

GEPHE SUMMARY

CYP392E8 (https://www.gephebase.org/search-criteria?/and+GeneGephebase=CYP392E8#gephebase-summary-title)	Gephebase Gene	GP00002397	GepheID
Published	Entry Status	Courtier	Main curator

PHENOTYPIC CHANGE

Physiology (https://www.gephebase.org/search-criteria?/and+TraitCategory=Physiology#gephebase-summary-title)	Trait Category		
Xenobiotic resistance (https://www.gephebase.org/search-criteria?/and+Trait=Xenobioticresistance#gephebase-summary-title)	Trait		
sensitive	Trait State in Taxon A		
resistant	Trait State in Taxon B		
Taxon A	Ancestral State		
Intraspecific (https://www.gephebase.org/search-criteria?/and+TaxonomicStatus=Intraspecific#gephebase-summary-title)	Taxonomic Status		

Taxon A	Latin Name	Taxon B	Latin Name
Tetranychus urticae (https://www.gephebase.org/search-criteria?/and+TaxonandSynonyms=Tetranychusurticae#gephebase-summary-title)	Tetranychus urticae	Tetranychus urticae (https://www.gephebase.org/search-criteria?/and+TaxonandSynonyms=Tetranychusurticae#gephebase-summary-title)	Tetranychus urticae
two-spotted spider mite	Common Name	two-spotted spider mite	Common Name
two-spotted spider mite; red spider mite; twospotted mite; Tetranychus urticae Koch, 1836	Synonyms	two-spotted spider mite; red spider mite; twospotted mite; Tetranychus urticae Koch, 1836	Synonyms
species	Rank	species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Chelicerata; Arachnida; Acari; Acariformes; Trombidiformes; Prostigmata; Eleutherengona; Raphignathae; Tetranychoidae; Tetranychidae; Tetranychus	Lineage	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Chelicerata; Arachnida; Acari; Acariformes; Trombidiformes; Prostigmata; Eleutherengona; Raphignathae; Tetranychoidae; Tetranychidae; Tetranychus	Lineage
Tetranychus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32263)	Parent	Tetranychus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32263)	Parent
32264 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32264)	NCBI Taxonomy ID	32264 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32264)	NCBI Taxonomy ID
No	is Taxon A an Intraspecies?	No	is Taxon B an Intraspecies?

GENOTYPIC CHANGE

-	Generic Gene Name	0	UniProtKB
-	Synonyms	0	GenebankID or UniProtKB
-	String		
-	Sequence Similarities		
-	GO - Molecular Function		
-	GO - Biological Process		
-	GO - Cellular Component		
No	(https://www.gephebase.org/search-criteria?/and+PresumptiveNull=No#gephebase-summary-title)		Presumptive Null
Cis-regulatory (https://www.gephebase.org/search-criteria?/and+MolecularType=Cis-regulatory#gephebase-summary-title)			Molecular Type

Unknown (<https://www.gephebase.org/search-criteria?/and+Aberration+Type=~Unknown^#gephebase-summary-title>)

Molecular Details of the Mutation

increase in transcription of CYP392E8.

Experimental Evidence

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

Main Reference

High-resolution genetic mapping reveals cis-regulatory and copy number variation in loci associated with cytochrome P450-mediated detoxification in a generalist arthropod pest. (2021)
(<https://pubmed.ncbi.nlm.nih.gov/34153029>)

Authors

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Abstract

Chemical control strategies are driving the evolution of pesticide resistance in pest populations. Understanding the genetic mechanisms of these evolutionary processes is of crucial importance to develop sustainable resistance management strategies. The acaricide pyflubumide is one of the most recently developed mitochondrial complex II inhibitors with a new mode of action that specifically targets spider mite pests. In this study, we characterize the molecular basis of pyflubumide resistance in a highly resistant population of the spider mite *Tetranychus urticae*. Classical genetic crosses indicated that pyflubumide resistance was incompletely recessive and controlled by more than one gene. To identify resistance loci, we crossed the resistant population to a highly susceptible *T. urticae* inbred strain and propagated resulting populations with and without pyflubumide exposure for multiple generations in an experimental evolution set-up. High-resolution genetic mapping by a bulked segregant analysis approach led to the identification of three quantitative trait loci (QTL) linked to pyflubumide resistance. Two QTLs were found on the first chromosome and centered on the cytochrome P450 CYP392A16 and a cluster of CYP392E6-8 genes. Comparative transcriptomics revealed a consistent overexpression of CYP392A16 and CYP392E8 in the experimental populations that were selected for pyflubumide resistance. We further corroborated the involvement of CYP392A16 in resistance by *in vitro* functional expression and metabolism studies. Collectively, these experiments uncovered that CYP392A16 N-demethylates the toxic carboxamide form of pyflubumide to a non-toxic compound. A third QTL coincided with cytochrome P450 reductase (CPR), a vital component of cytochrome P450 metabolism. We show here that the resistant population harbors three gene copies of CPR and that this copy number variation is associated with higher mRNA abundance. Together, we provide evidence for detoxification of pyflubumide by cytochrome P450s that is likely synergized by gene amplification of CPR.

Additional References

RELATED GEPHE

Related Genes

8 (Acetylcholinesterase (Ace-1), Chitin synthase 1 (CHS1), CPR, CYP392A16, 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