GEPHE SUMMARY

Gephebase Gene

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

Entry Status

Published

GepheID

GP00000038

Main curator

Martin

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

Bactrocera oleae- sensitive

Trait State in Taxon B

Bactrocera oleae - 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

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

Common Name

olive fruit fly

Synonyms

Bactrocera (Daculus) oleae; Bactrocera (Dacus) oleae; Dacus oleae; olive fruit fly; olive fly; Bactrocera oleae (Rossi, 1790)

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Diptera; Brachycera; Muscomorpha; Eremoneura; Cyclorrhapha; Schizophora; Acalyptratae; Tephritoidea; Tephritidae; Dacinae; Dacini; Bactrocera; Daculus

Parent

Daculus () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69624)

NCBI Taxonomy ID

104688 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 104688)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

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

Common Name

olive fruit fly

Synonyms

Bactrocera (Daculus) oleae; Bactrocera (Dacus) oleae; Dacus oleae; olive fruit fly; olive fly; Bactrocera oleae (Rossi, 1790)

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Diptera; Brachycera; Muscomorpha; Eremoneura; Cyclorrhapha; Schizophora; Acalyptratae; Tephritoidea; Tephritidae; Dacinae; Dacini; Bactrocera; Daculus

Parent

Daculus () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69624)

NCBI Taxonomy ID

104688 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 104688)

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)

UniProtKB Drosophila melanogaster

P07140 (http://www.uniprot.org/uniprot/P07140)

GenebankID or UniProtKB

ABF55414 (https://www.ncbi.nlm.nih.gov/nuccore/ABF55414)

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 - 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

Deletion (https://www.gephebase.org/search-criteria?/and+Aberration Type=^Deletion^#gephebase-summary-title)

Deletion Size

1-9 bp

Molecular Details of the Mutation

9bp deletion of three glutamine residues at positions 642_644

Experimental Evidence

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

Main Reference

A small deletion in the olive fly acetylcholinesterase gene associated with high levels of organophosphate resistance. (2008) (https://pubmed.ncbi.nlm.nih.gov/18625401)

Authors

Kakani EG; Ioannides IM; Margaritopoulos JT; Seraphides NA; Skouras PJ; Tsitsipis JA; Mathiopoulos KD

Abstract

Organophosphate resistance in the olive fly was previously shown to associate with two point mutations in the ace gene. The frequency of these mutations was monitored in Bactrocera oleae individuals of increasing resistance. In spite of the difference in resistance among the individuals, there was no correlation between mutation frequencies and resistance level, indicating that other factors may contribute to this variation. The search for additional mutations in the ace gene of highly resistant insects revealed a small deletion at the carboxyl terminal of the protein (termed Delta3Q). Significant correlation was shown between the mutation frequency and resistance level in natural populations. In addition, remaining activity of acetylcholinesterase enzyme (AChE) after dimethoate inhibition was higher in genotypes carrying the mutation. These results strongly suggest a role of Delta3Q in high levels of organophosphate (OP) resistance. Interestingly, the carboxyl terminal of AChE is normally cleaved and substituted by a glycosylphosphatidylinositol (GPI) anchor. We hypothesize that Delta3Q may improve GPI anchoring, thus increasing the amount of AChE that reaches the synaptic cleft. In this way, despite the presence of insecticide, enough enzyme would remain in the cleft for its normal role of acetylcholine hydrolysis, allowing the insect to survive. This provides a previously un-described mechanism of resistance.

Additional References

Altered GPI modification of insect AChE improves tolerance to organophosphate insecticides. (2011) (https://pubmed.ncbi.nlm.nih.gov/21112395)

RELATED GEPHE

Related Genes

1 (Acetylcholinesterase (Ace-2)) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^104688^/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=^104688^/or+Gene Gephebase=^Acetylcholinesterase (Ace)^/and+Taxon ID=^104688^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS