STUDIES ON OLIVIDAE. II.

FURTHER PROTOCONCH MORPHOMETRICAL DATA FOR *OLIVA* TAXONOMY.

B.Tursch and L. Germain,

Collectif de Bio-écologie, Faculté des Sciences,

Université libre de Bruxelles, Brussels, Belgium.

ABSTRACT.

Three novel protoconch measurements are defined. Their potential for Oliva taxonomy is evidenced.

RESUME.

Trois nouvelles mesures de protoconque sont définies. Leur potentiel pour la taxonomie du genre Oliva est mis en évidence.

KEYWORDS.

Gastropoda, Mollusca, morphometry, Oliva, protoconch.

INTRODUCTION.

In a previous paper (TURSCH & GERMAIN, 1986) we have underlined the desirability of a morphometric approach to the *Oliva* problem. It was demonstrated on a limited sample that such approach is feasible and yields satisfactory results.

In addition to several teleconch morphometric measurements, protoconch characters (SPRO, MPRO, LPRO and nw) were defined. They provide information about the number of whorls of the protoconch and some characteristics of its first and half volution. These data were shown to be especially valuable for taxonomic purposes. It was tempting to speculate that further protoconch characters (particularly measurements expressing the size and general shape of the protoconch) would be equally useful.

Protoconch illustrations are unfrequent in *Oliva* literature and when available they are generally not very informative. The aspect of the protoconch does indeed very much depend upon the orientation of the sample. Only a gifted observer could conclude that the drawings of Fig.1 all illustrate the same species (they actually depict the same specimen). Whatever data are to be extracted from such representations it is obvious that the orientation of the specimen will have to be standardized.

When drawn in the standardized way to be described hereunder, the protoconch of a the few species illustrated as an example in Pl.2 show striking differences. One has the feeling that simple quantification of their size and shape factors could constitute valuable taxonomic characters.

This paper does not aim as taxonomic results but only at the definition, testing and evaluation of tools for taxonomy.

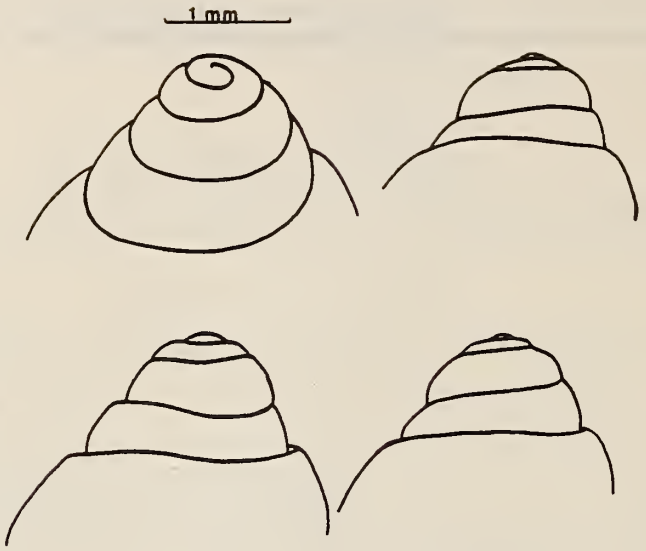

Fig. 1

Four views of the protoconch of *Oliva parkinsoni*, specimen BT-0694, (Papua New Guines, Laing Island).

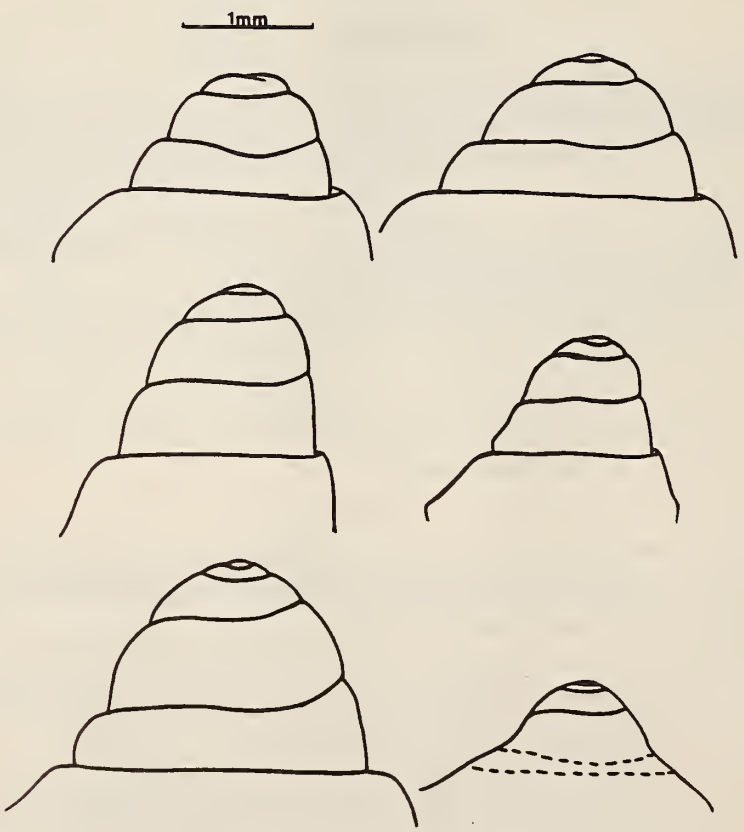

Fig. 2

The protoconchs of six species of *Oliva*, all drawn at the same scale. A is *Oliva bulowi* (specimen BT-0426), B is *Oliva caribaeensis* (specimen BT-3964), C is *Oliva porphyria* (specimen BT-3724), D is *Oliva oliva* (specimen BT-4591), E is *Oliva splendidula* (specimen BT-3731), and F is *Oliva carneola* (specimen BT-2548).

Timing.

Under optimal conditions, an experienced observer can perform these measurements in less than three minutes.

Reproductibility and dispersion of measurements.

Ten independent series of measurements were effected on the same specimen (*O.parkinsoni* Prior, Papua New Guinea, Laing Island, BT-0694). The results are given in Table I.

test	measurements on drawing					after conversion		
n°	RES4	RES5	RES7	cal.1	cal.2	RES4	RES5	RES7
1.	33.0	54.8	33.0	33.7	33.5	0.982	1.631	0.982
2.	32.5	55.0	32.8	33.5	33.5	0.970	1.642	0.979
3.	32.5	54.0	31.5	33.5	33.3	0.973	1.617	0.943
4.	31.8	54.0	32.2	33.3	33.5	0.952	1.617	0.964
5.	32.2	54.2	31.5	33.4	33.2	0.967	1.628	0.946
6.	32.6	56.0	32.3	34.5	34.5	0.945	1.623	0.936
7.	32.2	54.8	32.5	34.5	34.5	0.933	1.588	0.942
8.	33.3	56.2	32.5	34.5	34.5	0.965	1.629	0.942
9.	32.8	56.5	33.5	35.0	35.0	0.937	1.614	0.957
10.	32.8	56.2	32.8	34.8	34.8	0.943	1.615	0.943
					mean:	0.96	1.62	0.95
					standard deviation:	0.017	0.014	0.016
					% variability:	1.76	0.88	1.73

Table 1.
Analysis of ten independent measurements on the same shell (see text). Figures after conversion have not been rounded to their significant value.

METHODS.

Définitions and technique of measurements.

We shall henceforth adopt the convention described hereunder. Measurements are all performed upon careful drawings made with a binocular lens equipped with a camera lucida attachment. The measurements technique consists in five easy, consecutive steps.

1. The transition from protoconch to teleoconch is determined as accurately as possible under medium magnification (for instance 10 x 16). If the change of shell texture is not evident, abrupt modification of the suture or irregularities in the outline of the whorl are helpful indications. It helps to indicate the transition with a removable mark (for instance with a very fine felt pen).

2. Under small magnification (for instance 10 x 6.4) the specimen is oriented with its axis appearing roughly vertical in the microscope field and the transition facing the observer.

3. Under medium magnification (for instance 10 x 16), the specimen is now tilted in a vertical plane in such a way as to see the uppermost part (this is generally the sutural ramp) of the whorl just under the transition appear as much as possible as an horizontal straight line.

4. The shell is now rotated sideways until the transition appears in the middle of the line AB. The shell must now be oriented as shown in Fig. 3.

5. A careful drawing is now made with the help of the camera lucida attachment, at higher magnification (for instance 10 x 40). A segment of 1 mm (precalibrated on the ocular reticulum) is also drawn in duplicate in order to give the scale. On this drawing, a perpendicular is drawn from the apex upon the line AB. RES4, RES5 and RES7 are then measured in millimeters(with a ruler, decimals estimated) as indicated on Fig. 3. Their true values are obtained by dividing the measurements by the mean of the measured length of the 1 mm reference segments.

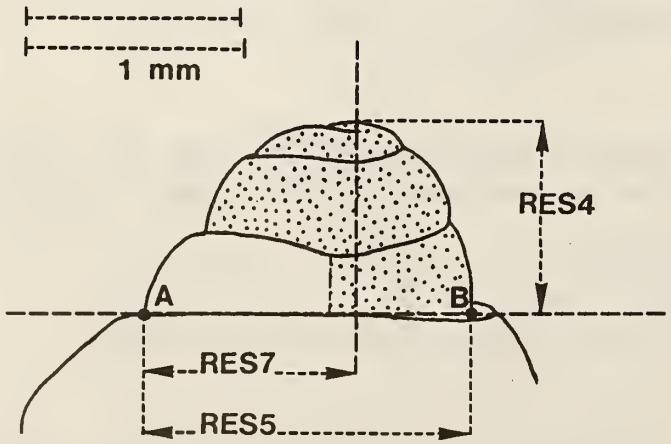

Fig. 3

The measurement of RES4, RES5 and RES7. The two 1 mm reference segments have been represented exaggeratedly unequal in order to indicate a possible source of experimental error.

Applications.

Two simple applications of these measurements to taxonomic problems are shown in Fig 4 and 5. The species selected are those pictured in Fig. 2. The taxonomic status of these samples is irrelevant for our demonstration. They are simply postulated to be separate phena and it is doubted that *Oliva* students will challenge this assumption. The observed distributions show that the proposed measurements constitute very sensitive tools for phenetic discrimination.

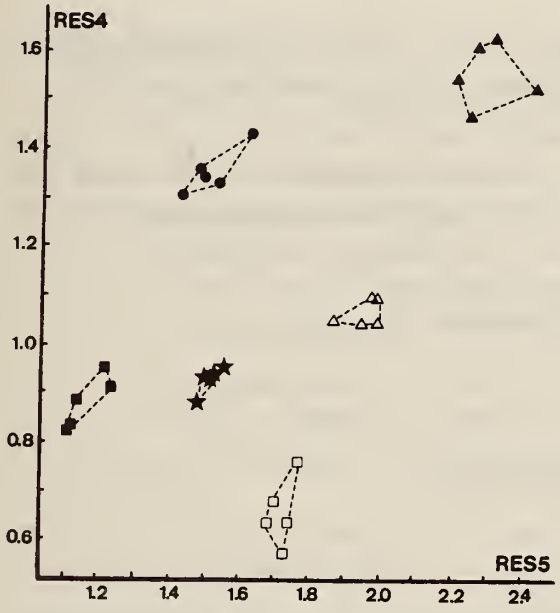

Fig. 4

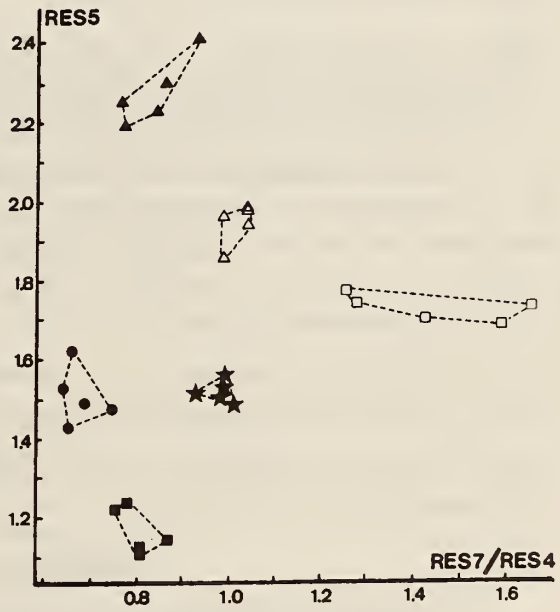

Fig. 5

Fig. 4

Scatter diagram of RES5 vs. RES4. Minimum convex polygons. Black dots are *Oliva porphyria*, black triangles are *Oliva splendidula*, open triangles are *Oliva caribaeensis*,black squares are *Oliva oliva*, stars are *Oliva bulowi* and open squares are *Oliva carneola*.

Fig. 5

Scatter diagram of RES7/RES4 vs. RES5. Minimum convex polygons. Black dots are *Oliva porphyria*, black triangles are *Oliva splendidula*, open triangles are *Oliva caribaeensis*, black squares are *Oliva oliva*, stars are *Oliva bulowi* and open squares are *Oliva carneola*.

MATERIEL EXAMINED

Measurements were performed on five specimens of each of the following species . BT- specimen numbers refer to the senior author's reference collection.

Oliva bulowi Sowerby, 1889. PAPUA NEW GUINEA : specimens BT-0422 to BT-0426 have all been dredged near Laing Island Biological Station in 45 m depth, sand.

Oliva caribaeensis Dall & Simpson, 1901. FLORIDA: specimens BT-2150 and BT-2154 are from Marathon Key, 1 fm. HAITI: specimens BT-2378, BT-3962 and BT-3964 from Gonave Bay, 15 fms.

Oliva carneola Gmelin, 1791. All from SOLOMON Islands. Specimen BT-0301 is from Guadalcanal, specimen BT-2516 from Langalanga lagoon, specimens BT-2548, 2549 and 2553: no accurate locality.

Oliva oliva Linnaeus, 1758. This taxon in its current acceptation is clouded by considerable uncertainty. We refer here to the jet black form common in the south of the Philippines (probably the form described by Linnaeus and the type species of the genus *Oliva*, see OLSSON and DANCE, 1966). PHILIPPINES : specimens BT-4589 to BT 4593 are all from the Sulu Sea area.

Oliva porphyria Linnaeus, 1758. PANAMA (Pacific Coast) : specimens BT-3717, 3722, 3724 and 3726 were dredged near Cebaco Island at a depth of 120 ft.

Oliva splendidula Sowerby, 1825. PANAMA (Pacific Coast, no accurate locality) specimens BT-3729, 3731, 3733, 3736 and 3737.

DISCUSSION.

RES5 measures the maximum diameter of the protoconch, RES4 its maximum height, while RES5 reflects the slope of the protoconch whorls.

For protoconch measurements to constitute useful taxonomic characters they should lead to appreciable differential clustering should appear in bi-dimensional sections of this hyperspace (scatter diagrams, see MAYR, 1969) as this would allow simple visual detection of special covariance sets (see GOULD, 1984) without the help of complex computer programs. Inspection of figures 4 and 5 shows that is indeed the case.

It would of cause be naive to hope that all species of the large and complex genus *Oliva* would be separated on the basis of only three characters. The set of species taken as example is biased and was selected to show some "good" cases chosen among many others.

Despite their usefulness for taxonomy, these characters will have a more restricted use for the quite separate purpose of specimen identification as measurements RES4 and RES7 require specimens with a perfect protoconch. This condition is rarely met for many species of *Oliva*, as the apex of commercially available specimens is often damaged. The measurement RES5 is especially helpful because it only necessitates the presence of the last protoconch volution and can still be performed on many imperfect specimens.

CONCLUSIONS.

Protoconch measurements RES4, RES5 and RES7 are fast, reproducible and lead to good differential clustering. In combination with the shell characters previously defined (TURSCH & GERMAIN, 1986) they constitute a powerful taxonomical tool in the genus *Oliva*. Their application to identification problems is limited by the availability of specimens with an intact protoconch. These characters could be equally useful in other Gastropod groups.

ACKNOWLEDGEMENTS.

We thanks Dr. Dietmar Greifeneder for stimulating discussions and criticism. We are grateful to Mr. Fernando Dayrit, Mr. Victor Dan and to Mr. and Mrs. Carlos and Fely Leobrera for their kind and valuable cooperation. We thanks Mr. Stephane Neven for his help with technical matters.

REFERENCES.

DALL,W.H. and C.T.SIMPSON, 1901. Mollusca of Puerto Rico. *Bull.U.S.Fish.Commission*, p.391,pl.56,fig.9.

GMELIN,J.F.,1791. *Caroli a Linné Systema naturae per regna triae naturae.* Editio decima tertia. Vol. 1, part 6. Vermes, pp. 3021-3910. Leipzig.

GOULD,S.J., 1984. Covariance sets and ordered geographic variation in *Cerion* from Aruba, Bonaire and Curaçao: a way of studying nonadaptation. *Systematic zoology*, 33(2), pp.217-237.

LINNAEUS,C.,1758. *Systema naturae per regna triae naturae*. Editio decima, reformata. Vol.1, Regnum Animale, part 1, 824 pp. Holmiae.

MAYR,E., 1969. *Principles of Systematic Zoology*. pp.428. McGraw-Hill, New York.

OLSSON,A.A. and S.P.DANCE, 1966. The Linnean Olives. *Bull. Am. Paleol.*, 50 : 227.

SOWERBY, G.B., 1825. *A catalogue of the shells contained in the collection of the last Earl of Tankerville*. pp. i-vi, app.pp. i-xxxiv, 9 col.pls., London.

SOWERBY, G.B., 1889. Descriptions of fourteen new Species of shells. *J.Lin.Soc.*, 20 : 395.

TURSCH,B. and L.GERMAIN, 1986. Studies on Olividae. I . A morphometric approach to the Oliva problem. *Indo-Malayan Zoology*, 2 (2): 331-352.