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A CYTOGENETICAL STUDY ON RED SEA MARINE BIVALVEIVALVES DOSINIA RADIATA (VENERIDAE: MOLLUSCA)

(With One Table & 2 Fig. & One Plate)

By

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دراسات وراثيه خلويه على احد ذوات المصراعين فى البحر الاحمر / دوزينيا راديانا)

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فى هذا البحث تم إجراء الفحوص والمعاملات المختبريه الدقيقه لتحديد التركيب الوراثى لنوع دوزينيا راديانا عن طريق التحليل الكروموسومى كما أستخدمت طريقة الزحف الكهربى (الالكتروفوريسس) لمعرفة بعض أنواع بروتينات الدم .

وقد تبين من الدراسه ان الاشكال السته المختلفه لهذا النوع تحتوى على نفس العدد الكروموسومى ٢ن = ١٤ ، هذا بالاضافه إلى أن دراسة الالكتروفوريسس أظهرت أن بروتينات الدم لهذاالنوع تحتوى على خمسة عشر بوتينا وأن هذه البروتينات موجوده فى أشكاله السته المختلفه مما يؤكد أن هذه الأشكال تنتمى إلى نوع واحد وهو دوزينيا راديانا .

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SUMMARY

Chromosomal analysis and electrophoretic studies were performed on six colour morphs of *Dosinia radiata* species collected from he same site (54 kms south of Quesir) on the Red Sea coast. Chromosomes were counted in preparations of gonads and gill tissues. The six colour morphs of this species have the same diploid chromosome number of 2n=14. Electrophoretic studies revealed the occurrence of 15 protein fractions in the haemolymph of the six morphs. Although all morphs of this species have the same electrophoretic protein pattern, there are a little variation of these protein concentrations due to some biological factors.

Keywords: Cytogenetical, Study, Red Sea Marine bivalve, *Dosinia radiata*

INTRODUCTION

In recent years cytogenetic studies have made a significant contribution to the development of animal taxonomy. Cytotaxonomists are concerned with chromosome differences (i.e. number and structure) which exist between different races, species, and higher taxonomic levels. Such differences are useful in distinguishing cryptic species that can not be separated morphologically *(WHITE 1973)*.

Although, there has been a considerable development of cytotaxonomic studies in the last twenty years, little information is available in the chromosome numbers and electrophoresis of the family Veneridae (Bivalvia) *(NAKAMURA, 1985 and CORNI and MANCINI, 1986)*. This is mainly due to technical difficulties caused by extremely small size of chromosome and difficulties in dissecting out the gonad for examination.

AVISE (1975) and POZDAL and NOEL (1984) reported that electrophoresis has become a powerful tool for distinguishing systematic relationship among groups of organisms, especially in the case of species which are morphologically polymorphic.

A review of literatures on the Red Sea bivalves revealed that these organisms have attracted the attention of a few investigators, *GOHAR and SOLIMAN (1963, a, b, c)* investigated some of the mytilids members. *SOLIMAN (1969, 1972)* investigated ecological aspects of a coral boring bivalve. Recently, *ABOUL-DAHAB (1984)* studied the internal argans and systems of the mytilid bivalve *Modiolus auriculatus*.

Although *Dosinia radiata* species is common in the Red Sea coast and it is of economic value as an important source of food, it has not attracted the attention of malacologists and cytogenetists. This organism displays considerable morphological variations in shell colour. The aim of the present work is to determine the chromosome number and protein variation for six morphs of this species.

MATERIALS and METHODS

Specimens of *Dosinia radiata* were collected from a single site on the Red Sea coast, 54 km south of the city of Quesir. They were housed in the tanks of aerated sea water and were fed continuously on microorganisms to promote somatic growth.

The warm-dry method of *CORNI and MANCINI (1986)* was adopted: one hour following an injection of 20 ul of 0.05% colchicine, pieces of testis, ovary and gill were dissected into 1% sodium citrate and left for 20 min., before fixation in Carnoy's fluid for 30 min., the treated tissues were then treated in 60% acetic acid on a warm slide on which they left rings of nuclei that were stained with Giemsa (pH 7) for 15-20 min.. Chromosome were examined and photographed with a Zeiss Ultraphot microscope.

The haemolymph of six healthy adult specimens from each morph of *Dosinia radiata* was obtained from the body cavity. The haemolymph was collected in clean bottles and stored at 4 °C before the electrophoretic run. The mussel haemolymph proteins were fractioned by sodium dodecyle sulphate polyacrylaide gel electrophoresis (SDS - PAGE), as described by *LAEMMLI (1970).*

RESULTS

Are present in Table 1 and One Figure and One Plate

DISCUSSION

Bosinia radiata is one of the common infaunal and sandy shore community of the Red Sea. It lives buried down to 15 centimeters below the surface level of the sand. The shape and ornamentation of the shell is similar to that of many sand burrowing bivalves. Dosinia radiata has six grades of colour.

Examination of a large number of the specimens has shown that ther is a diversity in the colour of the outer suface of the shell. The colouration of the periostracum can be differentiated into six grades as follows:

1- Yellowish white shell with white umbones.
2- Yellowish white shell, white umbones and brown, broad,
3- Yellowish white shell, white umbones and brown, broad, radial rays extending from umbones to the ventral margin of the shell.
4- Yellowish white shell with brownish umbones and brown radial rays extending from umbones to the ventral margin of the shell.
5- Pale brownish shell and umbones.
6- Yellowish white shell with brownish, circular rays near the umbo.

The chromsome number for *Dosinia radiata* was confirmeed by counts carried out on well spread metaphases obtained from gills, oogonial and spermatogonial germ line cells. At early pachytene stage (Fig. 1a), homologous chromosome forming each bivalent appear paired tight, indistinguishable and with irregular outlines, the staining of each element is not homogeneous because of the zones stained intensely than others. In the late pachytene stage, a shortening of the chromosomes seemed to take place and a polarized orientation of the chromosomes was present as shown in (Fig 1, b and c). At early and late diakinesis stages, it is no longer possible to surmise on the presence of chriasma because the chromosome appear tightly contracted (Fig. 1, d). There has been a large number of cells in early metaphase stage from testis in spermatogenesis and from ovary in oogenesis, as shown in (Fig. 1, e and f). The diploid chromosome number found has always been 2n=14 (Fig. 1, g) which has consequently confirmed the haploid number n=7 observed in meiotic plates (Fig. 1, h). The position of centromere was deduced from the presence in each element of a lighter zone. Because of the small size and the intense staining of the chromosomes, the authors were unable to make a karyotype for this species.

Polyacrylamide gel electrophoresis revealed the occurrence of 15 protein fractions in the haemolymph of the specimens of *Dosinia radiata* (P1. 1) and Fig. 2). These fractions persist in the haemolymph of the species and are identified as fractions A, to o. On the stained gels (P1, 1), six patterns were observed, each of them represents the pooled fraction of males and females of the same morph. The six morphs have similar electrophoretic pattern that consists of two strongly stained bands, plus slow and fast moving weakly stained bands at the top and bottom of the plate. These weak bands were too faint to show in photographs. The posterior region has the last five protein fractions (from A to E) ranging from 18, 500 to 36.000 g/d, while the region near the origin of the gel is backed with

a series of ten larger proteins (from F to O) with molecular weights more than 220,000 g/d. This area was difficult to interpert without the aid of a programmed scanner.

Although haemolymph proteins gave a similar pattern in each of the six morphs, the examination of the electrophoretic profiles (Fig. 2) revealed what appears to be quantitative changes in these different protein fractions between the different morphs. The concentration of each fraction of all mussel individuals is shown in Table 1.

CHENG (1964) reported that the protein concentration may vary up to 28% even using the same standardized technique and the variation in the protein concentration of each fraction is considered as a biological factor (i.e. nutritional state or reproductive condition). It would appear therefore that the colour pattern differences between individuals of *D. radiata*, while striking, are not related to genetic characters of the metabolic proteins.

The present authors conclude from the chromosomal analysis and electrophoretic studies that the six morphs are the product of intraspecific variation.

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Table 1: The relative intensity of various protein fractions from the haemolymph of the six morphs of Dosinia radiata.

Protein Fraction	Morph No. 1	2	3	4	5	6
A	4.10	7.50	7.40	7.10	2.80	9.80
B	0.50	0.40	3.30	0.90	1.70	0.90
C	0.90	24.50	2.40	2.50	1.10	1.80
D	1.00	2.50	2.00	2.60	0.80	1.90
E	0.20	2.40	4.00	1.40	2.00	0.80
F	7.50	5.00	7.00	15.20	2.50	18.50
G	5.80	26.00	3.80	1.50	1.60	1.20
H	1.00	7.50	8.00	2.50	3.70	2.00
I	1.10	3.80	21.80	1.40	0.70	11.00
J	1.70	4.80	2.40	3.00	0.10	0.70
K	0.80	22.00	6.00	32.10	0.60	0.80
L	0.80	5.10	26.90	9.30	22.40	35.20
M	33.30	6.80	10.00	11.20	11.30	23.60
N	28.80	2.50	6.50	7.60	35.50	30.00
O	27.10	12.10	20.20	19.50	22.10	2.00

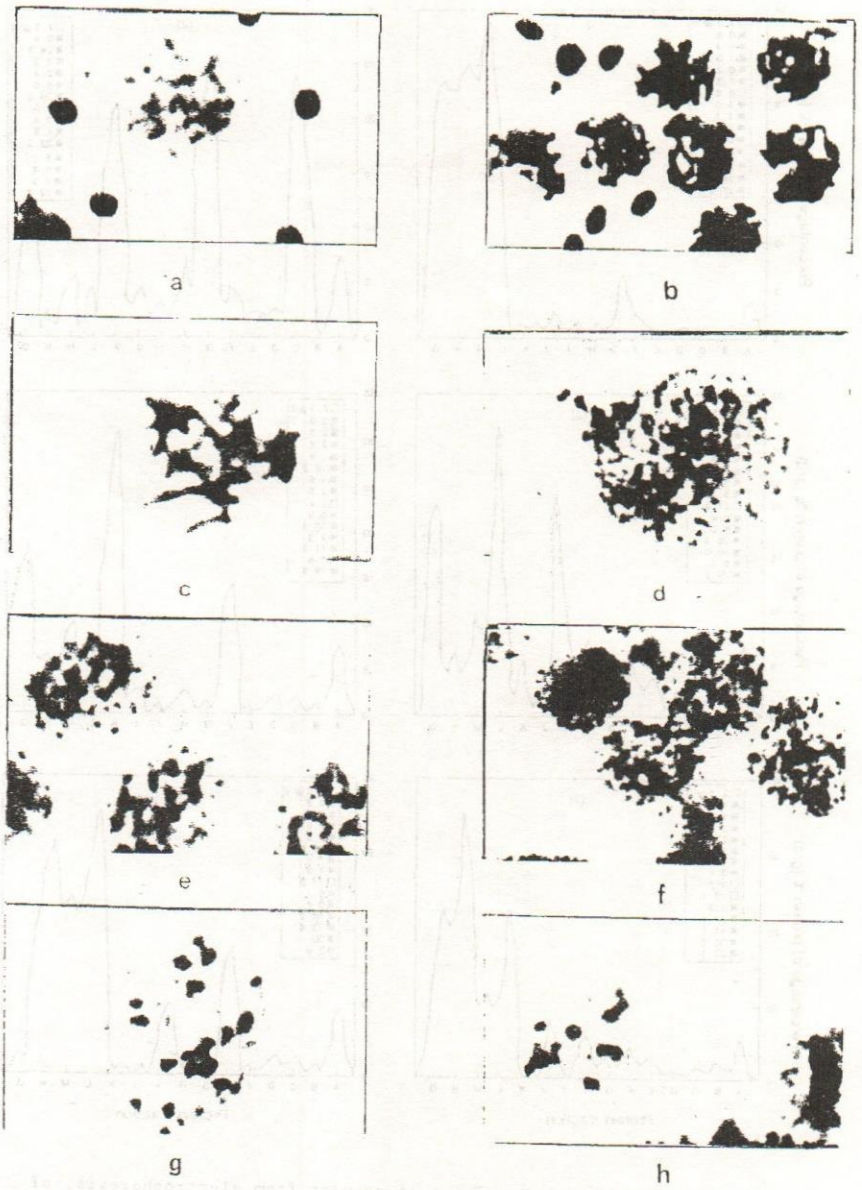


Fig. 1. *Dosinia radiata* species. (a) early pachytene stage. (b & c) late pachytene stage. (d) diakinesis stage showing the chromosomes appear tightly contracted. (e & f) a number of cells in early metaphase stage from spermatogenesis and oogenesis respectively, (g) metaphase stage showing the diploid chromosome number 2n=14, (h) the haploid chromosome number, n=7.

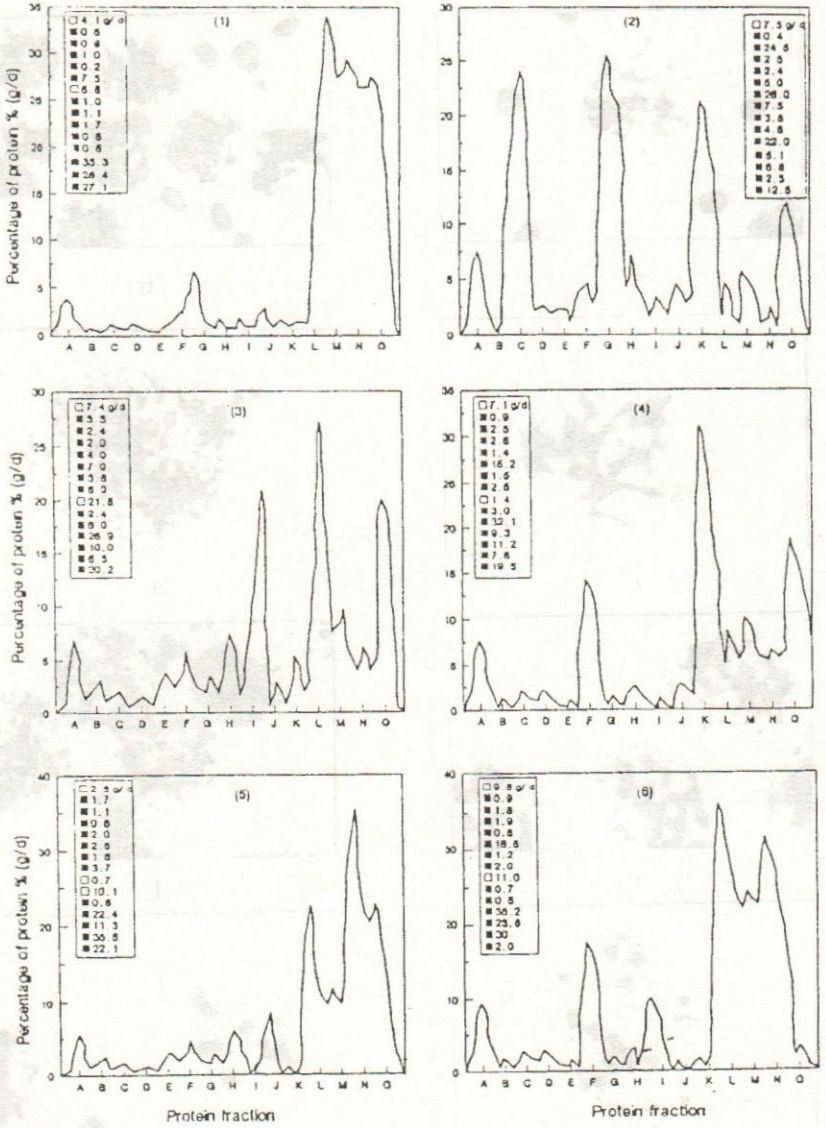
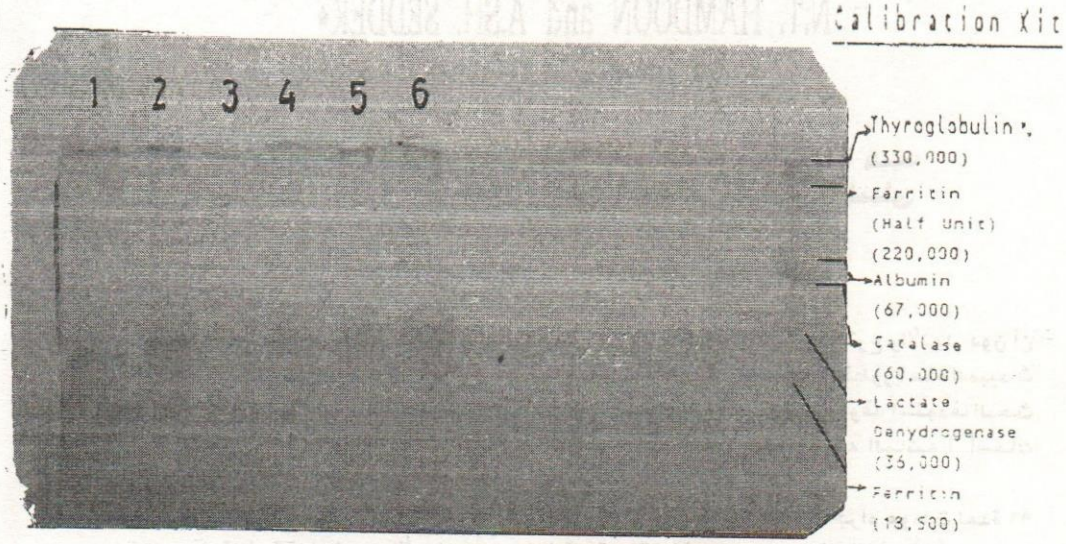


Fig. 2 . Densitometric tracing of results from electrophoresis, of protein fractions from the haemolymphatic fluid of *Dosinia radiata* using polyacrylamide technique (SDS-PAGE). Samples of the six morphs and the protein fractions are shown and marked in each legend.



Pl. 1. A photograph of stained polyacrylamide gel electrophorigrams showing the relative positions of the haemolyph protein fractions of the six morphs of Dosinia radiata.