GEPHE SUMMARY

Gephebase Gene

CYP337B3 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^CYP337B3^#gephebase-summary-title)

GepheID

GP00002482

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

Trait State in Taxon A

Helicoverpa armigera - susceptible

Trait State in Taxon B

Helicoverpa armigera - resistant strain from Africa - allele CYP337B3v5

Ancestral State

Taxon A

Taxonomic Status

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

Taxon A

Latin Name

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

Common Name

cotton bollworm

Synonyms

Heliothis (Helicoverpa) armigera; Heliothis armigera; cotton bollworm; American bollworm; corn ear worm; scarce bordered straw; tobacco budworm; Helicoverpa armigera (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; Heliothinae; Helicoverpa

Parent

Helicoverpa () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7112)

NCBI Taxonomy ID

29058 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 29058)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

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

Common Name

cotton bollworm

Synonyms

Heliothis (Helicoverpa) armigera; Heliothis armigera; cotton bollworm; American bollworm; corn ear worm; scarce bordered straw; tobacco budworm; Helicoverpa armigera (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; Heliothinae; Helicoverpa

Parent

Helicoverpa () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7112)

NCBI Taxonomy ID

29058 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 29058)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

CYP337B3

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 Helicoverpa armigera

A0A0H3V333 (http://www.uniprot.org/uniprot/A0A0H3V333)

GenebankID or UniProtKB Helicoverpa armigera

A0A0H3V333 (https://www.ncbi.nlm.nih.gov/nuccore/A0A0H3V333)

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; Joussen 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 (HÃ¼bner) 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.