GEPHE SUMMARY

Gephebase Gene

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

GepheID

GP00001903

Entry Status

Published

Main curator

Courtier

PHENOTYPIC CHANGE

Trait Category

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

Trait

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

Trait State in Taxon A

Lolium rigidum - sensitive

Trait State in Taxon B

Lolium rigidum - 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

Lolium rigidum (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Lolium rigidum^#gephebase-summary-title)

Common Name

-

Synonyms

Lolium rigidum Gaudin; Lolium rigidium

Rank

species

Lineage

cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliopsida; Mesangiospermae; Liliopsida; Petrosaviidae; commelinids; Poales; Poaceae; BOP clade; Pooideae; Poodae; Poeae; Poeae Chloroplast Group 2 (Poeae type); Loliinae; Lolium

Parent

Lolium () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4520)

NCBI Taxonomy ID

89674 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 89674)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

Lolium rigidum (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Lolium rigidum^#gephebase-summary-title)

Common Name

-

Synonyms

Lolium rigidum Gaudin; Lolium rigidium

Rank

species

Lineage

cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliopsida; Mesangiospermae; Liliopsida; Petrosaviidae; commelinids; Poales; Poaceae; BOP clade; Pooideae; Poodae; Poeae; Poeae Chloroplast Group 2 (Poeae type); Loliinae; Lolium

Parent

Lolium () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4520)

NCBI Taxonomy ID

89674 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 89674)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

At2g45300

Synonyms

F4L23.19; At2g45300

String

3702.AT2G45300.1 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 3702.AT2G45300.1)

Sequence Similarities

Belongs to the EPSP synthase family.

GO - Molecular Function

GO:0003866 : 3-phosphoshikimate 1-carboxyvinyltransferase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0003866)

GO - Biological Process

GO:0009073 : aromatic amino acid family biosynthetic process (https://www.ebi.ac.uk/QuickGO/term/GO:0009073)
GO:0009423 : chorismate biosynthetic process

UniProtKB Arabidopsis thaliana

P05466 (http://www.uniprot.org/uniprot/P05466)

GenebankID or UniProtKB

()

(https://www.ebi.ac.uk/QuickGO/term/GO:0009423)

GO - Cellular Component

GO:0009507 : chloroplast (https://www.ebi.ac.uk/QuickGO/term/GO:0009507)

GO:0009570 : chloroplast stroma (https://www.ebi.ac.uk/QuickGO/term/GO:0009570)

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

Pro106Ala

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	-	-	-

Main Reference

Glyphosate, paraquat and ACCase multiple herbicide resistance evolved in a Lolium rigidum biotype. (2007) (https://pubmed.ncbi.nlm.nih.gov/16906433)

Authors

Yu Q; Cairns A; Powles S

Abstract

Glyphosate is the world's most widely used herbicide. A potential substitute for glyphosate in some use patterns is the herbicide paraquat. Following many years of successful use, neither glyphosate nor paraquat could control a biotype of the widespread annual ryegrass (Lolium rigidum), and here the world's first case of multiple resistance to glyphosate and paraquat is confirmed. Dose-response experiments established that the glyphosate rate causing 50% mortality (LD(50)) for the resistant (R) biotype is 14 times greater than for the susceptible (S) biotype. Similarly, the paraquat LD(50)for the R biotype is 32 times greater than for the S biotype. Thus, based on the LD(50)R/S ratio, this R biotype of L. rigidum is 14-fold resistant to glyphosate and 32-fold resistant to paraquat. This R biotype also has evolved resistance to the acetyl-coenzyme A carboxylase (ACCase) inhibiting herbicides. The mechanism of paraquat resistance in this biotype was determined as restricted paraquat translocation. Resistance to ACCase-inhibiting herbicides was determined as due to an insensitive ACCase. Two mechanisms endowing glyphosate resistance were established: firstly, a point mutation in the 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) gene, resulting in an amino acid substitution of proline to alanine at position 106; secondly, reduced glyphosate translocation was found in this R biotype, indicating a co-occurrence of two distinct glyphosate resistance mechanisms within the R population. In total, this R biotype displays at least four co-existing resistance mechanisms, endowing multiple resistance to glyphosate, paraquat and ACCase herbicides. This alarming case in the history of herbicide resistance evolution represents a serious challenge for the sustainable use of the precious agrochemical resources such as glyphosate and paraquat.

Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

3 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^EPSPS^/and+Taxon ID=^89674^/or+Gene Gephebase=^EPSPS^/and+Taxon ID=^89674^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS