

## GEPHE SUMMARY

RYR ( <a href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase+RYR">#Gephebase-summary-title</a> )	Gephebase Gene	GP00002434	GepheID
Published	Entry Status	Courtier	Main curator

## PHENOTYPIC CHANGE

Physiology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait+Category+Physiology">#Gephebase-summary-title</a> )	Trait Category		
Xenobiotic resistance (insecticide ; diamide ; chlorantraniliprole ; flubendiamide) ( <a href="https://www.gephebase.org/search-criteria?/and+Trait+Xenobiotic+resistance+(insecticide+;+diamide+;+chlorantraniliprole+;+flubendiamide)#Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait+Xenobiotic+resistance+(insecticide+;+diamide+;+chlorantraniliprole+;+flubendiamide)#Gephebase-summary-title</a> )	Trait		
Plutella xylostella - susceptible	Trait State in Taxon A		
Plutella xylostella - resistant strain Sudlon	Trait State in Taxon B		
	Ancestral State		
	Taxonomic Status		
Intraspecific ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status+Intraspecific">#Gephebase-summary-title</a> )			
	Taxon A		Taxon B
Plutella xylostella ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms+Plutella+xylostella">#Gephebase-summary-title</a> )	Latin Name	Plutella xylostella ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms+Plutella+xylostella">#Gephebase-summary-title</a> )	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; Amphimesenoptera; 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; Amphimesenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Dityrsia; Yponomeutoidea; Plutellidae; Plutella	Lineage
Plutella () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51654">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51654</a> )	Parent	Plutella () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51654">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51654</a> )	Parent
51655 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51655">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51655</a> )	NCBI Taxonomy ID	51655 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51655">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=51655</a> )	NCBI Taxonomy ID
No	is Taxon A an Intraspecies?	Yes	is Taxon B an Intraspecies?
			Taxon B Description
			Sudlon : diamide resistant strain collected in a cabbage field located in Sudlon in Cebu Island in the Philippines

## GENOTYPIC CHANGE

RyR	Generic Gene Name	Q24498 ( <a href="http://www.uniprot.org/uniprot/Q24498">http://www.uniprot.org/uniprot/Q24498</a> )	UniProtKB Drosophila melanogaster
Ryr; CG10844; D-RyR; Dmel\CG10844; DmRyR; DRR; dry; DRY; dRyr; dRyR; dya; l(2)k00424; l(2)k04913; Rya-44F; Rya-r4; rya-r44F; Rya-r44F; Rya-R44F; Rya-r76CD; ryr; RYR; RyRs	Synonyms	()	GenebankID or UniProtKB
7227.FBpp0293114 ( <a href="http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0293114">http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0293114</a> )	String		
Belongs to the ryanodine receptor (TC 1.A.3.1) family.	Sequence Similarities		
GO:0005509 : calcium ion binding ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005509">https://www.ebi.ac.uk/QuickGO/term/GO:0005509</a> )	GO - Molecular Function		

GO:0048763 : calcium-induced calcium release activity  
 (https://www.ebi.ac.uk/QuickGO/term/GO:0048763)  
 GO:0005219 : ryanodine-sensitive calcium-release channel activity  
 (https://www.ebi.ac.uk/QuickGO/term/GO:0005219)

GO - Biological Process

GO:0006874 : cellular calcium ion homeostasis  
 (https://www.ebi.ac.uk/QuickGO/term/GO:0006874)  
 GO:0035206 : regulation of hemocyte proliferation  
 (https://www.ebi.ac.uk/QuickGO/term/GO:0035206)  
 GO:0006936 : muscle contraction (https://www.ebi.ac.uk/QuickGO/term/GO:0006936)  
 GO:0006816 : calcium ion transport (https://www.ebi.ac.uk/QuickGO/term/GO:0006816)  
 GO:0060047 : heart contraction (https://www.ebi.ac.uk/QuickGO/term/GO:0060047)  
 GO:0072347 : response to anesthetic (https://www.ebi.ac.uk/QuickGO/term/GO:0072347)

GO - Cellular Component

GO:0016021 : integral component of membrane  
 (https://www.ebi.ac.uk/QuickGO/term/GO:0016021)  
 GO:0030659 : cytoplasmic vesicle membrane  
 (https://www.ebi.ac.uk/QuickGO/term/GO:0030659)  
 GO:0030018 : Z disc (https://www.ebi.ac.uk/QuickGO/term/GO:0030018)  
 GO:0042383 : sarcolemma (https://www.ebi.ac.uk/QuickGO/term/GO:0042383)  
 GO:0033017 : sarcoplasmic reticulum membrane  
 (https://www.ebi.ac.uk/QuickGO/term/GO:0033017)  
 GO:0005790 : smooth endoplasmic reticulum  
 (https://www.ebi.ac.uk/QuickGO/term/GO:0005790)

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

G4946E due to GGG>GAA

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	GGG	GAA	-
Amino-acid	Gly	Glu	4946

Main Reference

Resistance to diamide insecticides in diamondback moth, *Plutella xylostella* (Lepidoptera: Plutellidae) is associated with a mutation in the membrane-spanning domain of the ryanodine receptor. (2012) (https://pubmed.ncbi.nlm.nih.gov/22982600)

Authors

Trocza B; Zimmer CT; Elias J; Schorn C; Bass C; Davies TG; Field LM; Williamson MS; Slater R; Nauen R

Abstract

Diamide insecticides such as chlorantraniliprole and flubendiamide are a new class of insecticide that selectively target insect ryanodine receptors (RyR), a distinct class of homo-tetrameric calcium release channels which play a pivotal role in calcium homeostasis in numerous cell types. Resistance to these insecticides has recently been reported in the diamondback moth, *Plutella xylostella* (Lepidoptera: Plutellidae), a global lepidopteran pest of cruciferous crops. In the present study a region of the gene encoding the proposed diamide binding site of the RyR from *P. xylostella* collected from the Philippines and Thailand and found to be over 200-fold resistant to both chlorantraniliprole and flubendiamide compared to susceptible strains, were amplified by RT-PCR and sequenced. Comparison of the sequence with those from several susceptible reference strains revealed non-synonymous mutations in each of the resistant strains that in both cases lead to a glycine to glutamic acid substitution (G4946E) in the protein. The independent evolution of the same amino acid substitution within a highly conserved region of the proposed diamide binding site in two geographically separated resistant strains of *P. xylostella* strongly suggests a causal association with diamide resistance. Furthermore we designed a pyrosequencing-based diagnostic assay for resistance monitoring purposes that can be used to detect the G4946E mutation in field-collected samples of diamondback moth. The implications of the reported findings for resistance management strategies are discussed.

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Additional References

Investigation of the contribution of RyR target-site mutations in diamide resistance by CRISPR/Cas9 genome modification in *Drosophila*. (2017) (https://pubmed.ncbi.nlm.nih.gov/28669775)

RELATED GEPHE

Related Genes

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

Related Haplotypes

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

## EXTERNAL LINKS

## COMMENTS

@Parallelism - independent evolution of the same amino acid substitution (but different codon changes GGG>GAG and GGG>GAA) within a highly conserved region of the proposed diamide binding site in two geographically separated resistant strains of *P. xylostella* - @TwoNucleotideChangesInSameCodon