

GEPHE SUMMARY

	Gephebase Gene		GepheID
Chitin synthase 1 (CHS1) (https://www.gephebase.org/search-criteria?/and+Gene)		GP00001602	
Gephebase="Chitin synthase 1 (CHS1)"#gephebase-summary-title)			Main curator
	Entry Status	Prigent	
Published			

PHENOTYPIC CHANGE

	Trait Category		
Physiology (https://www.gephebase.org/search-criteria?/and+Trait)			
Category="Physiology"#gephebase-summary-title)	Trait		
Xenobiotic resistance (insecticide; etoxazole acaricide) (<a (insecticide;="" acaricide)"#gephebase-summary-title"="" etoxazole="" href="https://www.gephebase.org/search-criteria?/and+Trait=" resistance="" xenobiotic="">https://www.gephebase.org/search-criteria?/and+Trait="Xenobiotic resistance (insecticide; etoxazole acaricide)"#gephebase-summary-title)			
	Trait State in Taxon A		
spider mite Tetranychus urticae susceptible			
	Trait State in Taxon B		
spider mite Tetranychus urticae strain HexR and strain005 hexythiazox clofentezine and etoxazole-resistant			
	Ancestral State		
Unknown			
	Taxonomic Status		
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic)			
Status="Intraspecific"#gephebase-summary-title)			
	Taxon A	Taxon B	
	Latin Name		Latin Name
Tetranychus urticae		Tetranychus urticae	
(https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="Tetranychus urticae"#gephebase-summary-title)		(https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="Tetranychus urticae"#gephebase-summary-title)	
	Common Name		Common Name
two-spotted spider mite		two-spotted spider mite	
	Synonyms		Synonyms
two-spotted spider mite; red spider mite; twospotted mite; Tetranychus urticae Koch, 1836		two-spotted spider mite; red spider mite; twospotted mite; Tetranychus urticae Koch, 1836	
	Rank		Rank
species		species	
	Lineage		Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Chelicerata; Arachnida; Acari; Acariformes; Trombidiformes; Prostigmata; Eleutherengona; Raphignathae; Tetranychoidae; Tetranychidae; Tetranychus		cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Chelicerata; Arachnida; Acari; Acariformes; Trombidiformes; Prostigmata; Eleutherengona; Raphignathae; Tetranychoidae; Tetranychidae; Tetranychus	
	Parent		Parent
Tetranychus () - (Rank: genus)		Tetranychus () - (Rank: genus)	
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32263)		(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32263)	
	NCBI Taxonomy ID		NCBI Taxonomy ID
32264		32264	
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32264)		(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32264)	
	is Taxon A an Intraspecies?		is Taxon B an Intraspecies?
Yes		Yes	
	Taxon A Description		Taxon B Description
spider mite Tetranychus urticae susceptible		spider mite Tetranychus urticae strain HexR and strain005 hexythiazox clofentezine and etoxazole-resistant	

GENOTYPIC CHANGE

	Generic Gene Name		UniProtKB Tetranychus urticae
chs1		H9U0G2 (http://www.uniprot.org/uniprot/H9U0G2)	
	Synonyms		GenebankID or UniProtKB
chs1; 107359084		()	
-	String		
-			
	Sequence Similarities		
-			
	GO - Molecular Function		
GO:0004100 : chitin synthase activity			
(https://www.ebi.ac.uk/QuickGO/term/GO:0004100)			
	GO - Biological Process		
-			

GO:0016021 : integral component of membrane
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0016021>)

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

A>T p.I1017F (I1056 in *D. melanogaster*) located in the C-terminal transmembrane domain

Experimental Evidence

Linkage Mapping (<https://www.gephebase.org/search-criteria?/and+Experimental Evidence=~Linkage Mapping^#gephebase-summary-title>)

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

Main Reference

High resolution genetic mapping uncovers chitin synthase-1 as the target-site of the structurally diverse mite growth inhibitors clofentazine, hexythiazox and etoxazole in *Tetranychus urticae*. (2014) (<https://pubmed.ncbi.nlm.nih.gov/24859419>)

Authors

Demaeght P; Osborne EJ; Odman-Naresh J; Gribi M; Nauen R; Merzendorfer H; Clark RM; Van Leeuwen T

Abstract

The acaricides clofentazine, hexythiazox and etoxazole are commonly referred to as 'mite growth inhibitors', and clofentazine and hexythiazox have been used successfully for the integrated control of plant mite pests for decades. Although they are still important today, their mode of action has remained elusive. Recently, a mutation in chitin synthase 1 (CHS1) was linked to etoxazole resistance. In this study, we identified and investigated a *Tetranychus urticae* strain (HexR) harboring recessive, monogenic resistance to each of hexythiazox, clofentazine, and etoxazole. To elucidate if there is a common genetic basis for the observed cross-resistance, we adapted a previously developed bulk segregant analysis method to map with high resolution a single, shared resistance locus for all three compounds. This finding indicates that the underlying molecular basis for resistance to all three compounds is identical. This locus is centered on the CHS1 gene, and as supported by additional genetic and biochemical studies, a non-synonymous variant (I1017F) in CHS1 associates with resistance to each of the tested acaricides in HexR. Our findings thus demonstrate a shared molecular mode of action for the chemically diverse mite growth inhibitors clofentazine, hexythiazox and etoxazole as inhibitors of an essential, non-catalytic activity of CHS1. Given the previously documented cross-resistance between clofentazine, hexythiazox and the benzylophenylurea (BPU) compounds flufenoxuron and cycloxuron, CHS1 should be also considered as a potential target-site of insecticidal BPUs.

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Additional References

Population bulk segregant mapping uncovers resistance mutations and the mode of action of a chitin synthesis inhibitor in arthropods. (2012) (<https://pubmed.ncbi.nlm.nih.gov/22393009>)

RELATED GEPHE

Related Genes

8 (Acetylcholinesterase (Ace-1), CPR, CYP392A16, CYP392E8, cytochrome b, glutamate-gated chloride channel (GluCl), para (kdr), PSST) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=~32264^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

Observed pattern is indicative of recurrent mutation and selection in EtoxR and Strain005. Transgenic flies with the same mutation is highly resistant to etoxazole and all tested benzoylureas as well as buprofezin