

## GEPHE SUMMARY

para (kdr) ( <a href="https://www.gephebase.org/search-criteria?/and+Gene Gephebase='para (kdr)'">#gephebase-summary-title)</a>	Gephebase Gene	GephelD
	GP00002499	Main curator
Published	Entry Status	Courtier

## PHENOTYPIC CHANGE

Trait Category			
Physiology ( <a href="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)</a>	Trait State in Taxon A		
Hyalella azteca	Trait State in Taxon B		
Hyalella azteca - resistant individuals in species B	Ancestral State		
Taxon A	Taxonomic Status		
Intraspecific ( <a href="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)</a>	Hyalella azteca ( <a href="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
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Crustacea; Multicrustacea; Malacostraca; Eumalacostraca; Peracarida; Amphipoda; Senticaudata; Talitrida; Talitroidea; Hyalellidae; Hyalella	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	Lineage
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> )	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> )	Parent
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			
para	Synonyms		UniProtKB Drosophila melanogaster
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	P35500 ( <a href="http://www.uniprot.org/uniprot/P35500">http://www.uniprot.org/uniprot/P35500</a> )		GenebankID or UniProtKB
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> )	String	0	
Belongs to the sodium channel (TC 1.A.1.10) family. Para subfamily.	Sequence Similarities		
	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 ([#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Presumptive+Null=^No))

Molecular Type

Coding ([#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Molecular+Type=^Coding))

Aberration Type

SNP ([#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Aberration+Type=^SNP))

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

M918L in species B

Experimental Evidence

Candidate Gene ([#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=^Candidate+Gene))

	Taxon A	Taxon B	Position
Codon	ATG	-	-
Amino-acid	Met	Leu	918

## Main Reference

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

Authors

Major KM; Weston DP; Lydy MJ; Wellborn GA; Poynton HC

Abstract

Pesticide runoff from terrestrial environments into waterways is often lethal to freshwater organisms, but exposure may also drive evolution of pesticide resistance. We analyzed the degree of resistance and molecular genetic changes underlying resistance in *Hyalella azteca*, a species complex of freshwater crustaceans inadvertently exposed to pesticide pollution via runoff. We surveyed 16 waterways encompassing most major watersheds throughout California and found that land use patterns are predictive of both pyrethroid presence in aquatic sediments and pyrethroid resistance in *H. azteca*. Nonsynonymous amino acid substitutions in the voltage-gated sodium channel including the M918L, L925I, or L925V confer resistance in *H. azteca*. The most frequently identified mutation, L925I, appears to be preferred within the species complex. The L925V substitution has been associated with pyrethroid resistance in another insect, but is novel in *H. azteca*. We documented a variety of pyrethroid resistance mutations across several species groups within this complex, indicating that pyrethroid resistance has independently arisen in *H. azteca* at least six separate times. Further, the high frequency of resistance alleles indicates that pesticide-mediated selection on *H. azteca* populations in waterways equals or exceeds that of targeted terrestrial pests. Widespread resistance throughout California suggests current practices to mitigate off-site movement of pyrethroids are inadequate to protect aquatic life from negative ecological impacts and implies the likelihood of similar findings globally.

Additional References

## RELATED GEPHE

## Related Genes

No matches found.

## Related Haplotypes

5 ([#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene+Gephebase=^para+(kdr)^/and+Taxon+ID=^294128^/or+Gene+Gephebase=^para+(kdr)^/and+Taxon+ID=^294128))

## EXTERNAL LINKS

## COMMENTS

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