

## GEPHE SUMMARY

para (kdr) ( <a href="https://www.gephebase.org/search-criteria?/and+Gene Gephebase='para (kdr)'#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Gene Gephebase='para (kdr)'#gephebase-summary-title</a> )	Gephebase Gene	GP00000839	Gepheid
	Entry Status	Martin	Main curator
Published			

## PHENOTYPIC CHANGE

	Trait Category
Physiology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait Category='Physiology'#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait Category='Physiology'#gephebase-summary-title</a> )	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
Hyalella azteca -sensitive to pyrethroids	Trait State in Taxon B
Hyalella azteca - resistant to pyrethroids - species D	Ancestral State
Taxon A	Taxonomic Status
Intraspecific ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic Status='Intraspecific'#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxonomic Status='Intraspecific'#gephebase-summary-title</a> )	

Taxon A	Latin Name	Taxon B	Latin Name
Hyalella azteca ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms='^Hyalella azteca'#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms='^Hyalella azteca'#gephebase-summary-title</a> )		Hyalella azteca ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms='^Hyalella azteca'#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms='^Hyalella azteca'#gephebase-summary-title</a> )	
-	Common Name	-	Common Name
Hyalella azteca Saussure, 1858	Synonyms	Hyalella azteca Saussure, 1858	Synonyms
species	Rank	species	Rank
	Lineage		Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Crustacea; Multicrustacea; Malacostraca; Eumalacostraca; Peracarida; Amphipoda; Senticaudata; Talitrida; Talitroidea; Hyalellidae; Hyalella		cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Crustacea; Multicrustacea; Malacostraca; Eumalacostraca; Peracarida; Amphipoda; Senticaudata; Talitrida; Talitroidea; Hyalellidae; Hyalella	
	Parent		Parent
Hyalella () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 199487">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 199487</a> )		Hyalella () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 199487">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 199487</a> )	
294128 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 294128">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 294128</a> )	NCBI Taxonomy ID	294128 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 294128">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 294128</a> )	NCBI Taxonomy ID
No	is Taxon A an Infraspecies?	No	is Taxon B an Infraspecies?

## GENOTYPIC CHANGE

	Generic Gene Name		UniProtKB Drosophila melanogaster
para	Synonyms	P35500 ( <a href="http://www.uniprot.org/uniprot/P35500">http://www.uniprot.org/uniprot/P35500</a> )	GenebankID or UniProtKB
bas; bss; CG9907; Dmel\CG9907; DmNav; DmNav1; DmNa[[v]]; DmNa[[V]]; DmNa[[v]]1; l(1)14Da; l(1)ESHS48; lincRNA.S9469; Nav1; Ocd; olfD; par; sbl; sbl-1; Shu; Shudderer	String	0	
7227.FBpp0303597 ( <a href="http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0303597">http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0303597</a> )	Sequence Similarities		
Belongs to the sodium channel (TC 1.A.1.10) family. Para subfamily.	GO - Molecular Function		
GO:0005509 : calcium ion binding ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005509">https://www.ebi.ac.uk/QuickGO/term/GO:0005509</a> )			
GO:0005244 : voltage-gated ion channel activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005244">https://www.ebi.ac.uk/QuickGO/term/GO:0005244</a> )			
GO:0005248 : voltage-gated sodium channel activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005248">https://www.ebi.ac.uk/QuickGO/term/GO:0005248</a> )			
GO:0005272 : sodium channel activity			

GO - Biological Process

GO:0045433 : male courtship behavior, veined wing generated song production  
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0045433>)  
 GO:0001666 : response to hypoxia (<https://www.ebi.ac.uk/QuickGO/term/GO:0001666>)  
 GO:0009612 : response to mechanical stimulus  
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0009612>)  
 GO:0034765 : regulation of ion transmembrane transport  
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0034765>)  
 GO:0035725 : sodium ion transmembrane transport  
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0035725>)  
 GO:0007638 : mechanosensory behavior  
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0007638>)  
 GO:0060078 : regulation of postsynaptic membrane potential  
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0060078>)

GO - Cellular Component

GO:0005887 : integral component of plasma membrane  
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0005887>)  
 GO:0001518 : voltage-gated sodium channel complex  
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0001518>)

Presumptive Null

No (<https://www.gephebase.org/search-criteria?/and+Presumptive+Null=%22No%22#gephebase-summary-title>)

Molecular Type

Coding (<https://www.gephebase.org/search-criteria?/and+Molecular+Type=%22Coding%22#gephebase-summary-title>)

Aberration Type

SNP (<https://www.gephebase.org/search-criteria?/and+Aberration+Type=%22SNP%22#gephebase-summary-title>)

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

L92S1 in species D

Experimental Evidence

Candidate Gene (<https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=%22Candidate+Gene%22#gephebase-summary-title>)

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	-	-	-

Main Reference

Multiple origins of pyrethroid insecticide resistance across the species complex of a nontarget aquatic crustacean, *Hyalella azteca*. (2013) (<https://pubmed.ncbi.nlm.nih.gov/24065824>)

Authors

Weston DP; Poynton HC; Wellborn GA; Lydy MJ; Blalock BJ; Sepulveda MS; Colbourne JK

Abstract

Use of pesticides can have substantial nonlethal impacts on nontarget species, including driving evolutionary change, often with unknown consequences for species, ecosystems, and society. *Hyalella azteca*, a species complex of North American freshwater amphipods, is widely used for toxicity testing of water and sediment and has frequently shown toxicity due to pyrethroid pesticides. We demonstrate that 10 populations, 3 from laboratory cultures and 7 from California water bodies, differed by at least 550-fold in sensitivity to pyrethroids. The populations sorted into four phylogenetic groups consistent with species-level divergence. By sequencing the primary pyrethroid target site, the voltage-gated sodium channel, we show that point mutations and their spread in natural populations were responsible for differences in pyrethroid sensitivity. At least one population had both mutant and WT alleles, suggesting ongoing evolution of resistance. Although nonresistant *H. azteca* were susceptible to the typical neurotoxic effects of pyrethroids, gene expression analysis suggests the mode of action in resistant *H. azteca* was not neurotoxicity but was oxidative stress sustained only at considerably higher pyrethroid concentrations. The finding that a nontarget aquatic species has acquired resistance to pesticides used only on terrestrial pests is troubling evidence of the impact of chronic pesticide transport from land-based applications into aquatic systems. Our findings have far-reaching implications for continued uncritical use of *H. azteca* as a principal species for monitoring and environmental policy decisions.

Additional References

Unintentional exposure to terrestrial pesticides drives widespread and predictable evolution of resistance in freshwater crustaceans. (2018) (<https://pubmed.ncbi.nlm.nih.gov/29875816>)

## RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

5 ([https://www.gephebase.org/search-criteria?/or+Gene+Gephebase=%22para+\(kdr\)%22/and+Taxon+ID=%22294128%22/or+Gene+Gephebase=%22para+\(kdr\)%22/and+Taxon+ID=%22294128%22#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene+Gephebase=%22para+(kdr)%22/and+Taxon+ID=%22294128%22/or+Gene+Gephebase=%22para+(kdr)%22/and+Taxon+ID=%22294128%22#gephebase-summary-title))

## EXTERNAL LINKS

## COMMENTS

The L925I resistance allele was identified at high frequencies across three different species of *Hyalella azteca* (B C and D).