GEPHE SUMMARY

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

GepheID
GP00000867

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
C3-C4 photosynthesis (enzymatic properties) (https://www.gephebase.org/search-criteria?/and+Trait=^C3-C4 photosynthesis (enzymatic properties)^#gephebase-summary-title)

Trait State in Taxon A
Flaveria pringlei : C3 photosynthesis

Trait State in Taxon B
Flaveria trinervia : C4 photosynthesis

Ancestral State
Data not curated

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

Taxon A

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

Common Name
-

Synonyms
Flaveria pringlei Gand.

Rank
species

Lineage
cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; asterids; campanulids; Asterales; Asteraceae; Asteroideae; Heliantheae alliance; Tageteae; Flaveria

Parent
Flaveria () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4223)

NCBI Taxonomy ID
4226 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4226)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
-

Synonyms
Flaveria australasica; Flaveria australasica Hook.; Flaveria trinervia (Spreng.) C.Mohr

Rank
species

Lineage
cellular organisms; Eukaryota; Viridiplantae; Streptophyta; Streptophytina; Embryophyta; Tracheophyta; Euphyllophyta; Spermatophyta; Magnoliophyta; Mesangiospermae; eudicotyledons; Gunneridae; Pentapetalae; asterids; campanulids; Asterales; Asteraceae; Asteroideae; Heliantheae alliance; Tageteae; Flaveria

Parent
Flaveria () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4223)

NCBI Taxonomy ID
4227 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 4227)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
PPCA

Synonyms
-

String
-

Sequence Similarities
Belongs to the PEPCase type 1 family.

GO - Molecular Function
GO:0008964 : phosphoenolpyruvate carboxylase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008964)

GO - Biological Process
GO:0006099 : tricarboxylic acid cycle (https://www.ebi.ac.uk/QuickGO/term/GO:0006099)
GO:0009760 : C4 photosynthesis (https://www.ebi.ac.uk/QuickGO/term/GO:0009760)
GO:0015977 : carbon fixation (https://www.ebi.ac.uk/QuickGO/term/GO:0015977)

UniProtKB Flaveria trinervia
P30694 (http://www.uniprot.org/uniprot/P30694)

GenebankID or UniProtKB
X61304 (https://www.ncbi.nlm.nih.gov/nuccore/X61304)

GO - Cellular Component

GO:0005737 : cytoplasm (https://www.ebi.ac.uk/QuickGO/term/GO:0005737)

Mutation #1

Presumptive Null

Yes (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Yes^#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

one important amino acid change in region 5: C3 plants: Ala274 and C4 plants: Ser274 - This single amino acid change was introduced by site-directed mutagenesis and shown to alter enzyme kinetics

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	Ala	Ser	274

Main Reference

Evolution of C4 phosphoenolpyruvate carboxylase in Flaveria, a conserved serine residue in the carboxyl-terminal part of the enzyme is a major determinant for C4-specific characteristics. (2000) (https://pubmed.ncbi.nlm.nih.gov/10871630)

Authors

BlÃ¤sing OE; Westhoff P; Svensson P

Abstract

C4 phosphoenolpyruvate carboxylases have evolved from ancestral C3 isoforms during the evolution of angiosperms and gained distinct kinetic and regulatory properties compared with the C3 isozymes. To identify amino acid residues and/or domains responsible for these C4-specific properties the C4 phosphoenolpyruvate carboxylase of Flaveria trinervia (C4) was compared with its orthologue in the closely related C3 plant Flaveria pringlei. Reciprocal enzyme chimera were constructed and the kinetic constants, K(0.5) and k(cat), as well as the Hill coefficient, h, were determined for the substrate phosphoenolpyruvate both in the presence and absence of the activator glucose 6-phosphate. By this approach two regions were identified which determined most of the kinetic differences of the C4 and C3 ppcA phosphoenolpyruvate carboxylases with respect to the substrate PEP. In addition, the experiments suggest that the two regions do not act additively but interact with each other. The region between amino acids 296 and 437 is essential for activation by glucose 6-phosphate. The carboxyl-terminal segment between amino acids 645 and 966 contains a C4 conserved serine or a C3 invariant alanine at position 774 in the respective enzyme isoform. Site-directed mutagenesis shows that this position is a key determinant for the kinetic properties of the two isozymes.

Additional References

Molecular evolution of C4 phosphoenolpyruvate carboxylase in the genus Flaveria--a gradual increase from C3 to C4 characteristics. (2003) (https://pubmed.ncbi.nlm.nih.gov/12811556)

Mutation #2

Presumptive Null

Yes (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Yes^#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

several candidate amino acid changes in region 2 - Region 2 between positions 296 and 437 makes a small but significant contribution (according to in vitro analysis of chimeric proteins)

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

Evolution of C4 phosphoenolpyruvate carboxylase in Flaveria, a conserved serine residue in the carboxyl-terminal part of the enzyme is a major determinant for C4-specific characteristics. (2000) (https://pubmed.ncbi.nlm.nih.gov/10871630)

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Additional References

Molecular evolution of C4 phosphoenolpyruvate carboxylase in the genus Flaveria--a gradual increase from C3 to C4 characteristics. (2003) (https://pubmed.ncbi.nlm.nih.gov/12811556)

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

2 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^phosphoenolpyruvate carboxylase (PEPC)^/and+Taxon ID=^4226^/or+Gene Gephebase=^phosphoenolpyruvate carboxylase (PEPC)^/and+Taxon ID=^4227^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS