

## GEPHE SUMMARY

Acetylcholinesterase (Ace-2) ( <a href="https://www.gephebase.org/search-criteria?/and+Gene">https://www.gephebase.org/search-criteria?/and+Gene</a> )	Gephebase Gene	GP00002585	GepheID
Gephebase="Acetylcholinesterase (Ace-2)"#gephebase-summary-title)			Main curator
Published	Entry Status	Courtier	

## PHENOTYPIC CHANGE

Physiology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait">https://www.gephebase.org/search-criteria?/and+Trait</a> )	Trait Category		
Category="Physiology"#gephebase-summary-title)			
Xenobiotic resistance (insecticide) ( <a (insecticide)"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=" resistance="" xenobiotic="">https://www.gephebase.org/search-criteria?/and+Trait="Xenobiotic resistance (insecticide)"#gephebase-summary-title</a> )	Trait		
Rhopalosiphum padi - sensitive	Trait State in Taxon A		
Rhopalosiphum padi- resistant	Trait State in Taxon B		
Taxon A	Ancestral State		
Intraspecific ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic">https://www.gephebase.org/search-criteria?/and+Taxonomic</a> )	Taxonomic Status		
Status="Intraspecific"#gephebase-summary-title)			
	Taxon A	Taxon B	
Rhopalosiphum padi	Latin Name	Rhopalosiphum padi	Latin Name
( <a href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=" padi"#gephebase-summary-title"="" rhopalosiphum="">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="Rhopalosiphum padi"#gephebase-summary-title</a> )		( <a href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=" padi"#gephebase-summary-title"="" rhopalosiphum="">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
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	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	Lineage
Rhopalosiphum padi complex () - (Rank: no rank)	Parent	Rhopalosiphum padi complex () - (Rank: no rank)	Parent
( <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> )	NCBI Taxonomy ID	( <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> )	NCBI Taxonomy ID
40932		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> )		( <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> )	
No	is Taxon A an Intraspecies?	No	is Taxon B an Intraspecies?

## GENOTYPIC CHANGE

Ace	Generic Gene Name	P07140 ( <a href="http://www.uniprot.org/uniprot/P07140">http://www.uniprot.org/uniprot/P07140</a> )	UniProtKB Drosophila melanogaster
AcChE; ace; ACE; ace-2; ache; AchE; AChE; CG17907; CHE; dAChE; dmAChE; DmAChE; Dmel\CG17907; Dm_ace; FBgn0000024; l(3)26; l(3)87Ed	Synonyms	()	GenebankID or UniProtKB
7227.FBpp0289713	String	( <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> )	
Belongs to the type-B carboxylesterase/lipase family.	Sequence Similarities		
GO:0042803 : protein homodimerization activity	GO - Molecular Function		
( <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: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)

No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title) Presumptive Null  
 Coding (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Coding^#gephebase-summary-title) Molecular Type  
 SNP (https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title) Aberration Type  
 Nonsynonymous SNP Coding Change  
 F368(290)L Molecular Details of the Mutation  
 Candidate Gene (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title) Experimental Evidence

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Phe	Leu	290

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

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 Genes  
 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) Related Haplotypes

EXTERNAL LINKS

COMMENTS

