

GEPHE SUMMARY

	Gephebase Gene		GepheID
Acetylcholinesterase (Ace-1) (https://www.gephebase.org/search-criteria?/and+Gene)		GP00002454	
Gephebase="Acetylcholinesterase (Ace-1)"#gephebase-summary-title)			Main curator
	Entry Status	Courtier	
Published			

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	
Plutella xylostella - sensitive		
	Trait State in Taxon B	
Plutella xylostella - resistant		
	Ancestral State	
Taxon A		
	Taxonomic Status	
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic)		
Status="Intraspecific"#gephebase-summary-title)		

Taxon A	Latin Name	Taxon B	Latin Name
Plutella xylostella (<a #gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Plutella+xylostella">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Plutella+xylostella"#gephebase-summary-title)		Plutella xylostella (<a #gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Plutella+xylostella">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Plutella+xylostella"#gephebase-summary-title)	
	Common Name		Common Name
diamondback moth		diamondback moth	
	Synonyms		Synonyms
diamondback moth; cabbage moth; Plutella xylostella (Linnaeus, 1758); Putella xylostella		diamondback moth; cabbage moth; Plutella xylostella (Linnaeus, 1758); Putella xylostella	
	Rank		Rank
species		species	
	Lineage		Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesnoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Dityrsia; Yponomeutoidea; Plutellidae; Plutella		cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesnoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Dityrsia; Yponomeutoidea; Plutellidae; Plutella	
	Parent		Parent
Plutella () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51654)		Plutella () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51654)	
	NCBI Taxonomy ID		NCBI Taxonomy ID
51655 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51655)		51655 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51655)	
	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; dAcChE; dmAcChE; DmAcChE; Dmel\CG17907; Dm_ace; FBgn0000024; l(3)26; l(3)87Ed		()
	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

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

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

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

Nonsynonymous SNP Coding Change

A298S and G324A Molecular Details of the Mutation

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Ala	Ser	298

Main Reference

Mutations of acetylcholinesterase1 contribute to prothiofos-resistance in *Plutella xylostella* (L.). (2007) (<https://pubmed.ncbi.nlm.nih.gov/17196934>)

Authors

Lee DW; Choi JY; Kim WT; Je YH; Song JT; Chung BK; Boo KS; Koh YH

Abstract

Insensitive acetylcholinesterase (AChE) is involved in the resistance of organophosphorous and carbamate insecticides. We cloned a novel full-length AChE cDNA encoding ace1 gene from adult heads of the diamondback moth (DBM, *Plutella xylostella*). The ace1 gene encoding 679 amino acids has conserved motifs including catalytic triad, choline-binding site and acyl pocket. Northern blot analysis revealed that the ace1 gene was expressed much higher than the ace2 in all examined body parts. The biochemical properties of expressed AChEs showed substrate specificity for acetylthiocholine iodide and inhibitor specificity for BW284C51 and eserine. Three mutations of AChE1 (D229G, A298S, and G324A) were identified in the prothiofos-resistant strain, two of which (A298S and G324A) were expected to be involved in the prothiofos-resistance through three-dimensional modeling. In vitro functional expression of AChEs in Sf9 cells revealed that only resistant AChE1 is less inhibited with paraoxon, suggesting that resistant AChE1 is responsible for prothiofos-resistance.

Additional References

Amino acid substitutions and intron polymorphism of acetylcholinesterase1 associated with mevinphos resistance in diamondback moth, *Plutella xylostella* (L.). (2014) (<https://pubmed.ncbi.nlm.nih.gov/24974111>)

Genotype to phenotype, the molecular and physiological dimensions of resistance in arthropods. (2015) (<https://pubmed.ncbi.nlm.nih.gov/26047113>)

Temperature-sensitive fitness cost of insecticide resistance in Chinese populations of the diamondback moth *Plutella xylostella*. (2015) (<https://pubmed.ncbi.nlm.nih.gov/25732547>)

Mutation #2

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

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

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

Nonsynonymous SNP Coding Change

A298S and G324A Molecular Details of the Mutation

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Gly	Ala	324

Main Reference

Mutations of acetylcholinesterase1 contribute to prothiofos-resistance in *Plutella xylostella* (L.). (2007) (<https://pubmed.ncbi.nlm.nih.gov/17196934>)

Authors

Lee DW; Choi JY; Kim WT; Je YH; Song JT; Chung BK; Boo KS; Koh YH

Abstract

Insensitive acetylcholinesterase (AChE) is involved in the resistance of organophosphorous and carbamate insecticides. We cloned a novel full-length AChE cDNA encoding ace1 gene from adult heads of the diamondback moth (DBM, *Plutella xylostella*). The ace1 gene encoding 679 amino acids has conserved motifs including catalytic triad, choline-binding site and acyl pocket. Northern blot analysis revealed that the ace1 gene was expressed much higher than the ace2 in all examined body parts. The biochemical properties of expressed AChEs showed substrate specificity for acetylthiocholine iodide and inhibitor specificity for BW284C51 and eserine. Three mutations of AChE1 (D229G, A298S, and G324A) were identified in the prothiofos-resistant strain, two of which (A298S and G324A) were expected to be involved in the prothiofos-resistance through three-dimensional modeling. In vitro functional expression of AChEs in Sf9 cells revealed that only resistant AChE1 is less inhibited with paraoxon, suggesting that resistant AChE1 is responsible for prothiofos-resistance.

Additional References

Amino acid substitutions and intron polymorphism of acetylcholinesterase1 associated with mevinphos resistance in diamondback moth, *Plutella xylostella* (L.). (2014) (<https://pubmed.ncbi.nlm.nih.gov/24974111>)

Genotype to phenotype, the molecular and physiological dimensions of resistance in arthropods. (2015) (<https://pubmed.ncbi.nlm.nih.gov/26047113>)

Temperature-sensitive fitness cost of insecticide resistance in Chinese populations of the diamondback moth *Plutella xylostella*. (2015) (<https://pubmed.ncbi.nlm.nih.gov/25732547>)

RELATED GEPHE

Related Genes

10 (ABCC2, Chitin synthase 1 (CHS1), CYP6BG1, FMO2, glutamate-gated chloride channel (GluCl), MAP4K4, nAChR, para (kdr), resistance to dieldrin, RYR) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=~51655~/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=~51655~/or+Gene Gephebase=Acetylcholinesterase \(Ace-1\)/and+Taxon ID=~51655~/#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene Gephebase=Acetylcholinesterase (Ace-1)/and+Taxon ID=~51655~/or+Gene Gephebase=Acetylcholinesterase (Ace-1)/and+Taxon ID=~51655~/#gephebase-summary-title))

EXTERNAL LINKS

COMMENTS

See also <https://www.sciencedirect.com/science/article/abs/pii/S1226861512000295>