Comparative cytogenetic mapping of rRNA genes among naked catfishes: Implications for genomic evolution in the bagridae family

Sapiwong, W., Liehr, T., Cioffi, M.B., Chaveerach, A., Kosyakova, N., Fan, X., Tanee, T., Tanomtong, A.

Abstract

In the present study, the karyotype and chromosomal characteristics of 9 species of the Bagridae fish family were investigated using conventional Giemsa staining as well as dual-color fluorescence in situ hybridization to detect the 18S and 5S rDNA sites. In addition to describing the karyotype of several Bagridae catfishes, we established molecular cytogenetic techniques to study this group. The 9 species contained a diploid chromosomal number, varying from 50 (Pseudomystus siamensis) to 62 (Hemibagrus wyckii), while none contained heteromorphic sex chromosomes. 18S rDNA sites were detected in only 1 chromosomal pair among all species evaluated. However, 3 different patterns were detected in only 1 chromosomal pair among all species evaluated. However, 3 different patterns were observed for the distribution of the 5S rDNA: 2 sites were found in the genus Mystus and in P. siamensis, multiple sites were observed in the genus Hemibagrus, and a syntenic condition for the 5S rDNA sites was identified in H. wyckii. The extensive variation in the number and distribution patterns even among closely related species. In summary, the distribution of repetitive DNAs provided novel, useful information regarding the evolutionary relationships between Bagridae fishes.

Author keywords
Fluorescence in situ hybridization; Freshwater fishes; Karyotype evolution; Molecular cytogenetics; Ribosomal DNA

Indexed keywords
EMTREE drug terms: DNA 18S; DNA 5S
EMTREE medical terms: 18S rRNA gene; SS rRNA gene; Article; catfish; chromosome pairing; chromosome positioning; cytogenetics; DNA sequence; eukaryote evolution; female; fluorescence in situ hybridization; gene cluster; gene mapping; genetic variability; genome; Hemibagrus filamentus; Hemibagrus nemurus; Hemibagrus wyckii; Hemibagrus wyckioideus; male; Mystus atrifasciatus; Mystus bocourti; Mystus mysticetus; nonhuman; Pseudomystus siamensis; RNA gene; sex chromosome

Species Index: Bagridae; Pisces; Siluriformes

Cited by 1 document

Chromosomal evolution in naked catfishes (Bagridae, Siluriformes): A comparative chromosome mapping study
Sapiwong, W., Liehr, T., Cioffi, M.B.
(2014) Zoologischer Anzeiger

Related documents

Karyotype and cytogenetic mapping of 9 classes of repetitive DNAs in the genome of the naked catfish Mystus bocourti (Siluriformes, Bagridae)
Sapiwong, W., Liehr, T., Cioffi, M.B.
(2013) Molecular Cytogenetics

Chromosomal evolution in naked catfishes (Bagridae, Siluriformes): A comparative chromosome mapping study
Sapiwong, W., Liehr, T., Cioffi, M.B.
(2014) Zoologischer Anzeiger

Chromosomal mapping of the major and minor ribosomal genes, (GATA)n and U2 snRNA gene by double-colour FISH in species of the Batrachoididae family
Ubodo-Manzanaro, M., Merlo, M.A., Palazón, J.L.
(2010) Genetica

Mendeley Readership Statistics

View this article in Mendeley

References (40)

View in search results format


<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Authors</th>
<th>Year</th>
<th>Journal</th>
<th>Volume</th>
<th>Pages</th>
<th>DOI</th>
<th>Cited Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Linkage disequilibrium and molecular drive in the rDNA gene family</td>
<td>Dover, G.A.</td>
<td>1989</td>
<td>Genetics</td>
<td>122</td>
<td>249-252</td>
<td>10.1139/g03-007</td>
<td>51</td>
</tr>
<tr>
<td>12</td>
<td>Checklist of catfishes, recent and fossil (Osteichthyes: Siluriformes), and catalogue of siluriform primary types</td>
<td>Ferraris Jr., C.J.</td>
<td>2007</td>
<td>Zootaxa</td>
<td>1418</td>
<td>1-628</td>
<td></td>
<td>311</td>
</tr>
<tr>
<td>13</td>
<td>Chromosomal mapping of 18S-28S and 5S rRNA genes by two-colour fluorescent in situ hybridization in six sturgeon species</td>
<td>Fontana, F., Lanfredi, M., Congiu, L., Leis, M., Chicca, M., Rossi, R.</td>
<td>2003</td>
<td>Genome</td>
<td>46</td>
<td>473-477</td>
<td>10.1139/g03-007</td>
<td>31</td>
</tr>
<tr>
<td>14</td>
<td>Mapping of the 18S and 5S ribosomal RNA genes in the fish Prochilodus argenteus Agassiz, 1829 (Characiformes, Prochilodontidae)</td>
<td>Hatanaka, T., Galetti, P.M.</td>
<td>2004</td>
<td>Genetics</td>
<td>122</td>
<td>239-244</td>
<td>10.1007/s10709-004-2039-y</td>
<td>138</td>
</tr>
<tr>
<td>15</td>
<td>Chromosomal location of 5S and 18S rRNA genes in Prochilodus lineatus (Characiformes, Prochilodontidae)</td>
<td>De Jesus, C.M., Moreira-Filho, O.</td>
<td>2003</td>
<td>Caryologia</td>
<td>56</td>
<td>281-287</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>18</td>
<td>Repeated genes in eukaryotes.</td>
<td>Levan, A., Fredga, K., Sandberg, A.A.</td>
<td>1964</td>
<td>Hereditas</td>
<td>52</td>
<td>201-220</td>
<td></td>
<td>2476</td>
</tr>
<tr>
<td>21</td>
<td>Mystus multiradiatus, M. castaneus, M. atrifasciatus, Batasio havmoller and Sperata acicularis from Thailand, Proceedings of the 47th Kasetsart University Annual Conference, Kasetsart, Fisheries. Kasetsart University, Bangkok</td>
<td>Magtoon, W., Donsakul, T.</td>
<td>2009</td>
<td>Mystus multiradiatus, M. castaneus, M. atrifasciatus, Batasio havmoller and Sperata acicularis from Thailand</td>
<td></td>
<td>328-336</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

http://www.scopus.com/record/display.url?eid=2-s2.0-84900312526&origin=resultslist&zone=contextBox
Comparative chromosomal mapping in Triportheus fish species. Analysis of synteny between ribosomal genes
doi: 10.1016/j.micron.2012.11.008
View at Publisher

Martins, C., Galetti Jr., P.M.
Chromosomal localization of 5S rDNA genes in Leporinus fish (anostomidae, characiformes)
doi: 10.1023/A:1009216030316
View at Publisher

Martins, C., Galetti Jr., P.M.
Conservative distribution of 5S rDNA loci in Schizodon (Pisces, Anostomidae) chromosomes
doi: 10.1023/A:1009243815280
View at Publisher

Martins, C., Galetti P.M., Jr.
Organization of 5s rDNA in species of the fish Leporinus: Two different genomic locations are characterized by distinct nontranscribed spacers
doi: 10.1139/gen-44-5-903
View at Publisher

Martins, C., Ferreira, I.A., Oliveira, C., Foresti, F., Galetti Jr., P.M.
Dynamics of 5S rDNA in the tilapia (Oreochromis niloticus) genome: Repeat units, inverted sequences, pseudogenes and chromosome loci
doi: 10.1159/000068542
View at Publisher

Moran, P., Martinez, J.L., Garcia-Vazquez, E., Pendas, A.M.
Sex chromosome linkage of 5S rDNA in rainbow trout (Oncorhynchus mykiss)
View at Publisher

Nakajima, R.T., Cabral-De-Mello, D.C., Valente, G.T., Venere, P.C., Martins, C.
Evolutionary dynamics of rRNA gene clusters in cichlid fish
doi: 10.1186/1471-2148-12-198
View at Publisher

Nanda, I., Schartl, M., Feichtinger, W., Schlupp, I., Parzefall, J., Schmid, M.
Chromosomal evidence for laboratory synthesis of a triploid hybrid between the gynogenetic teleost Poecilia formosa and its host species
doi: 10.1006/jfbi.1995.0165
View at Publisher

Nelson, J.S.
View on Web

Pendas, A.M., Moran, P., Freije, J.P., Garcia-Vazquez, E.
Chromosomal mapping and nucleotide sequence of two tandem repeats of Atlantic salmon 5S rDNA
View at Publisher

- Pinhal, D., Yoshimura, T.S., Araki, C.S., Martins, C.
- The 5S rDNA family evolves through concerted and birth-and-death evolution in fish genomes: An example from freshwater stingrays
(2011) BMC Evolutionary Biology, 11 (1), art. no. 151. Cited 19 times.
View at Publisher

- Pinkel, D., Straume, T., Gray, J.W.
- Cytogenetic analysis using quantitative, high-sensitivity, fluorescence hybridization
View at Publisher

- Poletto, A.B., Ferreira, I.A., Martins, C.
- The B chromosomes of the African cichlid fish Haplochromis obligidens harbour 18S rRNA gene copies
doi: 10.1186/1471-2156-11-1
View at Publisher

- Rainboth, W.J.

Food and Agriculture Organization of the United Nation, Rome

- Rocco, L., Costagliola, D., Fiorillo, M., Tinti, F., Stingo, V.
- Molecular and chromosomal analysis of ribosomal cistrons in two cartilaginous fish, Taeniura lyamma and Raja montagui (Chondrichthyes, Batoidea)
doi: 10.1007/s10709-004-2451-3
View at Publisher

- Numeric and structural chromosome polymorphism in Rineloricaria lima (Siluriformes: Loricariidae): Fusion points carrying 5S rDNA or telomere sequence vestiges
doi: 10.1007/s11160-011-9250-6
View at Publisher

- Sharma, O.P., Tripathi, N.K.
View at Publisher

- Vidhyayanon, C.
2nd edn. Sarakadee Press, Bangkok

Chaveerach, A.; Department of Biology, Khon Kaen University, Muangkhonkaen District, Thailand
© Copyright 2014 Elsevier B.V., All rights reserved.