GEPHE SUMMARY

Gephebase Gene
para (kdr) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^para (kdr)^#gephebase-summary-title)

GepheID
GP00000840

Entry Status
Published

Main curator
Martin

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=^Xenobiotic resistance (insecticide)^#gephebase-summary-title)

Trait State in Taxon A
Hyalella azteca -sensitive to pyrethroids

Trait State in Taxon B
Hyalella azteca - resistant to pyrethroids

Ancestral State
Taxon A

Taxonomic Status
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Intraspecific^#gephebase-summary-title)

Taxon A

Latin Name
Hyalella azteca (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Hyalella azteca^#gephebase-summary-title)

Common Name
-

Synonyms
Hyalella azteca Saussure, 1858

Rank
species

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

Parent
Hyalella () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 199487)

NCBI Taxonomy ID
294128 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 294128)

is Taxon A an Infraspecies?
No

Taxon B

Latin Name
Hyalella azteca (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Hyalella azteca^#gephebase-summary-title)

Common Name
-

Synonyms
Hyalella azteca Saussure, 1858

Rank
species

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

Parent
Hyalella () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 199487)

NCBI Taxonomy ID
294128 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 294128)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
para

Synonyms
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
7227.FBpp0303597 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0303597)

Sequence Similarities
Belongs to the sodium channel (TC 1.A.1.10) family. Para subfamily.

GO - Molecular Function
GO:0005509 : calcium ion binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005509)
GO:0005244 : voltage-gated ion channel activity (https://www.ebi.ac.uk/QuickGO/term/GO:0005244)
GO:0005248 : voltage-gated sodium channel activity (https://www.ebi.ac.uk/QuickGO/term/GO:0005248)
GO:0005272 : sodium channel activity

UniProtKB Drosophila melanogaster
P35500 (http://www.uniprot.org/uniprot/P35500)

GenebankID or UniProtKB
()

(https://www.ebi.ac.uk/QuickGO/term/GO:0005272)

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=^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

M918L - ATG>CTG

Experimental Evidence

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

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

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=^para (kdr)^/and+Taxon ID=^294128^/or+Gene Gephebase=^para (kdr)^/and+Taxon ID=^294128^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS

@Parallelism - The same amico acid change has also been found in the same species, due to another nucleotide change