

## GEPHE SUMMARY

|   |                |            |              |
|---|----------------|------------|--------------|
| ABCA2 ( <a href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=^ABCA2^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=^ABCA2^#gephebase-summary-title</a> ) | Gephebase Gene | GP00000003 | GepheID      |
| Published   | Entry Status   | Martin     | Main curator |

## PHENOTYPIC CHANGE

|   |                             |   |                             |
|---|-----------------------------|---|-----------------------------|
| Physiology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait+Category=^Physiology^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait+Category=^Physiology^#gephebase-summary-title</a> )  | Trait Category              |   |                             |
| Xenobiotic resistance (insecticide; Bt Cry2Ab toxin) ( <a href="https://www.gephebase.org/search-criteria?/and+Trait=^Xenobiotic+resistance+(insecticide;+Bt+Cry2Ab+toxin)^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait=^Xenobiotic+resistance+(insecticide;+Bt+Cry2Ab+toxin)^#gephebase-summary-title</a> )                            | Trait                       |   |                             |
| Helicoverpa armigera - Bt-Cry2Ab susceptible  | Trait State in Taxon A      |   |                             |
| Helicoverpa armigera - Bt-Cry2Ab resistant  | Trait State in Taxon B      |   |                             |
| Taxon A   | Ancestral State             |   |                             |
| Intraspecific ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=^Intraspecific^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=^Intraspecific^#gephebase-summary-title</a> )   | Taxonomic Status            |   |                             |
|   | Taxon A                     |   | Taxon B                     |
| Helicoverpa armigera<br>( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Helicoverpa+armigera^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Helicoverpa+armigera^#gephebase-summary-title</a> )   | Latin Name                  | Helicoverpa armigera<br>( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Helicoverpa+armigera^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Helicoverpa+armigera^#gephebase-summary-title</a> )   | Latin Name                  |
| cotton bollworm   | Common Name                 | cotton bollworm   | Common Name                 |
| Heliothis (Helicoverpa) armigera; Heliothis armigera; cotton bollworm; American bollworm; corn ear worm; scarce bordered straw; tobacco budworm; Helicoverpa armigera (Hubner, 1808)  | Synonyms                    | Heliothis (Helicoverpa) armigera; Heliothis armigera; cotton bollworm; American bollworm; corn ear worm; scarce bordered straw; tobacco budworm; Helicoverpa armigera (Hubner, 1808)  | Synonyms                    |
| species   | Rank                        | species   | Rank                        |
| cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Noctuoidea; Noctuidae; Heliothinae; Helicoverpa | Lineage                     | cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Noctuoidea; Noctuidae; Heliothinae; Helicoverpa | Lineage                     |
| Helicoverpa () - (Rank: genus)<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7112">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7112</a> )   | Parent                      | Helicoverpa () - (Rank: genus)<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7112">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7112</a> )   | Parent                      |
| 29058<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=29058">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=29058</a> )  | NCBI Taxonomy ID            | 29058<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=29058">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=29058</a> )  | NCBI Taxonomy ID            |
| No  | is Taxon A an Intraspecies? | No  | is Taxon B an Intraspecies? |

## GENOTYPIC CHANGE

|  |                         |  |                                |
|--|-------------------------|--|--------------------------------|
| ABCA2  | Generic Gene Name       | A0A0S0G7V0 ( <a href="http://www.uniprot.org/uniprot/A0A0S0G7V0">http://www.uniprot.org/uniprot/A0A0S0G7V0</a> ) | UniProtKB Helicoverpa armigera |
| -  | Synonyms                |  | GenebankID or UniProtKB        |
| -  | String                  |  |                                |
| -  | Sequence Similarities   |  |                                |
| -  | GO - Molecular Function |  |                                |
| GO:0005524 : ATP binding ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005524">https://www.ebi.ac.uk/QuickGO/term/GO:0005524</a> )   |                         |  |                                |
| GO:0042626 : ATPase activity, coupled to transmembrane movement of substances<br>( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0042626">https://www.ebi.ac.uk/QuickGO/term/GO:0042626</a> ) |                         |  |                                |
| -  | GO - Biological Process |  |                                |

GO:0016021 : integral component of membrane  
<https://www.ebi.ac.uk/QuickGO/term/GO:0016021>

Yes (<https://www.gephebase.org/search-criteria?/and+Presumptive+Null=~Yes^#gephebase-summary-title>)

Presumptive Null

Coding (<https://www.gephebase.org/search-criteria?/and+Molecular+Type=~Coding^#gephebase-summary-title>)

Molecular Type

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

Aberration Type

1-9 bp

Deletion Size

5bp deletion inducing a frameshift

Molecular Details of the Mutation

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

Experimental Evidence

Insect Resistance to *Bacillus thuringiensis* Toxin Cry2Ab Is Conferred by Mutations in an ABC Transporter Subfamily A Protein. (2015) (<https://pubmed.ncbi.nlm.nih.gov/26583651>)

Main Reference

Tay WT; Mahon RJ; Heckel DG; Walsh TK; Downes S; James WJ; Lee SF; Reineke A; Williams AK; Gordon KH

Authors

The use of conventional chemical insecticides and bacterial toxins to control lepidopteran pests of global agriculture has imposed significant selection pressure leading to the rapid evolution of insecticide resistance. Transgenic crops (e.g., cotton) expressing the Bt Cry toxins are now used world wide to control these pests, including the highly polyphagous and invasive cotton bollworm *Helicoverpa armigera*. Since 2004, the Cry2Ab toxin has become widely used for controlling *H. armigera*, often used in combination with Cry1Ac to delay resistance evolution. Isolation of *H. armigera* and *H. punctigera* individuals heterozygous for Cry2Ab resistance in 2002 and 2004, respectively, allowed aspects of Cry2Ab resistance (level, fitness costs, genetic dominance, complementation tests) to be characterised in both species. However, the gene identity and genetic changes conferring this resistance were unknown, as was the detailed Cry2Ab mode of action. No cross-resistance to Cry1Ac was observed in mutant lines. Biphasic linkage analysis of a Cry2Ab-resistant *H. armigera* family followed by exon-primed intron-crossing (EPIC) marker mapping and candidate gene sequencing identified three independent resistance-associated INDEL mutations in an ATP-Binding Cassette (ABC) transporter gene we named HaABCA2. A deletion mutation was also identified in the *H. punctigera* homolog from the resistant line. All mutations truncate the ABCA2 protein. Isolation of further Cry2Ab resistance alleles in the same gene from field *H. armigera* populations indicates unequal resistance allele frequencies and the potential for Bt resistance evolution. Identification of the gene involved in resistance as an ABC transporter of the A subfamily adds to the body of evidence on the crucial role this gene family plays in the mode of action of the Bt Cry toxins. The structural differences between the ABCA2, and that of the C subfamily required for Cry1Ac toxicity, indicate differences in the detailed mode-of-action of the two Bt Cry toxins.

Abstract

Additional References

## RELATED GEPHE

6 (Aminopeptidase N (APN), cadherin, CYP337B3, 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 Genes

2 (<https://www.gephebase.org/search-criteria?/or+Gene+Gephebase=~ABCA2^/and+Taxon+ID=~29058^/or+Gene+Gephebase=~ABCA2^/and+Taxon+ID=~29058^#gephebase-summary-title>)

Related Haplotypes

## EXTERNAL LINKS

## COMMENTS

Parallelism - intraspecific and interspecific