

1- MORPHOLOGICAL INVESTIGATION

Venerid clams were found inhabiting sandy, muddy and rocky shores of different stations. **Table (2)** shows the venerid clams species and sites of collection.

1-1- Identification of the collected samples:

1-1-1- Family: Veneridae Rafinesque, 1815

General characters of the family:

Veneridae (Bivalvia: Veneracea) is generally subtriangular in outline (**Plate 1**). The two adductor scars are usually equal and the pallial line may be indented. Shell ornamentation predominantly concentric; sometimes radial ribs appear, ligament external. Lunule and escutchen usually well developed, cardinal teeth three in each valve. Lateral teeth feeble or wanting; anterior lateral found in some species and pallial sinus varying in size and shape. The body has a pair of eulamellibranch gills. The foot well developed and the two siphons are of moderate length. This family is represented here by 4 subfamilies (Pitarinae, Dosiniinae, Circinae and Tapetinae), 6 genera (*Callista*, *Dosinia*, *Gafrarium*, *Paphia*, *Tapes* and *Venerupis*) and seven species (*Callista florida*, *Dosinia radiata*, *Gafrarium pectinatum*, *Paphia undulata*, *Tapes decussatus*, *Venerupis aureus* and *Venerupis pullastra*).

Key for separation of the recorded subfamilies:

- 1- Outline inequilaterally, shell smooth and glossy, pallial sinus wide, horizontal and pointed Pitarinae.

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- 2- Outline semicircular, almost equilateral, shell with concentric sculpture..... *Dosiniinae*.
 - 3- Outline subovate to triangular, the radial ribs are coarser, the shell is laterally compressed..... *Circinae*.
 - 4- Outline rectangular to ovate, sculpture with fine concentric lines *Tapetinae*.

Key for separation of the recorded genera:

- 1- Shell smooth and glossy with faint concentric ribs, pallial sinus wide, horizontal and pointed *Callista*.
- 2- Shell semicircular, sculpture of concentric ridges, pallial sinus triangular and pointed..... *Dosinia*.
- 3- Shell is laterally compressed, outline triangular, the radial ribs are coarser and nodules, no pallial sinus *Gafrarium*.
- 4- Shell elongate, sculpture with fine concentric lines, pallial sinus vertical and rounded..... *Paphia*.
- 5- Shell inequilateral, almost rectangular, sculpture of concentric grooves over crossed by fine radial ribs give the decussate appearance, pallial sinus deep rounded *Tapes*.
- 6- Shell almost rectangular, Sculpture with concentric lines, pallial sinus rounded..... *Venerupis*.

1-1-1-1- Subfamily: Pitarinae Stewart, 1930

This subfamily is represented here by one genus, *Callista*.

1-1-1-1-1- Genus: *Callista* Poli, 1971

This genus is represented here by only one species known as *Callista florida*.

1-1-1-1-1-1- *Callista florida* Lamarck, 1818**Hamraa****Plate (2 A)****References:**

El-Gamal (1988) and Ghobashy *et al.* (1992).

Occurrence:

It is a common edible bivalve in Suez Canal. It occurs in Port Said, Ismailia, Fayed, Suez and El-Ein El-Sukhna. Fresh samples were collected from sandy shores at 20 to 25 cm depth of sediment.

Diagnosis:

Shell oval to rectangular, inequilaterally, sculpture smooth, glossy with faint concentric ribs, ligament external, lunule is sculptured, hinge with three cardinals in each valve, muscle scars are equal and the pallial sinus horizontal pointed. The inner margin of the shell is smooth.

Colour:

The outer surface of each shell is brown with dark brown radial rays, while the inner surface is white. The margin and the two scars are purple.

Measurements:

The collected samples ranged between 2 to 6.2 cm in length and 1.2 to 4.5 cm in width.

1-1-1-2- Subfamily: *Dosiniinae* Deshayes, 1853

This subfamily is represented by one genus, *Dosinia*.

1-1-1-2-1- Genus: *Dosinia* Scopoli, 1777

This genus is represented by only one species; namely *Dosinia radiata*.

1-1-1-2-1-1- *Dosinia radiata* Reeve, 1850

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Plate (2 B)

References:

Bavay, 1898; Tillier & Bavay, 1905; Moazzo, 1939 and Sharabati, 1984.

Occurrence:

This species presents in Ismailia, Fayed and Suez. It is most abundant in clean and coarse sand at depth 30 to 35 cm depth of sediment.

Diagnosis:

Shell lenticular, equivalve, subequilateral, semicircular, sculpture of concentric ridges; lunule present sculptured, escutchen wanting, pointed ligament in groove, hinge with strong cardinals, muscle scars are dimyarian; isomyarian, pallial sinus present; triangular; pointed and inner shell margin smooth.

Colour:

The colour externally white to beige, usually with radial brownish rays. Internally yellowish white.

Measurements:

Collected samples ranged from 2.5 to 6.5 cm in length and from 1.8 to 5.8 cm in width.

1-1-1-3- Subfamily: Circinae Dall, 1896

This subfamily is represented here by one genus, *Gafrarium*.

1-1-1-3-1- Genus: *Gafrarium* Roding, 1798

This genus is represented here by one species, *Gafrarium pectinatum*.

1-1-1-3-1-1- *Gafrarium pectinatum* Linnaeus, 1758**Kheshna****Plate (2 C)****References:**

Sharabati, 1984; Lindner, 1987; Bitar & Kouli-Bitar, 1999; Mienis, 1999 and Fishelson, 2000.

Occurrence:

This species was collected from muddy gravels and sands of Ismailia, Fayed and Suez shores at depth 10 to 15 cm of sediment.

Diagnosis:

Shell medium sized, slightly laterally compressed. Outline subovate distinctly longer than high with umbones towards the anterior part. Sculpture of nodulose radial ribs; asymmetrical ribs on

the posterior slope where they change direction and are obliquely placed in relation to the central ribs; the divaricate ribs of the posterior slope are concentrically striae from the top to the bottom and concentric grooves continue into the symmetrical radial ribs near the ventral margin. Narrow heart-shaped lunule. No pallial sinus. Inner margin crenulated.

Colour:

Exteriorly beige to cream occasionally spotted upon the radial ribs with brown beaks. Internally white with a cream flush within the pallial line area, ligament stained with violet.

Measurements:

The collected species were 2.5 to 5.5 cm in length and 1.8 to 4.5 cm in width.

1-1-1-4- Subfamily: Tapetinae H. & A. Adams, 1857

This subfamily represented here by three genera, *Paphia*, *Tapes* and *Venerupis*.

1-1-1-4-1- Genus: *Paphia* Roding, 1798

This genus represented here by one species known as *Paphia undulata*.

1-1-1-4-1-1- *Paphia undulata* Born, 1778

Araise

Plate (2 D)

References:

Moazzo, 1939 and Barash & Danin, 1973.

Occurrence:

This species was collected from Ismailia and Fayed shores from soft sandy areas at depth 25 to 35 cm of sediment.

Diagnosis:

Shell elongate, compressed, equivalve, inequilateral, sculpture smooth with faint concentric lines, ligament external, hinge with three cardinals; middle one bifid, the two muscle scars are identical, pallial sinus narrow rounded vertical and shell inner margin smooth.

Colour:

Externally beige or pale yellow with a characteristic zig-zag pattern in brown. Internally white.

Measurements:

Collected specimens ranged from 2.6 to 6.5 cm in length and 1.2 to 3.8 cm in width.

1-1-1-4-2- Genus: *Tapes* Mühlfeld, 1811

This genus represented here by one species namely *Tapes decussatus*.

1-1-1-4-2-1- *Tapes decussatus* Linnaeus, 1758**Baladi
Plate (3 A)****References:**

Riedl, 1970 and Bodoy *et al.*, (1981).

Occurrence:

This species is common in most investigated coasts, which occurs in Marsa Matrouh, Alexandria, Port Said, Ismailia, Fayed and Suez. The investigated samples were found burrowing either in sandy

and muddy shores in shallow water from the intertidal zone to 4 m deep.

Diagnosis:

Shell ovate, elongate, equivalve, inequilateral, sculpture of concentric grooves over crossed by fine radial ribs which give the decussate appearance, ligament external, hinge with three cardinals; middle one bifid and lateral teeth wanting, the two muscle scars similar. Pallial sinus deep rounded and inner shell margin smooth.

Colour:

The shell is grey with black marking externally and white internally.

Measurements:

The collected specimens ranged between 2 to 6 cm in length and 1.3 to 4.5 cm in width.

1-1-1-4-3- Genus: *Venerupis* Lamark, 1818

This genus is represented here by two species known as *Venerupis aureus* and *Venerupis pullastra*.

1-1-1-4-3-1- *Venerupis aureus* Gmelin, 1791

Bolti

Plate (3 B)

Reference:

Riedle, 1970.

Occurrence:

This species is common in most investigated coasts of Suez Canal. It is found in Port Said, Ismailia and Fayed. Fresh samples

were collected from soft sandy shores below the mid tide level to a few meters deep, usually in quiet waters at depth 3 m.

Diagnosis:

Shell ovate, equivalve, inequilateral, sculpture of mainly faint concentric lines, and some fine radial lines in the posterior part, ligament external, hinge with three cardinals in each valve, lunule present, elongate lateral teeth wanting, pallial sinus short, wide and rounded and the shell inner margin smooth.

Colour:

This species have different colours externally. It may be white, cream, beige, grey or olive, but all individuals have a white colour internally.

Measurements:

The collected samples ranged from 1.5 to 3.2 cm in length and 0.9 to 2.2 cm in width.

1-1-1-4-3-2- *Venerupis pullastra* Montagu, 1803

Sebaa

Plate (3 C)

References:

Riedl (1970) and Gofas *et al.* (2001).

Occurrence:

The present species occurs in Ismailia and Fayed which burrows in sand or muddy-gravel bottoms below the mid tide level at about 4 m deep.

Diagnosis:

Shell large, solid, equivalve, inequilateral. Outline almost rectangular, longer than high. Beaks at the anterior 1/3, pointing towards the front. Coarse sculpture of numerous concentric striae. The radial ribs are absent, ligament external, hinge with three cardinals; middle one bifid and lateral teeth wanting, the two muscle scars similar. Pallial sinus deep rounded and inner shell margin smooth.

Colour:

The collected individuals have a white colour with three violet or dark brown rays or a cream colour with irregular brown lines and three broken brown rays. Internally the colour is white.

Measurements:

The collected samples ranged from 2 to 5.5 cm in length and 1.2 to 4.0 cm in width.

1-2- Common venerid (*Tapes decussatus*) collected from the different stations:

ANOVA revealed non-significant differences in *T. decussatus* shell length or width ($P \geq 0.05$) at all stations. Specimens collected from Ismailia and Suez were slightly darker in colour than those of Marsa Matrouh and Alexandria, and some of them had abnormalities (about 5-7% deformed from the collected specimens in each collection), which in many cases affect the closing of the shells. **Plate (4)** shows the abnormalities in *T. decussatus* and other venerids shells which collected from Suez Canal.

Table (2): Venerid clams species and stations of collection.

Species	Stations												
	Mediterranean Sea		Suez Canal				Suez Gulf and Red Sea						
	Marsa Matrouh	Alexandria	Port Said	Ismailia	Fayed	Suez	El-Ein El-Sukhna	Zaafarana	Ras-Gharib	Ras- Shukeir	Gabal El-Zeit	Hurghada	Safaga
<i>Callista florida</i>	-	-	+	+++	+++	+++	+	-	-	-	-	-	-
<i>Dosinia radiata</i>	-	-	-	+	+	+	-	-	-	-	-	-	-
<i>Gafrarium pectinatum</i>	-	-	-	+++	+++	+++	-	-	-	-	-	-	-
<i>Paphia undulata</i>	-	-	-	+++	+++	-	-	-	-	-	-	-	-
<i>Tapes decussatus</i>	+++	+++	++	+++	++	+	-	-	-	-	-	-	-
<i>Venerupis aureus</i>	-	-	++	+++	++	-	-	-	-	-	-	-	-
<i>Venerupis pullastra</i>	-	-	-	++	++	-	-	-	-	-	-	-	-

(Species present in heavy amount, +++; moderate, ++; little, + and species absent, -).

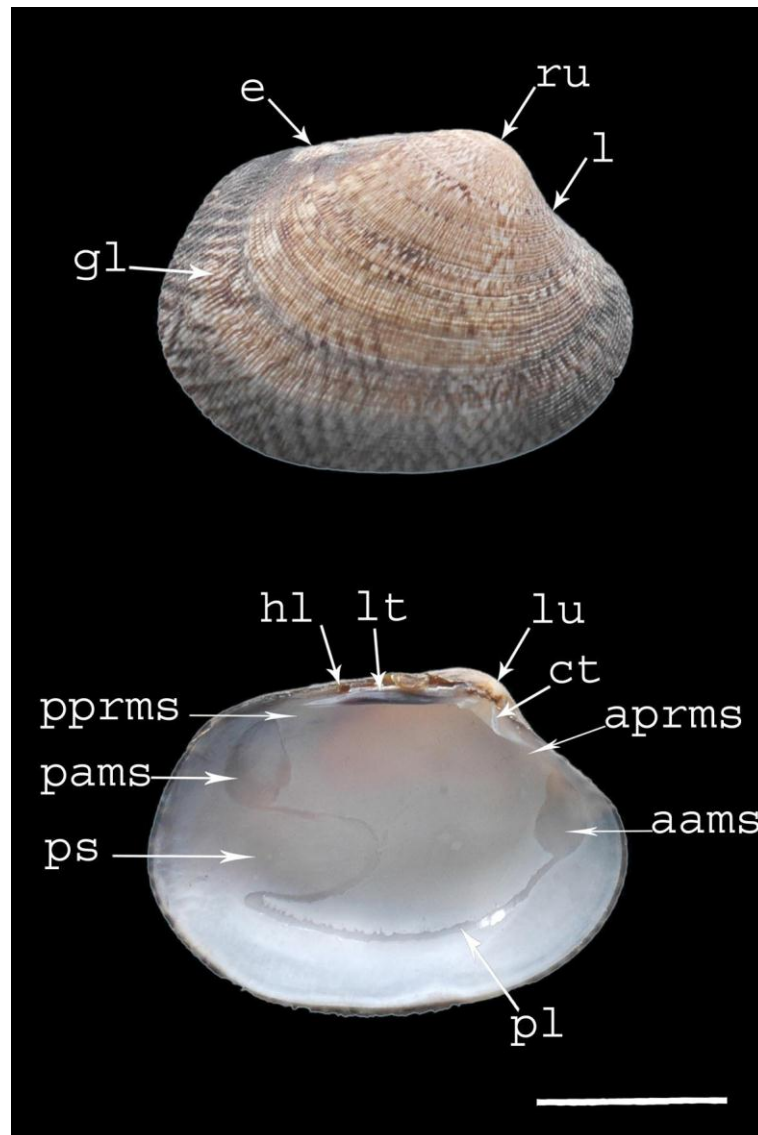


Plate (1): Exterior (of right valve) and interior (of left valve) views of common venerid (*Tapes decussatus*) shell showing the morphological characters of the family. **aams, anterior adductor muscle scar; **aprms**, anterior pedal retractor muscle scar; **ct**, cardinal tooth; **e**, escutchen; **gl**, growth line; **hl**, hinge ligament; **l**, lunule; **lt**, lateral tooth; **lu**, left umbo; **pams**, posterior adductor muscle scar; **pl**, pallial line; **pprms**, posterior pedal retractor muscle scar; **ps**, pallial sinus and **ru**, right umbo. Scale bar = 1.5 cm.**

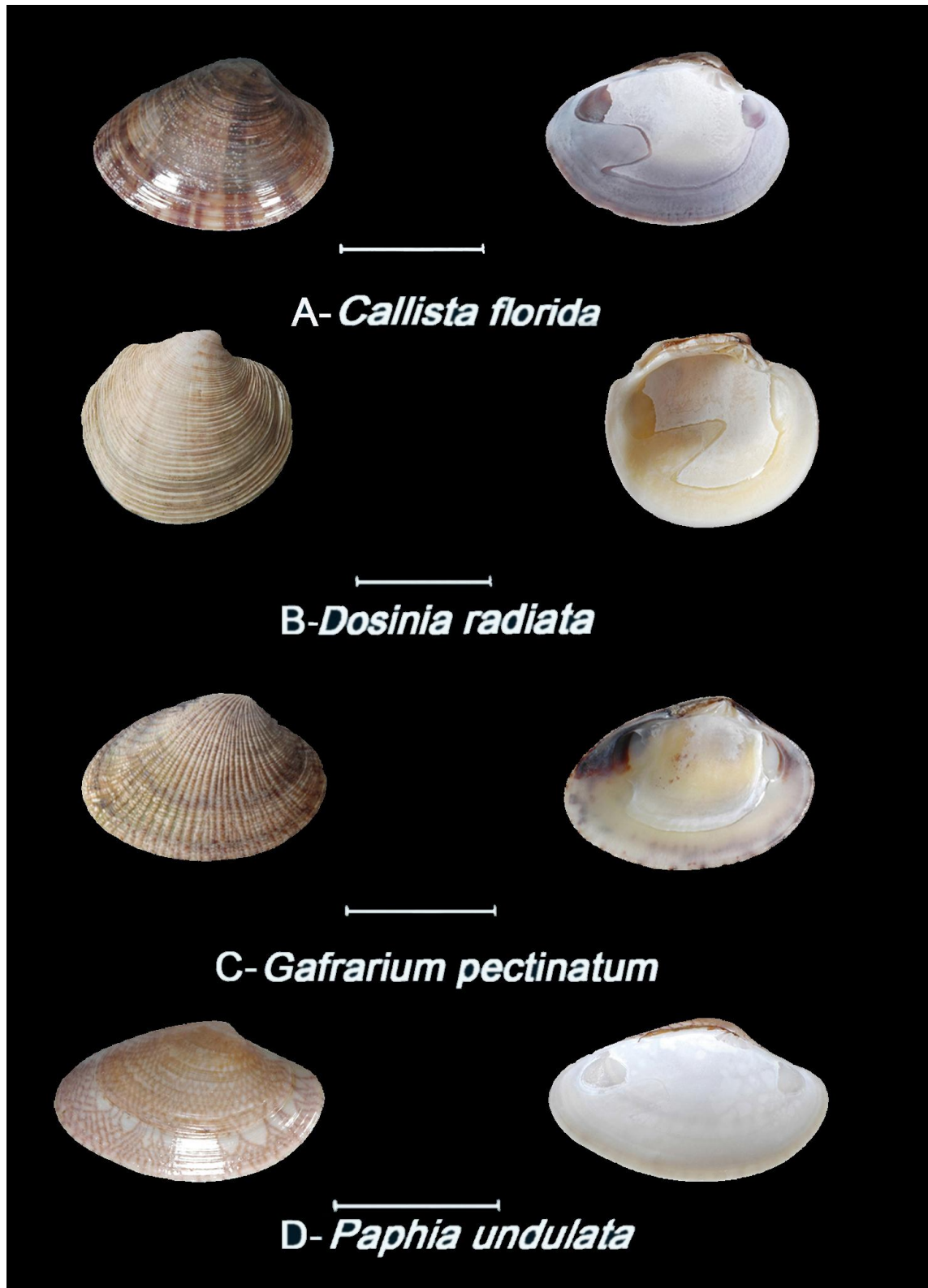


Plate (2): Exterior (of right valve) and interior (of left valve) views of the venerid clams shells. Scale bars = 3 cm.



Plate (3): Exterior (of right valve) and interior (of left valve) views of the venerid clams shells. Scale bars = 3 cm

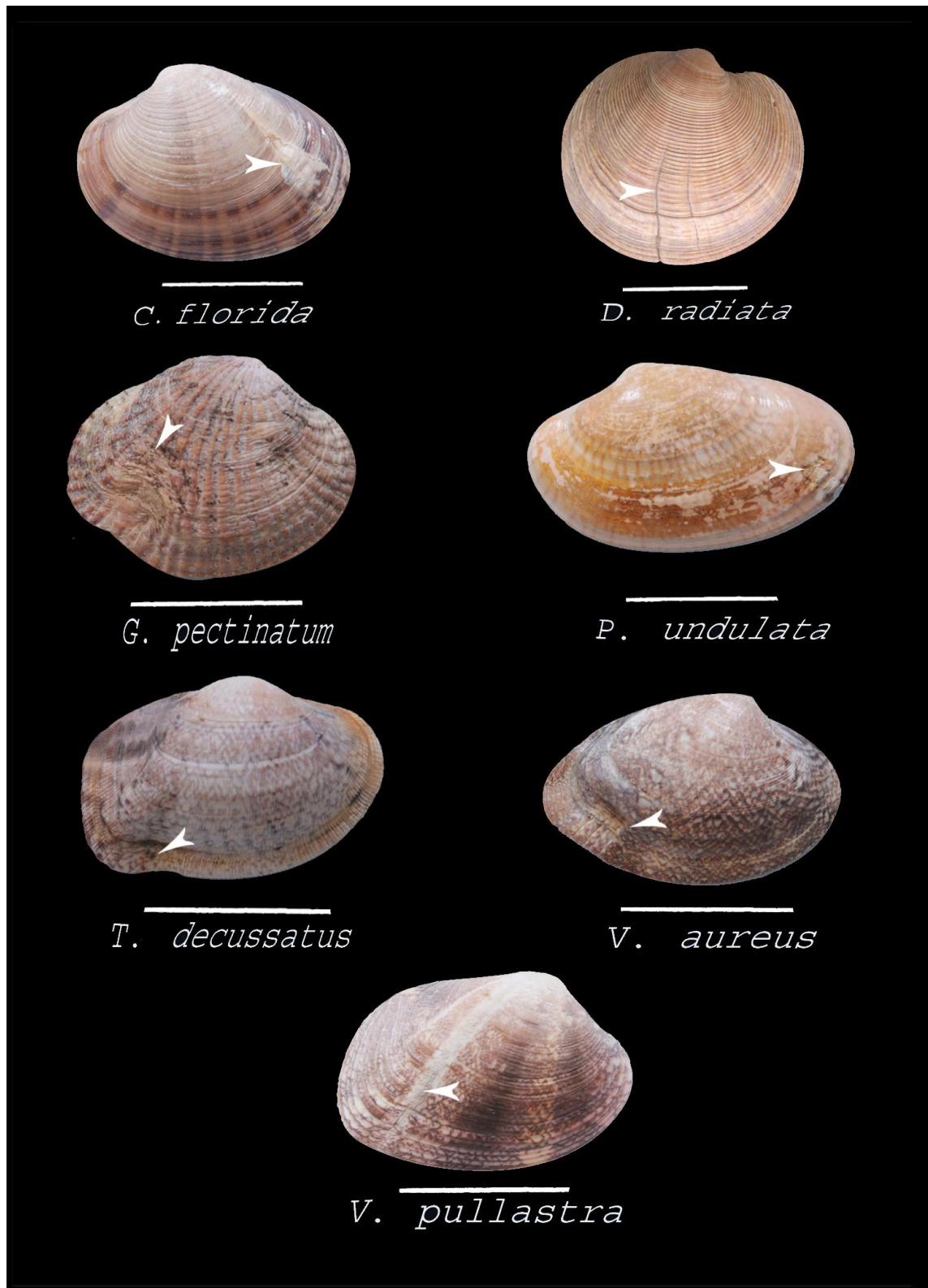


Plate (4): Venerid clams shells show some abnormalities (indicated by arrows heads). Scale bar = 2 cm.

