

GEPHE SUMMARY

nAChR (https://www.gephebase.org/search-criteria?/and+GeneGephebase=nAChR#gephebase-summary-title)	Gephebase Gene	GP00002653	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 (insecticide; spinosad) (https://www.gephebase.org/search-criteria?/and+Trait=Xenobiotic resistance (insecticide; spinosad)#gephebase-summary-title)	Trait		
Plutella xylostella - sensitive	Trait State in Taxon A		
Plutella xylostella - resistant - SZ-SpinR strain after laboratory selection with spinosad	Trait State in Taxon B		
	Ancestral State		
Experimental Evolution (https://www.gephebase.org/search-criteria?/and+TaxonomicStatus=Experimental Evolution#gephebase-summary-title)	Taxonomic Status		
	Taxon A		Taxon B
Plutella xylostella (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=Plutella xylostella#gephebase-summary-title)	Latin Name	Plutella xylostella (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=Plutella xylostella#gephebase-summary-title)	Latin Name
diamondback moth	Common Name	diamondback moth	Common Name
diamondback moth; cabbage moth; Plutella xylostella (Linnaeus, 1758); Putella xylostella	Synonyms	diamondback moth; cabbage moth; Plutella xylostella (Linnaeus, 1758); Putella xylostella	Synonyms
species	Rank	species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Dityrsia; Yponomeutoidea; Plutellidae; Plutella	Lineage	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Dityrsia; Yponomeutoidea; Plutellidae; Plutella	Lineage
Plutella () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51654)	Parent	Plutella () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51654)	Parent
51655 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51655)	NCBI Taxonomy ID	51655 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51655)	NCBI Taxonomy ID
No	is Taxon A an Intraspecies?	No	is Taxon B an Intraspecies?

GENOTYPIC CHANGE

CHRNA6	Generic Gene Name	Q15825 (http://www.uniprot.org/uniprot/Q15825)	UniProtKB Homo sapiens
CHNRA6	Synonyms	()	GenebankID or UniProtKB
9606.ENSP00000276410 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSP00000276410)	String		
Belongs to the ligand-gated ion channel (TC 1.A.9) family. Acetylcholine receptor (TC 1.A.9.1) subfamily. Alpha-6/CHRNA6 sub-subfamily.	Sequence Similarities		
GO:0015464 : acetylcholine receptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0015464)	GO - Molecular Function		
GO:0022848 : acetylcholine-gated cation-selective channel activity (https://www.ebi.ac.uk/QuickGO/term/GO:0022848)			
GO:1904315 : transmitter-gated ion channel activity involved in regulation of postsynaptic			

membrane potential (<https://www.ebi.ac.uk/QuickGO/term/GO:1904315>)
GO:0005231 : excitatory extracellular ligand-gated ion channel activity
(<https://www.ebi.ac.uk/QuickGO/term/GO:0005231>)
GO:0030594 : neurotransmitter receptor activity
(<https://www.ebi.ac.uk/QuickGO/term/GO:0030594>)

GO - Biological Process

GO:0007165 : signal transduction (<https://www.ebi.ac.uk/QuickGO/term/GO:0007165>)
GO:0007268 : chemical synaptic transmission
(<https://www.ebi.ac.uk/QuickGO/term/GO:0007268>)
GO:0034220 : ion transmembrane transport
(<https://www.ebi.ac.uk/QuickGO/term/GO:0034220>)
GO:0050877 : nervous system process
(<https://www.ebi.ac.uk/QuickGO/term/GO:0050877>)
GO:0042391 : regulation of membrane potential
(<https://www.ebi.ac.uk/QuickGO/term/GO:0042391>)
GO:0014059 : regulation of dopamine secretion
(<https://www.ebi.ac.uk/QuickGO/term/GO:0014059>)
GO:0051899 : membrane depolarization
(<https://www.ebi.ac.uk/QuickGO/term/GO:0051899>)
GO:2000300 : regulation of synaptic vesicle exocytosis
(<https://www.ebi.ac.uk/QuickGO/term/GO:2000300>)

GO - Cellular Component

GO:0005886 : plasma membrane (<https://www.ebi.ac.uk/QuickGO/term/GO:0005886>)
GO:0005887 : integral component of plasma membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0005887>)
GO:0043005 : neuron projection (<https://www.ebi.ac.uk/QuickGO/term/GO:0043005>)
GO:0045202 : synapse (<https://www.ebi.ac.uk/QuickGO/term/GO:0045202>)
GO:0005892 : acetylcholine-gated channel complex
(<https://www.ebi.ac.uk/QuickGO/term/GO:0005892>)
GO:0099055 : integral component of postsynaptic membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0099055>)
GO:0099056 : integral component of presynaptic membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0099056>)
GO:0070161 : anchoring junction (<https://www.ebi.ac.uk/QuickGO/term/GO:0070161>)
GO:0098691 : dopaminergic synapse (<https://www.ebi.ac.uk/QuickGO/term/GO:0098691>)

Presumptive Null

Yes (<https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Yes^#gephebase-summary-title>)

Molecular Type

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

Aberration Type

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

Deletion Size

1-9 bp

Molecular Details of the Mutation

a three amino acid (3-aa) deletion in the fourth transmembrane domain (TM4) of the nAChR $\hat{I}\pm 6$ subunit

Experimental Evidence

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

Main Reference

A three amino acid deletion in the transmembrane domain of the nicotinic acetylcholine receptor $\hat{I}\pm 6$ subunit confers high-level resistance to spinosad in *Plutella xylostella*. (2016)
(<https://pubmed.ncbi.nlm.nih.gov/26855198>)

Authors

Wang J; Wang X; Lansdell SJ; Zhang J; Millar NS; Wu Y

Abstract

Spinosad is a macrocyclic lactone insecticide that acts primarily at the nicotinic acetylcholine receptors (nAChRs) of target insects. Here we describe evidence that high levels of resistance to spinosad in the diamondback moth (*Plutella xylostella*) are associated with a three amino acid (3-aa) deletion in the fourth transmembrane domain (TM4) of the nAChR $\hat{I}\pm 6$ subunit ($Px\hat{I}\pm 6$). Following laboratory selection with spinosad, the SZ-SpinR strain of *P. xylostella* exhibited 940-fold resistance to spinosad. In addition, the selected insect population had 1060-fold cross-resistance to spinetoram but, in contrast, no cross-resistance to abamectin was observed. Genetic analysis indicates that spinosad resistance in SZ-SpinR is inherited as a recessive and autosomal trait, and that the 3-aa deletion (IIA) in TM4 of $Px\hat{I}\pm 6$ is tightly linked to spinosad resistance. Because of well-established difficulties in functional expression of cloned insect nAChRs, the analogous resistance-associated deletion mutation was introduced into a prototype nAChR (the cloned human $\hat{I}\pm 7$ subunit). Two-electrode voltage-clamp recording with wild-type and mutated nAChRs expressed in *Xenopus laevis* oocytes indicated that the mutation causes a complete loss of agonist activation. In addition, radioligand binding studies indicated that the 3-aa deletion resulted in significantly lower-affinity binding of the extracellular neurotransmitter-binding site. These findings are consistent with the 3-amino acid (IIA) deletion within the transmembrane domain of $Px\hat{I}\pm 6$ being responsible for target-site resistance to spinosad in the SZ-SpinR strain of *P. xylostella*.

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Additional References

RELATED GEPHE

Related Genes

10 (ABCC2, Acetylcholinesterase (Ace-1), Chitin synthase 1 (CHS1), CYP6BG1, FMO2, glutamate-gated chloride channel (GluCl), MAP4K4, para (kdr), resistance to dieldrin, RYR)
(<https://www.gephebase.org/search-criteria?/or+Taxon ID=^51655^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

2 (<https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^nAChR^/and+Taxon ID=^51655^/or+Gene Gephebase=^nAChR^/and+Taxon ID=^51655^#gephebase-summary-title>)

EXTERNAL LINKS

COMMENTS