GEPHE SUMMARY

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

GepheID
GP00002621

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
Tuta absoluta - sensitive

Trait State in Taxon B
Tuta absoluta - resistant

Ancestral State
Taxon A

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

Taxon A

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

Common Name
-

Synonyms
Gnorimoschema absoluta; Phthorimaea absoluta; Scrobipalpula absoluta; Scrobipalpuloides absoluta; Tuta absoluta (Meyrick, 1917)

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; Gelechioidea; Gelechiidae; Gelechiinae; Tuta

Parent
Tuta () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 702716)

NCBI Taxonomy ID
702717 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 702717)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
-

Synonyms
Gnorimoschema absoluta; Phthorimaea absoluta; Scrobipalpula absoluta; Scrobipalpuloides absoluta; Tuta absoluta (Meyrick, 1917)

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; Gelechioidea; Gelechiidae; Gelechiinae; Tuta

Parent
Tuta () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 702716)

NCBI Taxonomy ID
702717 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 702717)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
nAChRbeta1

Synonyms
AChR; AchR64B; AChR64B; Acr64B; AcrD; ard; Ard; ARD; beta 64B; beta1 nAChR; CG11348; CG11348-PA; CG12606; Dbeta1; Dmel\CG11348; nAChR; nAChR-beta64B; nAcR64B; nAcRbeta-64B

String
7227.FBpp0073155 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0073155)

Sequence Similarities
Belongs to the ligand-gated ion channel (TC 1.A.9) family. Acetylcholine receptor (TC 1.A.9.1) subfamily.

GO - Molecular Function
GO:0004888 : transmembrane signaling receptor activity

UniProtKB Drosophila melanogaster
P04755 (http://www.uniprot.org/uniprot/P04755)

GenebankID or UniProtKB
()

(https://www.ebi.ac.uk/QuickGO/term/GO:0004888)
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:0007271 : synaptic transmission, cholinergic
(https://www.ebi.ac.uk/QuickGO/term/GO:0007271)
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 - Cellular Component

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:0045211 : postsynaptic membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0045211)
GO:0045202 : synapse (https://www.ebi.ac.uk/QuickGO/term/GO:0045202)
GO:0070161 : anchoring junction (https://www.ebi.ac.uk/QuickGO/term/GO:0070161)

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

G275E in nAchR alpha 6 due to a single nucleotide change

Experimental Evidence

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

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

Main Reference

Mutation (G275E) of the nicotinic acetylcholine receptor Î±6 subunit is associated with high levels of resistance to spinosyns in Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae). (2016) (https://pubmed.ncbi.nlm.nih.gov/27265820)

Authors

Silva WM; Berger M; Bass C; Williamson M; Moura DM; Ribeiro LM; Siqueira HA

Abstract

The tomato leafminer, Tuta absoluta, now a major pest of tomato crops worldwide, is primarily controlled using chemical insecticides. Recently, high levels of resistance to the insecticide spinosad have been described in T. absoluta populations in Brazil. Selection of a resistant field-collected strain led to very high levels of resistance to spinosad and cross-resistance to spinetoram, but not to other insecticides that target the nicotinic acetylcholine receptor (nAChR). In this study the mechanisms underlying resistance to spinosad were investigated using toxicological, biochemical and molecular approaches. Inhibition of metabolic enzymes using synergists and biochemical assessment of detoxification enzyme activity provided little evidence of metabolic resistance in the selected strain. Cloning and sequencing of the nAChR Î±6 subunit from T. absoluta, the spinosad target-site, from susceptible and spinosad-resistant strains were done to investigate the role of a target-site mechanism in resistance. A single nucleotide change was identified in exon 9 of the Î±6 subunit of the resistant strain, resulting in the replacement of the glycine (G) residue at position 275 observed in susceptible T. absoluta strains with a glutamic acid (E). A high-throughput DNA-based diagnostic assay was developed and used to assess the prevalence of the G275E mutation in 17 field populations collected from different geographical regions of Brazil. The resistant allele was found at low frequency, and in the heterozygous form, in seven of these populations but at much higher frequency and in the homozygous form in a population collected in the Iraquara municipality. The frequency of the mutation was significantly correlated with the mortality of these populations in discriminating dose bioassays. In summary our results provide evidence that the G275E mutation is an important mechanism of resistance to spinosyns in T. absoluta, and may be used as a marker for resistance monitoring in field populations.

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Additional References

A CRISPR/Cas9 mediated point mutation in the alpha 6 subunit of the nicotinic acetylcholine receptor confers resistance to spinosad in Drosophila melanogaster. (2016) (https://pubmed.ncbi.nlm.nih.gov/27117524)

RELATED GEPHE

Related Genes

2 (para (kdr), RYR) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^702717^/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS