GEPHE SUMMARY

Gephebase Gene
protoporphyrinogen oxidase (PPO2 = PPX2L) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^protoporphyrinogen oxidase (PPO2 = PPX2L)^#gephebase-summary-title)

GepheID
GP00000929

Entry Status
Published

Main curator
Martin

PHENOTYPIC CHANGE

Trait Category
Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Physiology^#gephebase-summary-title)

Trait
Xenobiotic resistance (herbicides) (https://www.gephebase.org/search-criteria?/and+Trait=^Xenobiotic resistance (herbicides)^#gephebase-summary-title)

Trait State in Taxon A
Amaranthus tuberculatus - sensitive

Trait State in Taxon B
Amaranthus tuberculatus - resistant

Ancestral State
Taxon A

Taxonomic Status
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Intraspecific^#gephebase-summary-title)

Taxon A

Latin Name
Amaranthus tuberculatus (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Amaranthus tuberculatus^#gephebase-summary-title)

Common Name
-

Synonyms
Amaranthus rudis; Amaranthus rudis J.D.Sauer; Amaranthus tuberculatus (Moq.) J.D.Sauer

Rank
species

Lineage
cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; Caryophyllales; Amaranthaceae; Amaranthus

Parent
Amaranthus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 3564)

NCBI Taxonomy ID
277990 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 277990)

is Taxon A an Infraspecies?
No

Taxon B

Latin Name
Amaranthus tuberculatus (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Amaranthus tuberculatus^#gephebase-summary-title)

Common Name
-

Synonyms
Amaranthus rudis; Amaranthus rudis J.D.Sauer; Amaranthus tuberculatus (Moq.) J.D.Sauer

Rank
species

Lineage
cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; Caryophyllales; Amaranthaceae; Amaranthus

Parent
Amaranthus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 3564)

NCBI Taxonomy ID
277990 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 277990)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
PPX2L

Synonyms
-

String
-

Sequence Similarities
Belongs to the protoporphyrinogen oxidase family.

GO - Molecular Function
GO:0004729 : oxygen-dependent protoporphyrinogen oxidase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004729)

GO - Biological Process
GO:0006782 : protoporphyrinogen IX biosynthetic process (https://www.ebi.ac.uk/QuickGO/term/GO:0006782)

GO - Cellular Component
-

UniProtKB Amaranthus tuberculatus
Q0NZW6 (http://www.uniprot.org/uniprot/Q0NZW6)

GenebankID or UniProtKB
DQ386117 (https://www.ncbi.nlm.nih.gov/nuccore/DQ386117)

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

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

Deletion Size

1-9 bp

Molecular Details of the Mutation

3bp deletion; deletion of G210

Experimental Evidence

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

Main Reference

A codon deletion confers resistance to herbicides inhibiting protoporphyrinogen oxidase. (2006) (https://pubmed.ncbi.nlm.nih.gov/16894159)

Authors

Patzoldt WL; Hager AG; McCormick JS; Tranel PJ

Abstract

Herbicides that act by inhibiting protoporphyrinogen oxidase (PPO) are widely used to control weeds in a variety of crops. The first weed to evolve resistance to PPO-inhibiting herbicides was Amaranthus tuberculatus, a problematic weed in the midwestern United States that previously had evolved multiple resistances to herbicides inhibiting two other target sites. Evaluation of a PPO-inhibitor-resistant A. tuberculatus biotype revealed that resistance was a (incompletely) dominant trait conferred by a single, nuclear gene. Three genes predicted to encode PPO were identified in A. tuberculatus. One gene from the resistant biotype, designated PPX2L, contained a codon deletion that was shown to confer resistance by complementation of a hemG mutant strain of Escherichia coli grown in the presence and absence of the PPO inhibitor lactofen. PPX2L is predicted to encode both plastid- and mitochondria-targeted PPO isoforms, allowing a mutation in a single gene to confer resistance to two herbicide target sites. Unique aspects of the resistance mechanism include an amino acid deletion, rather than a substitution, and the dual-targeting nature of the gene, which may explain why resistance to PPO inhibitors has been rare.

Additional References

RELATED GEPHE

Related Genes

2 (ALS, EPSPS) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^277990^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS