GEPHE SUMMARY

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

GepheID
GP00000254

Entry Status
Published

Main curator
Martin

PHENOTYPIC CHANGE

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

Trait
Dermal bone (loss of armor plates) (https://www.gephebase.org/search-criteria?/and+Trait=^Dermal bone (loss of armor plates)^#gephebase-summary-title)

Trait State in Taxon A
Gasterosteus aculeatus (marine)

Trait State in Taxon B
Gasterosteus aculeatus (freshwater)

Ancestral State
Taxon A

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

Taxon A

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

Common Name
three-spined stickleback

Synonyms
three-spined stickleback; three spined stickleback; Gasterosteus aculeatus Linnaeus, 1758

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Euteleosteomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorphata; Euacanthomorphacea; Percomorphaceae; Eupercaria; Perciformes; Cottioidei; Gasterosteales; Gasterosteidae; Gasterosteus

Parent
Gasterosteus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69292)

NCBI Taxonomy ID
69293 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69293)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
three-spined stickleback

Synonyms
three-spined stickleback; three spined stickleback; Gasterosteus aculeatus Linnaeus, 1758

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Euteleosteomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorphata; Euacanthomorphacea; Percomorphaceae; Eupercaria; Perciformes; Cottioidei; Gasterosteales; Gasterosteidae; Gasterosteus

Parent
Gasterosteus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69292)

NCBI Taxonomy ID
69293 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69293)

is Taxon B an Infraspecies?
Yes

Taxon B Description
Gasterosteus aculeatus (freshwater)

GENOTYPIC CHANGE

Generic Gene Name
Eda

Synonyms
Ta; Ed1; HED; EDA1; XLHED; tabby; Eda-A1; Eda-A2; Tnlg7c

String
10090.ENSMUSP00000109409 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=10090.ENSMUSP00000109409)

Sequence Similarities
Belongs to the tumor necrosis factor family.

GO - Molecular Function
GO:0038177 : death receptor agonist activity (https://www.ebi.ac.uk/QuickGO/term/GO:0038177)
GO:0005123 : death receptor binding

UniProtKB Mus musculus
O54693 (http://www.uniprot.org/uniprot/O54693)

GenebankID or UniProtKB
AAY27076 (https://www.ncbi.nlm.nih.gov/nuccore/AAY27076)

(https://www.ebi.ac.uk/QuickGO/term/GO:0005123)
GO:0005164 : tumor necrosis factor receptor binding
(https://www.ebi.ac.uk/QuickGO/term/GO:0005164)

GO - Biological Process

GO:0006955 : immune response (https://www.ebi.ac.uk/QuickGO/term/GO:0006955)
GO:0030154 : cell differentiation (https://www.ebi.ac.uk/QuickGO/term/GO:0030154)
GO:0043473 : pigmentation (https://www.ebi.ac.uk/QuickGO/term/GO:0043473)
GO:0010628 : positive regulation of gene expression
(https://www.ebi.ac.uk/QuickGO/term/GO:0010628)
GO:0051092 : positive regulation of NF-kappaB transcription factor activity
(https://www.ebi.ac.uk/QuickGO/term/GO:0051092)
GO:0019221 : cytokine-mediated signaling pathway
(https://www.ebi.ac.uk/QuickGO/term/GO:0019221)
GO:0007160 : cell-matrix adhesion (https://www.ebi.ac.uk/QuickGO/term/GO:0007160)
GO:0010467 : gene expression (https://www.ebi.ac.uk/QuickGO/term/GO:0010467)
GO:0001942 : hair follicle development
(https://www.ebi.ac.uk/QuickGO/term/GO:0001942)
GO:0060789 : hair follicle placode formation
(https://www.ebi.ac.uk/QuickGO/term/GO:0060789)
GO:0042475 : odontogenesis of dentin-containing tooth
(https://www.ebi.ac.uk/QuickGO/term/GO:0042475)
GO:0090263 : positive regulation of canonical Wnt signaling pathway
(https://www.ebi.ac.uk/QuickGO/term/GO:0090263)
GO:0043123 : positive regulation of I-kappaB kinase/NF-kappaB signaling
(https://www.ebi.ac.uk/QuickGO/term/GO:0043123)
GO:1901224 : positive regulation of NIK/NF-kappaB signaling
(https://www.ebi.ac.uk/QuickGO/term/GO:1901224)
GO:1901222 : regulation of NIK/NF-kappaB signaling
(https://www.ebi.ac.uk/QuickGO/term/GO:1901222)
GO:0060662 : salivary gland cavitation
(https://www.ebi.ac.uk/QuickGO/term/GO:0060662)
GO:0043588 : skin development (https://www.ebi.ac.uk/QuickGO/term/GO:0043588)
GO:0061153 : trachea gland development
(https://www.ebi.ac.uk/QuickGO/term/GO:0061153)

GO - Cellular Component

GO:0005887 : integral component of plasma membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0005887)
GO:0005576 : extracellular region (https://www.ebi.ac.uk/QuickGO/term/GO:0005576)
GO:0005789 : endoplasmic reticulum membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0005789)
GO:0045177 : apical part of cell (https://www.ebi.ac.uk/QuickGO/term/GO:0045177)
GO:0005581 : collagen trimer (https://www.ebi.ac.uk/QuickGO/term/GO:0005581)
GO:0005811 : lipid droplet (https://www.ebi.ac.uk/QuickGO/term/GO:0005811)

Presumptive Null

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

Molecular Type

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

Aberration Type

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

Molecular Details of the Mutation

large haplotype- includes a T-> G regulatory change that affect expression based on differential responsiveness to Wnt signaling

Experimental Evidence

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

Main Reference

Widespread parallel evolution in sticklebacks by repeated fixation of Ectodysplasin alleles. (2005) (https://pubmed.ncbi.nlm.nih.gov/15790847)

Authors

Colosimo PF; Hosemann KE; Balabhadra S; Villarreal G; Dickson M; Grimwood J; Schmutz J; Myers RM; Schluter D; Kingsley DM

Abstract

Major phenotypic changes evolve in parallel in nature by molecular mechanisms that are largely unknown. Here, we use positional cloning methods to identify the major chromosome locus controlling armor plate patterning in wild threespine sticklebacks. Mapping, sequencing, and transgenic studies show that the Ectodysplasin (EDA) signaling pathway plays a key role in evolutionary change in natural populations and that parallel evolution of stickleback low-plated phenotypes at most freshwater locations around the world has occurred by repeated selection of Eda alleles derived from an ancestral low-plated haplotype that first appeared more than two million years ago. Members of this clade of low-plated alleles are present at low frequencies in marine fish, which suggests that standing genetic variation can provide a molecular basis for rapid, parallel evolution of dramatic phenotypic change in nature.

Additional References

The genomic basis of adaptive evolution in threespine sticklebacks. (2012) (https://pubmed.ncbi.nlm.nih.gov/22481358)
A recurrent regulatory change underlying altered expression and Wnt response of the stickleback armor plates gene EDA. (2015) (https://pubmed.ncbi.nlm.nih.gov/25629660)

RELATED GEPHE

Related Genes

1 (GDF6) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^69293^/and+Trait=Dermal bone/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

Functional validation: comparison of enhancer reporter assays with T/C polymorphism. Behavioral phenotype in schooling ability verified in CMV:EDA transgenic fish