GEPHE SUMMARY

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

GepheID
GP00001102

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

Trait State in Taxon A
food shortage accelerates development

Trait State in Taxon B
food shortage has no effect on developmental time. Synchronization of individuals reared in mass population.

Ancestral State
Taxon A

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

Taxon A

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

Common Name
domestic silkworm

Synonyms
domestic silkworm; silk moth; silkworm; Bombyx mori Linnaeus, 1758

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; Obtectomera; Bombycoidea; Bombycidae; Bombycinae; Bombyx

Parent
Bombyx () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7090)

NCBI Taxonomy ID
7091 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7091)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
domestic silkworm

Synonyms
domestic silkworm; silk moth; silkworm; Bombyx mori Linnaeus, 1758

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; Obtectomera; Bombycoidea; Bombycidae; Bombycinae; Bombyx

Parent
Bombyx () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7090)

NCBI Taxonomy ID
7091 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7091)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
Eo

Synonyms
CG9504; Dmel\CG9504; DmEO; EO; EObeta1; Eo-RA; Dmel_CG9504

String
7227.FBpp0073792 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0073792)

Sequence Similarities
-

GO - Molecular Function
GO:0050660 : flavin adenine dinucleotide binding (https://www.ebi.ac.uk/QuickGO/term/GO:0050660)
GO:0047875 : ecdysone oxidase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0047875)

GO - Biological Process

UniProtKB Drosophila melanogaster
Q9VY01 (http://www.uniprot.org/uniprot/Q9VY01)

GenebankID or UniProtKB
()

GO:0008205 : ecdysone metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0008205)

GO - Cellular Component

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

Presumptive Null

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

Molecular Type

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

Aberration Type

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

Insertion Size

100-999 bp

Molecular Details of the Mutation

insertion of a 512bp fragment of a Taguchi transposable element 462 bp upstream of the transcription start site of the EO gene. The TE insertion enhances the transcription of flanking genes after 20-hydroxyecdysone treatment.

Experimental Evidence

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

Main Reference

An adaptive transposable element insertion in the regulatory region of the EO gene in the domesticated silkworm, Bombyx mori. (2014) (https://pubmed.ncbi.nlm.nih.gov/25213334)

Authors

Sun W; Shen YH; Han MJ; Cao YF; Zhang Z

Abstract

AIthough there are many studies to show a key role of transposable elements (TEs) in adaptive evolution of higher organisms, little is known about the molecular mechanisms. In this study, we found that a partial TE (Taguchi) inserted in the cis-regulatory region of the silkworm ecdysone oxidase (EO) gene, which encodes a crucial enzyme to reduce the titer of molting hormone (20-hydroxyecdysone, 20E). The TE insertion occurred during domestication of silkworm and the frequency of the TE insertion in the domesticated silkworm (Bombyx mori) is high, 54.24%. The linkage disequilibrium in the TE inserted strains of the domesticated silkworm was elevated. Molecular population genetics analyses suggest that this TE insertion is adaptive for the domesticated silkworm. Luminescent reporter assay shows that the TE inserted in the cis-regulatory region of the EO gene functions as a 20E-induced enhancer of the gene expression. Further, phenotypic bioassay indicates that the silkworm with the TE insertion exhibited more stable developmental phenotype than the silkworm without the TE insertion when suffering from food shortage. Thus, the inserted TE in the cis-regulatory region of the EO gene increased developmental uniformity of silkworm individuals through regulating 20E metabolism, partially explaining transformation of a domestication developmental trait in the domesticated silkworm. Our results emphasize the exceptional role of gene expression regulation in developmental transition of domesticated animals.

Additional References

Green cocoons in silkworm Bombyx mori resulting from the quercetin 5-O-glucosyltransferase of UGT86, is an evolved response to dietary toxins. (2013)
(https://pubmed.ncbi.nlm.nih.gov/23271130)

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

@TE - Food shortage leads to higher levels of ecdysone in both types of individuals. This leads to higher levels of ecdysone oxidase in individuas carrying the TE (Taxon B) compared to the ones without TE insertion (Taxon A); and thus back to normal ecdysone levels and no accelerated development.