fester&journal=Planta&volume=221&pages=184-196&publication_year=2005&doi=10.1007%2Fs00425-004-1436-x)

Hoagland DR, Arnon DI (1950) The water-culture method for growing plants without soil. Calif Agr Expt Sta Circ 347:1–32
Google Scholar (https://scholar.google.com/scholar?q=Hoagland%20DR%2C%20Arnon%20DI%20%281950%29%20The%20water-culture%20method%20for%20growing%20plants%20without%20soil.%20Calif%20Agr%20Expt%20Sta%20Circ%20347%3A1%E2%80%9332)

Javot H, Penmetsa RV, Terzaghi N, Cook DR, Harrison MJ (2007) A Medicago truncatula phosphate transporter indispensable for the arbuscular mycorrhizal symbiosis. Proc Natl Acad Sci U S A 104:1720–1725
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1785290)
CrossRef (https://doi.org/10.1073/pnas.0608136104)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=17242358)
Google Scholar (http://scholar.google.com/scholar_lookup?title=A%20Medicago%20truncatula%20phosphate%20transporter%20indispensable%20for%20the%20arbuscular%20mycorrhizal%20symbiosis&author=H.%20Javot&author=RV.%20Penmetsa&author=N.%20Terzaghi&author=DR.%20Cook&author=MJ.%20Harrison&journal=Proc%20Natl%20Acad%20Sci%20U%20S%20A&volume=104&pages=1720-1725&publication_year=2007)

John L, Drake R, Farrell A, Cooper W, Lee P, Horton P, Grierson D (1995) Delayed leaf senescence in ethylene-deficient ACC-oxidase antisense tomato plants: molecular and physiological analysis. Plant J 7:483–490
Google Scholar (https://scholar.google.com/scholar?q=John%20L%2C%20Drake%20R%2C%20Farrell%20A%2C%20Cooper%20W%2C%20Lee%20P%2C%20Horton%20P%2C%20Grierson%20D%20%281995%29%20Delayed%20leaf%20senescence%20in%20ethylene-deficient%20ACC-oxidase%20antisense%20tomato%20plants%3A%20molecular%20and%20physiological%20analysis.%20Plant%20J%207%3A483%E2%80%93490)

Jones DA, Jones JDG (1997) The role of leucine-rich repeat proteins in plant defences. Adv Bot Res 24:89–167
CrossRef (https://doi.org/10.1016/S0065-2296(08)60072-5)
Google Scholar (http://scholar.google.com/scholar_lookup?title=The%20role%20of%20leucine-rich%20repeat%20proteins%20in%20plant%20defences&author=DA.%20Jones&author=JDG.%20Jones&journal=Adv%20Bot%20Res&volume=24&pages=89-167&publication_year=1997)

Jung SC, Martinez-Medina A, Lopez-Raez JA, Pozo MJ (2012) Mycorrhiza-induced resistance and priming of plant defenses. J Chem Ecol 38:651–664
Google Scholar (https://scholar.google.com/scholar?q=Jung%20SC%2C%20Martinez-Medina%20A%2C%20Lopez-Raez%20JA%2C%20Pozo%20MJ%20%282012%29%20Mycorrhiza-induced%20resistance%20and%20priming%20of%20plant%20defenses.%20J%20Chem%20Ecol%2038%3A651%E2%80%93664)

Kapoor R, Evelin H, Mathur P, Giri B (2013) Arbuscular mycorrhiza: approaches for abiotic stress tolerance in crop plants for sustainable agriculture. In: Tuteja N, Gill SS (eds) Plant acclimation to environmental stress. Springer Science, New York, pp 359–401
CrossRef (https://doi.org/10.1007/978-1-4614-5001-6_14)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Arbuscular%20mycorrhiza%3A%20approaches%20for%20abiotic%20stress%20tolerance%20in%20crop%20plants%20for%20sustainable%20agriculture&author=R.%20Kapoor&author=H.%20Evelin&author=P.%20Mathur&author=B.%20Giri&pages=359-401&publication_year=2013)

Kobae Y, Tamura Y, Takai S, Banba M, Hata S (2010) Localized expression of arbuscular mycorrhiza-inducible ammonium transporters in soybean. Plant Cell Physiol 51:1411–1415
CrossRef (https://doi.org/10.1093/pcp/pcq099)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=20627949)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Localized%20expression%20of%20arbuscular%20mycorrhiza-inducible%20ammonium%20transporters%20in%20soybean&author=Y.%20Kobae&author=Y.%20Tamura&author=S.%20Takai&author=M.%20Banba&author=S.%20Hata&journal=Plant%20Cell%20Physiol&volume=51&pages=1411-1415&publication_year=2010)

Kruger JN (1990) Carbohydrate synthesis and degradation. In: Dennis DT, Turpin DH (eds) Plant physiology, biochemistry, and molecular biology. Longman Scientific and Technical Publishers, Harlow, pp 59–76
Google Scholar (http://scholar.google.com/scholar_lookup?title=Carbohydrate%20synthesis%20and%20degradation&author=JN.%20Kruger&pages=59-76&publication_year=1990)

Lander ES, Waterman MS (1988) Genomic mapping by fingerprinting random clones: a mathematical analysis. Genomics 2:231–239
CrossRef (https://doi.org/10.1016/0888-7543(88)90007-9)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=3294162)

Google Scholar (http://scholar.google.com/scholar_lookup?title=Genomic%20mapping%20by%20fingerprinting%20random%20clones%3A%20a%20mathematical%20analysis&author=ES.%20Lander&author=MS.%20Waterman&journal=Genomics&volume=2&pages=231-239&publication_year=1988)

Liu J, Maldonado-Mendoza I, Lopez-Meyer M, Cheung F, Town CD, Harrison MJ (2007) Arbuscular mycorrhizal symbiosis is accompanied by local and systemic alterations in gene expression and an increase in disease resistance in the shoots. Plant J Cell Mol Biol 50:529–544. doi: 10.1111/j.1365-313X.2007.03069.x (https://doi.org/10.1111/j.1365-313X.2007.03069.x)
CrossRef (https://doi.org/10.1111/j.1365-313X.2007.03069.x)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Arbuscular%20mycorrhizal%20symbiosis%20is%20accompanied%20by%20local%20and%20systemic%20alterations%20in%20gene%20expression%20and%20an%20increase%20in%20disease%20resistance%20in%20the%20shoots&author=J.%20Liu&author=I.%20Maldonado-Mendoza&author=M.%20Lopez-Meyer&author=F.%20Cheung&author=CD.%20Town&author=MJ.%20Harrison&journal=Plant%20J%20Cell%20Mol%20Biol&volume=50&pages=529-544&publication_year=2007&doi=10.1111%2Fj.1365-313X.2007.03069.x)

Liu Y, Zhou J, White KP (2014) RNA-seq differential expression studies: more sequence or more replication? Bioinformatics 30(3):301–304
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3904521)
CrossRef (https://doi.org/10.1093/bioinformatics/btt688)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=24319002)
Google Scholar (http://scholar.google.com/scholar_lookup?title=RNA-seq%20differential%20expression%20studies%3A%20more%20sequence%20or%20more%20replication%3F&author=Y.%20Liu&author=J.%20Zhou&author=KP.%20White&journal=Bioinformatics&volume=30&issue=3&pages=301-304&publication_year=2014)

López-Ráez JA, Verhage A, Fernández I, García JM, Azcón-Aguilar C, Flors V, Pozo MJ (2010) Hormonal and transcriptional profiles highlight common and differential host responses to arbuscular mycorrhizal fungi and the regulation of the oxylipin pathway. J Exp Bot 61:2589–2601. doi: 10.1093/jxb/erq089 (https://doi.org/10.1093/jxb/erq089)
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2882257)
CrossRef (https://doi.org/10.1093/jxb/erq089)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=20378666)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Hormonal%20and%20transcriptional%20profiles%20highlight%20common%20and%20differential%20host%20responses%20to%20arbuscular%20mycorrhizal%20fungi%20and%20the%20regulation%20of%20the%20oxylipin%20pathway&author=JA.%20L%C3%B3pez-R%C3%A1ez&author=A.%20Verhage&author=I.%20Fern%C3%A1ndez&author=JM.%20Garc%C3%ADa&author=C.%20Azc%C3%B3n-Aguilar&author=V.%20Flors&author=MJ.%20Pozo&journal=J%20Exp%20Bot&volume=61&pages=2589-2601&publication_year=2010&doi=10.1093%2Fjxb%2Ferq089)

Marioni J, Mason C, Mane S, Stephens M, Gilad Y (2008) RNA-Seq: an assessment of technical reproducibility and comparison with gene expression arrays. Genome Res 18:1509–1517
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2527709)
CrossRef (https://doi.org/10.1101/gr.079558.108)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=18550803)
Google Scholar (http://scholar.google.com/scholar_lookup?title=RNA-Seq%3A%20an%20assessment%20of%20technical%20reproducibility%20and%20comparison%20with%20gene%20expression%20arrays&author=J.%20Marioni&author=C.%20Mason&author=S.%20Mane&author=M.%20Stephens&author=Y.%20Gilad&journal=Genome%20Res&volume=18&pages=1509-1517&publication_year=2008)

McHale L, Tan X, Koehl P, Michelmore RW (2006) Plant NBS-LRR proteins: adaptable guards. Genome Biol 7:212. doi: 10.1186/gb-2006-7-4-212 (https://doi.org/10.1186/gb-2006-7-4-212)
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1557992)
CrossRef (https://doi.org/10.1186/gb-2006-7-4-212)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=16677430)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Plant%20NBS-LRR%20proteins%3A%20adaptable%20guards&author=L.%20McHale&author=X.%20Tan&author=P.%20Koehl&author=RW.%20Michelmore&journal=Genome%20Biol&volume=7&pages=212&publication_year=2006&doi=10.1186%2Fgb-2006-7-4-212)

Mora-Romero GA et al (2015) PvLOX2 silencing in common bean roots impairs arbuscular mycorrhiza-induced resistance without affecting symbiosis establishment. Funct Plant Biol. doi: 10.1071/FP14101 (https://doi.org/10.1071/FP14101)
Google Scholar (http://scholar.google.com/scholar_lookup?title=PvLOX2%20silencing%20in%20common%20bean%20roots%20impairs%20arbuscular%20mycorrhiza-induced%20resistance%20without%20affecting%20symbiosis%20establishment&author=GA.%20Mora-Romero&journal=Funct%20Plant%20Biol&publication_year=2015&doi=10.1071%2FFP14101)

Ouziad F, Wilde P, Schmelzer E, Hildebrandt U, Bothe H (2006) Analysis of aquaporins and Na+/H+ transporters in tomato colonized by arbuscular mycorrhizal fungi and affected by salt stress. Exp Environ Bot 57:177–186
CrossRef (https://doi.org/10.1016/j.envexpbot.2005.05.011)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Analysis%20of%20aquaporins%20and%20Na%2B%2FH%2B%20transporters%20in%20tomato%20colonized%20by%20arbuscular%20mycorrhizal%20fungi%20and%20affected%20by%20salt%20stress&author=F.%20Ouziad&author=P.%20Wilde&author=E.%20Schmelzer&author=U.%20Hildebrandt&author=H.%20Bothe&journal=Exp%20Environ%20Bot&volume=57&pages=177-186&publication_year=2006)

Pérez-Tienda J, Corrêa A, Azcón-Aguilar C, Ferrol N (2014) Transcriptional regulation of host NHþ 4 transporters and GS/GOGAT pathway in arbuscular mycorrhizal rice roots. Plant Physiol Biochem 75:1–8
CrossRef (https://doi.org/10.1016/j.plaphy.2013.11.029)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=24361504)

Google Scholar (http://scholar.google.com/scholar_lookup?title=Transcriptional%20regulation%20of%20host%20NH%C3%BE%204%20transporters%20and%20GS%2FGOGAT%20pathway%20in%20arbuscular%20mycorrhizal%20rice%20roots&author=J.%20P%C3%A9rez-Tienda&author=A.%20Corr%C3%AAa&author=C.%20Azc%C3%B3n-Aguilar&author=N.%20Ferrol&journal=Plant%20Physiol%20Biochem&volume=75&pages=1-8&publication_year=2014)

Phillips JM, Hayman DS (1970) Improved procedures for clearing roots and staining parasitic and vesicular-arbuscular mycorrhizal fungi for rapid assessment of infection. Trans Br Mycol Soc 55:158–161
CrossRef (https://doi.org/10.1016/S0007-1536(70)80110-3)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Improved%20procedures%20for%20clearing%20roots%20and%20staining%20parasitic%20and%20vesicular-arbuscular%20mycorrhizal%20fungi%20for%20rapid%20assessment%20of%20infection&author=JM.%20Phillips&author=DS.%20Hayman&journal=Trans%20Br%20Mycol%20Soc&volume=55&pages=158-161&publication_year=1970)

Porcel R, Aroca R, Azcón R, Ruiz-Lozano JM (2006) PIP aquaporin gene expression in arbuscular mycorrhizal Glycine max and Lactuca sativa plants in relation to drought stress tolerance. Plant Mol Biol 60:389–404
CrossRef (https://doi.org/10.1007/s11103-005-4210-y)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=16514562)
Google Scholar (http://scholar.google.com/scholar_lookup?title=PIP%20aquaporin%20gene%20expression%20in%20arbuscular%20mycorrhizal%20Glycine%20max%20and%20Lactuca%20sativa%20plants%20in%20relation%20to%20drought%20stress%20tolerance&author=R.%20Porcel&author=R.%20Aroca&author=R.%20Azc%C3%B3n&author=JM.%20Ruiz-Lozano&journal=Plant%20Mol%20Biol&volume=60&pages=389-404&publication_year=2006)

Pozo MJ, Azcon-Aguilar C (2007) Unraveling mycorrhiza-induced resistance. Curr Opin Plant Biol 10:393–398. doi: 10.1016/j.pbi.2007.05.004 (https://doi.org/10.1016/j.pbi.2007.05.004)
CrossRef (https://doi.org/10.1016/j.pbi.2007.05.004)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=17658291)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Unraveling%20mycorrhiza-induced%20resistance&author=MJ.%20Pozo&author=C.%20Azcon-Aguilar&journal=Curr%20Opin%20Plant%20Biol&volume=10&pages=393-398&publication_year=2007&doi=10.1016%2Fj.pbi.2007.05.004)

Pozo MJ, Jung SC, López-Ráez JA, Azcón-Aguilar C (2010) Impact of arbuscular mycorrhizal symbiosis on plant response to biotic stress: the role of plant defence mechanisms. In: Koltai H, Kapulnik Y (eds) Arbuscular mycorrhizas: physiology and function. Springer, Netherlands, pp 193–207. doi: 10.1007/978-90-481-9489-6_9 (https://doi.org/10.1007/978-90-481-9489-6_9)
CrossRef (https://doi.org/10.1007/978-90-481-9489-6_9)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Impact%20of%20arbuscular%20mycorrhizal%20symbiosis%20on%20plant%20response%20to%20biotic%20stress%3A%20the%20role%20of%20plant%20defence%20mechanisms&author=MJ.%20Pozo&author=SC.%20Jung&author=JA.%20L%C3%B3pez-R%C3%A1ez&author=C.%20Azc%C3%B3n-Aguilar&pages=193-207&publication_year=2010)

Prescott AG, John P (1996) Dioxygenases: molecular structure and role in plant metabolism. Annu Rev Plant Physiol Plant Mol Biol 47:245–271. doi: 10.1146/annurev.arplant.47.1.245 (https://doi.org/10.1146/annurev.arplant.47.1.245)
CrossRef (https://doi.org/10.1146/annurev.arplant.47.1.245)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=15012289)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Dioxygenases%3A%20molecular%20structure%20and%20role%20in%20plant%20metabolism&author=AG.%20Prescott&author=P.%20John&journal=Annu%20Rev%20Plant%20Physiol%20Plant%20Mol%20Biol&volume=47&pages=245-271&publication_year=1996&doi=10.1146%2Fannurev.arplant.47.1.245)

Ruiz-Lozano JM, Porcel R, Aroca R (2006) Does the enhanced tolerance of arbuscular mycorrhizal plants to water deficit involve modulation of drought-induced plant genes? New Phytol 171:693–698
CrossRef (https://doi.org/10.1111/j.1469-8137.2006.01841.x)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=16918542)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Does%20the%20enhanced%20tolerance%20of%20arbuscular%20mycorrhizal%20plants%20to%20water%20deficit%20involve%20modulation%20of%20drought-induced%20plant%20genes%3F&author=JM.%20Ruiz-Lozano&author=R.%20Porcel&author=R.%20Aroca&journal=New%20Phytol&volume=171&pages=693-698&publication_year=2006)

Salvioli A, Zouari I, Chalot M, Paola B (2012) The arbuscular mycorrhizal status has an impact on the transcriptome profile and amino acid composition of tomato fruit. BMC Plant Biol 12:44
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3362744)
CrossRef (https://doi.org/10.1186/1471-2229-12-44)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=22452950)
Google Scholar (http://scholar.google.com/scholar_lookup?title=The%20arbuscular%20mycorrhizal%20status%20has%20an%20impact%20on%20the%20transcriptome%20profile%20and%20amino%20acid%20composition%20of%20tomato%20fruit&author=A.%20Salvioli&author=I.%20Zouari&author=M.%20Chalot&author=B.%20Paola&journal=BMC%20Plant%20Biol&volume=12&pages=44&publication_year=2012)

Secco D, Baumann A, Poirier Y (2010) Characterization of the rice PHO1 gene family reveals a key role for OsPHO1;2 in phosphate homeostasis and the evolution of a distinct clade in dicotyledons. Plant Physiol 152:1693–1704
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2832267)
CrossRef (https://doi.org/10.1104/pp.109.149872)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=20081045)

Google Scholar (http://scholar.google.com/scholar_lookup?title=Characterization%20of%20the%20rice%20PHO1%20gene%20family%20reveals%20a%20key%20role%20for%20OsPHO1%3B2%20in%20phosphate%20homeostasis%20and%20the%20evolution%20of%20a%20distinct%20clade%20in%20dicotyledons&author=D.%20Secco&author=A.%20Baumann&author=Y.%20Poirier&journal=Plant%20Physiol&volume=152&pages=1693-1704&publication_year=2010)

Smith SE, Read DJ (2008) Mycorrhizal symbiosis, 3rd edn. Academic Press, Amsterdam
Google Scholar (http://scholar.google.com/scholar_lookup?title=Mycorrhizal%20symbiosis&author=SE.%20Smith&author=DJ.%20Read&publication_year=2008)

Smith SE, Jakobsen I, Grønlund M, Smith FA (2011) Roles of arbuscular mycorrhizas in plant phosphorus nutrition: interactions between pathways of phosphorus uptake in arbuscular mycorrhizal roots have important implications for understanding and manipulating plant phosphorus acquisition. Plant Physiol 156(3):1050–1057
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3135927)
CrossRef (https://doi.org/10.1104/pp.111.174581)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=21467213)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Roles%20of%20arbuscular%20mycorrhizas%20in%20plant%20phosphorus%20nutrition%3A%20interactions%20between%20pathways%20of%20phosphorus%20uptake%20in%20arbuscular%20mycorrhizal%20roots%20have%20important%20implications%20for%20understanding%20and%20manipulating%20plant%20phosphorus%20acquisition&author=SE.%20Smith&author=I.%20Jakobsen&author=M.%20Gr%C3%B8nlund&author=FA.%20Smith&journal=Plant%20Physiol&volume=156&issue=3&pages=1050-1057&publication_year=2011)

Stracke S et al (2002) A plant receptor-like kinase required for both bacterial and fungal symbiosis. Nature 417:959–962
CrossRef (https://doi.org/10.1038/nature00841)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=12087405)
Google Scholar (http://scholar.google.com/scholar_lookup?title=A%20plant%20receptor-like%20kinase%20required%20for%20both%20bacterial%20and%20fungal%20symbiosis&author=S.%20Stracke&journal=Nature&volume=417&pages=959-962&publication_year=2002)

The Tomato Genome Consortium (2012) The tomato genome sequence provides insights into fleshy fruit evolution. Nature 485:635–641
CrossRef (https://doi.org/10.1038/nature11119)
Google Scholar (http://scholar.google.com/scholar_lookup?title=The%20tomato%20genome%20sequence%20provides%20insights%20into%20fleshy%20fruit%20evolution&journal=Nature&volume=485&pages=635-641&publication_year=2012)

Thimm O et al (2004) MAPMAN: a user-driven tool to display genomics data sets onto diagrams of metabolic pathways and other biological processes. Plant J 37:914–939
CrossRef (https://doi.org/10.1111/j.1365-313X.2004.02016.x)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=14996223)
Google Scholar (http://scholar.google.com/scholar_lookup?title=MAPMAN%3A%20a%20user-driven%20tool%20to%20display%20genomics%20data%20sets%20onto%20diagrams%20of%20metabolic%20pathways%20and%20other%20biological%20processes&author=O.%20Thimm&journal=Plant%20J&volume=37&pages=914-939&publication_year=2004)

Usadel B et al (2006) PageMan: an interactive ontology tool to generate, display, and annotate overview graphs for profiling experiments. BMC Bioinformatics 7:535
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1766370)
CrossRef (https://doi.org/10.1186/1471-2105-7-535)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=17176458)
Google Scholar (http://scholar.google.com/scholar_lookup?title=PageMan%3A%20an%20interactive%20ontology%20tool%20to%20generate%2C%20display%2C%20and%20annotate%20overview%20graphs%20for%20profiling%20experiments&author=B.%20Usadel&journal=BMC%20Bioinformatics&volume=7&pages=535&publication_year=2006)

van Loon LC, Geraats BPJ, Linthorst HJM (2006) Ethylene as a modulator of disease resistance in plants. Trends Plant Sci 11:184–191
CrossRef (https://doi.org/10.1016/j.tplants.2006.02.005)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=16531096)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Ethylene%20as%20a%20modulator%20of%20disease%20resistance%20in%20plants&author=LC.%20Loon&author=BPJ.%20Geraats&author=HJM.%20Linthorst&journal=Trends%20Plant%20Sci&volume=11&pages=184-191&publication_year=2006)

Verhagen BW, Glazebrook J, Zhu T, Chang HS, van Loon LC, Pieterse CM (2004) The transcriptome of rhizobacteria-induced systemic resistance in arabidopsis. Mol Plant Microbe Interact 17:895–908. doi: 10.1094/mpmi.2004.17.8.895 (https://doi.org/10.1094/mpmi.2004.17.8.895)
CrossRef (https://doi.org/10.1094/MPMI.2004.17.8.895)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=15305611)
Google Scholar (http://scholar.google.com/scholar_lookup?title=The%20transcriptome%20of%20rhizobacteria-induced%20systemic%20resistance%20in%20arabidopsis&author=BW.%20Verhagen&author=J.%20Glazebrook&author=T.%20Zhu&author=HS.%20Chang&author=LC.%20Loon&author=CM.%20Pieterse&journal=Mol%20Plant%20Microbe%20Interact&volume=17&pages=895-908&publication_year=2004&doi=10.1094%2Fmpmi.2004.17.8.895)

Wasternack C et al (2006) The wound response in tomato—role of jasmonic acid. J Plant Physiol 163:297–306
CrossRef (https://doi.org/10.1016/j.jplph.2005.10.014)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=16368162)

Google Scholar (http://scholar.google.com/scholar_lookup?title=The%20wound%20response%20in%20tomato%E2%80%94role%20of%20jasmonic%20acid&author=C.%20Wasternack&journal=J%20Plant%20Physiol&volume=163&pages=297-306&publication_year=2006)

Whipps JM (2004) Prospects and limitations for mycorrhizas in biocontrol of root pathogens. Can J Bot 82:1198–1227
CrossRef (https://doi.org/10.1139/b04-082)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Prospects%20and%20limitations%20for%20mycorrhizas%20in%20biocontrol%20of%20root%20pathogens&author=JM.%20Whipps&journal=Can%20J%20Bot&volume=82&pages=1198-1227&publication_year=2004)

Xu X et al (2013) Parallel comparison of Illumina RNA-Seq and Affymetrix microarray platforms on transcriptomic profiles generated from 5-aza-deoxy-cytidine treated HT-29 colon cancer cells and simulated datasets. BMC Bioinforma 14:S1
CrossRef (https://doi.org/10.1186/1471-2105-14-S9-S1)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Parallel%20comparison%20of%20Illumina%20RNA-Seq%20and%20Affymetrix%20microarray%20platforms%20on%20transcriptomic%20profiles%20generated%20from%205-aza-deoxy-cytidine%20treated%20HT-29%20colon%20cancer%20cells%20and%20simulated%20datasets&author=X.%20Xu&journal=BMC%20Bioinforma&volume=14&pages=S1&publication_year=2013)

Zouari I et al (2014) From root to fruit: RNA-Seq analysis shows that arbuscular mycorrhizal symbiosis may affect tomato fruit metabolism. BMC Genomics 15:221
PubMedCentral (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3997964)
CrossRef (https://doi.org/10.1186/1471-2164-15-221)
PubMed (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=24655934)
Google Scholar (http://scholar.google.com/scholar_lookup?title=From%20root%20to%20fruit%3A%20RNA-Seq%20analysis%20shows%20that%20arbuscular%20mycorrhizal%20symbiosis%20may%20affect%20tomato%20fruit%20metabolism&author=I.%20Zouari&journal=BMC%20Genomics&volume=15&pages=221&publication_year=2014)

Copyright information

About this article

Cite this article as:
Cervantes-Gámez, R.G., Bueno-Ibarra, M.A., Cruz-Mendívil, A. et al. Plant Mol Biol Rep (2016) 34: 89. https://doi.org/10.1007/s11105-015-0903-9

- DOI (Digital Object Identifier) https://doi.org/10.1007/s11105-015-0903-9
- Publisher Name Springer US
- Print ISSN 0735-9640
- Online ISSN 1572-9818

- About this journal
- Reprints and Permissions

Personalised recommendations