

GEPHE SUMMARY

CYP337B3 (https://www.gephebase.org/search-criteria?/and+GeneGephebase=~CYP337B3^#gephebase-summary-title)	Gephebase Gene	GP00002484	GephelD
	Entry Status	Courtier	Main curator
	Published		

PHENOTYPIC CHANGE

Physiology (https://www.gephebase.org/search-criteria?/and+TraitCategory=~Physiology^#gephebase-summary-title)		Trait Category	
Xenobiotic resistance (insecticide; pyrethroid) (https://www.gephebase.org/search-criteria?/and+Trait=~Xenobiotic+resistance+(insecticide;+pyrethroid)^#gephebase-summary-title)		Trait	
Helicoverpa armigera - susceptible		Trait State in Taxon A	
Helicoverpa armigera - resistant strain from China and Korea - allele CYP337B3v7		Trait State in Taxon B	
Taxon A		Ancestral State	
Intraspecific (https://www.gephebase.org/search-criteria?/and+TaxonomicStatus=~Intraspecific^#gephebase-summary-title)		Taxonomic Status	
Taxon A		Taxon B	
Helicoverpa armigera (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~Helicoverpa+armigera^#gephebase-summary-title)		Helicoverpa armigera (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~Helicoverpa+armigera^#gephebase-summary-title)	
cotton bollworm		cotton bollworm	
Heliothis (Helicoverpa) armigera; Heliothis armigera; cotton bollworm; American bollworm; corn ear worm; scarce bordered straw; tobacco budworm; Helicoverpa armigera (Hubner, 1808)		Heliothis (Helicoverpa) armigera; Heliothis armigera; cotton bollworm; American bollworm; corn ear worm; scarce bordered straw; tobacco budworm; Helicoverpa armigera (Hubner, 1808)	
species		species	
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; Heliothinae; Helicoverpa		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; Heliothinae; Helicoverpa	
Helicoverpa () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7112)		Helicoverpa () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7112)	
29058 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=29058)		29058 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=29058)	
No		No	

GENOTYPIC CHANGE

CYP337B3		UniProtKB Helicoverpa armigera	
-		GenebankID or UniProtKB Helicoverpa armigera	
-		A0A0H3V333 (https://www.ncbi.nlm.nih.gov/nuccore/A0A0H3V333)	
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			

reduction of molecular oxygen (<https://www.ebi.ac.uk/QuickGO/term/GO:0016705>)
GO - Biological Process

-
GO - Cellular Component

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

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

Complex Change (<https://www.gephebase.org/search-criteria?/and+Aberration Type=~Complex Change~#gephebase-summary-title>)
Molecular Details of the Mutation

The P450 chimeric gene CYP337B3 arose from unequal crossing-over between two parental P450 genes CYP337B2 and CYP337B1 . CYP337B3 can metabolize pyrethroids in vitro. Neither parental enzyme has the ability to metabolize pyrethroids in vitro. Distinct alleles resulting from different crossing-overs within the CYP337B1 and CYP337B2 parental genes with different alleles of CYP337B1 and CYP337B2 involved in the crossing-overs.

Experimental Evidence

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

Multiple recombination events between two cytochrome P450 loci contribute to global pyrethroid resistance in *Helicoverpa armigera*. (2018) (<https://pubmed.ncbi.nlm.nih.gov/30383872>)
Authors

Walsh TK; Joussem N; Tian K; McGaughran A; Anderson CJ; Qiu X; Ahn SJ; Bird L; Pavlidi N; Vontas J; Ryu J; Rasool A; Barony Macedo I; Tay WT; Zhang Y; Whitehouse MEA; Silvie PJ; Downes S; Nemec L; Heckel DG

Abstract

The cotton bollworm, *Helicoverpa armigera* (H¹/₄bner) is one of the most serious insect pest species to evolve resistance against many insecticides from different chemical classes. This species has evolved resistance to the pyrethroid insecticides across its native range and is becoming a truly global pest after establishing in South America and having been recently recorded in North America. A chimeric cytochrome P450 gene, CYP337B3, has been identified as a resistance mechanism for resistance to fenvalerate and cypermethrin. Here we show that this resistance mechanism is common around the world with at least eight different alleles. It is present in South America and has probably introgressed into its closely related native sibling species, *Helicoverpa zea*. The different alleles of CYP337B3 are likely to have arisen independently in different geographic locations from selection on existing diversity. The alleles found in Brazil are those most commonly found in Asia, suggesting a potential origin for the incursion of *H. armigera* into the Americas.

Additional References

RELATED GEPHE

Related Genes

6 (ABCA2, Aminopeptidase N (APN), cadherin, Ha_BtR, para (kdr), tetraspanin) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=~29058~/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

7 (<https://www.gephebase.org/search-criteria?/or+Gene Gephebase=~CYP337B3~/and+Taxon ID=~29058~/or+Gene Gephebase=~CYP337B3~/and+Taxon ID=~29058~#gephebase-summary-title>)

EXTERNAL LINKS

COMMENTS

@Parallelism - Resistance to pyrethroids as a result from the formation of a chimeric P450 gene CYP337B3 has arisen multiple times during evolution of the cotton bollworm *H. armigera*.