GEPHE SUMMARY

Gephebase Gene

CYP9A (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^CYP9A^#gephebase-summary-title)

GepheID

GP00002476

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

Trait State in Taxon A

Spodoptera frugiperda - sensitive

Trait State in Taxon B

Spodoptera frugiperda - resistant

Ancestral State

Data not curated

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

-

Synonyms

-

String

-

Sequence Similarities

-

GO - Molecular Function

-

GO - Biological Process

-

GO - Cellular Component

-

UniProtKB

()

GenebankID or UniProtKB

()

Presumptive Null

No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)

Molecular Type

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

Aberration Type

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

Insertion Size

unknown

Molecular Details of the Mutation

In sensitive alleles the gene cluster is composed of 12 CYP9A genes and two alcohol dehydrogenase genes. All 30 resistant alleles have two copies of this unit while 28 and 6 alleles of the sensitive individuals had one and two copies; respectively.

Experimental Evidence

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

Main Reference

Adaptation by copy number variation increases insecticide resistance in the fall armyworm. (2020) (https://pubmed.ncbi.nlm.nih.gov/33184418)

Authors

Gimenez S; Abdelgaffar H; Goff GL; Hilliou F; Blanco CA; HÃ¤nniger S; Bretaudeau A; Legeai F; NÃ¨gre N; Jurat-Fuentes JL; d'AlenÃ§on E; Nam K

Abstract

Understanding the genetic basis of insecticide resistance is a key topic in agricultural ecology. The adaptive evolution of multi-copy detoxification genes has been interpreted as a cause of insecticide resistance, yet the same pattern can also be generated by the adaptation to host-plant defense toxins. In this study, we tested in the fall armyworm, Spodoptera frugiperda (Lepidoptera: Noctuidae), if adaptation by copy number variation caused insecticide resistance in two geographically distinct populations with different levels of resistance and the two host-plant strains. We observed a significant allelic differentiation of genomic copy number variations between the two geographic populations, but not between host-plant strains. A locus with positively selected copy number variation included a CYP gene cluster. Toxicological tests supported a central role for CYP enzymes in deltamethrin resistance. Our results indicate that copy number variation of detoxification genes might be responsible for insecticide resistance in fall armyworm and that evolutionary forces causing insecticide resistance could be independent of host-plant adaptation.

Additional References

RELATED GEPHE

Related Genes

2 (ABCC2, GSTe) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^7108^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS