

ART. V.—*Notes on the Relation of the two genera of tubicolous Annelids, Vermilia Lamarek, 1818, and Pomatoceros Philippi, 1844; by K. J. Bush, Ph.D.*

[Brief Contributions to Zoology from the Museum of Yale Univ., No. LXVII.]

IN 1844 Philippi described a species from the Mediterranean, figuring its operculum (*P*) under the name of *Pomatoceros tricuspis*, creating for it the then new genus *Pomatoceros*, at the same time calling attention to its possible identity with *Serpula triquetroides* Delle Chiaje '28, which identity was established by Claparède '69 (p. 182). Philippi also pointed out its resemblance to *Vermilia triquetra* Lamarek '18, but on a later page applied this latter name to a form having a different operculum cap, which he also figured (*F*).

Among a number (12) of beautifully preserved specimens recently received from the Naples aquarium, under the name *Pomatoceros triquetroides* (*Vermilia triquetra*),* two have the operculum capped by a low asymmetrical calcareous cone surmounted by a group of three conspicuous tapered spines, well figured (*P*) in front view by Philippi, as *P. tricuspis*. Two have a similar but much elongated cone gradually tapered to the narrow truncated tip without spines, well figured (*F*) in back view by Philippi,† as *Vermilia triquetra* Lamarek; one is splitting at the summit, revealing a shorter interior cone. All of the others have the short cone without spines, comparatively broadly truncated on the end, the tip sometimes elongated and indistinctly notched. Similar great variation in form of the operculum cap is found among specimens in the Yale Museum, of *Pomatoceros triquetra* Linné from Denmark. The same forms were also figured by Sowerby '20 (pl. 1, figs. 2 *a, b, c*), as *Serpula triquetra* Linné‡ (*Vermilia* Lamarek, explanation of plate). The various species and even the genera with which these forms, being separated, have been identified by several more recent authors, apparently without establishing other more essential differences, has brought about the present great misconception or misinterpretation of the original application of names. In the two species under observation no generic differences, as the development of the tho-

* This combination is given by Lo Bianco '93 (p. 86).

† The operculum is often found with concave base, the wall drawn upward, giving in back view the effect of the median angle shown in Philippi's figure.

‡ As the fragment of mollusk to which the tubes of *Vermilia* represented in Sowerby's figure 2 are attached is presumably that of *Pecten maximus* found on the coast of England, his species could not have been the true *Serpula triquetra*. Its identity as suggested by Johnston '65, with *Vermilia conica* Fleming '25 and *Serpula armata* Johnston (not Edwards + Lütken + Grube), seems not to have been definitely established.

racic membrane, form of collar, setæ and uncini, are found, but only those of specific importance, as comparative size, number of branchiæ, comparative length and breadth of setæ and number of teeth on uncini, as well as the form of the operculum cap. The form of the tubes from Naples is also accurately shown in Sowerby's figure 2.

Lamarck '18, under this name (*Vermilia triquetra*), gives three widely separated localities (European Ocean, Mediterranean Sea, and Australian Sea), showing that there must have been three similar but distinct species under consideration, presumably *Serpula triqueter* Linné from North Atlantic, *Serpula triquetroides* Delle Chiaje (Philippi's figure *F*) from the Mediterranean, and variety *b* from Australia, which does not appear to have been identified with any of the more recently established species from that region.

As *V. rostrata*, the first species given by Lamarck under his genus *Vermilia*, has been found to be a typical *Spirobranchus* (Blainville '17), the second species would naturally stand for the type and the first named locality as the type locality, thus making *Serpula triqueter* Linné* (Lamarck in part) the type of the genus *Vermilia*, and as the *triqueter* Linné *non* Lamarck has been correctly referred by more recent authors to the genus *Pomatoceros* (Philippi '44), this name becomes synonymous with *Vermilia*, but for convenience might possibly be used as a varietal name to distinguish the form having the cluster of spines on the operculum cap, which occurs in the various species. Quatrefages '65 united *Pomatoceros* and *Vermilia*, but extended the limits of this genus to include many distinct genera.

Among the nine (9) species placed in the genus by Philippi '44, the first (*Vermilia triquetra*) only occurs among the eight (8) originally described by Lamarck, so that Philippi's interpretation is correct only as far as his species agree with this type. His species differ, however, not only in having the operculum capped by a calcareous or chitinous end, but also in the form of the peduncle, some being simple, stemlike, sometimes annulated, others somewhat compressed with conspicuous side appendages, as *V. triquetra* (fig. *F*), *V. elongata* (fig. *L*), *V. polytrema* (fig. *N*), a character apparently not hitherto considered of special interest; the manner of its attachment to the operculum or the relation of one to the other, which considerably modifies the form of both, is also important. These facts have been either ignored or, as stated by Claparède '70 (p. 523), thought of small importance, until the genus

* This was erroneously given by the writer '05 (p. 222) as the type of the genus *Pomatoceros*. *P. tricuspis* Philippi '44 (not Leuckart '49) was the only species given by Philippi.

Vermilia has become a kind of dumping ground for ill-defined, little understood, often unfigured forms, even sometimes for the empty tubes themselves. As more material has been studied, the species thus becoming better understood, the animals in many instances have been found to agree only in having a more or less bulbous operculum on a simple stemlike peduncle, capped by a horn-colored chitinous end (see Langerhans, Marenzeller, Ehlers, Moore). Comparative studies of other characters have revealed tangible differences, showing that even this interpretation, often designated as the *Vermilia* of Philippi, has been too laxly applied, necessitating the establishing of new genera, as follows:—

VERMILIOPSIS Saint-Joseph '94, restricted,—type *V. infundibulum* Philippi '44, as *Vermilia*, figure, not of authors. See p. 56. Mediterranean Sea.

The uncini have about 13 angular closely appressed teeth (in profile), the last one large and truncated. The abdominal setæ are strongly bent at the base of the rather broad angular tapered blades.

METAVERMILIA Bush '05,—type *M. multicristata* (Philippi '44, as *Vermilia*, figure+Marenzeller '93, as *Vermilia*, figures) Bush. Mediterranean Sea.

The uncini approach the form of those characteristic of the genus *Protula* and have about 18 sharp closely appressed teeth, the last one long, slender and curved. The abdominal setæ are but moderately bent, with broad abruptly tapered blades.

PARAVERMILIA Bush '05,—type *P. bermudensis* Bush '05. Bermuda.

The uncini with about 15 sharp appressed teeth, the last one large and truncated and more prominent. The abdominal setæ are but little curved, with long angular regularly tapered blades. Thoracic membrane forming a 3-lobed collar and lateral border to about the fifth segment; no posterior border.

PSEUDOVERMILIA gen. nov.,—*P. occidentalis* (McIntosh '85, as *Spirobranchus*, figures) Bush. Bermuda.

The uncini with about 13 closely appressed teeth, the last one prominent, large and bifid on end. The abdominal setæ bent, with long, angular abruptly tapered blades. Thoracic membrane forming a 3-lobed collar only, without lateral and posterior border.—

Specimens of *Vermilia triquetra* Linné (*Pomatoceros triquetra* Mörch) in the Yale Museum from Denmark are of good size, twice as large as *V. triquetroides* (Delle Chiaje), with 7 thoracic and about 70 abdominal segments, the branchiæ and peduncle beautifully banded with blue. There are 16 rather short, stout branchiæ in each lobe, connected by a basal mem-

branous web. The peduncle arising from the outer base of one of the lobes is compressed, with a thin gradually widening membrane on each side terminating in a long tapered free end at the base of the operculum, which, developing abruptly at the back, is in profile somewhat triangular in form, deep in front, oblique beneath, and truncated on top, capped by a calcareous more or less flattened disk having an abruptly developed asymmetrical cone-shaped mass or node of calcareous deposit on top, often bearing a group of three conspicuous spines, in other instances very irregular in outline; none seen forming a regular elongated cone as in Sowerby's figure 2c. The thoracic membrane is conspicuously developed, forming a deep rolling 3-lobed collar, the median lobe large, deepest in the middle, with conspicuously fimbriated edge, the lateral lobes less fimbriated, extending backward as a wide free lateral border joining a deep angular posterior flap. Inside the collar at the base of each lateral incision or cleft is an elongated irregular-shaped organ. Collar fascicle small, the setæ somewhat geniculate, with rapidly tapered blades; other six fascicles in very oblique series at the end of long tori situated in the posterior border of separate membranous areas, the setæ simple tapered; the uncini trapezoidal with 8 rather coarse strongly curved pointed teeth, the terminal one square cut and twisted. Abdominal setæ a little flaring with serrate edge and long slender tapered end. *Vermilia triquetroides* (Delle Chiaje) is readily distinguished by the very different form of the operculum and operculum cap, it being rather shallow, concave beneath, but giving evidence of becoming inflated and bulbous in form under favorable conditions; the cap is invariably an asymmetrical calcareous cone roughened by concentric lines of growth (see p. 52).

There are 14 or 15 branchiæ in each lobe united for a considerable distance by a delicate membranous web. The thoracic membrane is much developed, forming a very deep rolling 3-lobed collar, with conspicuously fimbriated edge merging into a wide lateral border and deep tapered posterior lobe. A peculiar irregularly shaped elongated organ is attached inside the collar at the base of each lateral cleft or incision. Philippi '44 and Lo Bianco '93 give the number of branchiæ as 18 in each lobe, so that the specimens under consideration cannot be fully developed.

Animals taken from the tubes are beautifully banded with blue.

A very young specimen between 2 and 3^{mm} long, taken from its tube, has the side appendages on the peduncle with the very slender free ends at the base of the small angular operculum, which is capped by a simple unequally thickened calca-

reous disk (there are 5 branchiæ in each lobe). Another considerably larger specimen has a scarcely raised asymmetrical cone, which in profile has the appearance of an unevenly thickened disk very much like figure *N* given by Philippi as *Vermilia polytrema* (p. 194) and described as a very short oblique cone, so that there can be little question that his species represents the young of the Mediterranean *V. triquetroides*. The figure given by Langerhans '83, under the name *V. polytrema* variety *digitata*, from Madeira is also probably the young of some species; the drawing (fig. 48) is, however, very misleading, as the digitate or fimbriate edge of the collar appears as a part of the operculum. The *Vermilia dinema* Mörch '63 (p. 388) also becomes synonymous.

Historical Notes on the name Vermilia infundibulum.

SERPULA INFUNDIBULUM Martini, 1776 (figure); Gmelin, ed. 1806 (p. 607); Lamarck 1818 (p. 364). Seas of India, on stones, tube only.

Lamarck describes tubes in his cabinet from the same locality with variety *b* from Isle of King, Australia. The name does not occur under his genus *Vermilia*. West Indies is given by Mörch '63 (p. 389) as the locality for Martini's species, which does not appear to be again mentioned under any of the species belonging to that fauna; Lamarck is quoted (p. 382) in the synonymy of *Serpula vermicularis*; his locality, however, is omitted. Both Quatrefages '65 (p. 524) and Claparède '70 (p. 523) state that it is impossible to correctly determine Gmelin's species.

Serpula infundibulum Delle Chiaje '28 (p. 226, figures) + Lo Bianco '93 (p. 83) *non* Martini.

SERPULA CRATER Claparède '70 (p. 525, figures). Mediterranean, Bay of Naples.

This species is referred to the genus *Hydroides* by Mörch '63 (p. 380).

Vermilia infundibulum Philippi '44 (p. 193, figure) not of authors.

Vermilia multivaricosa Mörch '63 (p. 389) + Marenzeller '93 (p. 39, figures) *non* Lo Bianco.

Vermiliopsis multivaricosa Saint-Joseph '94 + Bush '05 (type, p. 223).

VERMILIOPSIS INFUNDIBULUM (Philippi) Bush *non* Saint-Joseph. Mediterranean.

As none of the foregoing species prove to be the same as Philippi's, the name *multivaricosa* becomes superfluous, unfortunately causing great confusion in names, especially as *multivaricosa* was given for the type of the genus *Vermiliopsis* in

1905 and Saint-Joseph's interpretation in 1906 does not appear to be in accord with Philippi's species. A comparison of the figures of the operculum given by the two authors, as well as of those of the setæ and uncini given by Langerhans '84, as *V. infundibulum* and *V. spirorbis*, and Marenzeller '93, as *V. multivaricosa*, reveals well-marked differences. The species described by Lo Bianco '93 appears very like the one given by Marion and Bobretzky '75, as *V. infundibulum*.

Vermilia infundibulum Claparède '70 (p. 523, figures) + Langerhans '80 (p. 119, figures) non Philippi.

Genus? CLAPARÈDEI nom. nov.

Bay of Naples and Atlantic at Madeira.

Although well-figured and described, the true generic relation of this species, for which a new name is required, cannot be determined, as the thoracic membrane is not sufficiently well defined. It is described as large, forming a 3-lobed collar, and is represented in the figure as not forming a posterior border. The species is cited by Saint-Joseph as a typical *Vermilia*. Figures given by Langerhans '84 as *V. spirorbis* show marked affinity with those of Claparède.

Vermilia infundibulum Marion and Bobretzky '75 (p. 98, figures) non Philippi and Claparède.

? *Vermilia multivaricosa* Lo Bianco '93 (p. 93) non Marenzeller.

Genus? MARSEILLESSENSIS nom. nov.

Mediterranean at Marseilles and Bay of Naples; off Cannes?

Generic relation doubtful, shows affinity with the species dredged off Cannes, figured (116) by Saint-Joseph '06, as *Vermiliopsis infundibulum* in part. The *Vermilia galeata* Grube '60 (p. 113, figure) from Porto Re, Adriatic, is a related species.

Vermilia infundibulum Langerhans '84 (p. 278) non '80 and preceding authors. (Teste Saint-Joseph.)

Vermiliopsis infundibulum Saint-Joseph '06 (p. 249, figure) in part.

PARAVERMILIA (?) MEDITERRANEA nom. nov.

Atlantic at Madeira and Mediterranean off St. Raphaël.

This species as described by Saint-Joseph has some affinity with the type of the genus *Paravermilia*, but a comparison of the setæ and uncini is necessary before this generic relationship can be definitely established. The second briefly mentioned example seems a distinct species.

BIBLIOGRAPHY.

- Blainville, H. M. D. de. 1819. Dictionnaire d'histoire Naturelles, Paris, France.
- Bush, K. J. 1905. Tubicolous Annelides of the Tribes Sabel-
lides and Serpulides from the Pacific. Harriman Alaska
Expedition, XII, New York, U. S. A.
- Chiaje, St. Delle. 1828. Memorie sulla storie e notomia degli
animali senza vertebre del regno di Napoli, III.
- Claparède, E. 1869-70. Les annélides Chétopodes du golfe de
Naples. Mem. Soc. phys. Hist. nat. Genève, XX.
- Fleming, J. 1825. On the British Testaceous Annelides. Edin-
burgh Phil. Jour., XII.
- Gmelin. Edition 1806. Systema Naturæ.
- Johnston, G. 1865. Catalogue of the British non-parasitical
worms in the collection of the British Museum.
- Lamarck, J. B. P. A. de. 1818. Histoire naturelle des animaux
sans vertébrés, V.
- Langerhans, P. 1880 and 1884. Die Wurmfauna von Madeira,
Pts. II and IV. Zeitsch. wiss. Zool., XXXIII and XL.
- Linné, C. von. 1767. Systema Naturæ, XII.
- Lo Bianco, S. 1893. Gli anellidi tubicoli trovati nel golfo di
Napoli. Atti R. Accad. Sci. Napoli (2), V.
- McIntosh, W. C. 1885. Report on the Annelida Polychæta
H. M. S. Challenger, XII.
- Marenzeller, E. von. 1893. Polychaeten des Grundes. Denks.
Kais. Akad. wiss., LX.
- Marion, A. F., et Bobretzky, N. 1875. Annélides du golfe de
Marseilles. Ann. Sci. Nat. (6), II.
- Martini. 1776. Berl. Beschäft., 2.
- Mörch, A. L. 1863. Revisio Critica Serpulidarum. Naturhist.
Tidsskrift, I.
- Philippi, A. 1844. On the genus *Serpula*, enumeration of Medi-
terranean species. Archiv für Naturg., X.
- Quatrefages, A. de. 1865. Histoire Naturelle des Années, II.
- Saint-Joseph, Baron de. 1894 and 1906. Annélides polychètes
des cotes de Dinard. Ann. Sci. Nat. (7), XVIII. Annélides
polychètes des cotes de France. Ann. Sci. Nat. (9), III.
- Sowerby, J. 1820. Genera of recent and fossil Shells, I.
Zoological Laboratory,
December 14th, 1906.