

GEPHE SUMMARY

|                                                                                                                                                                                                                                                                                                            |                |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------|
|                                                                                                                                                                                                                                                                                                            | Gephebase Gene | GepheID      |
| FRD3 (FERRIC REDUCTASE DEFECTIVE3) ( <a href="https://www.gephebase.org/search-criteria?/and+Gene=Gephebase=^FRD3 (FERRIC REDUCTASE DEFECTIVE3)^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Gene=Gephebase=^FRD3 (FERRIC REDUCTASE DEFECTIVE3)^#gephebase-summary-title</a> ) | GP00000355     | Main curator |
|                                                                                                                                                                                                                                                                                                            | Martin         |              |
| Published                                                                                                                                                                                                                                                                                                  | Entry Status   |              |

PHENOTYPIC CHANGE

|                                                                                                                                                                                                                                                                                    |                             |  |                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--|-------------------------------------------|
|                                                                                                                                                                                                                                                                                    | Trait Category              |  |                                           |
| Physiology ( <a href="https://www.gephebase.org/search-criteria?/and+TraitCategory=^Physiology^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+TraitCategory=^Physiology^#gephebase-summary-title</a> )                                                   | Trait                       |  |                                           |
| Metal tolerance ( <a href="https://www.gephebase.org/search-criteria?/and+Trait=^Metal tolerance^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait=^Metal tolerance^#gephebase-summary-title</a> )                                                    | Trait State in Taxon A      |  |                                           |
| Arabidopsis thaliana - Sha                                                                                                                                                                                                                                                         | Trait State in Taxon B      |  |                                           |
| Arabidopsis thaliana- Bay-0 (Zn tolerant)                                                                                                                                                                                                                                          | Ancestral State             |  |                                           |
| Data not curated                                                                                                                                                                                                                                                                   | Taxonomic Status            |  |                                           |
| Intraspecific ( <a href="https://www.gephebase.org/search-criteria?/and+TaxonomicStatus=^Intraspecific^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+TaxonomicStatus=^Intraspecific^#gephebase-summary-title</a> )                                      |                             |  |                                           |
|                                                                                                                                                                                                                                                                                    | Taxon A                     |  | Taxon B                                   |
|                                                                                                                                                                                                                                                                                    | Latin Name                  |  | Latin Name                                |
| Arabidopsis thaliana ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Arabidopsis thaliana^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Arabidopsis thaliana^#gephebase-summary-title</a> )           | Common Name                 |  | Common Name                               |
| thale cress                                                                                                                                                                                                                                                                        | Synonyms                    |  | Synonyms                                  |
| thale cress; mouse-ear cress; thale-cress; Arabidopsis thaliana (L.) Heynh.; Arabidopsis thaliana (thale cress); Arabidopsis_thaliana; Arbisopsis thaliana; thale kress                                                                                                            | Rank                        |  | Rank                                      |
| species                                                                                                                                                                                                                                                                            | Lineage                     |  | Lineage                                   |
| cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; rosids; malvids; Brassicales; Brassicaceae; Camelineae; Arabidopsis | Parent                      |  | Parent                                    |
| Arabidopsis () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=3701">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=3701</a> )                                                                                                 | NCBI Taxonomy ID            |  | NCBI Taxonomy ID                          |
| 3702 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=3702">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=3702</a> )                                                                                                                           | is Taxon A an Infrappecies? |  | is Taxon B an Infrappecies?               |
| Yes                                                                                                                                                                                                                                                                                | Taxon A Description         |  | Taxon B Description                       |
| Arabidopsis thaliana - Sha                                                                                                                                                                                                                                                         |                             |  | Arabidopsis thaliana- Bay-0 (Zn tolerant) |

GENOTYPIC CHANGE

|                                                                                                                                                                                                                  |                         |                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                  | Generic Gene Name       | UniProtKB Arabidopsis thaliana                                                                                         |
| DTX43                                                                                                                                                                                                            | Synonyms                | Q9SFB0 ( <a href="http://www.uniprot.org/uniprot/Q9SFB0">http://www.uniprot.org/uniprot/Q9SFB0</a> )                   |
| ATFRD3; FERRIC REDUCTASE DEFECTIVE 3; MAN1; MANGANESE ACCUMULATOR 1; FRD3; At3g08040; F17A17.38; T8G24.8                                                                                                         | String                  | GenebankID or UniProtKB                                                                                                |
| 3702.AT3G08040.1 ( <a href="http://string-db.org/newstring.cgi/show_network_section.pl?identifier=3702.AT3G08040.1">http://string-db.org/newstring.cgi/show_network_section.pl?identifier=3702.AT3G08040.1</a> ) |                         | AC074395 ( <a href="https://www.ncbi.nlm.nih.gov/nuccore/AC074395">https://www.ncbi.nlm.nih.gov/nuccore/AC074395</a> ) |
|                                                                                                                                                                                                                  | Sequence Similarities   |                                                                                                                        |
| Belongs to the multi antimicrobial extrusion (MATE) (TC 2.A.66.1) family.                                                                                                                                        | GO - Molecular Function |                                                                                                                        |
| GO:0015297 : antiporter activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0015297">https://www.ebi.ac.uk/QuickGO/term/GO:0015297</a> )                                                                   |                         |                                                                                                                        |
| GO:0015137 : citrate transmembrane transporter activity                                                                                                                                                          |                         |                                                                                                                        |

(<https://www.ebi.ac.uk/QuickGO/term/GO:0015137>)  
GO:0046873 : metal ion transmembrane transporter activity  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0046873>)  
GO:0005215 : transporter activity (<https://www.ebi.ac.uk/QuickGO/term/GO:0005215>)  
GO - Biological Process

GO:0006879 : cellular iron ion homeostasis  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0006879>)  
GO:0071281 : cellular response to iron ion  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0071281>)  
GO:0009737 : response to abscisic acid  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0009737>)  
GO:0016036 : cellular response to phosphate starvation  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0016036>)  
GO:0055072 : iron ion homeostasis (<https://www.ebi.ac.uk/QuickGO/term/GO:0055072>)  
GO:0071369 : cellular response to ethylene stimulus  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0071369>)  
GO:0071732 : cellular response to nitric oxide  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0071732>)  
GO:0030001 : metal ion transport (<https://www.ebi.ac.uk/QuickGO/term/GO:0030001>)  
GO - Cellular Component

GO:0016021 : integral component of membrane  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0016021>)  
GO:0005886 : plasma membrane (<https://www.ebi.ac.uk/QuickGO/term/GO:0005886>)

Mutation #1

Presumptive Null

No (<https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title>)

Molecular Type

Coding (<https://www.gephebase.org/search-criteria?/and+Molecular Type=^Coding^#gephebase-summary-title>)

Aberration Type

SNP (<https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title>)

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

the Sha allele (Zn-sensitive) shows non-functional protein due to N116S and L117P

Experimental Evidence

Linkage Mapping (<https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Linkage Mapping^#gephebase-summary-title>)

|            | Taxon A | Taxon B | Position |
|------------|---------|---------|----------|
| Codon      | -       | -       | -        |
| Amino-acid | Asn     | Ser     | 116      |

Main Reference

Natural variation at the FRD3 MATE transporter locus reveals cross-talk between Fe homeostasis and Zn tolerance in Arabidopsis thaliana. (2012)  
(<https://pubmed.ncbi.nlm.nih.gov/23236296>)

Authors

Pineau C; Loubet S; Lefoulon C; Chalies C; Fizames C; Lacombe B; Ferrand M; Loudet O; Berthomieu P; Richard O

Abstract

Zinc (Zn) is essential for the optimal growth of plants but is toxic if present in excess, so Zn homeostasis needs to be finely tuned. Understanding Zn homeostasis mechanisms in plants will help in the development of innovative approaches for the phytoremediation of Zn-contaminated sites. In this study, Zn tolerance quantitative trait loci (QTL) were identified by analyzing differences in the Bay-0 and Shahdara accessions of Arabidopsis thaliana. Fine-scale mapping showed that a variant of the Fe homeostasis-related FERRIC REDUCTASE DEFECTIVE3 (FRD3) gene, which encodes a multidrug and toxin efflux (MATE) transporter, is responsible for reduced Zn tolerance in A. thaliana. Allelic variation in FRD3 revealed which amino acids are necessary for FRD3 function. In addition, the results of allele-specific expression assays in F1 individuals provide evidence for the existence of at least one putative metal-responsive cis-regulatory element. Our results suggest that FRD3 works as a multimer and is involved in loading Zn into xylem. Cross-homeostasis between Fe and Zn therefore appears to be important for Zn tolerance in A. thaliana with FRD3 acting as an essential regulator.

Additional References

Mutation #2

Presumptive Null

No (<https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title>)

Molecular Type

Coding (<https://www.gephebase.org/search-criteria?/and+Molecular Type=^Coding^#gephebase-summary-title>)

Aberration Type

SNP (<https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title>)

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

the Sha allele (Zn-sensitive) shows non-functional protein due to N116S and L117P

Experimental Evidence

Linkage Mapping (<https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Linkage Mapping^#gephebase-summary-title>)

|            | Taxon A | Taxon B | Position |
|------------|---------|---------|----------|
| Codon      | -       | -       | -        |
| Amino-acid | Leu     | Phe     | 117      |

Main Reference

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(<https://pubmed.ncbi.nlm.nih.gov/23236296>)

Authors

Pineau C; Loubet S; Lefoulon C; Chalias C; Fizames C; Lacombe B; Ferrand M; Loudet O; Berthomieu P; Richard O

Abstract

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Additional References

RELATED GEPHE

Related Genes

5 (FPN2, heavy metal atpase3 (HMA3), heavy metal atpase5 (HMA5), Molybdenum transporter1 (MOT1), heavy metal atpase4 (HMA4)) ([https://www.gephebase.org/search-criteria?/or+Taxon+ID=~3702\\*/and+Trait=Metal+tolerance/and+groupHaplotypes=true#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Taxon+ID=~3702*/and+Trait=Metal+tolerance/and+groupHaplotypes=true#gephebase-summary-title))

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

The weaker expression of the gene is possibly due to 27-bp and 28bp deletions in promoter @SeveralMutationsWithEffect