GEPHE SUMMARY

Gephebase Gene
CYP321A8 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^CYP321A8^#gephebase-summary-title)

GepheID
GP00002394

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 (organophosphate; chlorpyrifos; pyrethroid; cypermethrin; deltamethrin) (https://www.gephebase.org/search-criteria?/and+Trait=^Xenobiotic resistance (organophosphate; chlorpyrifos; pyrethroid; cypermethrin; deltamethrin)^#gephebase-summary-title)

Trait State in Taxon A
sensitive

Trait State in Taxon B
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
Spodoptera exigua (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Spodoptera exigua^#gephebase-summary-title)

Common Name
beet armyworm

Synonyms
beet armyworm; pigweed caterpillar; small mottled willow caterpillar; Spodoptera exigua (Hubner, 1808)

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; Noctuoidea; Noctuidae; Amphipyrinae; Spodoptera

Parent
Spodoptera () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7106)

NCBI Taxonomy ID
7107 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7107)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
beet armyworm

Synonyms
beet armyworm; pigweed caterpillar; small mottled willow caterpillar; Spodoptera exigua (Hubner, 1808)

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; Noctuoidea; Noctuidae; Amphipyrinae; Spodoptera

Parent
Spodoptera () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7106)

NCBI Taxonomy ID
7107 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7107)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
CYP321A8

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:0004497 : monooxygenase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004497)
GO:0016705 : oxidoreductase activity, acting on paired donors, with incorporation or

UniProtKB Spodoptera exigua
A0A286QUG5 (http://www.uniprot.org/uniprot/A0A286QUG5)

GenebankID or UniProtKB Spodoptera exigua
A0A286QUG5 (https://www.ncbi.nlm.nih.gov/nuccore/A0A286QUG5)

reduction of molecular oxygen (https://www.ebi.ac.uk/QuickGO/term/GO:0016705)

GO - Biological Process

-

GO - Cellular Component

-

Presumptive Null

No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)

Molecular Type

Cis-regulatory (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Cis-regulatory^#gephebase-summary-title)

Aberration Type

SNP (https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title)

Molecular Details of the Mutation

A > G at position -197bp in a cis-regulatory region, leading to increased expression of the gene

Experimental Evidence

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

Main Reference

Changes in both trans- and cis-regulatory elements mediate insecticide resistance in a lepidopteron pest, Spodoptera exigua. (2021) (https://pubmed.ncbi.nlm.nih.gov/33690635)

Authors

Hu B; Huang H; Hu S; Ren M; Wei Q; Tian X; Esmail Abdalla Elzaki M; Bass C; Su J; Reddy Palli S

Abstract

The evolution of insect resistance to insecticides is frequently associated with overexpression of one or more cytochrome P450 enzyme genes. Although overexpression of CYP450 genes is a well-known mechanism of insecticide resistance, the underlying regulatory mechanisms are poorly understood. Here we uncovered the mechanisms of overexpression of the P450 gene, CYP321A8 in a major pest insect, Spodoptera exigua that is resistant to multiple insecticides. CYP321A8 confers resistance to organophosphate (chlorpyrifos) and pyrethroid (cypermethrin and deltamethrin) insecticides in this insect. Constitutive upregulation of transcription factors CncC/Maf are partially responsible for upregulated expression of CYP321A8 in the resistant strain. Reporter gene assays and site-directed mutagenesis analyses demonstrated that CncC/Maf enhanced the expression of CYP321A8 by binding to specific sites in the promoter. Additional cis-regulatory elements resulting from a mutation in the CYP321A8 promoter in the resistant strain facilitates the binding of the orphan nuclear receptor, Knirps, and enhances the promoter activity. These results demonstrate that two independent mechanisms; overexpression of transcription factors and mutations in the promoter region resulting in a new cis-regulatory element that facilitates binding of the orphan nuclear receptor are involved in overexpression of CYP321A8 in insecticide-resistant S. exigua.

Additional References

RELATED GEPHE

Related Genes

4 (ABCC2, CYP9A186, GSTe, RYR) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^7107^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS