GEPHE SUMMARY

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

GepheID
GP00002014

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
Leptinotarsa decemlineata - sensitive

Trait State in Taxon B
Leptinotarsa decemlineata - 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
Leptinotarsa decemlineata (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Leptinotarsa decemlineata^#gephebase-summary-title)

Common Name
Colorado potato beetle

Synonyms
Leptinotarsa decimlineata; Stilodes decemlineata; Colorado potato beetle; Leptinotarsa decemlineata (Say, 1824)

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Coleoptera; Polyphaga; Cucujiformia; Chrysomeloidea; Chrysomelidae; Chrysomelinae; Doryphorini; Leptinotarsa

Parent
Leptinotarsa () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7538)

NCBI Taxonomy ID
7539 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7539)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
Colorado potato beetle

Synonyms
Leptinotarsa decimlineata; Stilodes decemlineata; Colorado potato beetle; Leptinotarsa decemlineata (Say, 1824)

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Coleoptera; Polyphaga; Cucujiformia; Chrysomeloidea; Chrysomelidae; Chrysomelinae; Doryphorini; Leptinotarsa

Parent
Leptinotarsa () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7538)

NCBI Taxonomy ID
7539 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7539)

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)

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

GenebankID or UniProtKB
()

GO:0043199 : sulfate binding (https://www.ebi.ac.uk/QuickGO/term/GO:0043199)

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)

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

Ser>Gly (238 is the corresponding position in Torpedo)

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	Gly	238

Main Reference

A Point Mutation of Acetylcholinesterase Associated with Azinphosmethyl Resistance and Reduced Fitness in Colorado Potato Beetle. (1996) (https://pubmed.ncbi.nlm.nih.gov/8980034)

Authors

Zhu KY; Lee SH; Clark JM

Abstract

A serine to glycine point mutation of acetylcholinesterase (AChE, EC 1.1.1.7) was identified in an azinphosmethyl-resistant strain of Colorado potato beetle [Leptinotarsa decemlineata (Say)]. The position of the mutation corresponds to Val 238 of the Torpedo AChE and represents the first amino acid residue to form the alpha-helix, alpha-E'1. The predicted secondary structure of the mutation-containing region of AChE suggested that the transition from the turn to the alpha-helix occurs sooner in the sequence when serine is replaced by glycine. Thus, conformational changes in the AChE due to the alpha-helix deformation were expected to impinge upon both the catalytic and the peripheral binding sites, resulting in the modification of the bindings of organophosphorus insecticides and other ligands to these sites. The mutation appeared to be associated with the fitness of the beetle. The intrinsic rate of increase of the azinphosmethyl-resistant (AZ-R) strain was relatively low when the beetles were reared on the Russet Burbank potato cultivar, but was relatively high when they were reared on the NDA 1725-1 potato cultivar. Because these two potato cultivars contain different amounts of steroidal glycoalkaloids (e.g., alpha-solanine and alpha-chaconine), the different fitness of the AZ-R strain on different potato cultivars may be partially attributed to the increased sensitivity of the azinphosmethyl-resistant form of AChE to the inhibition by alpha-solanine and reduced sensitivity to alpha-chaconine as previously reported.

Additional References

RELATED GEPHE

Related Genes

2 (Acetylcholinesterase (Ace-2), para (kdr)) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^7539^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

1 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^Acetylcholinesterase (Ace)^/and+Taxon ID=^7539^/or+Gene Gephebase=^Acetylcholinesterase (Ace)^/and+Taxon ID=^7539^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS