

axial striae but without pustules. *Mitra langfordiana* is marked with dark red-brown bands, while *M. peasei* is buff with slender brown cords and no large color bands. The aperture is creamy yellow in *M. langfordiana*, white in *M. peasei*; the columellar folds in *M. langfordiana* are coarser, and less evenly graduated from large to small than those in *M. peasei*.

*Mitra langfordiana* is probably more similar to *M. papilio* (Link, 1807) (syn. *M. sphaerulata* Martyn) than to *M. peasei*, though differing widely from this species in ornament and coloration. Their similarities are chiefly in their general proportions and coarse ornamentation, *M. peasei* being of a slim, delicate appearance while *M. papilio* and *M. langfordiana* share a strong, robust form.

### Acknowledgment

I should like to express once again my gratitude to all who helped me with the problems relating to this study; in addition to those already named, without whom it could not have been attempted, I will mention the curators of the various museums where I was privileged to

visit in person; Miss Virginia Orr who so promptly furnished the information I needed from ANSP; Dr. Rudolf Stohler who generously translated German literature dealing with *Mitra sanguinolenta*; and as always, Crawford Cate whose patience and understanding provided a helpful environment in which to work.

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## Hybrids between *Cypraea tigris* LINNAEUS, 1758 and *Cypraea pantherina* SOLANDER, 1786 (Mollusca : Gastropoda)

BY

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*Cypraea tigris* Linnaeus, 1758, and *C. pantherina* Solander, 1786, have been classified as distinct species by all authors; there are many distinctive characters which have been discussed by Schilder & Schilder in 1939 (p. 185). *Cypraea tigris* lives in the Indo-Pacific Ocean from the coast of East Africa to Polynesia, whereas *C. pantherina* is restricted to the Red Sea.

Recently we have received from Mr. W. L. Lander, Aden, a series of cowries collected by himself at Aden last year. The series includes both *Cypraea tigris* and *C. pantherina* with typ-

ical features as well as several intermediate specimens with mixed or intermediate characters: these shells cannot be determined exactly as *C. tigris* nor as *C. pantherina*, and they should be regarded as hybrids, we think. Similar intermediates (and true *C. pantherina*) have been collected, several decades ago, by Major Yerbury also at Aden; they are preserved now in the British Museum (see Schilder & Schilder, 1939, p. 185). A further intermediate shell approaching *C. tigris* has been collected on the opposite shore of the Gulf of Aden at Jibuti; it is preserved among the duplicates in the Jous-seaume Collection (Museum of Paris).



The pale dwarf shells, however, which we have named *Cypraea pantherina* *catulus* in 1924 (p. 192) should be classified as *C. pantherina* according to the present paper, as the holotype only shows some characters recalling *C. tigris* a little. This variety undoubtedly comes from Aden too, as the holotype and the paratype have been collected by Steindachner and have been given to the author by the late curator of the Museum of Vienna, R. Sturany, in 1920; later on, we have seen three very similar shells also said to come from Aden: two in the Sullioti Collection, Genoa (one of which is now in the writer's collection), and one collected by Yerbury (see above).

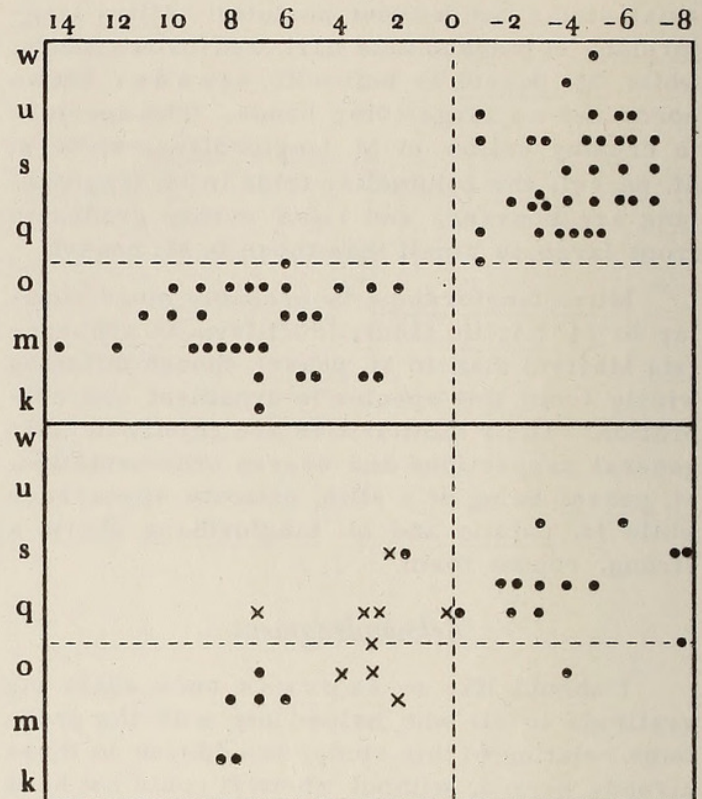
In the present paper we have treated 30 *Cypraea tigris* from the Western Indian Ocean between Kenya (leg. R. S. Benton), Mozambique (leg. Peters), and the Seychelles (leg. Winckworth), 34 *C. pantherina* from the Red Sea between Suez and Assab (various collectors), and 30 specimens from the Gulf of Aden, viz. 29 from Aden (leg. Lander, Yerbury) and one from Jibuti (leg. Jousseume). We have classified the following four most essential characters:

1. The relative breadth of the shell, i. e., the maximum breadth expressed in percent of the length. There is a distinct correlation between this character and the swelling of margins and base: narrow shells exhibit steep margins and flat bases, whereas in broad shells both margins and base are convex. Besides, there is a distinct correlation between the length and the average relative breadth, so that in both species small specimens are usually broader than large ones. The common limit separating most specimens of the broader *Cypraea tigris* and the slender *C. pantherina* is about the relative breadth "B" (in percent) in shells of the length "L" (in mm.) as follows:

L	45	50	55	60	65	70	75	80	85	90	95	100
B	70	69	68	67	66	65	64	63	62	61	60	59

Therefore, the corrected relative breadth of each shell can be expressed by a positive or negative figure, indicating the difference between the real relative breadth and the limit between the two species as indicated above.

2. The relative closeness of the columellar teeth expressed by the letters "k" to "w" as explained by Schilder in 1958. The corresponding figures indicating the relative number of columellar teeth in shells of 25 mm. (Schilder & Schilder, 1938, p. 124) have been added in the table below.



The upper half of our diagram shows the correlation between these two characters in 30 *Cypraea tigris* (left below) and 34 *C. pantherina* (right above) from the Indian Ocean and from the Red Sea, respectively: there is a distinct gap between the two species. The lower half of the diagram shows the variability of the shells coming from the Gulf of Aden: there is a continuous zone from typical *C. tigris* to typical *C. pantherina*, the centres of which seem to be slightly displaced towards the common limit (the crosses indicate specimens believed to be real hybrids).

Additionally, we have examined two more characters evidently independent from the two characters just discussed:

3. The posterior extremity of the inner lip, varying from very blunt to acuminately produced and curved to the left.
4. The size and the color of the lateral spots bordering the base, which vary from large and dark brown to small and pure orange.

In each of these four characters we have distinguished six classes: class 2 and 5 indicate typical *Cypraea tigris* and *C. pantherina*, respectively; class 3 and 4 designate intermediate degrees; and class 1 and 6 designate extreme characters. The meaning of the figures is as follows:



Class	Corrected Relative Breadth	Columellar Teeth	Posterior Extremity	Lateral Spots
1	+14 to + 9	k - l (14-15)	Very blunt	Very large, dark
2	+ 8 to + 5	m - n (16)	Rather blunt	Large, dark
3	+ 4 to + 1	o - p (17-18)	Rather acuminate, but straight	Large, partially paler
4	0 to - 2	q - r (19)	Acuminate, slightly impressed on the left	Smaller, brown only
5	- 3 to - 5	s - t (20-21)	Distinctly bent to the left	Small, brownish and orange mixed
6	- 6 to - 8	u - w (22-24)	Extremely produced and bent	Small, orange only

The following list contains the 94 specimens just examined personally, with four figures indicating the classes of the four characters arranged as in this table; in each group the specimens have been enumerated according to the sum of the four figures.

Cypraea tigris from East Africa

Kenya

1211  
1221  
1221  
1221  
1222  
1222  
1321  
1321  
2123  
2132  
2132  
2213  
2222  
2222  
2231  
3122  
2142  
2322  
2331  
2332  
3232  
3332  
3343

Mozambique

1212  
1232  
3142

Seychelles

2222  
2232  
2233  
2332  
2342

Aden Gulf (X = hybrids)

Lander

2122  
2221  
2231  
2133  
2322  
2233  
X3343  
X3335  
X3533  
X2454  
X4443  
3554  
4445  
4455  
4455  
4455  
5455  
5456  
5565

Yerbury

X 3242  
X 3443  
X 3345  
5455  
5455  
6555  
6555 cat.

Jibuti

X 3432

C. t. catulus

5346 typ.  
6365  
6556

Cypraea pantherina from Red Sea

4354  
4454  
4455  
4554  
5445  
5445

5454  
5455  
5455  
5455  
5455  
5455



5545  
5554  
5554  
5554  
4655  
5456  
5465

5546  
5546  
5645  
5645  
6446  
6455  
6455

6545  
5655  
6555  
6555

6556  
6565  
6655  
6665

We can plot these figures by pairs:

TYPICAL REGIONS								ADEN GULF								
Breadth		1 2 3 4 5 6								1 2 3 4 5 6						
Teeth	{	6	-	-	-	1	3	2		6	-	-	-	-	-	-
		5	-	-	-	1	6	5		5	-	-	2	-	1	3
		4	-	-	-	2	10	3		4	-	1	2	5	4	-
		3	2	5	2	1	-	-		3	-	1	3	-	1	1
		2	7	7	1	-	-	-		2	-	3	1	-	-	-
		1	-	4	2	-	-	-		1	-	2	-	-	-	-
Spots		1 2 3 4 5 6								1 2 3 4 5 6						
Posterior Extremity	{	6	-	-	-	-	3	-		6	-	-	-	-	2	-
		5	-	-	-	7	13	2		5	-	-	-	2	8	2
		4	-	3	1	-	6	3		4	-	1	3	-	2	1
		3	2	8	1	-	-	-		3	1	1	3	-	1	-
		2	5	7	1	-	-	-		2	1	2	-	-	-	-
		1	1	1	1	-	-	-		1	-	-	-	-	-	-

One will observe that the figures accumulate in the lower left quarter (*Cypraea tigris*) and in the upper right quarter (*C. pantherina*), if we consider the East African and the Red Sea specimens only (the two left tables: the species are separated by the vertical line between class 3 and 4 regarding the breadth and the spots); in the Aden shells (the two right tables), however, there is a uniform band across the table. This fact may be shown both by considering the two characters first indicated (breadth and dentition: the two upper tables) as well as by comparing the two last-named ones (lateral spots and posterior extremity: the two lower tables).

The sum of the four figures designating the four characters of each shell indicates the general tendency of the specimen to approach typical *Cypraea tigris* ( $4 \times 2 = 8$ ) or *C. pantherina* ( $4 \times 5 = 20$ ); sums which are outside these limits 8 to 20 indicate specimens with exaggerated specific characters, while sums between 8 and 20 indicate shells intermediate in a more or less distinct way. The following table contains the sums obtained from 30 East African *C. tigris* (T), 34 *C. pantherina* from the Red Sea (P),

and 30 shells from the Gulf of Aden, separated into true *C. tigris* (t), true *C. pantherina* (p), and intermediate shells thought to be hybrids (h):

SUM	T	P	t	p	h
5	1	-	-	-	-
6	3	-	-	-	-
7	4	-	2	-	-
8	10	-	1	-	-
9	4	-	2	-	-
10	5	-	1	-	-
11	2	-	-	-	1
12	-	-	-	-	1
13	1	-	-	-	1
14	-	-	-	-	3
15	-	-	-	-	3
16	-	1	-	-	-
17	-	1	-	2	-
18	-	5	-	4	-
19	-	9	-	3	-
20	-	11	-	2	-
21	-	3	-	3	-
22	-	3	-	1	-
23	-	1	-	-	-



This table confirms that the fauna of Aden contains both species and real intermediates.

Note: Mr. Lander found true *Cypraea tigris* at Tarshyne Point only, and the hybrids seem to be restricted to the same area, whereas typical *C. pantherina* have been collected also in remote areas of the Aden region: the material is still too scanty, but it seems to point to the local genetic influence of *C. tigris*. The dwarf *C. pantherina* catulus may live in a very restricted place not yet detected by Mr. Lander.

### Summary

*Cypraea tigris* Linnaeus, 1758, and *C. pantherina* Solander, 1786, are well separable if

they come from regions where only one species lives; in the Gulf of Aden, however, where both species occur in the same place, one can observe intermediate shells of various degrees which should be interpreted as hybrids.

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## Preliminary Report on Time Elements involved in Hydrotropism in *Helix aspersa* (Gastropoda : Pulmonata) Following Dehydration

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(3 Textfigures)

It has long been known that certain terrestrial animals tend to accumulate either in dry or wet areas. The terrestrial snail *Helix aspersa* is of the first type. Under dry conditions this animal will go into a state of dormancy, which may be changed to a state of activity upon moistening the animal or upon the introduction of water to its immediate area (Tryon, 1882).

One adaptive mechanism in some animals is a behavioral tendency to select a region of optimum humidity. In arthropods there is an

optimal humidity for various species, and such functions as reproductive rate, rate of individual development, proportion of individuals maturing are increased under optimal humidity conditions (Ludwig, 1945). African migratory locusts prefer dry air to wet air (Kennedy, 1937) and a similar preference is found in the mealworm beetle (Gunn and Pielow, 1940). Cockroaches have a mixed reaction to a humidity gradient, but they become more hygropositive when desiccated (Gunn and Cosway, 1938). The wood



Schilder, F. A. 1962. "Hybrids between *Cypraea tigris* Linnaeus, 1758 and *Cypraea pantherina* Solander, 1786 (Mollusca: Gastropoda)." *The veliger* 5, 83–87.

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