GEPHE SUMMARY

Gephebase Gene

CYP6B1 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^CYP6B1^#gephebase-summary-title)

GepheID

GP00000205

Entry Status

Published

Main curator

Martin

PHENOTYPIC CHANGE

Trait #1

Trait Category

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

Trait

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

Trait State in Taxon A

Other butterflies

Trait State in Taxon B

Papilio polyxenes

Trait #2

Trait Category

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

Trait

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

Trait State in Taxon A

-

Trait State in Taxon B

-

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

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

Common Name

brushfoots

Synonyms

brushfoots; brush-footed butterflies

Rank

family

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea

Parent

Papilionoidea (butterflies) - (Rank: superfamily) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 37572)

NCBI Taxonomy ID

33415 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 33415)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

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

Common Name

black swallowtail

Synonyms

black swallowtail; American swallowtail; eastern black swallowtail; Papilio polyxenes Fabricius, 1775

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea; Papilionidae; Papilioninae; Papilionini; Papilio

Parent

Papilio () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7145)

NCBI Taxonomy ID

7146 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7146)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

CYP6B1

Synonyms

-

String

-

Sequence Similarities

Belongs to the cytochrome P450 family.

GO - Molecular Function

GO:0020037 : heme binding (https://www.ebi.ac.uk/QuickGO/term/GO:0020037)
GO:0005506 : iron ion binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005506)
GO:0070330 : aromatase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0070330)

GO - Biological Process

-

GO - Cellular Component

GO:0005789 : endoplasmic reticulum membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0005789)
GO:0031090 : organelle membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0031090)

UniProtKB Papilio polyxenes

Q04552 (http://www.uniprot.org/uniprot/Q04552)

GenebankID or UniProtKB

U05037 (https://www.ncbi.nlm.nih.gov/nuccore/U05037)

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

Ile484Phe and probably other a.a. substitutions

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	Ile	Phe	484

Main Reference

Diversification of furanocoumarin-metabolizing cytochrome P450 monooxygenases in two papilionids: Specificity and substrate encounter rate. (2003) (https://pubmed.ncbi.nlm.nih.gov/12968082)

Authors

Li W; Schuler MA; Berenbaum MR

Abstract

Diversification of cytochrome P450 monooxygenases (P450s) is thought to result from antagonistic interactions between plants and their herbivorous enemies. However, little direct evidence demonstrates the relationship between selection by plant toxins and adaptive changes in herbivore P450s. Here we show that the furanocoumarin-metabolic activity of CYP6B proteins in two species of swallowtail caterpillars is associated with the probability of encountering host plant furanocoumarins. Catalytic activity was compared in two closely related CYP6B4 and CYP6B17 groups in the polyphagous congeners Papilio glaucus and Papilio canadensis. Generally, P450s from P. glaucus, which feeds occasionally on furanocoumarin-containing host plants, display higher activities against furanocoumarins than those from P. canadensis, which normally does not encounter furanocoumarins. These P450s in turn catalyze a larger range of furanocoumarins at lower efficiency than CYP6B1, a P450 from Papilio polyxenes, which feeds exclusively on furanocoumarin-containing host plants. Reconstruction of the ancestral CYP6B sequences using maximum likelihood predictions and comparisons of the sequence and geometry of their active sites to those of contemporary CYP6B proteins indicate that host plant diversity is directly related to P450 activity and inversely related to substrate specificity. These predictions suggest that, along the lineage leading to Papilio P450s, the ancestral, highly versatile CYP6B protein presumed to exist in a polyphagous species evolved through time into a more efficient and specialized CYP6B1-like protein in Papilio species with continual exposure to furanocoumarins. Further diversification of Papilio CYP6Bs has likely involved interspersed events of positive selection in oligophagous species and relaxation of functional constraints in polyphagous species.

Additional References

RELATED GEPHE

Related Genes

2 (CYP6B4, Na/K-ATPase alpha-subunit) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^33415^/and+Trait=Xenobiotic resistance/or+Taxon ID=^33415^/and+Trait=Host plant specialization/or+Taxon ID=^7146^/and+Trait=Xenobiotic resistance/or+Taxon ID=^7146^/and+Trait=Host plant specialization/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS