GEPHE SUMMARY

Gephebase Gene

ABCC2 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^ABCC2^#gephebase-summary-title)

GepheID

GP00002461

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

Trait State in Taxon A

Spodoptera frugiperda - susceptible

Trait State in Taxon B

Spodoptera frugiperda - individuals from from Puerto Rico resistant to transgenic maize expressing the Cry1Fa toxin

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

Common Name

fall armyworm

Synonyms

fall armyworm; Spodoptera frugiperda (Smith, 1797)

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Endopterygota; 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

7108 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7108)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

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

Common Name

fall armyworm

Synonyms

fall armyworm; Spodoptera frugiperda (Smith, 1797)

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Endopterygota; 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

7108 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7108)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

MRP1

Synonyms

-

String

-

Sequence Similarities

-

GO - Molecular Function

GO:0005524 : ATP binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005524)
GO:0008514 : organic anion transmembrane transporter activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008514)
GO:0140359 : ABC-type transporter activity (https://www.ebi.ac.uk/QuickGO/term/GO:0140359)

GO - Biological Process

UniProtKB Drosophila melanogaster

H8YF43 (http://www.uniprot.org/uniprot/H8YF43)

GenebankID or UniProtKB

()

-

GO - Cellular Component

GO:0005887 : integral component of plasma membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0005887)

Presumptive Null

Yes (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Yes^#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

A nine-base deletion (position 39â€“47) and a two-base insertion (GC at position 2218) lead to a frameshift and the occurrence of a premature stop codon. The truncated protein is 746 amino acids whereas the ABCC2 of the susceptible strain encodes a protein of 1349 amino acids.

Experimental Evidence

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

Main Reference

Mechanism and DNA-based detection of field-evolved resistance to transgenic Bt corn in fall armyworm (Spodoptera frugiperda). (2017) (https://pubmed.ncbi.nlm.nih.gov/28883440)

Authors

Banerjee R; Hasler J; Meagher R; Nagoshi R; Hietala L; Huang F; Narva K; Jurat-Fuentes JL

Abstract

Evolution of resistance threatens sustainability of transgenic crops producing insecticidal proteins from the bacterium Bacillus thuringiensis (Bt). The fall armyworm (Spodoptera frugiperda) is a devastating pest of corn in the Western Hemisphere initially controlled by transgenic Bt corn producing the Cry1Fa insecticidal protein (event TC1507). However field-evolved resistance to TC1507 was observed in Puerto Rico in 2007 and has subsequently been reported in a number of locations in North and South America. Early studies on Puerto Rico fall armyworm populations found that the resistance phenotype was associated with reduced expression of alkaline phosphatase. However, in this work we show that field-evolved resistance to Cry1Fa Bt corn in Puerto Rico is closely linked to a mutation in an ATP Binding Cassette subfamily C2 (ABCC2) gene that functions as a Cry1Fa receptor in susceptible insects. Furthermore, we report a DNA-based genotyping test used to demonstrate the presence of the resistant (SfABCC2mut) allele in Puerto Rico populations in 2007, coincident with the first reports of damage to TC1507 corn. These DNA-based field screening data provide strong evidence that resistance to TC1507 in fall armyworm maps to the SfABCC2 gene and provides a useful molecular marker for detecting the SfABCC2mut allele in resistant fall armyworm.

Additional References

Mutational disruption of the ABCC2 gene in fall armyworm, Spodoptera frugiperda, confers resistance to the Cry1Fa and Cry1A.105 insecticidal proteins. (2018) (https://pubmed.ncbi.nlm.nih.gov/29740041)

RELATED GEPHE

Related Genes

2 (CYP9A, GSTe) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^7108^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

1 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^ABCC2^/and+Taxon ID=^7108^/or+Gene Gephebase=^ABCC2^/and+Taxon ID=^7108^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS