GEPHE SUMMARY

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

GepheID
GP00002585

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
Rhopalosiphum padi - sensitive

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

Common Name
bird cherry-oat aphid

Synonyms
bird cherry-oat aphid; Rhopalosiphum padi (Linnaeus, 1758)

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Paraneoptera; Hemiptera; Sternorrhyncha; Aphidomorpha; Aphidoidea; Aphididae; Aphidinae; Aphidini; Rhopalosiphum; Rhopalosiphum padi complex

Parent
Rhopalosiphum padi complex () - (Rank: no rank) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 202396)

NCBI Taxonomy ID
40932 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 40932)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
bird cherry-oat aphid

Synonyms
bird cherry-oat aphid; Rhopalosiphum padi (Linnaeus, 1758)

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Paraneoptera; Hemiptera; Sternorrhyncha; Aphidomorpha; Aphidoidea; Aphididae; Aphidinae; Aphidini; Rhopalosiphum; Rhopalosiphum padi complex

Parent
Rhopalosiphum padi complex () - (Rank: no rank) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 202396)

NCBI Taxonomy ID
40932 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 40932)

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

F368(290)L

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	Phe	Leu	290

Main Reference

Mutations in acetylcholinesterase genes of Rhopalosiphum padi resistant to organophosphate and carbamate insecticides. (2007) (https://pubmed.ncbi.nlm.nih.gov/17546082)

Authors

Chen MH; Han ZJ; Qiao XF; Qu MJ

Abstract

Apple grain aphid, Rhopalosiphum padi (Linnaeus), is an important wheat pest. In China, it has been reported that R. padi has developed high resistance to carbamate and organophosphate insecticides. Previous work cloned from this aphid 2 different genes encoding acetylcholinesterase (AChE), which is the target enzyme for carbamate and organophosphate insecticides, and its insensitive alteration has been proven to be an important mechanism for insecticide resistance in other insects. In this study, both resistant and susceptible strains of R, padi were developed, and their AChEs were compared to determine whether resistance resulted from this mechanism and whether these 2 genes both play a role in resistance. Bioassays showed that the resistant strain used was highly or moderately resistant to pirimicarb, omethoate, and monocrotophos (resistance ratio, 263.8, 53.8, and 17.5, respectively), and showed little resistance to deltamethrin or thiodicarb (resistance ratio, 5.2 and 3.4, respectively). Correspondingly, biochemistry analysis found that AChE from resistant aphids was very insensitive to the first 3 insecticides (I50 increased 43.0-, 15.2-, and 8.8-fold, respectively), but not to thiodicarb (I50 increased 1.1-fold). Enzyme kinetics tests showed that resistant and susceptible strains had different AChEs. Sequence analysis of the 2 AChE genes cloned from resistant and susceptible aphids revealed that 2 mutations in Ace2 and 1 in Ace1 were consistently associated with resistance. Mutation F368(290)L in Ace2 localized at the same position as a previously proven resistance mutation site in other insects. The other 2 mutations, S329(228)P in Ace1 and V435(356)A in Ace2, were also found to affect the enzyme structure. These findings indicate that resistance in this aphid is mainly the result of insensistive AChE alteration, that the 3 mutations found might contribute to resistance, and that the AChEs encoded by both genes could serve as targets of insecticides.

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

1 (Acetylcholinesterase (Ace-1)) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^40932^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

1 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^Acetylcholinesterase (Ace-2)^/and+Taxon ID=^40932^/or+Gene Gephebase=^Acetylcholinesterase (Ace-2)^/and+Taxon ID=^40932^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS