A CHROMOSOMIC STUDY OF THE MARINE BIVALVE *MODIOLUS ARCUATULUS* (HANELY 1844) (PTERIOMORPHIA : MYTILIDAE)

ABSTRACT

Chromosomes were counted in the preparations of gill and gonad tissues from *Modiolus arcuatulus*, a predominant mytilid collected from Lake Timsah (Suez Canal, Egypt). A basic chromosome number of (2n = 24) was presented. The karyotype consists of 5 metacentric and 7 submetacentric chromosome pairs. This result was recorded for the first time in Egypt.

Introduction

CYTOGENETICS has made a tremendous contribution to the development of animal taxonomy. White (1973) reported that cytogenetics is concerned with the cytotaxonomic differences which exist between related species. They rarely involve major differences in the genetic mechanism, but often deal with differences in the chromosome complement, such differences are sometimes useful to distinguish cryotic species that can not be separated by non-cytologists.

Because of the scarcity of workers in the field of cytogenetics of invertebrates, molluscan cytogenetics has lagged behind the rapid technological developments in the cytogenetics of man and other vertebrates. Early work in molluscan cytogenetics was generally aimed at the establishment of chromosome counts for freshwater snails by Patterson (1971). Later workers were able to obtain information about the chromosome size and centromeric position. Some excellent results have been obtained including G and C banding preparation form land snails by Babrakzia *et al.* (1975).

Subclass Pteriomorphia consists of three orders, Arcoida, Mytiloida and Pterioida and is accepted by many paleontologists as a phylogenetic unit (Newell, 1965). Within the last two decades, chromosome numbers for 39 species in this subclass have been reported based on the squash or the flame drying method (Ahmed, 1974).

Nakamura (1985) reviewed recent investigations on chromosomes of 125 bivalve species belonging to 102 recent families. Of these 125 species, 73 belonging to the Mytilidae, Pectinidae, Ostreidae and Unionacea and other species are scattered mostly within the pteriomorphia, with a fewer within the Heterodonta.

Cytogenetic information related to the bivalve species is somewhat confusing largely due to different methods of tissue preparation and slide manufacture which have been employed in the separate studies (Ahmed and Sparks, 1970; Ieyama and Inaba, 1974; Thiriot and Ayraud, 1982; Rasotto *et al.*, 1981; Corni and Trentini, 1986).

To the best of our knowledge chromosomal studies on Egyptian invertebrates are generally lacking except Yassen (1990); Yassen and EL-Shimy (1990); Yaseen *et al.* (1990); Mona *et al.* (1990); Yassen *et al.* (1991 a, b). *Modiolus arcuatulus* is the most commercially important bivalve of the family Mytilidae in Egypt. So, the aim of the present study is to determine the chromosome number and describe the karyotype of this species.

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Materials and methods

The specimens of *Modiolus arcuatulus* were collected from Lake Timsah, Suez Canal from November 1989 to April 1990. They were housed in the laboratory tanks of aerated sea water, and fed continuously to promote somatic growth.

Chromosomal preparations : Whole animals were treated 2-4 hours with 0.05% colchicine in sea water. Then the gills and gonad tissues were removed under the dissecting microscope and treated 40 min. in 0.9% sodium citrate. The materials were then fixed in freshly prepared mixture of absolute and acetic acid (3:1) with three changes of 20 min. duration. Slide preparations were made following an air-drying technique of Kligerman and Bloom (1977) with some modifications made by Nakamura (1986).

Data analysis : The number of chromosomes seen in the photomicrographs of at least 10 spread metaphases were counted for this species. Then, the photographs of individual chromosomes from the better spreads were cut out and arranged in pairs on the basis of size and centromere position for the karyotype. Nomenclature of chromosome types adopted by Levan *et al.* (1964) was used in the present study.

Results and discussion

The chromosomes of 20 mitotic metaphase spreads were counted. All cells showed the diploid chromosome number of 2n = 24 as shown in the (Pl. I A). The chromosome complements were arranged into pairs in two groups on the basis of size and centromere position for karyotype (Pl. I B). Arm ratio, relative length and centromeric indices were given in Table 1. Idiograms (Fig. 1 a, b), were constructed from relative length and centromeric indices with the centromeres drawn at the same level to make visual comparison more easier.

TABLE 1. *Averages of ten cell spreads of chromosome measurements and classification of* Modiolus arcuatulus

Chromosome pair number	Chromosome length: long arm mean ± S.D	Chromosome length: short arm mean ± S.D	Total	Relative length %: Long arm	Relative length %: short arm	Total	Arm ratio	Centromeric index %	Classification
1	3.99±0.2	3.99±0.1	7.98	5.99	5.99	11.89	1.00	50.00	M
2	3.77±0.4	2.70±0.6	6.47	5.65	4.05	9.70	1.4	41.73	M
3	3.55±0.3	2.54±0.2	6.09	5.32	3.81	9.13	1.4	41.70	M
4	2.76±0.5	2.42±1.2	5.18	4.14	3.63	7.77	1.14	46.72	M
5	1.75±0.5	1.70±0.1	3.45	2.62	2.55	5.17	1.03	49.28	M
6	4.91±0.3	1.69±1.1	6.60	7.36	2.53	9.89	2.91	25.60	SM
7	4.26±0.4	2.03±0.2	6.29	6.39	3.04	9.43	2.10	32.27	SM
8	3.75±0.4	1.86±0.7	5.61	5.62	2.79	8.41	2.01	33.16	SM
9	3.65±0.4	1.70±0.9	5.35	5.47	2.55	8.02	2.15	31.78	SM
10	3.48±0.3	1.60±1.1	5.08	5.12	2.4	7.61	2.18	31.50	SM
11	3.36±0.5	1.52±0.8	4.88	5.04	2.28	7.32	2.21	31.15	SM
12	2.35±0.3	1.36±0.2	3.71	3.52	2.04	5.56	1.73	36.66	SM
Sum			66.69						

As shown in the Table and Plate (I B), the karyotype consists of 5 metacentric and 7 submetacentric chromosome pairs.

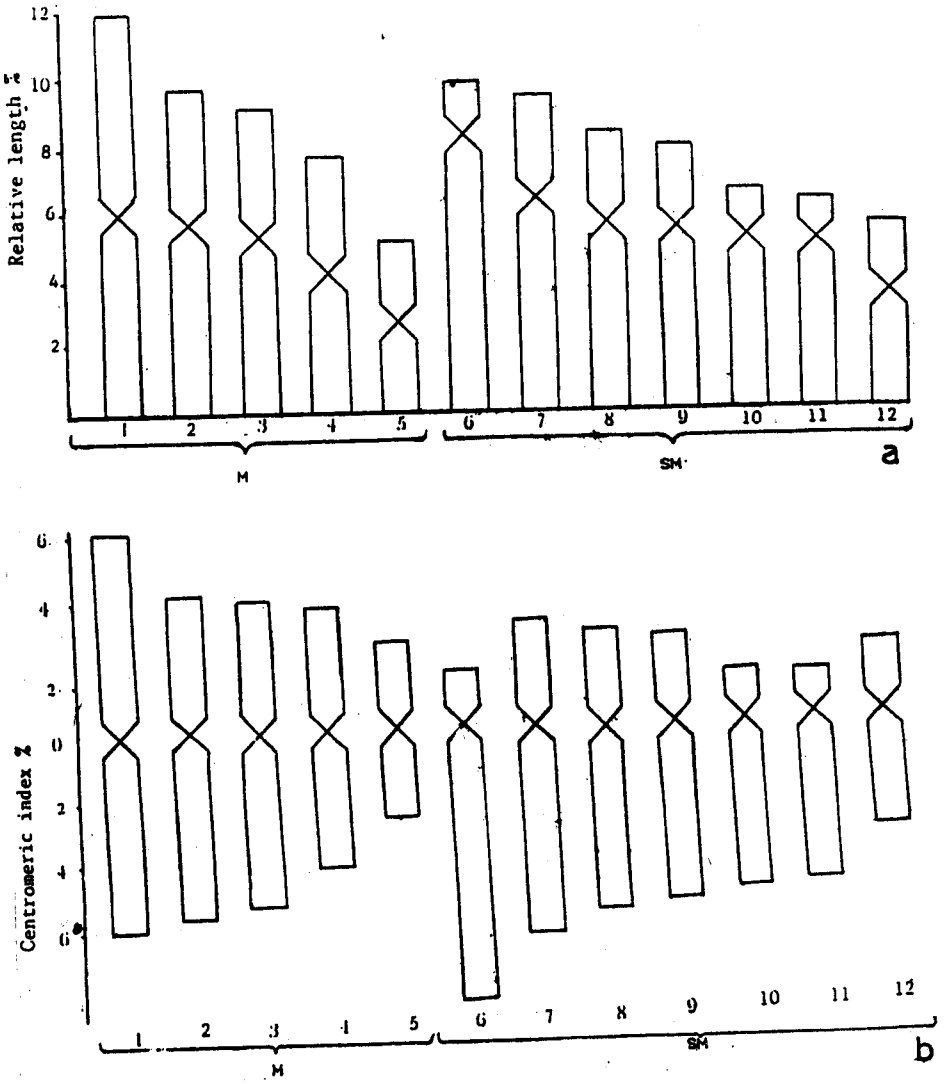

FIG. 1. Idiogram of the chromosomes of *M. arcuatulus* : a. relative to relative length and b. to the centromeric index.

In the family mytilidae diploid number of chromosomes (2n) have been reported to be 32 in *Lithophaga curta* (Ieyama, 1984), 28 in *Musculus laevigatus, Mytilus edulis* and *Siptifer keenae* (Ieyama, 1983 a, b 1984), 22 in *Vignadula atrata* (Ieyama, 1977). In the present study diploid chromosome number was reported

to be 24 in *Modiolus arcuatulus*. Thus, chromosome number is not constant within the family mytilidae. This is in disagreement with the statement of Patterson (1971) that there is a tendency for chromosome number to be stable within families of Pelecypoda such as Ostreidae.

The chromosomes of the present species are only of two types; metacentric and submetacentric. However, further studies using banding methods should be needed for precise chromosomes classifications.

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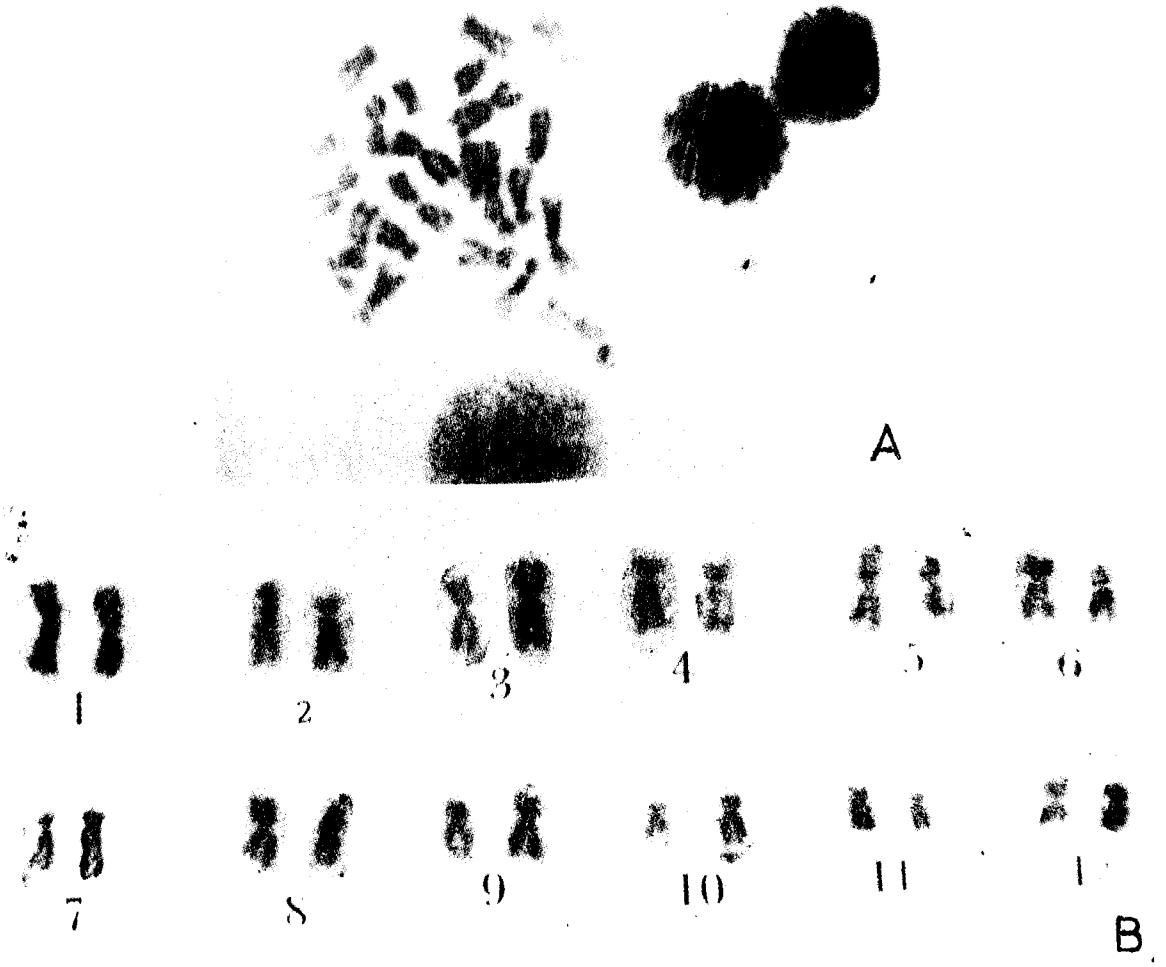

PLATE I. *Modiolus arcuatulus* : A Cell spread and B. Karyotype.