

CYP9M6 (https://www.gephebase.org/search-criteria?/and+GeneGephebase=~CYP9M6~#gephebase-summary-title)	Gephebase Gene	GP00002448	GepheID
Published	Entry Status	Courtier	Main curator

Taxon A	Taxon B	Trait Category
Physiology (https://www.gephebase.org/search-criteria?/and+TraitCategory=^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
Aedes aegypti		Trait State in Taxon B
Aedes aegypti - resistant selected strain		Ancestral State
Experimental Evolution (https://www.gephebase.org/search-criteria?/and+TaxonomicStatus=^Experimental Evolution^#gephebase-summary-title)		Taxonomic Status

Taxon A		Taxon B	
Aedes aegypti (<a +aedes="" aegypti`#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="+Aedes aegypti`#gephebase-summary-title)	Latin Name	Aedes aegypti (<a +aedes="" aegypti`#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="+Aedes aegypti`#gephebase-summary-title)	Latin Name
yellow fever mosquito	Common Name	yellow fever mosquito	Common Name
Stegomyia aegypti; yellow fever mosquito; Aedes aegypti (Linnaeus, 1762)	Synonyms	Stegomyia aegypti; yellow fever mosquito; Aedes aegypti (Linnaeus, 1762)	Synonyms
species	Rank	species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Diptera; Nematocera; Culicomorpha; Culicoidea; Culicidae; Culicinae; Aedini; Aedes; Stegomyia	Lineage	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Diptera; Nematocera; Culicomorpha; Culicoidea; Culicidae; Culicinae; Aedini; Aedes; Stegomyia	Lineage
Stegomyia () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 53541)	Parent	Stegomyia () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 53541)	Parent
7159 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7159)	NCBI Taxonomy ID	7159 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7159)	NCBI Taxonomy ID
is Taxon A an Intraspecies?		is Taxon B an Intraspecies?	
No		No	

CYP9M6	Generic Gene Name	X5ICl6 (http://www.uniprot.org/uniprot/X5ICl6)	UniProtKB Aedes aegypti
	Synonyms		GenebankID or UniProtKB
CYP9M6; CYP9M6v1; CYP9M6v2; CYP9M6v3; CYP9M6v4; CYP9M6v5; AAEL001312			Aedes aegypti
-	String	X5ICl6 (https://www.ncbi.nlm.nih.gov/nucore/X5ICl6)	
	Sequence Similarities		
Belongs to the cytochrome P450 family.			
	GO - Molecular Function		
GO:0020037 : heme binding (https://www.ebi.ac.uk/QuickGO/term/GO:0020037)			
GO:0005506 : iron ion binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005506)			
GO:0004497 : monooxygenase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004497)			
GO:0016705 : oxidoreductase activity, acting on paired donors, with incorporation or reduction of molecular oxygen (https://www.ebi.ac.uk/QuickGO/term/GO:0016705)			
	GO - Biological Process		
-			
	GO - Cellular Component		

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

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

Gene Amplification (<https://www.gephebase.org/search-criteria?/and+Molecular Type=~Gene Amplification~#gephebase-summary-title>)

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

unknown

CYP9M6 has the capability to metabolize permethrin and is over expressed in the resistant strain partially due to gene amplification. The average copy number of the CYP9M9 gene is 4.6-fold more than the standard strain based on qPCR.

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

Mechanisms of pyrethroid resistance in the dengue mosquito vector, *Aedes aegypti*: target site insensitivity, penetration, and metabolism. (2014) (<https://pubmed.ncbi.nlm.nih.gov/24945250>)

Kasai S; Komagata O; Itokawa K; Shono T; Ng LC; Kobayashi M; Tomita T

Aedes aegypti is the major vector of yellow and dengue fevers. After 10 generations of adult selection, an *A. aegypti* strain (SP) developed 1650-fold resistance to permethrin, which is one of the most widely used pyrethroid insecticides for mosquito control. SP larvae also developed 8790-fold resistance following selection of the adults. Prior to the selections, the frequencies of V1016G and F1534C mutations in domains II and III, respectively, of voltage-sensitive sodium channel (V_{ssc}, the target site of pyrethroid insecticide) were 0.44 and 0.56, respectively. In contrast, only G1016 alleles were present after two permethrin selections, indicating that G1016 can more contribute to the insensitivity of V_{ssc} than C1534. In vivo metabolism studies showed that the SP strain excreted permethrin metabolites more rapidly than a susceptible SMK strain. Pretreatment with piperonyl butoxide caused strong inhibition of excretion of permethrin metabolites, suggesting that cytochrome P450 monooxygenases (P450s) play an important role in resistance development. In vitro metabolism studies also indicated an association of P450s with resistance. Microarray analysis showed that multiple P450 genes were over expressed during the larval and adult stages in the SP strain. Following quantitative real time PCR, we focused on two P450 isoforms, CYP9M6 and CYP6BB2. Transcription levels of these P450s were well correlated with the rate of permethrin excretion and they were certainly capable of detoxifying permethrin to 4'-HO-permethrin. Over expression of CYP9M6 was partially due to gene amplification. There was no significant difference in the rate of permethrin reduction from cuticle between SP and SMK strains.

Pyrethroid resistance in *Aedes aegypti* and *Aedes albopictus*: Important mosquito vectors of human diseases. (2016) (<https://pubmed.ncbi.nlm.nih.gov/27742355>)

RELATED GEPHE

4 (ABCB4, CYP9J26, para (kdr), resistance to dieldrin) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=~7159~/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title>)

No matches found.

EXTERNAL LINKS

COMMENTS

After 10 generations of adult selection this *A. aegypti* strain noted SP developed 1650-fold resistance to permethrin. The gene was identified based on transcriptome comparison with a non selected strain.