

Chromosomes of *Girella laevisfrons* (Tschudi 1846) (Osteichthyes: Kyphosidae)

Cromosomas de *Girella laevisfrons* (Tschudi 1846) (Osteichthyes: Kyphosidae)

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RESUMEN

El número cromosómico y la morfología del cariotipo de *Girella laevisfrons* (Tschudi 1846) son descritos por primera vez. *G. laevisfrons* presenta un número cromosómico $2n = 48$ y su cariotipo está constituido por 24 pares de cromosomas acrocéntricos en ambos sexos, similar a lo documentado previamente para otras especies del género *Girella* Gray, 1835.

ABSTRACT

The chromosome number and karyotype morphology of *Girella laevisfrons* (Tschudi 1846) are described for the first time. *G. laevisfrons* presents a chromosome number of $2n = 48$ and its karyotype is formed in both sexes by 24 acrocentric chromosome pairs, similar to what has been described for other species of *Girella* Gray, 1835.

Girella laevisfrons (Tschudi 1846) is an abundant fish species distributed in the Pacific coast and islands from Guañape in Perú to El Tabo in Chile (8°S to 33°S; Pequeño & Sáez 2008). At present, genetic studies on *G. laevisfrons* are not available and basic aspects, such as chromosome number and karyotype structure, remain unknown. The lack of genetic studies on *G. laevisfrons* contrasts with the varied systematics research centered in other species of *Girella*, which include information on karyotypes, C and Ag-NOR banding, allozyme electrophoresis, PCR-RFLP markers, and gene sequences (Hinegardner & Rosen 1972, Ueno & Ojima 1991, Yagishita *et al.* 2002, Matsuoka 2002, Hardie & Hebert 2004, Itoi *et al.* 2007, Saito *et al.* 2008). The characterization of karyotype changes (e.g., numerical and/or structural) among related fish species is important to understand processes of genetic variation, genome evolution and speciation, as well as to delimit taxa (Winkler *et al.* 2004).

Here we describe for the first time the karyotype morphology of *G. laevisfrons* and compare it with that already reported for other species of the genus.

Ten specimens including five males and five females of *G. laevisfrons* were collected at the Pacific coast in a beach located in front of the Universidad de Antofagasta, San Jorge Bay, Chile (23° 42 'S; 70° 26 'W). The

cytological protocol described by Northland-Leppe *et al.* (2009) was followed. Chromosomes were measured in photomicrographic enlargements of ten metaphases. The karyotype was made up with the chromosomes ordered on the basis of decreasing length.

Male and female individuals of *G. laevisfrons* showed a diploid chromosome number $2n = 48$ (NF = 48); the karyotype is composed only by acrocentric chromosomes (Fig. 1). Chromosomes are small (length < 4.0 μ m). Chromosomes lack secondary constriction and satellites. Sex chromosomes were not identified using conventional Giemsa staining.

Resemblance in chromosome number and karyotype morphology was observed among *G. laevisfrons* and the Japanese species *G. melanichthys* Richardson, 1846 and *G. punctata* Gray, 1835 (Nishikawa & Karasawa 1972, Ueno & Ojima 1991). However, conspicuous secondary constrictions co-localized with Ag-NOR bands in one pair of large chromosomes described in kidney cells of *G. melanichthys* (Ueno & Ojima 1991) were not observed in chromosomes of *G. laevisfrons* obtained from gill cells. The absence of secondary constrictions in *G. laevisfrons* may be due to technical artefacts, or by the existence of functional differences of ribosomal genes among different tissues of different species (Sánchez *et al.* 1990). The use

of Fluorescence *in situ* hybridization aimed to locate rDNA would help clarify this issue.

The karyotype resemblance among species of *Girella* is remarkable and can also be extended to species of *Kyphosus* Lacepede, 1801 (Table I). Karyological resemblance between these two genera of the family Kyphosidae is also seen in DNA C-values. C-values of *Girella* fall within the range documented for *Kyphosus* and other genera of Kyphosidae (Table I). These genome similarities (i.e., chromosome number and morphology, DNA C-values),

although partial, support the close relationship among *Girella* and *Kyphosus* previously proposed by Yagishita et al. (2002) based on molecular phylogenies. Interestingly, *G. mezina* Jordan & Starks, 1907 and *G. punctata* Gray, 1835 included in that same phylogeny appeared as very close species, which is consistent with the karyotype resemblances discussed in the present work.

Finally, despite recent advances on genetic studies in *Girella* species, several issues remain unclear. Additional research using conventional and/or molecular cytogenetic techniques

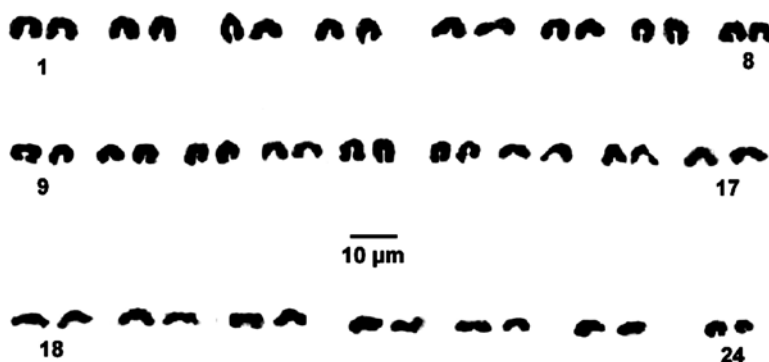


FIGURE 1. Karyotype of *Girella laevisfrons*, $2n = 48$.

FIGURA 1. Cariotipo de *Girella laevisfrons*, $2n = 48$.

TABLE I. Cytogenetic characters of species of Kyphosidae from Chile and Japan. $2n$, somatic chromosome number; FN, arms fundamental number; L, largest chromosome length; S, shortest chromosome length; CV(pg), haploid DNA content in picograms (C-value).

TABLA I. Caracteres citogenéticos de especies de Kyphosidae de Chile y Japón. $2n$, Número cromosómico somático; FN, número fundamental de brazos; L, longitud del cromosoma más largo; S, longitud del cromosoma más corto; CV(pg), contenido de ADN haploide en picogramas (valor C).

| Species | $2n$ | FN | CV(pg) | Haploid karyotype formula | References |
|--|------|----|--------|----------------------------------|----------------------------|
| <i>Girella laevisfrons</i> (Tschudi 1846) | 48 | 48 | - | 24 acrocentric | Present study |
| <i>G. melanichthys</i> Richardson, 1846 | 48 | 48 | - | 24 acrocentric | Ueno & Ojima (1991) |
| <i>G. punctata</i> Gray, 1835 | 48 | - | - | - | Nishikawa & Karasawa 1972) |
| <i>G. nigricans</i> Ayres, 1860 | - | - | 1.10 | - | Hinegardner & Rosen (1972) |
| <i>G. tricuspidata</i> Quoy & Gaimard, 1824 | - | - | 0.90 | - | Hardie & Hebert (2004) |
| <i>Kyphosus</i> sp. Lacepede, 1801 | 48 | 50 | - | 1 submetacentric, 23 acrocentric | Takai & Ueno (1997) |
| <i>K. lembus</i> (Cuvier, 1831) | 48 | 50 | - | 1 submetacentric, 23 acrocentric | Takai & Ueno (1997) |
| <i>K. cinerascens</i> (Forsskal, 1775) | 48 | 50 | - | 1 submetacentric, 23 acrocentric | Takai & Ueno (1997) |
| <i>K. bigibbus</i> Lacepede, 1801 | 48 | - | 0.87 | - | Ojima & Yamamoto (1990) |
| <i>Labracoglossa argentiventris</i> Peters, 1866 | - | - | 0.90 | - | Ojima & Yamamoto (1990) |
| <i>Medialuna californiensis</i> (Steindachner, 1876) | - | - | 0.81 | - | Hinegardner & Rosen (1972) |
| <i>Scorpius lineolatus</i> Kner, 1865 | - | - | 1.06 | - | Hardie & Hebert (2004) |

could be applied to study *G. laevisfrons* and insular Chilean species of *Girella* (e. g., *G. albostrata* Steindachner, 1898; *G. felicianana* Clark, 1938; *G. nigricans*) (Pequeño & Sáez 2000). These studies would allow envisaging mechanisms of karyotype evolution within the genus. Advances in this field have been documented by Takai & Ueno (1997) for species of the genus *Kyphosus* in which some characters (e. g. chromosome number and morphology, Ag-NOR location, some C-bands) are conserved and perhaps have been retained from the common ancestor of the group, whereas karyotype modification would be mainly caused by amplification of constitutive heterochromatin.

ACKNOWLEDGEMENTS

Our thanks to two anonymous reviewers for their comments.

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Recibido: 12.05.10
Aceptado: 09.09.10