GEPHE SUMMARY

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

GepheID
GP00002653

Entry Status
Published

Main curator
Courtier

PHENOTYPIC CHANGE

Trait Category
Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Physiology^#gephebase-summary-title)

Trait
Xenobiotic resistance (insecticide; spinosad) (https://www.gephebase.org/search-criteria?/and+Trait=^Xenobiotic resistance (insecticide; spinosad)^#gephebase-summary-title)

Trait State in Taxon A
Plutella xylostella - sensitive

Trait State in Taxon B
Plutella xylostella - resistant - SZ-SpinR strain after laboratory selection with spinosad

Ancestral State
Taxon A

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

Taxon A

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

Common Name
diamondback moth

Synonyms
diamondback moth; cabbage moth; Plutella xylostella (Linnaeus, 1758); Putella xylostella

Rank
species

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; Ditrysia; Yponomeutoidea; Plutellidae; Plutella

Parent
Plutella () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 51654)

NCBI Taxonomy ID
51655 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 51655)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
diamondback moth

Synonyms
diamondback moth; cabbage moth; Plutella xylostella (Linnaeus, 1758); Putella xylostella

Rank
species

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; Ditrysia; Yponomeutoidea; Plutellidae; Plutella

Parent
Plutella () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 51654)

NCBI Taxonomy ID
51655 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 51655)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
CHRNA6

Synonyms
CHNRA6

String
9606.ENSP00000276410 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=9606.ENSP00000276410)

Sequence Similarities
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.

GO - Molecular Function
GO:0015464 : acetylcholine receptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0015464)
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

UniProtKB Homo sapiens
Q15825 (http://www.uniprot.org/uniprot/Q15825)

GenebankID or UniProtKB
()

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 Î±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 Î±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 Î±6 subunit (PxÎ±6). Following laboratory selection with spinosad, the SZ-SpinR strain of P.Â 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 PxÎ±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 Î±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 PxÎ±6 being responsible for target-site resistance to spinosad in the SZ-SpinR strain of P.Â 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