GEPHE SUMMARY

Gephebase Gene
Green-sensitive opsin (RH2) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Green-sensitive opsin (RH2)^#gephebase-summary-title)

GepheID
GP00002356

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

Trait State in Taxon A
color vision

Trait State in Taxon B
reduced or loss of color vision

Ancestral State
Taxon A

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

Taxon A

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

Common Name
zebrafish

Synonyms
Brachydanio rerio; Brachydanio rerio frankei; Cyprinus rerio; Danio frankei; Danio rerio frankei; zebrafish; leopard danio; zebra danio; zebra fish; Cyprinus rerio Hamilton, 1822; Danio rerio (Hamilton, 1822); Brachidanio rerio

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Otomorpha; Ostariophysi; Otophysi; Cypriniphysae; Cypriniformes; Cyprinoidei; Cyprinidae; Danio

Parent
Danio () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7954)

NCBI Taxonomy ID
7955 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7955)

is Taxon A an Infraspecies?
No

Taxon B #1

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

Common Name
-

Synonyms
Sinocyclocheilus anshuiensis Gan, Wu, Wei & Yang, 2013; KIZ 12060239; KIZ 12070271; KIZ 12070276; KIZ 12070277; KIZ 12070280; KIZ:12060239; KIZ:12070271; KIZ:12070276; KIZ:12070277; KIZ:12070280

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Otomorpha; Ostariophysi; Otophysi; Cypriniphysae; Cypriniformes; Cyprinoidei; Cyprinidae; Cypininae; Sinocyclocheilus

Parent
Sinocyclocheilus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 75365)

NCBI Taxonomy ID
1608454 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 1608454)

is Taxon B an Infraspecies?
No

Taxon B #2

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

Common Name
-

Synonyms
Barbus grahami; Barbus grahami Regan, 1904; Sinocyclocheilus grahami (Regan, 1904); BMNH:1904.1.26.27

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Otomorpha; Ostariophysi; Otophysi; Cypriniphysae; Cypriniformes; Cyprinoidei; Cyprinidae; Cypininae; Sinocyclocheilus

Parent

Sinocyclocheilus () - (Rank: genus)
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 75365)

NCBI Taxonomy ID

75366
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 75366)

is Taxon B an Infraspecies?

No

Taxon B #3

Latin Name

Sinocyclocheilus rhinocerous
(https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Sinocyclocheilus rhinocerous^#gephebase-summary-title)

Common Name

-

Synonyms

Sinocyclocheilus rhinocerous Li & Tao, 1994

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Otomorpha; Ostariophysi; Otophysi; Cypriniphysae; Cypriniformes; Cyprinoidei; Cyprinidae; Cyprininae; Sinocyclocheilus

Parent

Sinocyclocheilus () - (Rank: genus)
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 75365)

NCBI Taxonomy ID

307959
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 307959)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

opn1mw2

Synonyms

grops1; grops2; RH2-2; rh2.2; wu:fk57c11; si:zc263a23.4; rh22

String

-

Sequence Similarities

Belongs to the G-protein coupled receptor 1 family. Opsin subfamily.

GO - Molecular Function

GO:0008020 : G protein-coupled photoreceptor activity
(https://www.ebi.ac.uk/QuickGO/term/GO:0008020)

GO - Biological Process

GO:0007186 : G protein-coupled receptor signaling pathway
(https://www.ebi.ac.uk/QuickGO/term/GO:0007186)
GO:0018298 : protein-chromophore linkage
(https://www.ebi.ac.uk/QuickGO/term/GO:0018298)
GO:0007601 : visual perception (https://www.ebi.ac.uk/QuickGO/term/GO:0007601)
GO:0071482 : cellular response to light stimulus
(https://www.ebi.ac.uk/QuickGO/term/GO:0071482)
GO:0007602 : phototransduction (https://www.ebi.ac.uk/QuickGO/term/GO:0007602)

GO - Cellular Component

GO:0005887 : integral component of plasma membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0005887)
GO:0001750 : photoreceptor outer segment
(https://www.ebi.ac.uk/QuickGO/term/GO:0001750)

UniProtKB Danio rerio

Q8AYM8 (http://www.uniprot.org/uniprot/Q8AYM8)

GenebankID or UniProtKB

()

Presumptive Null

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

Molecular Type

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

Aberration Type

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

Deletion Size

-

Molecular Details of the Mutation

Rh2-2 coding sequence absent from the full genome sequence of the three Sinocyclocheilus species

Experimental Evidence

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

Main Reference

The Sinocyclocheilus cavefish genome provides insights into cave adaptation. (2016) (https://pubmed.ncbi.nlm.nih.gov/26728391)

Authors

Yang J; Chen X; Bai J; Fang D; Qiu Y; Jiang W; Yuan H; Bian C; Lu J; He S; Pan X; Zhang Y; Wang X; You X; Wang Y; Sun Y; Mao D; Liu Y; Fan G; Zhang H; Chen X; Zhang X; Zheng L; Wang J; Cheng L; Chen J; Ruan Z; Li J; Yu H; Peng C; Ma X; Xu J; He Y; Xu Z; Xu P; Wang J; Yang H; Wang J; Whitten T; Xu X; Shi Q

Abstract

An emerging cavefish model, the cyprinid genus Sinocyclocheilus, is endemic to the massive southwestern karst area adjacent to the Qinghai-Tibetan Plateau of China. In order to understand whether orogeny influenced the evolution of these species, and how genomes change under isolation, especially in subterranean habitats, we performed whole-genome sequencing and comparative analyses of three species in this genus, S. grahami, S. rhinocerous and S. anshuiensis. These species are surface-dwelling, semi-cave-dwelling and cave-restricted, respectively.

The assembled genome sizes of S. grahami, S. rhinocerous and S. anshuiensis are 1.75 Gb, 1.73 Gb and 1.68 Gb, respectively. Divergence time and population history analyses of these species reveal that their speciation and population dynamics are correlated with the different stages of uplifting of the Qinghai-Tibetan Plateau. We carried out comparative analyses of these genomes and found that many genetic changes, such as gene loss (e.g. opsin genes), pseudogenes (e.g. crystallin genes), mutations (e.g. melanogenesis-related genes), deletions (e.g. scale-related genes) and down-regulation (e.g. circadian rhythm pathway genes), are possibly associated with the regressive features (such as eye degeneration, albinism, rudimentary scales and lack of circadian rhythms), and that some gene expansion (e.g. taste-related transcription factor gene) may point to the constructive features (such as enhanced taste buds) which evolved in these cave fishes.

As the first report on cavefish genomes among distinct species in Sinocyclocheilus, our work provides not only insights into genetic mechanisms of cave adaptation, but also represents a fundamental resource for a better understanding of cavefish biology.

Additional References

RELATED GEPHE

Related Genes

1 (opsin - rhodopsin (LWS)) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^7955^/and+Trait=Color vision/or+Taxon ID=^1608454^/and+Trait=Color vision/or+Taxon ID=^75366^/and+Trait=Color vision/or+Taxon ID=^307959^/and+Trait=Color vision/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

1 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^Green-sensitive opsin (RH2)^/and+Taxon ID=^7955^/or+Gene Gephebase=^Green-sensitive opsin (RH2)^/and+Taxon ID=^1608454^/or+Gene Gephebase=^Green-sensitive opsin (RH2)^/and+Taxon ID=^75366^/or+Gene Gephebase=^Green-sensitive opsin (RH2)^/and+Taxon ID=^307959^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS