

GEPHE SUMMARY

<p>tetraspanin (<a +tetraspanin+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase="+tetraspanin+"#gephebase-summary-title)</p> <p>Published</p>	<p>Gephebase Gene</p> <p>Entry Status</p>	<p>GP00002468</p> <p>Courtier</p>	<p>GepheID</p> <p>Main curator</p>
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PHENOTYPIC CHANGE

<p>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)</p> <p>Xenobiotic resistance (insecticide; Bt Cry1Ac toxin) (<a +xenobiotic+resistance+(insecticide;+bt+cry1ac+toxin)+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=">https://www.gephebase.org/search-criteria?/and+Trait="+Xenobiotic+resistance+(insecticide;+Bt+Cry1Ac+toxin)+"#gephebase-summary-title)</p> <p>Helicoverpa armigera - Bt-Cry1Ac susceptible</p> <p>Helicoverpa armigera - Bt-Cry1Ac resistant</p> <p>Taxon A</p> <p>Intraspecific (<a +intraspecific+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=">https://www.gephebase.org/search-criteria?/and+Taxonomic+Status="+Intraspecific+"#gephebase-summary-title)</p>	<p>Trait Category</p> <p>Trait</p> <p>Trait State in Taxon A</p> <p>Trait State in Taxon B</p> <p>Ancestral State</p> <p>Taxonomic Status</p>	<p>Helicoverpa armigera</p> <p>Helicoverpa armigera</p> <p>cotton bollworm</p> <p>Heliothis (Helicoverpa) armigera; Heliothis armigera; cotton bollworm; American bollworm; corn ear worm; scarce bordered straw; tobacco budworm; Helicoverpa armigera (Hubner, 1808)</p> <p>species</p> <p>cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesnoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Noctuoidea; Noctuidae; Heliothinae; Helicoverpa</p> <p>Helicoverpa () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7112)</p> <p>29058 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=29058)</p> <p>No</p>	<p>Taxon A</p> <p>Latin Name</p> <p>Common Name</p> <p>Synonyms</p> <p>Rank</p> <p>Lineage</p> <p>Parent</p> <p>NCBI Taxonomy ID</p> <p>is Taxon A an Intraspecies?</p>	<p>Helicoverpa armigera</p> <p>Helicoverpa armigera</p> <p>cotton bollworm</p> <p>Heliothis (Helicoverpa) armigera; Heliothis armigera; cotton bollworm; American bollworm; corn ear worm; scarce bordered straw; tobacco budworm; Helicoverpa armigera (Hubner, 1808)</p> <p>species</p> <p>cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesnoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Noctuoidea; Noctuidae; Heliothinae; Helicoverpa</p> <p>Helicoverpa () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7112)</p> <p>29058 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=29058)</p> <p>No</p>	<p>Taxon B</p> <p>Latin Name</p> <p>Common Name</p> <p>Synonyms</p> <p>Rank</p> <p>Lineage</p> <p>Parent</p> <p>NCBI Taxonomy ID</p> <p>is Taxon B an Intraspecies?</p>
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GENOTYPIC CHANGE

<p>Tsp2A</p> <p>CG11415; D8.7; Dm.Tsp2A; Dmel\CG11415; EG:8D8.7; tsp2A</p> <p>7227.FBpp0070204 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0070204)</p> <p>Belongs to the tetraspanin (TM4SF) family.</p> <p>-</p> <p>GO:0008347 : glial cell migration (https://www.ebi.ac.uk/QuickGO/term/GO:0008347)</p>	<p>Generic Gene Name</p> <p>Synonyms</p> <p>String</p> <p>Sequence Similarities</p> <p>GO - Molecular Function</p> <p>GO - Biological Process</p>	<p>O46101 (http://www.uniprot.org/uniprot/O46101)</p> <p>()</p> <p>UniProtKB Drosophila melanogaster</p> <p>GenebankID or UniProtKB</p>
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GO:0061028 : establishment of endothelial barrier
 (https://www.ebi.ac.uk/QuickGO/term/GO:0061028)
 GO:0090528 : smooth septate junction assembly
 (https://www.ebi.ac.uk/QuickGO/term/GO:0090528)

GO - Cellular Component

GO:0016021 : integral component of membrane
 (https://www.ebi.ac.uk/QuickGO/term/GO:0016021)
 GO:0005887 : integral component of plasma membrane
 (https://www.ebi.ac.uk/QuickGO/term/GO:0005887)
 GO:0016327 : apicolateral plasma membrane
 (https://www.ebi.ac.uk/QuickGO/term/GO:0016327)
 GO:0005920 : smooth septate junction
 (https://www.ebi.ac.uk/QuickGO/term/GO:0005920)

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

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Molecular Details of the Mutation

L31S due to a nucleotide substitution T92C. CRISPR knockout of the tetraspanin gene restored susceptibility to a resistant strain whereas inserting the mutation conferred 125-fold resistance in a susceptible strain.

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	TTG	TCG	92
Amino-acid	Leu	Ser	31

Main Reference

Dominant point mutation in a tetraspanin gene associated with field-evolved resistance of cotton bollworm to transgenic Bt cotton. (2018) (https://pubmed.ncbi.nlm.nih.gov/30381456)

Authors

Jin L; Wang J; Guan F; Zhang J; Yu S; Liu S; Xue Y; Li L; Wu S; Wang X; Yang Y; Abdelgaffar H; Jurat-Fuentes JL; Tabashnik BE; Wu Y

Abstract

Extensive planting of crops genetically engineered to produce insecticidal proteins from the bacterium *Bacillus thuringiensis* (Bt) has suppressed some major pests, reduced insecticide sprays, enhanced pest control by natural enemies, and increased grower profits. However, rapid evolution of resistance in pests is reducing these benefits. Better understanding of the genetic basis of resistance to Bt crops is urgently needed to monitor, delay, and counter pest resistance. We discovered that a point mutation in a previously unknown tetraspanin gene in the cotton bollworm (*Helicoverpa armigera*), a devastating global pest, confers dominant resistance to Cry1Ac, the sole Bt protein produced by transgenic cotton planted in China. We found the mutation using a genome-wide association study, followed by fine-scale genetic mapping and DNA sequence comparisons between resistant and susceptible strains. CRISPR/Cas9 knockout of the tetraspanin gene restored susceptibility to a resistant strain, whereas inserting the mutation conferred 125-fold resistance in a susceptible strain. DNA screening of moths captured from 23 field sites in six provinces of northern China revealed a 100-fold increase in the frequency of this mutation, from 0.001 in 2006 to 0.10 in 2016. The correspondence between the observed trajectory of the mutation and the trajectory predicted from simulation modeling shows that the dominance of the mutation accelerated adaptation. Proactive identification and tracking of the tetraspanin mutation demonstrate the potential for genomic analysis, gene editing, and molecular monitoring to improve management of resistance.

Additional References

RELATED GEPHE

Related Genes

6 (ABCA2, Aminopeptidase N (APN), cadherin, CYP337B3, Ha_BtR, para (kdr)) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^29058^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

