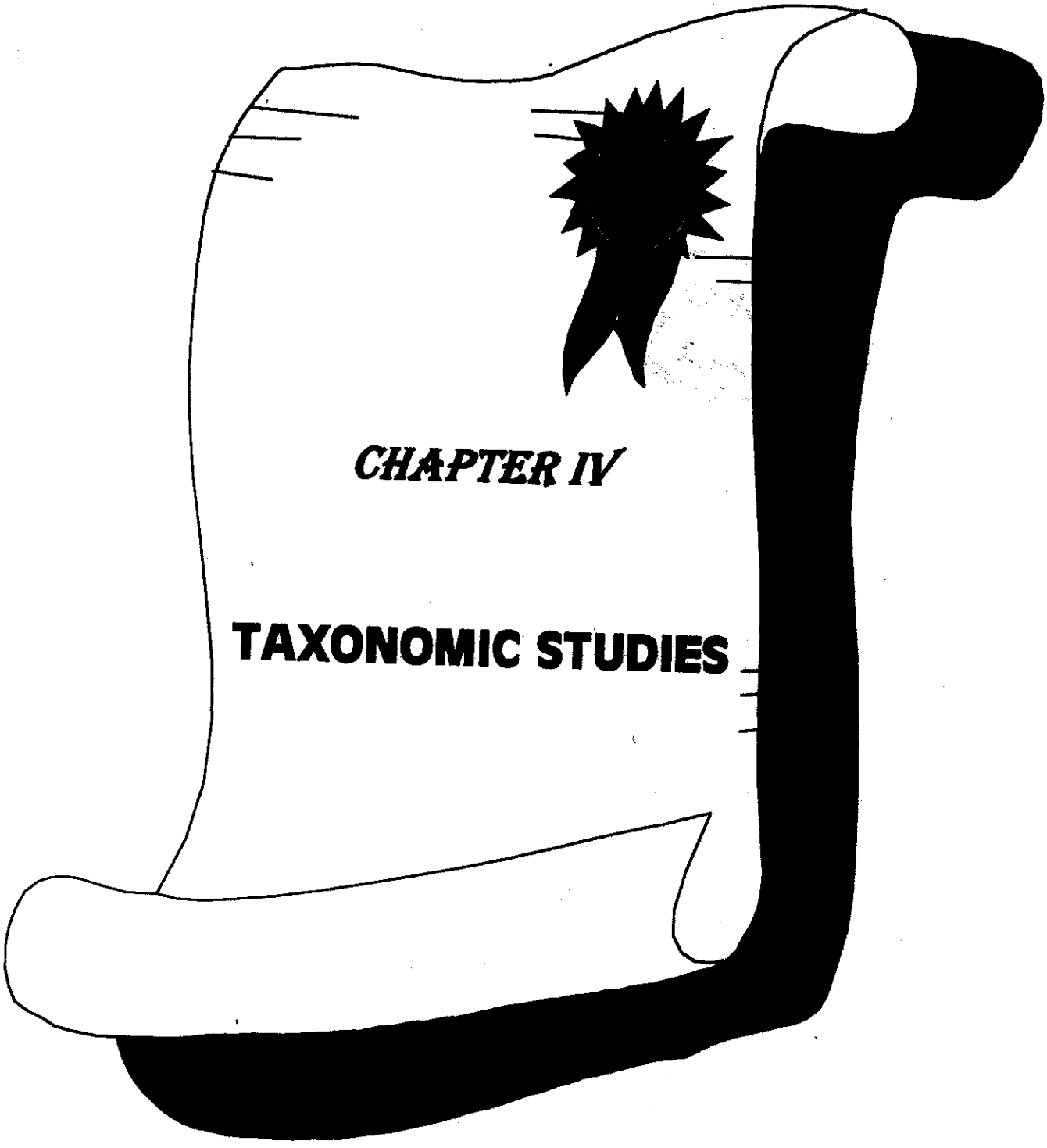

CHAPTER IV

TAXONOMIC STUDIES

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4-1 Morphology

4-1-1 Venerupis aurea (Gmelin, 1791) (The Golden Venus) (Plate I,A)

Class : Pelecypoda

Order : Veneroida

Family : Veneridae

Subfamily: Venerinae

References

Venus aurea, **Gmelin, 1791**. Syst. Nat. P. 3320 . P. 175

Tapes aureus var. bicolor. Montgaue: **Tillier & Bavay 1905**. Bull. Soc. Zool . P 175.

Tapes aureus: var texturata. Montgaue: **Tillier & Bavay, 1905**. Bull. Soc. Zool. P. 175

Venerupis aurea: **Fischer & Metivier, 1971**. Rev. Tap. Moll. Bull. Mus. LXXI, P 5-8

Diagnostic characters:

Shell ovate to elliptical, solid, medium size, moderately convex, valves roughly rhomboidal, equivalve and inequilateral. The periostracum is thin and glossy. The colour varied with zigzag lines or patches. The sculpture is confined to moderately impressed concentric growth lines except for the posterior slope. On the other hand, the inside of the valves is consistently golden yellow (hence the name golden venus). The teeth is heterodont with 2 bifid cardinal teeth in each valve. Pallial sinus short with rounded tips. The two muscle scars are similar (dimyarian, isomyarian)

Venerupis aurea is one of those species which exhibit a wide range of colour morphs. This fact had caused in the past a considerable confusion in the identification of this species. Some authors have treated each morph as a separate taxon. **Abu-Zied (1991)** distinguished 15 colour morphs of ***Venerupis aurea*** in Suez Canal which are:

1- Uniform white shell (both valves are white)

2- White with dark area on the right valve only

3- White with the posterior third usually brown

4- Uniform yellowish

5- Uniform grey greenish

6- Posterior darker with white patches at the postero-dorsal margin

7- Shell dark with patches as in 6

8- Creamy yellowish with 3-4 radial dark and light lines

9- As in 8 but with darker posterior area

10- Shell with fine zigzag anteriorly and dark posterior area

11- Coarse zigzag with lighter background

12- Dark brown uniform with fine zigzag lines

13- Brown with black area on the postero-dorsal margin.

14- As in 13 but with posterior area dark brown

15- Brown with dark anterior and posterior areas.

However, the present observation reveals that these colour morphs can not sharply distinguished from each other. Combination of two or more of them can be found in one morph

4-2- Electrophoretic Studies

The results concerning the electrophoretical picture of foot muscle proteins of the studied species are illustrated in figures (1 - 4) and tables (1 - 3).

The electropherograms showed that the foot muscle protein of the bivalve ***Venerupis aurea*** was separated into 22 fractions (Figure 1). There are only 20 fractions for the gastropod ***Strombus tricornis*** (Figure 2) and 23 fractions for the cephalopod ***Sepia officinalis*** (Figure 3).

Table (1) shows the frequency of appearance of individual foot muscle proteins fractions for the studied molluscs. It was found that the frequency of appearance of fractions number 1 & 14 in all tested individuals of all the studied species was 100% (absolute appearance)

In case of *V. **aurea*** the fractions 2 - 17 revealed high frequency, most of these fractions showed absolute appearance (fractions 2, 3, 5, 7, 9, 10, 12, 13, 14, 15 & 16). However, fractions 18 - 22 showed low polymorphic frequency (< 90%) ranged from 60% in fraction 18 to only 10% in fraction 22.

Similarly, fractions 1 - 17 of *S. **tricornis*** revealed high frequency which varied from absolute (100%) for fractions 1, 8, 12, 14 & 16; to constant (90% or more) for the fractions 7, 10, 11, 13, 15 and polymorphic (< 90%) appearance for fractions 2, 3, 4, 5, 6, 9 & 17. On the other hand, fractions 18 - 20 showed relatively low frequencies.

In case of ***S. officinalis*** high frequency was generally obvious in all fractions except the last two fractions (22 & 23) which revealed low frequency of appearance.

For the sake of convenience, each fraction was studied from two points: the first was the relative mobility which shows the relative genetic distance in which the fraction migrates from the application sample's point to its position in the electropherogram. The second was the relative area percentage which indicates the quantitative percentage of the fraction. So, the fraction which has been disappeared completely in any group has a relative area value equaled to zero, but has no relative mobility value. Hence, no comparison in the term of relative mobility was found if the fraction disappeared completely in either the two compared groups and this is illustrated by stars in the comparison table.

In terms of relative mobility, the fraction number 1 is the most mobile fraction, so it has the maximum (100%) relative migration distance. Consequently it does not show any significant variation in the term of relative mobility between any two compared groups.

Table (2A & B) shows the mean and the standard error of relative mobility and relative area, respectively,of individual foot muscle protein for the studied species. It was found that the higher content (relative area percentage of fraction) was observed in fraction number 2 for the bivalve ***V. aurea***, number 8 for the gastropod ***S. tricornis*** and number 9 for the cephalopod ***S. officinalis***.

Table (3A & B) illustrates comparison of the relative mobility and relative area percentage of individual foot muscle protein fractions between different species.

In the term of relative mobility, the bivalve *V. aurea* and the gastropod *S. tricornis*, showed significant difference in fractions 19 & 20 only ($p < 0.01$), but in the term of relative area percentage, they showed significant difference in fractions 1 ($P < 0.001$), and 3, 8, 10, 11, 14 & 15 ($P < 0.05$). No comparison was done for the fractions 21 & 22 due to their disappearance in the gastropod species.

In case of the bivalve *V. aurea* and the cephalopod *S. officinalis*, the comparison showed relative mobility significant difference in the fractions 17 & 20 only ($P < 0.01$). On the other hand ,they showed relative area significant difference in 8 fractions: [4, 11, 18 & 19 ($P < 0.05$); 2 & 15 ($P < 0.01$) and 8 & 16 ($P < 0.001$)]. No comparison was done in fractions 22 & 23 due to their disappearance in the bivalve species (fractions 23 was present in one individual)

The comparison between the gastropod *S. tricornis* and the cephalopod *S. officinalis* indicated a significant difference between both species either in their relative mobility [as in 7 fractions: 14 ($P < 0.05$), 15, 16, 19 & 20 ($P < 0.01$) and 17 & 18 ($P < 0.001$)] or their relative area [as in 6 fractions: 8, 13 & 14 ($P < 0.05$) and 1, 16 & 18 ($P < 0.01$)]. Due to disappearance of fractions 21, 22 & 23 in the gastropod species, no comparison was done in these fractions.

In term of relative mobility, the correlation coefficient (Figure 1) was 0.82 between *V. aurea* & *S. tricornis*, 0.86 between *V. aurea* & *S. officinalis*, and 0.57 in case of *St. tricornis* & *S. officinalis*.

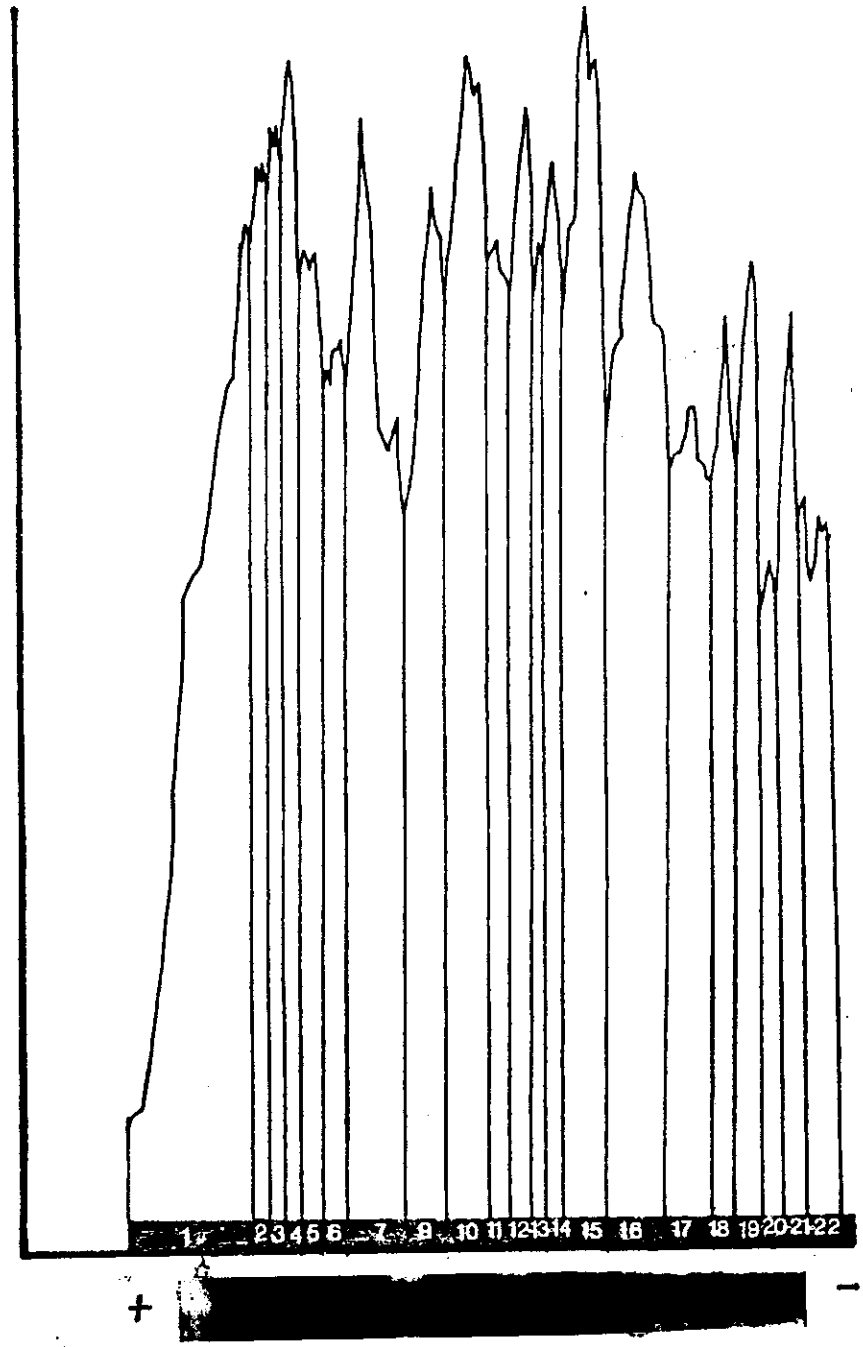

Fig.(1): Foot muscle proteins electropherograms for the bivalve *Venerupis aurea*.

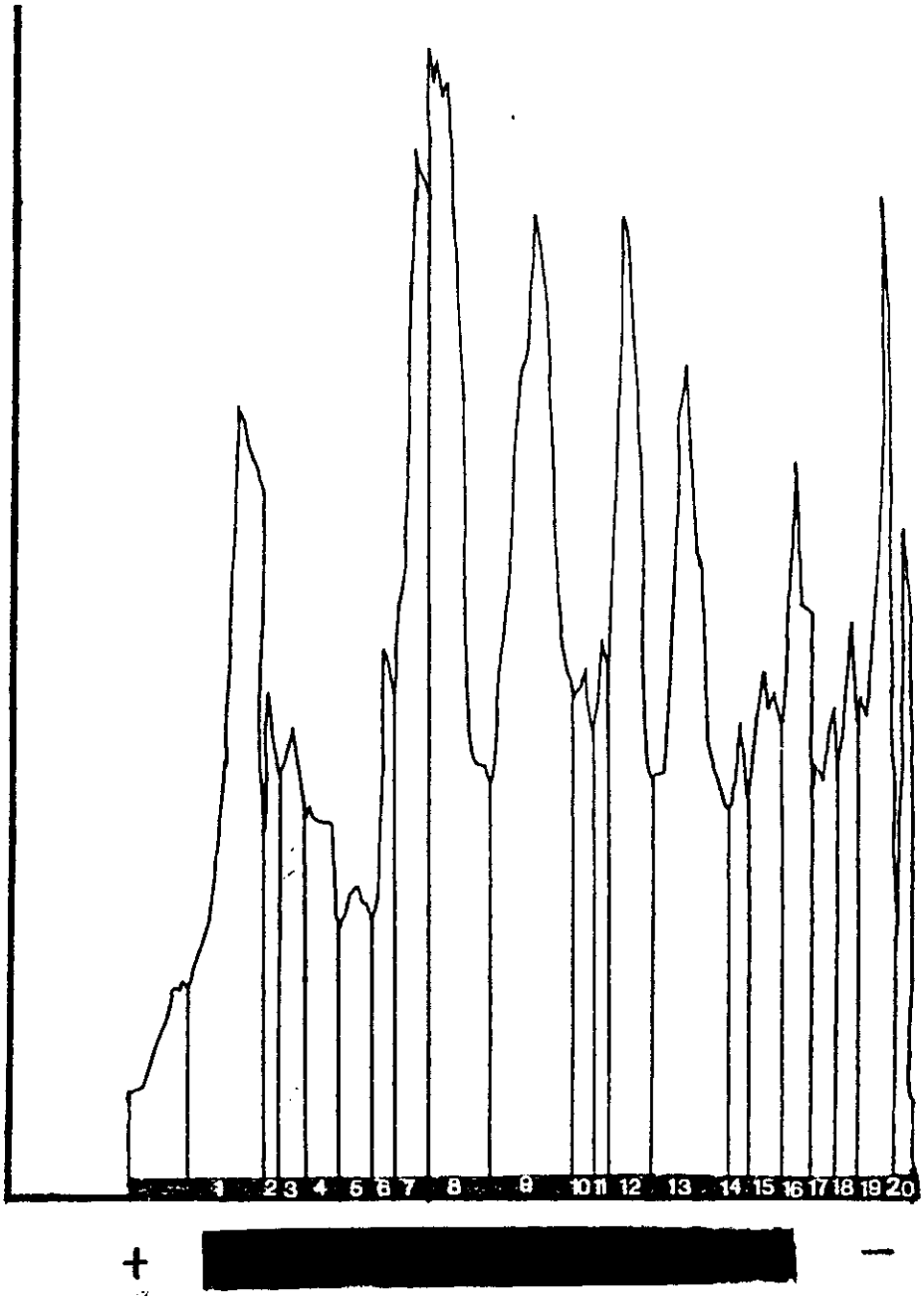

Fig.(2): Foot muscle proteins electropherograms for the gastropod *Strombus tricornis*

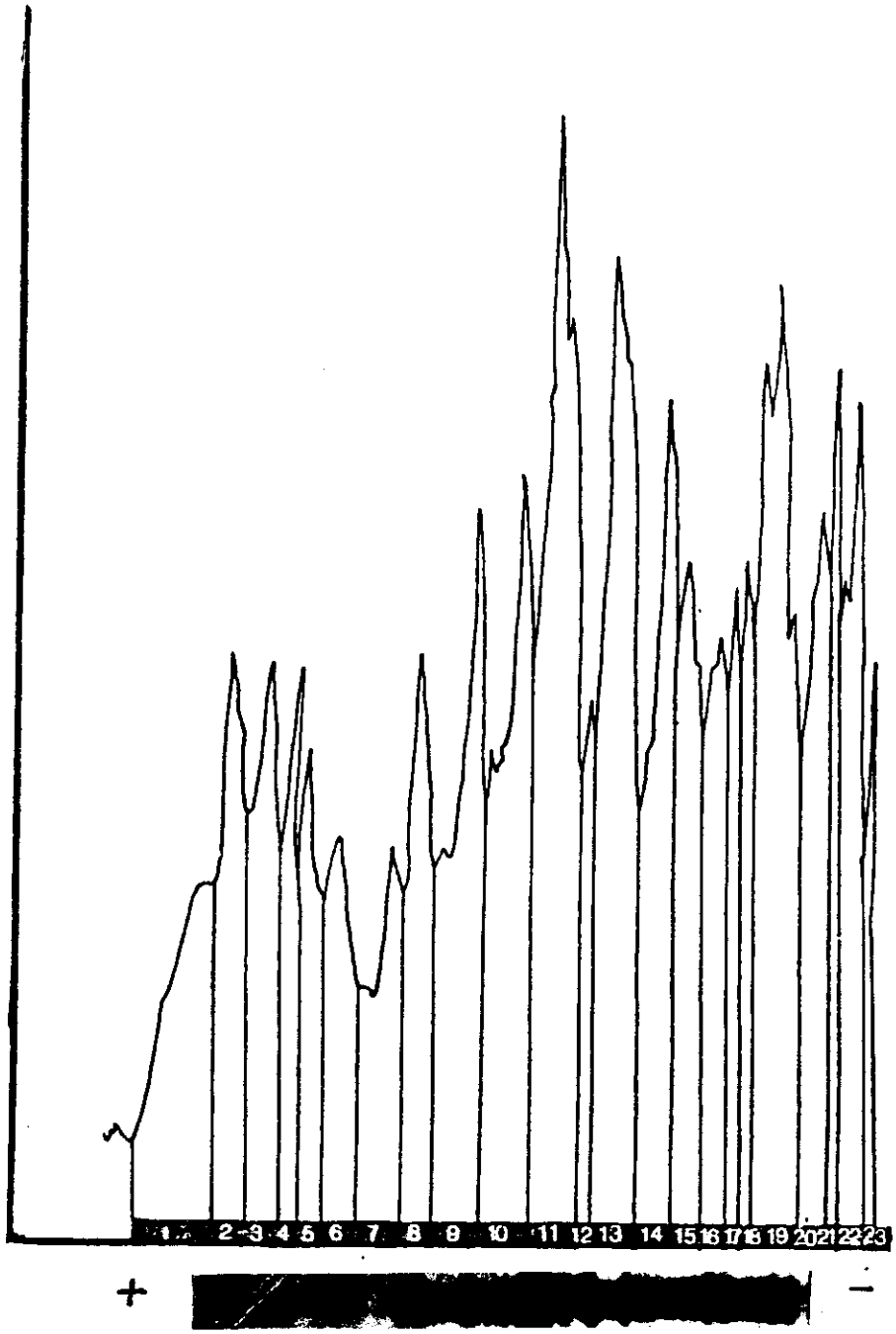

Fig.(3): Foot muscle proteins electropherograms for the cephalopod *Sepia officinalis.*

Table (1) : Frequency appearance of individual foot muscle proteins fractions in the studied molluscan species.

Spcies	Total No		Fraction number																					
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
V. aurea	10	No	10	10	10	9	10	9	10	9	10	10	8	10	10	10	10	10	9	6	5	5	2	1	0
		%	100	100	100	90	100	90	100	90	100	100	80	100	100	100	100	100	90	60	50	50	20	10	0
S. tricornis	10	No	10	7	8	8	8	7	9	10	8	9	9	10	9	10	9	10	8	6	7	5	0	0	0
		%	100	70	80	80	80	70	90	100	80	90	90	100	90	100	90	100	80	60	70	50	0	0	0
S. officinalis	10	No	9	8	9	9	9	8	9	8	9	8	9	8	9	9	9	8	9	9	7	9	8	6	2
		%	100	88.9	100	100	100	88.9	100	88.9	100	88.9	100	88.9	100	100	100	88.9	100	100	77.8	100	88.9	66.7	22.2

No. : Number of samples showing each fraction

% : Percentage frequency of appearance

Table (2A): Mean and standard error of relative mobility for individual muscle protein fractions of the studied molluscan species

Sp.		Fraction number																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
V. aurea	M	100	91.99	87.6	82.11	76.25	69.8	64.69	56.91	53.19	48.84	45.06	40.33	33.8	28.08	23.2	19.39	15.45	14.87	12.93	10.88	11.75	11.4	-
	±S.E	0.00	1.39	2.14	2.78	3.02	3.39	2.95	2.47	2.52	2.41	3.15	2.80	2.85	2.81	2.33	2.62	2.65	2.51	2.49	2.36	4.25	-	-
S. tricornis	M	100	94.05	89.88	82.36	78.43	70.19	66.67	58.05	55.96	45.2	42.6	35.33	30.18	24.33	21.14	16.24	13.49	10.10	5.10	3.94	-	-	-
	±S.E	0.00	1.11	1.35	1.69	2.48	2.24	2.95	2.88	3.56	2.13	2.25	2.50	3.18	2.39	2.25	2.53	1.73	1.22	1.17	0.49	-	-	-
S. officinalis	M	100	94.28	88.28	81.70	77.10	69.86	63.20	58.60	55.20	49.70	45.60	37.80	34.60	29.10	26.40	23.40	21.30	17.90	11.12	9.30	6.13	3.93	3.90
	±S.E	0.00	1.20	1.66	2.41	2.38	2.81	2.42	2.52	1.65	1.58	2.04	1.26	1.42	1.26	0.94	0.57	0.61	0.91	1.27	1.16	0.66	0.69	-

M ±SE: Mean ± Standard error

- : Fraction absolutely disappeared

Table (2B): Mean and standard errors of relative area percentage for individual foot muscle protein fraction of the studied molluscan species.

Sp.		Fraction number																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
V. aurea	M	5.46	9.24	5.33	5.25	5.16	6.68	6.03	6.49	6.58	5.09	5.08	6.77	6.20	4.09	4.48	3.68	2.63	3.93	2.99	2.69	2.82	3.73	0.00
	±S.E	1.09	1.86	1.13	1.00	0.66	0.98	0.78	0.56	0.96	0.80	0.90	0.93	1.02	0.33	0.33	0.34	0.48	0.49	0.45	1.01	0.005	0.00	0.00
S. tricornis	M	2.02	4.92	2.92	5.27	7.75	5.75	6.36	9.85	8.96	8.82	8.08	5.96	7.31	6.34	3.49	4.21	4.96	3.41	3.84	5.54	0.00	0.00	0.00
	±S.E	0.42	1.31	0.53	1.22	2.05	1.83	1.59	2.04	1.72	1.46	1.64	1.04	0.95	0.89	0.43	0.46	1.10	0.29	0.83	1.88	0.00	0.00	0.00
S. officinalis	M	4.05	4.48	4.36	3.21	4.85	4.75	5.53	3.93	8.13	5.87	5.87	7.99	6.21	5.29	3.97	2.62	2.43	3.96	4.62	4.55	3.79	1.44	5.12
	±S.E	1.50	1.38	2.27	1.24	1.65	1.91	1.73	1.47	4.33	4.18	3.06	3.07	1.69	1.46	1.26	0.48	2.51	3.27	1.46	1.94	1.55	0.70	0.35

M ±SE: Mean ± Standard error

Table (3A): Comparison of the relative mobility of individual foot muscle protein fractions between the studied molluscan species.

group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	S.C.
Vx St	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	H.S.	H.S.	*	*		0.82
V.XS	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	H.S.	N	N	H.S.	N	*	*	0.86
St xS	N	N	N	N	N	N	N	N	N	N	N	N	N	S.	H.S.	H.S.	VHS	VHS	H.S.	H.S.	*	*	*	0.57

Table (3B): Comparison of the relative area percentage of individual foot muscle protein fractions between the studied molluscan species.

group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Vx St	V.H.S	N	S	N	N	N	N	S	N	S	S	N	N	S	S	N	N	N	N	N	*	*	
V.XS	N	H.S	N	S	N	N	N	VHS	N	N	S	N	N	N	H.S.	VHS	N	S	S	N	N	*	*
St x S	H.S.	N	N	N	N	N	N	S	N	N	N	N	S	S	N	H.S	N	H.S	N	N	*	*	*

N : Non significant
S : Significant ($P < 0.05$)
HS : High significant ($P < 0.01$)
VHS: Very high significant ($P < 0.001$)

V: *Venerupis aurea*
St: *Strombus tricornis*
S: *Sepia officinalis*

S.C.: Similarity coefficient

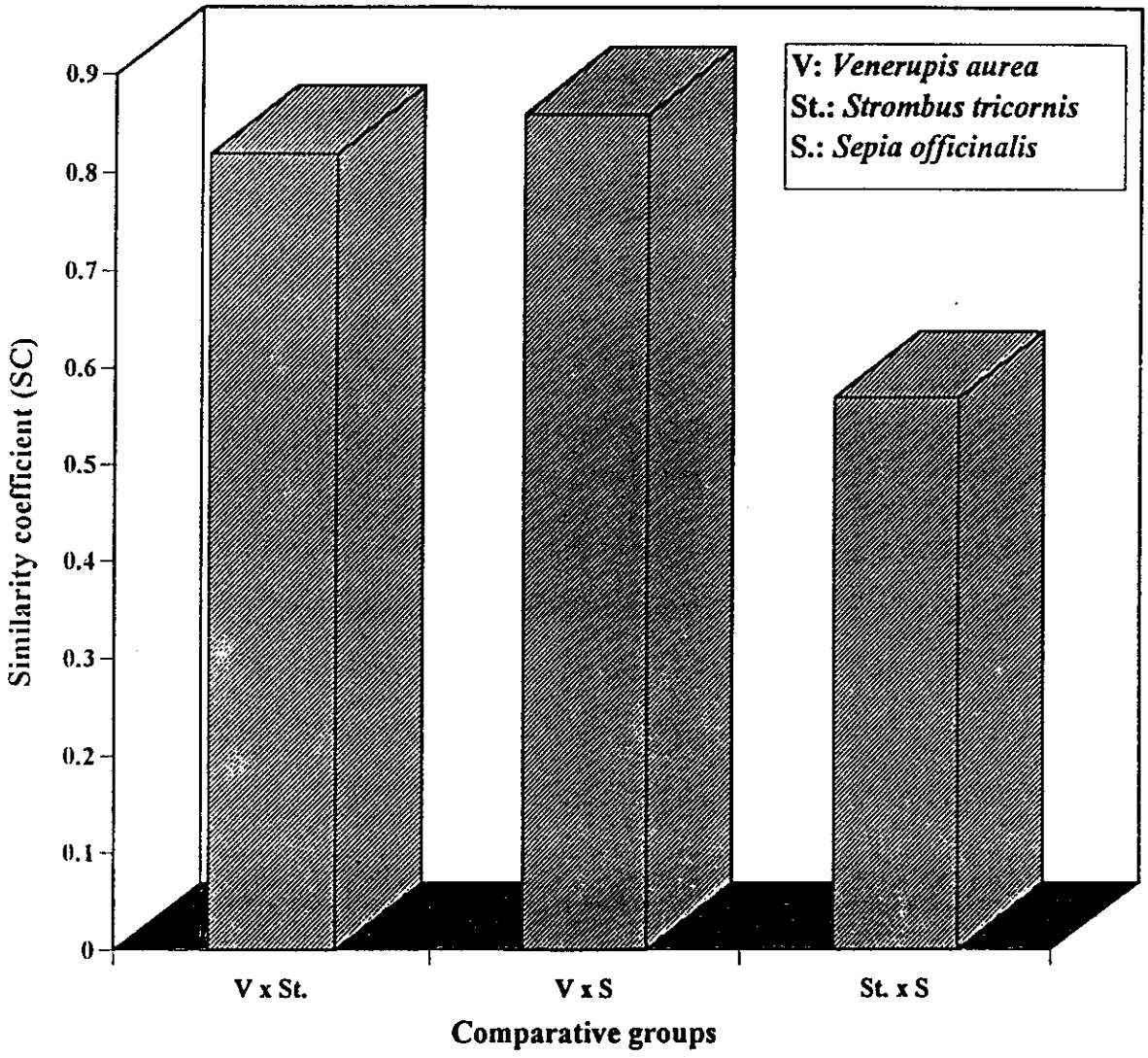

Figure (4): Similarity coefficients of foot muscle proteins electrophoretic patterns for the studied molluscan species.