

GEPHE SUMMARY

	Gephebase Gene		GepheID
Acetylcholinesterase (Ace-2) (https://www.gephebase.org/search-criteria?/and+Gene)		GP00002585	
Gephebase= [^] Acetylcholinesterase (Ace-2) [^] #gephebase-summary-title			Main curator
Published	Entry Status	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)			
criteria= [^] 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		Taxon B	
	Latin Name		Latin Name
Rhopalosiphum padi		Rhopalosiphum padi	
(https://www.gephebase.org/search-criteria?/and+Taxon)		(https://www.gephebase.org/search-criteria?/and+Taxon)	
padi [^] #gephebase-summary-title	Common Name	padi [^] #gephebase-summary-title	Common Name
bird cherry-oat aphid		bird cherry-oat aphid	
	Synonyms		Synonyms
bird cherry-oat aphid; Rhopalosiphum padi (Linnaeus, 1758)		bird cherry-oat aphid; Rhopalosiphum padi (Linnaeus, 1758)	
	Rank		Rank
species		species	
	Lineage		Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia;		cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia;	
Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta;		Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta;	
Dicondylia; Pterygota; Neoptera; Paraneoptera; Hemiptera; Sternorrhyncha; Aphidomorpha;		Dicondylia; Pterygota; Neoptera; Paraneoptera; Hemiptera; Sternorrhyncha; Aphidomorpha;	
Aphidoidea; Aphididae; Aphidinae; Aphidini; Rhopalosiphum; Rhopalosiphum padi complex		Aphidoidea; Aphididae; Aphidinae; Aphidini; Rhopalosiphum; Rhopalosiphum padi complex	
	Parent		Parent
Rhopalosiphum padi complex () - (Rank: no rank)		Rhopalosiphum padi complex () - (Rank: no rank)	
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=202396)	NCBI Taxonomy ID	(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=202396)	NCBI Taxonomy ID
40932		40932	
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=40932)		(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=40932)	
	is Taxon A an Intraspecies?		is Taxon B an Intraspecies?
No		No	

GENOTYPIC CHANGE

	Generic Gene Name		UniProtKB Drosophila melanogaster
Ace		P07140 (http://www.uniprot.org/uniprot/P07140)	
	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		
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)			

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.

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

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

