

## GEPHE SUMMARY

	Gephebase Gene	GephelD
Acetylcholinesterase (Ace-2) ( <a href="https://www.gephebase.org/search-criteria?/and+Gene">https://www.gephebase.org/search-criteria?/and+Gene</a> Gephebase=^Acetylcholinesterase (Ace-2)^#gephebase-summary-title)	GP00002586	Main curator
	Entry Status	Courtier
Published		

## PHENOTYPIC CHANGE

	Trait Category
Physiology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait">https://www.gephebase.org/search-criteria?/and+Trait</a> Category=^Physiology^#gephebase-summary-title)	Trait
Xenobiotic resistance (insecticide) ( <a href="https://www.gephebase.org/search-criteria?/and+Trait=^Xenobiotic+resistance+(insecticide)^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait=^Xenobiotic+resistance+(insecticide)^#gephebase-summary-title</a> )	Trait State in Taxon A
Rhopalosiphum padi - sensitive	Trait State in Taxon B
Rhopalosiphum padi- resistant	Ancestral State
Taxon A	Taxonomic Status
Intraspecific ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic">https://www.gephebase.org/search-criteria?/and+Taxonomic</a> Status=^Intraspecific^#gephebase-summary-title)	

Taxon A	Latin Name	Taxon B	Latin Name
Rhopalosiphum padi ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Rhopalosiphum+padi^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Rhopalosiphum+padi^#gephebase-summary-title</a> )		Rhopalosiphum padi ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Rhopalosiphum+padi^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Rhopalosiphum+padi^#gephebase-summary-title</a> )	
bird cherry-oat aphid	Common Name	bird cherry-oat aphid	Common Name
bird cherry-oat aphid; Rhopalosiphum padi (Linnaeus, 1758)	Synonyms	bird cherry-oat aphid; Rhopalosiphum padi (Linnaeus, 1758)	Synonyms
species	Rank	species	Rank
	Lineage		Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Paraneoptera; Hemiptera; Sternorrhyncha; Aphidoidea; Aphididae; Aphidinae; Aphidini; Rhopalosiphum; Rhopalosiphum padi complex		cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Paraneoptera; Hemiptera; Sternorrhyncha; Aphidoidea; Aphididae; Aphidinae; Aphidini; Rhopalosiphum; Rhopalosiphum padi complex	
Rhopalosiphum padi complex () - (Rank: no rank) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=202396">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=202396</a> )	Parent	Rhopalosiphum padi complex () - (Rank: no rank) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=202396">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=202396</a> )	Parent
40932 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=40932">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=40932</a> )	NCBI Taxonomy ID	40932 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=40932">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=40932</a> )	NCBI Taxonomy ID
No	is Taxon A an Infraspecies?	No	is Taxon B an Infraspecies?

## GENOTYPIC CHANGE

	Generic Gene Name	UniProtKB Drosophila melanogaster
Ace	Synonyms	GenebankID or UniProtKB
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	0
7227.FBpp0289713 ( <a href="http://string-db.org/newstring_cgi/show_network_section.pl?identifier=7227.FBpp0289713">http://string-db.org/newstring_cgi/show_network_section.pl?identifier=7227.FBpp0289713</a> )	Sequence Similarities	
Belongs to the type-B carboxylesterase/lipase family.	GO - Molecular Function	
GO:0042803 : protein homodimerization activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0042803">https://www.ebi.ac.uk/QuickGO/term/GO:0042803</a> )		
GO:0003990 : acetylcholinesterase activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0003990">https://www.ebi.ac.uk/QuickGO/term/GO:0003990</a> )		
GO:0004104 : cholinesterase activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0004104">https://www.ebi.ac.uk/QuickGO/term/GO:0004104</a> )		
GO:0043199 : sulfate binding ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0043199">https://www.ebi.ac.uk/QuickGO/term/GO:0043199</a> )		

## 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

V435(356)A

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	Val	Ala	356

## 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 thiocarb (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 (150 increased 43-, 15.2-, and 8.8-fold, respectively), but not to thiocarb (150 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 insensitive 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

