

GEPHE SUMMARY

Gephebase Gene
EPSPS

Entry Status
Published

GepheID
GP00001883

Main curator
Courtier

PHENOTYPIC CHANGE

Trait Category
Physiology

Trait
Xenobiotic resistance (herbicides; glyphosate)

Trait State in Taxon A
Amaranthus palmeri - sensitive

Trait State in Taxon B
Amaranthus palmeri - resistant

Ancestral State
Taxon A

Taxonomic Status
Intraspecific

	Taxon A
Latin Name	<i>Amaranthus palmeri</i>
Common Name	-
Synonyms	Amaranthus palmeri S.Watson
Rank	species
Lineage	cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliopsida; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetales; Caryophyllales; Amaranthaceae; Amaranthus
Parent	Amaranthus () - (Rank: genus)
NCBI Taxonomy ID	107608
is Taxon A an Intraspecies?	No

	Taxon B
Latin Name	<i>Amaranthus palmeri</i>
Common Name	-
Synonyms	Amaranthus palmeri S.Watson
Rank	species
Lineage	cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliopsida; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetales; Caryophyllales; Amaranthaceae; Amaranthus
Parent	Amaranthus () - (Rank: genus)
NCBI Taxonomy ID	107608
is Taxon B an Intraspecies?	No

GENOTYPIC CHANGE

Generic Gene Name
At2g45300

Synonyms
F4L23.19; At2g45300

String
3702.AT2G45300.1

Sequence Similarities
Belongs to the EPSP synthase family.

GO - Molecular Function
GO:0003866 : 3-phosphoshikimate 1-carboxyvinyltransferase activity

GO - Biological Process
GO:0009073 : aromatic amino acid family biosynthetic process
GO:0009423 : chorismate biosynthetic process

GO - Cellular Component
GO:0009507 : chloroplast
GO:0009570 : chloroplast stroma

Presumptive Null
No

UniProtKB Arabidopsis thaliana
P05466

GenebankID or UniProtKB

Molecular Type
Gene Amplification

Aberration Type
Insertion

Insertion Size
10-100 kb

Molecular Details of the Mutation

Genomes of resistant plants contain from 5-fold to more than 160-fold more copies of the EPSPS gene than did genomes of susceptible plants - the duplicated section of DNA including the 10â€‰%kb EPSPS gene is at least 30â€‰%kb long

Experimental Evidence
Candidate Gene

Main Reference

Gene amplification confers glyphosate resistance in *Amaranthus palmeri*. (2010)

Authors

Gaines TA; Zhang W; Wang D; Bukun B; Chisholm ST; Shaner DL; Nissen SJ; Patzoldt WL; Tranel PJ; Culpepper AS; Grey TL; Webster TM; Vencill WK; Sammons RD; Jiang J; Preston C; Leach JE; Westra P

Abstract

The herbicide glyphosate became widely used in the United States and other parts of the world after the commercialization of glyphosate-resistant crops. These crops have constitutive overexpression of a glyphosate-insensitive form of the herbicide target site gene, 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS). Increased use of glyphosate over multiple years imposes selective genetic pressure on weed populations. We investigated recently discovered glyphosate-resistant *Amaranthus palmeri* populations from Georgia, in comparison with normally sensitive populations. EPSPS enzyme activity from resistant and susceptible plants was equally inhibited by glyphosate, which led us to use quantitative PCR to measure relative copy numbers of the EPSPS gene. Genomes of resistant plants contained from 5-fold to more than 160-fold more copies of the EPSPS gene than did genomes of susceptible plants. Quantitative RT-PCR on cDNA revealed that EPSPS expression was positively correlated with genomic EPSPS relative copy number. Immunoblot analyses showed that increased EPSPS protein level also correlated with EPSPS genomic copy number. EPSPS gene amplification was heritable, correlated with resistance in pseudo-F(2) populations, and is proposed to be the molecular basis of glyphosate resistance. FISH revealed that EPSPS genes were present on every chromosome and, therefore, gene amplification was likely not caused by unequal chromosome crossing over. This occurrence of gene amplification as an herbicide resistance mechanism in a naturally occurring weed population is particularly significant because it could threaten the sustainable use of glyphosate-resistant crop technology.

Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

No matches found.

COMMENTS

The EPSPS gene is present on all chromosomes