## GEPHE SUMMARY

Gephebase Gene
Acetylcholinesterase (Ace-1) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Acetylcholinesterase (Ace-1)^#gephebase-summary-title)

GepheID
GP00002454

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

Common Name
diamondback moth

Synonyms
diamondback moth; cabbage moth; Plutella xylostella (Linnaeus, 1758); Putella xylostella

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Yponomeutoidea; Plutellidae; Plutella

Parent
Plutella () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 51654 )

NCBI Taxonomy ID
51655 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 51655 )

is Taxon A an Infraspecies?
No

### Taxon B

Latin Name
Plutella xylostella (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Plutella xylostella^#gephebase-summary-title)

Common Name
diamondback moth

Synonyms
diamondback moth; cabbage moth; Plutella xylostella (Linnaeus, 1758); Putella xylostella

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Yponomeutoidea; Plutellidae; Plutella

Parent
Plutella () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 51654 )

NCBI Taxonomy ID
51655 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 51655 )

is Taxon B an Infraspecies?
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 (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)

UniProtKB Drosophila melanogaster
P07140 (http://www.uniprot.org/uniprot/P07140)

GenebankID or UniProtKB
()

GO - Biological Process

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

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

A298S and G324A

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 | 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

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

A298S and G324A

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 | 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)

## EXTERNAL LINKS

## COMMENTS

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