

THE KARYOTYPE OF *SCORPAENA BRASILIENSIS* AND *S. ISTHMENSIS*  
(SCORPAENIFORMES: SCORPAENIDAE: SCORPAENINAE) FROM MARGARITA  
ISLAND, VENEZUELA.

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**Abstract:** We report on the results of the cytogenetic study of *Scorpaena brasiliensis* and *S. isthmensis* from Venezuela by conventional Giemsa staining and silver staining. *S. brasiliensis* has a complement  $2n=46$  composed of two metacentric (M), 8 submetacentric (SM) and 36 subtelocentric (ST/A), NF= 56 with NORs located in the terminal position of the short arms of the pair number 7, whereas *S. isthmensis* showed a diploid number  $2n=38$ , composed of 8 M, 8 SM y 22 A, NF= 54 with NORs located in terminal position in the long arm of the pair number 9. The comparison of these results with those of a previous report from Brazil reflects a clear differentiation at chromosomal level between the populations from the Caribbean and those from Brazil, which is, explained as the result of gross chromosome reorganization involving fusion, pericentric inversion and translocation processes. Since the Caribbean and Brazilian populations of these species are separated by the massive discharge of fresh water from the Amazonas and the Orinoco rivers, we suggest that further studies will be necessary to determine the status of these two groups either as distinct populations or as separate species.

**Keywords:** Karyotype, NORs, populations, Scorpaenidae, *Scorpaena brasiliensis*, *S. isthmensis*.

#### INTRODUCTION:

With mimetic habits and adaptation capacity that allow Scorpaenidae to live in a variety of marine environments, this family is common in all tropical and temperate seas (NELSON 2006). This group contains 227 valid species, including three subfamilies Scorpaeninae, Caracanthinae and Pteroinae with 196, 4 and 27 species, respectively (ESCHMEYER & FONG 2016).

In spite of their high number of species, cytogenetic studies on Scorpaeninae are scarce. Indeed, the most comprehensive checklist on fish karyotypes (ARAI 2011 and references herein) shows that only 17 species of this subfamily were karyotyped (about 8%) exhibiting a remarkable chromosome diversity with variable diploid number ( $2n=36-48$ ) and arm number (FN= 52 – 86).

Specimens of *Scorpaena brasiliensis* and *S. isthmensis* from Rio de Janeiro coast (Brazil) were karyotyped by CORREA & GALETTI (1997) who found  $2n=46$  and  $2n=40$  respectively. In this paper we provide karyological information about these two species from Venezuela with the main aim of comparing the karyotypic structure of these markedly separated populations.

#### MATERIALS AND METHODS:

Eight specimens of *Scorpaena brasiliensis* and four of *S. isthmensis*, collected at southeast of Peninsula of Macanao (10°55'N, 64°11'W), Margarita Island, Venezuela, were analyzed.

Twenty-four hours before chromosome preparations, the fishes were injected intramuscularly with a yeast glucose solution (OLIVEIRA *et al.* 1988) to stimulate mitosis.

Following the guidelines of the American Veterinary Medical Association for euthanasia of animals (AVMA 2013), fish were sacrificed by numbing them with an overdose of Benzocaine (250 mg/l) until the cessation of opercula movement, before removing the kidney. The specimens were fixed in 10% formalin, preserved in 70% alcohol, identified and vouchers deposited in the fish collection of Escuela de Ciencias Aplicadas del Mar, Universidad de Oriente, Venezuela (Voucher number: *S. brasiliensis* ECAM-0917; *S. isthmensis* ECAM-907).

Chromosome preparations were obtained from kidney cells according to the techniques described by NIRCHIO & OLIVEIRA (2006). Active nucleolus organizer regions (NORs) were revealed by silver (Ag) staining as described by HOWELL & BLACK (1980) sequentially after Giemsa staining (RÁBOVÁ *et al.* 2015).

Stained metaphases were photographed using a Motic B400 microscope, equipped with a Moticam 5000C digital camera. Chromosomes were classified according to the arm ratio criteria (LEVAN *et al.* 1964).

## RESULTS AND DISCUSSION:

*Scorpaena brasiliensis* here analyzed, presented a karyotype  $2n=46$  composed of two metacentric (M), 8 submetacentric (SM) and 36 subtelo/acrocentric (ST/A),  $NF=56$ ; whereas *S. isthmensis* showed a diploid number  $2n=38$ , composed of 8 M, 8 SM and 22 A,  $NF=54$ . In *S. brasiliensis* the NORs were located in the terminal position of the short arms of the pair number 7 and in *S. isthmensis* in the terminal position in the long arm of the pair number 9.

TABLE 1 presents a summary of the cytogenetic results of CORREA & GALETTI (1997) and those obtained in the present study. It is not easy to establish comparisons between our results and those reported by CORREA & GALETTI (1997) since these authors did not employ the nomenclature of LEVAN *et al.* (1964) for classifying the chromosomes and the figures of the karyotypes that appear in their paper do not allow establishing homologies among the chromosomal pairs.

Nonetheless, in the case of *S. isthmensis*, differences in diploid number and position of NORs are so evident that lead to assume that those modifications have probably arisen through at least the fusion of two ST/A chromosome pairs reducing the diploid number from  $2n=40$  in the Brazilian sample to  $2n=38$  in Venezuelan sample or vice versa, and a pericentric inversion that could change the position of the NORs in the same chromosome or a translocation of the NOR from the tips of the short arm of chromosome pair number 5 in the Brazilian sample to the tips of the long arm of the chromosome pair number 9 in the Venezuelan sample or vice versa.

Since populations of fishes from the Caribbean and those from Brazil are separated by a geographical barrier such as the discharge of freshwater from the Amazonas and Orinoco rivers (ROCHA 2003), the clear differentiation at chromosomal level (diploid number, NOR bearing chromosomes and position of the NORs on the carrier elements) among these population, lead to conclude that further studies will be necessary to determinate the population or species level status of these groups.

TABLE 1. Summary of the cytogenetic results of CORREA AND GALETTI (1997) and those obtained in the present study.

Species	<i>S. brasiliensis</i>		<i>S. isthmensis</i>	
	Brazil	Venezuela	Brazil	Venezuela
Diploid number	46	46	40	38
Number of M/SM	14	4	14	16
Number of ST/A	32	42	26	22
FN	60	50	54	54
NOR-bearing chromosomes/position	2/tips of short arms	7/tips of short arms	5/tips of short arms	9/tips of long arms

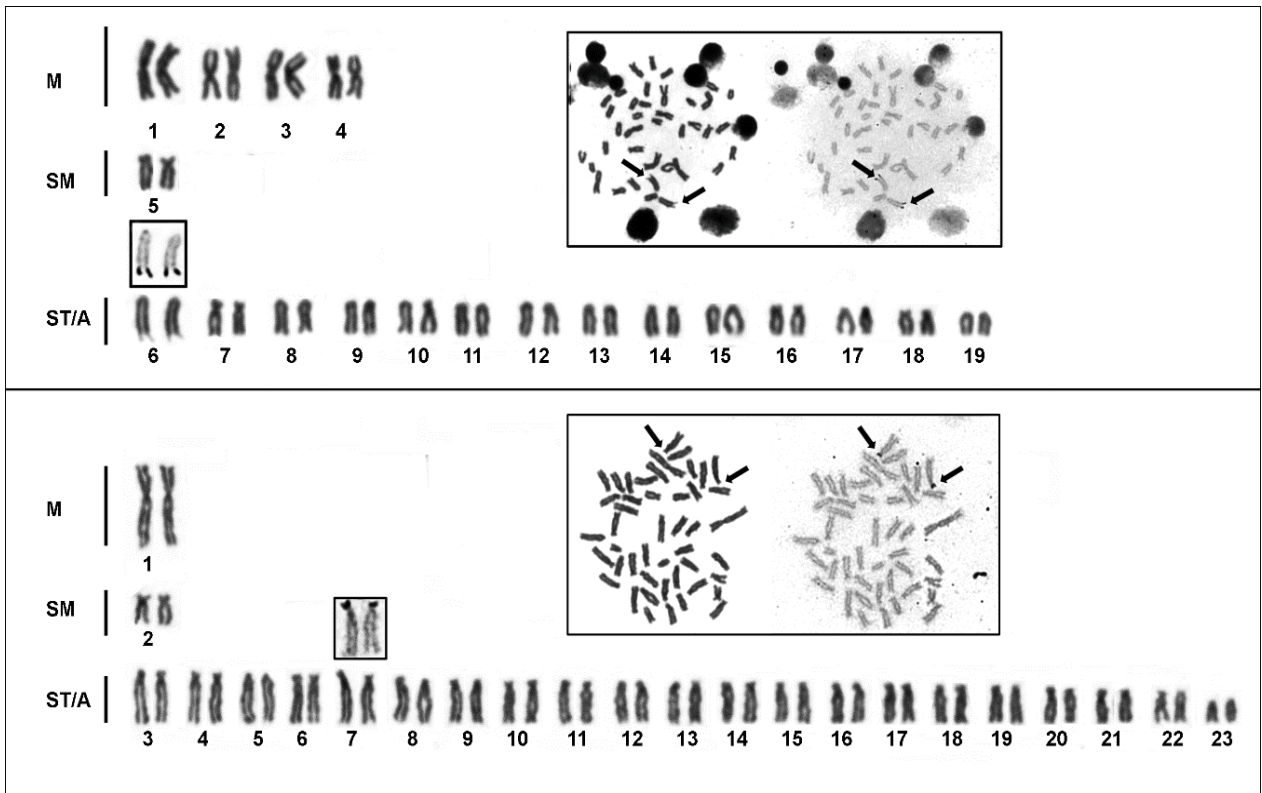


Figure 1. Conventional Giemsa-stained karyotype of a) *Scorpaena isthmensis*, b) *Scorpaena brasiliensis*. In the insets the NOR-bearing chromosomes identified through sequential staining. Plates after sequential staining are showed.

#### ACKNOWLEDGEMENTS:

This research was partially funded by Consejo de Investigacion, Universidad de Oriente, through Research Project CI-6-030602-1 303/2006.

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Recibido: Marzo 2016

Aceptado: Abril 2016