GEPHE SUMMARY

Gephebase Gene
Acetylcholinesterase (Ace)

GephelD
GP00000038

Entry Status
Published

Main curator
Martin

PHENOTYPIC CHANGE

Trait Category
Physiology

Trait
Xenobiotic resistance (insecticide)

Trait State in Taxon A
Bactrocera oleae- sensitive

Trait State in Taxon B
Bactrocera oleae - resistant

Ancestral State
Taxon A

Taxonomic Status
Intraspecific

Taxon A

Latin Name
Bactrocera oleae

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)

NCBI Taxonomy ID
104688

is Taxon A an Infraspecies?
No

Taxon B

Latin Name
Bactrocera oleae

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)

NCBI Taxonomy 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

Sequence Similarities
Belongs to the type-B carboxylesterase/lipase family.

GO - Molecular Function
GO:0042803 : protein homodimerization activity
GO:0003990 : acetylcholinesterase activity
GO:0004104 : cholinesterase activity
GO:0043199 : sulfate binding

GO - Biological Process
GO:0006581 : acetylcholine catabolic process
GO:0001507 : acetylcholine catabolic process in synaptic cleft

UniProtKB Drosophila melanogaster
P07140

GenebankID or UniProtKB
ABF55414

GO:0007268 : chemical synaptic transmission
GO:0042426 : choline catabolic process
GO:0042331 : phototaxis

GO - Cellular Component
GO:0005886 : plasma membrane
GO:0005737 : cytoplasm
GO:0031225 : anchored component of membrane
GO:0030054 : cell junction
GO:0043083 : synaptic cleft

Presumptive Null
No

Molecular Type
Coding

Aberration Type
Deletion

Deletion Size
1-9 bp

Molecular Details of the Mutation
9bp deletion of three glutamine residues at positions 642_644

Experimental Evidence
Candidate Gene

Main Reference
A small deletion in the olive fly acetylcholinesterase gene associated with high levels of organophosphate resistance. (2008)

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)

RELATED GEPHE

Related Genes
No matches found.
Related Haplotypes
1

COMMENTS