

GEPHE SUMMARY

Gephebase Gene
Acetylcholinesterase (Ace)

Entry Status
Published

GepheID
GP00000036

Main curator
Martin

PHENOTYPIC CHANGE

Trait Category
Physiology

Trait
Xenobiotic resistance (insecticide)

Trait State in Taxon A
Aphis gossypii

Trait State in Taxon B
Aphis gossypii

Ancestral State
Data not curated

Taxonomic Status
Intraspecific

Taxon A

Latin Name
Aphis gossypii

Common Name
cotton aphid

Synonyms
cotton aphid; melon aphid; Aphis gossypii Glover, 1877; Aphis gossypii

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Paraneoptera; Hemiptera; Sternorrhyncha; Aphidomorpha; Aphidoidea; Aphididae; Aphidinae; Aphidini; Aphis; Aphis

Parent
Aphis () - (Rank: subgenus)

NCBI Taxonomy ID
80765

is Taxon A an Intraspecies?
No

Taxon B

Latin Name
Aphis gossypii

Common Name
cotton aphid

Synonyms
cotton aphid; melon aphid; Aphis gossypii Glover, 1877; Aphis gossypii

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Paraneoptera; Hemiptera; Sternorrhyncha; Aphidomorpha; Aphidoidea; Aphididae; Aphidinae; Aphidini; Aphis; Aphis

Parent
Aphis () - (Rank: subgenus)

NCBI Taxonomy ID
80765

is Taxon B an Intraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
Ace

Synonyms
AcChE; ace; ACE; ace-2; ache; AchE; AChE; CG17907; CHE; dAChE; dmAChE; DmAChE; Dmel\CG17907; Dm_ace; FBgn0000024; l(3)26; l(3)87Ed

String
7227.FBpp0289713

Sequence Similarities
Belongs to the type-B carboxylesterase/lipase family.

GO - Molecular Function
GO:0042803 : protein homodimerization activity
GO:0003990 : acetylcholinesterase activity
GO:0004104 : cholinesterase activity
GO:0043199 : sulfate binding

GO - Biological Process
GO:0006581 : acetylcholine catabolic process
GO:0001507 : acetylcholine catabolic process in synaptic cleft
GO:0007268 : chemical synaptic transmission
GO:0042426 : choline catabolic process

UniProtKB Drosophila melanogaster
P07140

GenebankID or UniProtKB
ALE67001

GO:0042331 : phototaxis

GO - Cellular Component

GO:0005886 : plasma membrane

GO:0005737 : cytoplasm

GO:0031225 : anchored component of membrane

GO:0030054 : cell junction

GO:0043083 : synaptic cleft

Mutation #1

Presumptive Null

No

Molecular Type

Gene Amplification

Aberration Type

Insertion

Insertion Size

1-10 kb

Molecular Details of the Mutation

Duplications; A302S and S431F

Experimental Evidence

Candidate Gene

Main Reference

Extensive Ace2 duplication and multiple mutations on Ace1 and Ace2 are related with high level of organophosphates resistance in *Aphis gossypii*. (2014)

Authors

Shang Q; Pan Y; Fang K; Xi J; Wong A; Brennan JA; Cao C

Abstract

Aphis gossypii (Glover) has been found to possess multiple mutations in the acetylcholinesterase (AChE) gene (Ace) that might involve target site insensitivity. In vitro functional expression of AChEs reveals that the resistant Ace1 (Ace1R) and Ace2 (Ace2R) were significantly less inhibited by eserine, omethoate, and malaoxon than the susceptible Ace1 (Ace1S) and Ace2 (Ace2S). Furthermore, in both the mutant and susceptible AChEs, Ace2 was significantly less sensitive to eserine, omethoate, and malaoxon than Ace1. These results suggested that both the mutant Ace1 and Ace2 were responsible for omethoate resistance, while the mutant Ace2 played a major role in insecticide resistance. The DNA copy number and transcription level of Ace2 were 1.52- and 1.88-fold higher in the ORR strain than in the OSS strain. Furthermore, the DNA copy number and transcription level of Ace2 were significantly higher than that of Ace1 in either OSS or ORR strains, demonstrating the involvement of Ace2 gene duplication in resistance. Thus, the authors conclude that omethoate resistance in cotton aphids appears to have evolved through a combination of multiple mutations and extensive Ace2R gene duplication.

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Additional References

Mutation #2

Presumptive Null

No

Molecular Type

Coding

Aberration Type

SNP

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

Duplications; A302S and S431F

Experimental Evidence

Candidate Gene

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Ala	Ser	302

Main Reference

Extensive Ace2 duplication and multiple mutations on Ace1 and Ace2 are related with high level of organophosphates resistance in *Aphis gossypii*. (2014)

Authors

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Additional References

Mutation #3

Presumptive Null

No

Molecular Type

Coding

Aberration Type

SNP

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

Duplications: A302S and S431F

Experimental Evidence

Candidate Gene

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Ser	Phe	431

Main Reference

Extensive Ace2 duplication and multiple mutations on Ace1 and Ace2 are related with high level of organophosphates resistance in *Aphis gossypii*. (2014)

Authors

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Abstract

Aphis gossypii (Glover) has been found to possess multiple mutations in the acetylcholinesterase (AChE) gene (Ace) that might involve target site insensitivity. In vitro functional expression of AChEs reveals that the resistant Ace1 (Ace1R) and Ace2 (Ace2R) were significantly less inhibited by eserine, omethoate, and malaoxon than the susceptible Ace1 (Ace1S) and Ace2 (Ace2S). Furthermore, in both the mutant and susceptible AChEs, Ace2 was significantly less sensitive to eserine, omethoate, and malaoxon than Ace1. These results suggested that both the mutant Ace1 and Ace2 were responsible for omethoate resistance, while the mutant Ace2 played a major role in insecticide resistance. The DNA copy number and transcription level of Ace2 were 1.52- and 1.88-fold higher in the ORR strain than in the OSS strain. Furthermore, the DNA copy number and transcription level of Ace2 were significantly higher than that of Ace1 in either OSS or ORR strains, demonstrating the involvement of Ace2 gene duplication in resistance. Thus, the authors conclude that omethoate resistance in cotton aphids appears to have evolved through a combination of multiple mutations and extensive Ace2R gene duplication.

Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

@SeveralMutationsWithEffect

