

GEPHE SUMMARY

	Gephebase Gene	GepheID
Acetylcholinesterase (Ace-1) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase="Acetylcholinesterase (Ace-1)"#gephebase-summary-title)	GP00000036	
	Entry Status	Main curator
Published	Martin	

PHENOTYPIC CHANGE

	Trait Category		
Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category="Physiology"#gephebase-summary-title)			
	Trait		
Xenobiotic resistance (insecticide) (<a #gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=Xenobiotic+resistance+(insecticide)">https://www.gephebase.org/search-criteria?/and+Trait=Xenobiotic+resistance+(insecticide)"#gephebase-summary-title)			
	Trait State in Taxon A		
Aphis gossypii			
	Trait State in Taxon B		
Aphis gossypii			
	Ancestral State		
Data not curated			
	Taxonomic Status		
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic Status="Intraspecific"#gephebase-summary-title)			
	Taxon A		Taxon B
	Latin Name		Latin Name
Aphis gossypii (<a #gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Aphis+gossypii">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Aphis+gossypii"#gephebase-summary-title)		Aphis gossypii (<a #gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Aphis+gossypii">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Aphis+gossypii"#gephebase-summary-title)	
	Common Name		Common Name
cotton aphid		cotton aphid	
	Synonyms		Synonyms
cotton aphid; melon aphid; Aphis gossypii Glover, 1877; Aphis gossypii		cotton aphid; melon aphid; Aphis gossypii Glover, 1877; Aphis gossypii	
	Rank		Rank
species		species	
	Lineage		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		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		Parent
Aphis () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=464929)		Aphis () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=464929)	
	NCBI Taxonomy ID		NCBI Taxonomy ID
80765 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=80765)		80765 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=80765)	
	is Taxon A an Intraspecies?		is Taxon B an Intraspecies?
No		No	

GENOTYPIC CHANGE

	Generic Gene Name	UniProtKB Drosophila melanogaster
Ace		P07140 (http://www.uniprot.org/uniprot/P07140)
	Synonyms	GenebankID or UniProtKB
AcChE; ace; ACE; ace-2; ache; AchE; AChE; CG17907; CHE; dAChE; dmAChE; DmAChE; Dmel\CG17907; Dm_ace; FBgn0000024; l(3)26; l(3)87Ed		ALE67001 (https://www.ncbi.nlm.nih.gov/nuccore/ALE67001)
	String	
7227.FBpp0289713 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0289713)		
	Sequence Similarities	
Belongs to the type-B carboxylesterase/lipase family.		
	GO - Molecular Function	
GO:0042803 : protein homodimerization activity (https://www.ebi.ac.uk/QuickGO/term/GO:0042803)		
GO:0003990 : acetylcholinesterase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0003990)		
GO:0004104 : cholinesterase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004104)		
GO:0043199 : sulfate binding (https://www.ebi.ac.uk/QuickGO/term/GO:0043199)		

GO:0006581 : acetylcholine catabolic process
(<https://www.ebi.ac.uk/QuickGO/term/GO:0006581>)
GO:0001507 : acetylcholine catabolic process in synaptic cleft
(<https://www.ebi.ac.uk/QuickGO/term/GO:0001507>)
GO:0007268 : chemical synaptic transmission
(<https://www.ebi.ac.uk/QuickGO/term/GO:0007268>)
GO:0042426 : choline catabolic process
(<https://www.ebi.ac.uk/QuickGO/term/GO:0042426>)
GO:0042331 : phototaxis (<https://www.ebi.ac.uk/QuickGO/term/GO:0042331>)
GO - Cellular Component
GO:0005886 : plasma membrane (<https://www.ebi.ac.uk/QuickGO/term/GO:0005886>)
GO:0005737 : cytoplasm (<https://www.ebi.ac.uk/QuickGO/term/GO:0005737>)
GO:0031225 : anchored component of membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0031225>)
GO:0030054 : cell junction (<https://www.ebi.ac.uk/QuickGO/term/GO:0030054>)
GO:0043083 : synaptic cleft (<https://www.ebi.ac.uk/QuickGO/term/GO:0043083>)

Mutation #1

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

1-10 kb

Molecular Details of the Mutation

Duplications; A302S and S431F = S331F

Experimental Evidence

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

Main Reference

Extensive Ace2 duplication and multiple mutations on Ace1 and Ace2 are related with high level of organophosphates resistance in Aphis gossypii. (2014) (<https://pubmed.ncbi.nlm.nih.gov/22489048>)

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

Identification of mutations conferring insecticide-insensitive AChE in the cotton-melon aphid, Aphis gossypii Glover. (2004) (<https://pubmed.ncbi.nlm.nih.gov/15373812>)
Biochemical evidence that an S431F mutation in acetylcholinesterase-1 of Aphis gossypii mediates resistance to pirimicarb and omethoate. (2004) (<https://pubmed.ncbi.nlm.nih.gov/15532677>)
Two amino acid substitutions in acetylcholinesterase associated with pirimicarb and organophosphorous insecticide resistance in the cotton aphid, Aphis gossypii Glover (Homoptera: Aphididae). (2004) (<https://pubmed.ncbi.nlm.nih.gov/15373811>)

Mutation #2

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

Nonsynonymous

Molecular Details of the Mutation

Duplications; A302S and S431F

Experimental Evidence

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

	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)

(<https://pubmed.ncbi.nlm.nih.gov/22489048>)

Authors

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Identification of mutations conferring insecticide-insensitive AChE in the cotton-melon aphid, Aphis gossypii Glover. (2004) (<https://pubmed.ncbi.nlm.nih.gov/15373812>)
Insecticide resistance traits differ among and within host races in Aphis gossypii. (2010) (<https://pubmed.ncbi.nlm.nih.gov/19908228>)

Mutation #3

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

Nonsynonymous

Molecular Details of the Mutation

Duplications; A302S and S431F

Experimental Evidence

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

	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) (<https://pubmed.ncbi.nlm.nih.gov/22489048>)

Authors

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

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Additional References

Identification of mutations conferring insecticide-insensitive AChE in the cotton-melon aphid, Aphis gossypii Glover. (2004) (<https://pubmed.ncbi.nlm.nih.gov/15373812>)
Insecticide resistance traits differ among and within host races in Aphis gossypii. (2010) (<https://pubmed.ncbi.nlm.nih.gov/19908228>)

RELATED GEPHE

Related Genes

3 (Acetylcholinesterase (Ace-2), nAChR, para (kdr)) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=^80765^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

1 ([https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^Acetylcholinesterase \(Ace-1\)^/and+Taxon ID=^80765^/or+Gene Gephebase=^Acetylcholinesterase \(Ace-1\)^/and+Taxon ID=^80765^#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^Acetylcholinesterase (Ace-1)^/and+Taxon ID=^80765^/or+Gene Gephebase=^Acetylcholinesterase (Ace-1)^/and+Taxon ID=^80765^#gephebase-summary-title))

EXTERNAL LINKS

COMMENTS

@SeveralMutationsWithEffect