GEPHE SUMMARY

Gephebase Gene

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

GepheID

GP00002598

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)

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

A441G

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

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

Authors

Zhang LJ; Jing YP; Li XH; Li CW; Bourguet D; Wu G

Abstract

Alleles conferring a higher adaptive value in one environment may have a detrimental impact on fitness in another environment. Alleles conferring resistance to pesticides and drugs provide textbook examples of this trade-off as, in addition to conferring resistance to these molecules, they frequently decrease fitness in pesticide/drug-free environments. We show here that resistance to chlorpyrifos, an organophosphate (OP), in Chinese populations of the diamondback moth, Plutella xylostella, is conferred by two mutations of ace1 - the gene encoding the acetylcholinesterase enzyme targeted by OPs - affecting the amino acid sequence of the corresponding protein. These mutations were always linked, consistent with the segregation of a single resistance allele, ace1R, carrying both mutations, in the populations studied. We monitored the frequency of ace1R (by genotyping more than 20Â 000 adults) and the level of resistance (through bioassays on more than 50Â 000 individuals) over several generations. We found that the ace1R resistance allele was costly in the absence of insecticide and that this cost was likely recessive. This fitness costs involved a decrease in fecundity: females from resistant strains laid 20% fewer eggs, on average, than females from susceptible strains. Finally, we found that the fitness costs associated with the ace1R allele were greater at high temperatures. At least two life history traits were involved: longevity and fecundity. The relative longevity of resistant individuals was affected only at high temperatures and the relative fecundity of resistant females - which was already affected at temperatures optimal for development - decreased further at high temperatures. The implications of these findings for resistance management are discussed.

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Additional References

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

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