

GEPHE SUMMARY

	Gephebase Gene		GepheID
phosphoenolpyruvate carboxylase (PEPC) ( <a +phosphoenolpyruvate+carboxylase+(pepc)+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase="+phosphoenolpyruvate+carboxylase+(PEPC)+"#gephebase-summary-title</a> )	GP00000867		
	Courtier		Main curator
Published	Entry Status		

PHENOTYPIC CHANGE

	Trait Category		
Physiology ( <a +physiology+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait+Category=">https://www.gephebase.org/search-criteria?/and+Trait+Category="+Physiology+"#gephebase-summary-title</a> )		Trait	
C3-C4 photosynthesis (enzymatic properties) ( <a +c3-c4+photosynthesis+(enzymatic+properties)+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=">https://www.gephebase.org/search-criteria?/and+Trait="+C3-C4+photosynthesis+(enzymatic+properties)+"#gephebase-summary-title</a> )			
	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 ( <a +interspecific+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=">https://www.gephebase.org/search-criteria?/and+Taxonomic+Status="+Interspecific+"#gephebase-summary-title</a> )			
	Taxon A		Taxon B
	Latin Name		Latin Name
Flaveria pringlei ( <a +flaveria+pringlei+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Flaveria+pringlei+"#gephebase-summary-title</a> )		Flaveria trinervia ( <a +flaveria+trinervia+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Flaveria+trinervia+"#gephebase-summary-title</a> )	
-	Common Name	-	Common Name
	Synonyms		Synonyms
Flaveria pringlei Gand.		Flaveria australasica; Flaveria australasica Hook.; Flaveria trinervia (Spreng.) C.Mohr	
	Rank		Rank
species		species	
	Lineage		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		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		Parent
Flaveria () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4223">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4223</a> )		Flaveria () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4223">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4223</a> )	
4226	NCBI Taxonomy ID	4227	NCBI Taxonomy ID
( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4226">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4226</a> )		( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4227">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=4227</a> )	
	is Taxon A an Infraspecies?		is Taxon B an Infraspecies?
No		No	

GENOTYPIC CHANGE

	Generic Gene Name		UniProtKB Flaveria trinervia
PPCA		P30694 ( <a href="http://www.uniprot.org/uniprot/P30694">http://www.uniprot.org/uniprot/P30694</a> )	
	Synonyms		GenebankID or UniProtKB
-		X61304 ( <a href="https://www.ncbi.nlm.nih.gov/nuccore/X61304">https://www.ncbi.nlm.nih.gov/nuccore/X61304</a> )	
	String		
-			
	Sequence Similarities		
Belongs to the PEPCase type 1 family.			
	GO - Molecular Function		
GO:0008964 : phosphoenolpyruvate carboxylase activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0008964">https://www.ebi.ac.uk/QuickGO/term/GO:0008964</a> )			
	GO - Biological Process		
GO:0006099 : tricarboxylic acid cycle ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0006099">https://www.ebi.ac.uk/QuickGO/term/GO:0006099</a> )			
GO:0009760 : C4 photosynthesis ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0009760">https://www.ebi.ac.uk/QuickGO/term/GO:0009760</a> )			
GO:0015977 : carbon fixation ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0015977">https://www.ebi.ac.uk/QuickGO/term/GO:0015977</a> )			

## Mutation #1

Presumptive Null

Yes ([https://www.gephebase.org/search-criteria?/and+Presumptive Null=~Yes~#gephebase-summary-title](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](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](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](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

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

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

Main Reference

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Authors

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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](https://www.gephebase.org/search-criteria?/or+Gene+Gephebase=))

EXTERNAL LINKS

COMMENTS