

CONTRIBUTIONS TO JAPANESE ASCIDIAN FAUNA XXIV.  
ON *SIGILLINARIA CLAVATA* OKA, 1933<sup>1)</sup>

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*With 2 Text-Figures*

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At the chance when I was asked for the exact identification of a complicatedly branched colony of a compound ascidian from an unknown locality, which belongs to the Biological Laboratory, Ycshida College of Kyoto University, I reviewed the genus *Sigillinaria* OKA, 1933 together with the type species of the genus, *S. clavata* OKA, 1933. Three other similar colonies which came from the king crab fishing ground off West Kamchatka were submitted to me for identification by the Zoological Institute of Hokkaido University. The structure of zooids from these four colonies was found quite the same as that of the zooids from a small piece of the OKA's type colony of *Sigillinaria clavata*. Then the original description of *S. clavata* was checked. The relation between the genera *Ritterella* and *Sigillinaria* was discussed and the resting stage of *S. clavata* was referred to.

*Sigillinaria clavata* OKA, 1933

OKA, A., 1933. Proc. Imp. Acad., 9 (2), pp. 78-81, 2 figs.

*Ritterella clavata*: TOKIOKA, 1963. Publ. Seto Mar. Biol. Lab., 11 (1), p. 133.

- Material*: No. 1: Loc. unknown, possibly the Tisima (Kurile) Islands; one colony. Sp. No. 3356, Biol. Lab., Yoshida Coll. Kyoto Univ.
- No. 2: 55°46' N × 155°11' E, 60 m; June 4, 1959; Hokuho-Marū coll., one colony.
- No. 3: 56°16' N × 155°09' E, 65 m; August 19, 1959; Hokuho-Marū coll., one colony.
- No. 4: 55°27' N × 155°12' E; July 24, 1957; the 5th Katsura-Marū coll., one colony.

*No. 1 colony* (Fig. 1 A): About 14 cm long complicatedly branched colony. The colony consists of six branches attached to the common stem, about 7 cm long and 9-12 mm in diameter. Each branch, then, consists of a rather slender peduncle,

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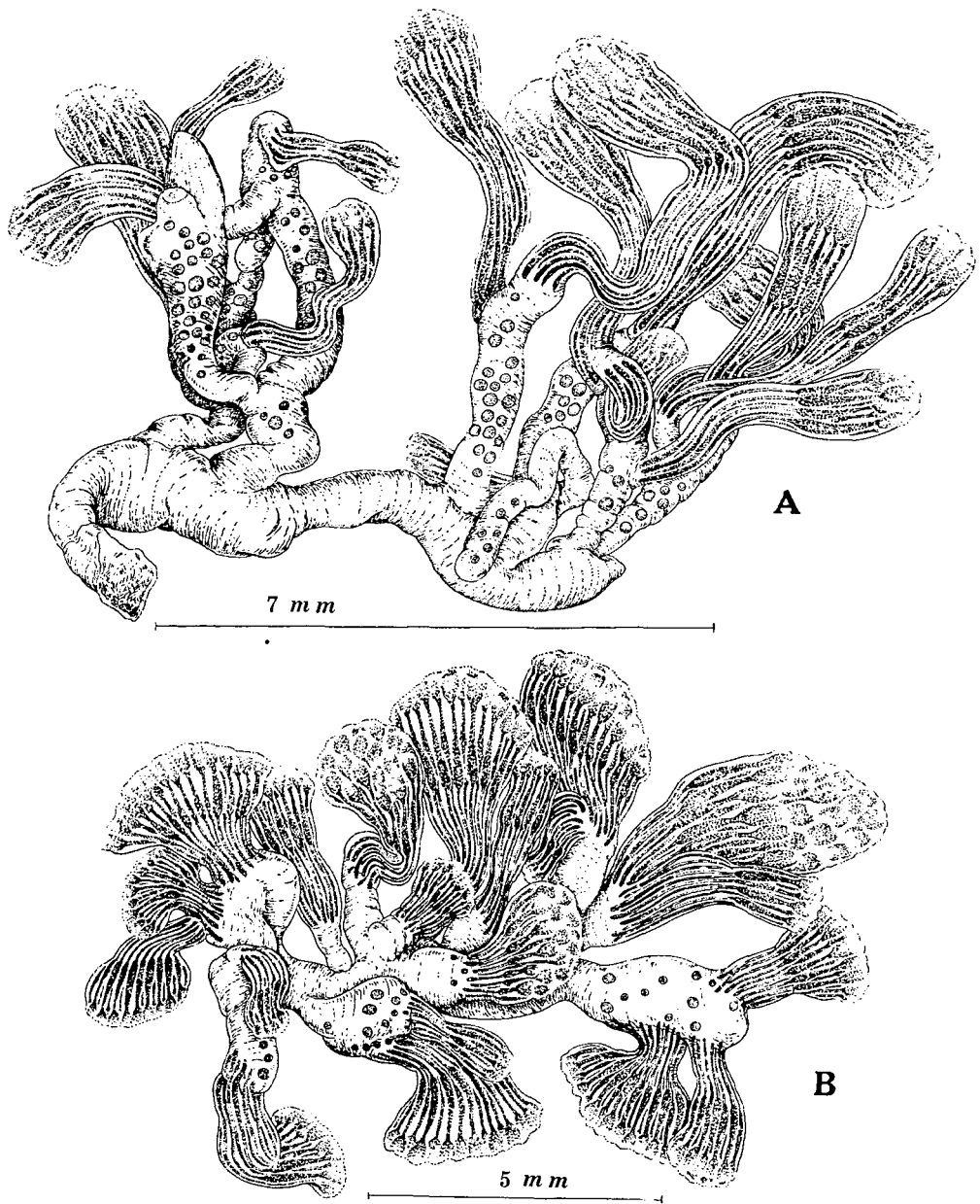


Fig. 1. *Sigillinaria clavata* OKA, 1933. A: No. 1 colony with longer peduncles, from? Tisima (Kurile) Islands. B: No. 2 colony with shorter stout peduncles, from the king crab fishing ground off West Kamchatka.

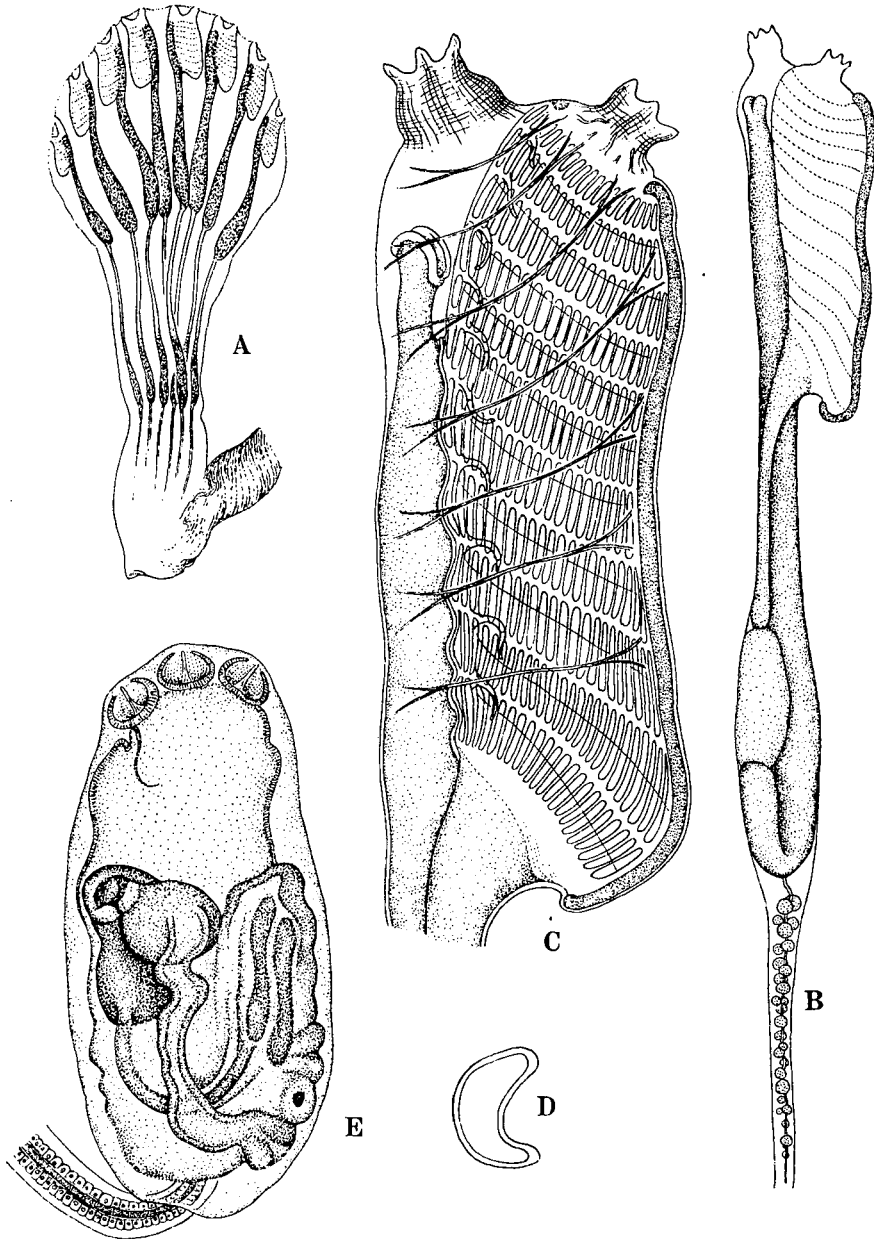


Fig. 2. *Sigillinaria clavata* OKA, 1933. A: Optical section of a cormidium. B: Right side of thorax, abdomen, and anterior portion of postabdomen. C: Right side of thorax. D: Cross section of stomach. E: Left side of embryo,  $\times 73$ .

about 6 mm in diameter, and two or three cormidia. The cormidium is about 40 mm long, generally club-shaped; the largest one 45 mm long and 25 mm in diameter; zooids embedded with their ventral side towards the periphery (Fig. 2 A). The common stem and peduncle are cartilaginous rather than gelatinous, milky white and translucent; the peduncles contain various numbers of somewhat pinkish spherical bodies, up to 2 mm in diameter. The proximal portion of the cormidium containing pinkish postabdomens is also faintly milky white, translucent, and rather hard. The middle portion of the cormidium containing abdomens becomes softer and transparent. The distal portion of the cormidium, the corona, which includes the thoraces is very soft and quite transparent. As the alimentary canal, exclusive of the oesophagus and stomach, but often together with the branchial sac, is packed with silt, the corona and the thoracic layer of the cormidium are coloured muddy. The colony surface is free from any foreign matters and nearly smooth.

The thorax (Fig. 2 C) is 5.5 mm to 7 mm in length, the abdomen is 9 to 12 mm, and the postabdomen attains to 22 mm, though sometimes it is only as long as the abdomen. Both the branchial and atrial apertures are six-lobed and open each directly to the exterior; in a considerably contracted state the atrial is always situated anterior to the level of the branchial. The exact arrangement of the thoracic muscles is uncertain, because of an unsatisfactory state of preservation, though at least several oblique or transverse muscles are clearly discernible.

Stigmatal rows are 11 to 13, most frequently 11 to 12; probably 20 to 25 very elongate stigmata in each row on respective sides. The horizontal membrane is well developed, especially along several posterior transverse vessels; there the free margin of the membrane may attain the middle of the following stigmatal row when the membrane is flapped down. The dorsal languets are very slender and displaced in the posterior part of the branchial sac to the left side for several stigmata. OKA gave the tentacle formula as 6 large-6 intermediate-12 small, but in the present material smaller ones else than 6 (or 8) larger could not be counted exactly. The ciliated groove is a small elliptical opening. The distal end of the rectum is attached to the branchial sac nearly at the level of the sixth transverse vessel, but the anus which is distinctly bilobed is further protruded out anteriorly for two to three stigmatal rows so that the level of the anus approaches in a more or less contracted state the anterior end of the branchial sac. Several elongate embryos are found in the incubatory pouch on the right dorsal side of the thorax.

The abdomen (Fig. 2 B) is very slender. The oesophagus is thin, the posterior portion is slightly thickened and faintly pinkish. The stomach is elongate, the cardiac end begins approximately at the middle of the abdomen and the pyloric end is situated at the middle of the posterior half of the abdomen. It is pinkish orange and the surface is quite smooth. In cross section it is crescent-shaped, being concave on the side facing the intestine (Fig. 2 D). No other distinct junction was observed on the following part of the alimentary canal. The circum-intestinal gland was obscure in

zooids of the present material.

The postabdomen (Fig. 2 A, B) is very long and thin; the posterior portion is slightly swollen and packed with pinkish parenchymal tissue; a vascular vessel issued from the posterior end penetrates deep into the peduncle. A number of small ova, some of which, at least the posterior ones, might be testicular follicles, are found in the anterior portion in some zooids.

The embryos (Fig. 2 E) are elongate,  $990\ \mu$  long and  $460\ \mu$  wide (mean of 4 embryos). Three spherical attachment processes are sessile and arranged linearly; the pigment spot of the sensory organ is situated very posteriorly.

*No. 2 colony* (Fig. 1 B): About 13 cm long colony, branched just similarly to the No. 1 colony. In this colony, however, the peduncles are very short and stout, and the spherical bodies which are very abundant in the No. 1 colony are distributed much more sparsely near the proximal end of the postabdominal layer of respective cormidia and somewhat smaller, about 1 mm in diameter. One to three, most frequently two to three cormidia are attached to each peduncle. The distal part of the cormidium including the corona and the thoracic layer is nearly spherical, club-shaped, or expanded to a fan-shape. The general appearance of the colony surface and the exact structure of the zooid are quite the same as those of the No. 1 colony.

*No. 3 and No. 4 colonies*: These colonies assume the appearance of the No. 2 colony deprived of the soft distal part of respective cormidia. The spherical bodies embedded in the peduncle are much more numerous and become a little larger, up to 2 mm in diameter.

### Considerations

The above-mentioned features agree exactly with the original description given by OKA (1933) only except the number of the stigmatal rows. According to OKA, "Bei fast allen Individuen konnte ich 16 Kiemenspaltenreihen zählen" (p. 80). In spite of my efforts, no more stigmatal rows than 13 were observed. Very fortunately, it was found that a small piece of the type colony of *S. clavata* was in my hand. Though the state of preservation of zooids was not so good, the existence of 12 stigmatal rows was confirmed. As the free edge of the horizontal membranes cuts the stigmatal rows into the anterior and posterior halves when they are flapped down, it is not impossible that some posterior rows were counted under microscope twice as much. Most probably, however, 16 is a misprint for 12.

The No. 1 colony reminded me of the Polycitoridae form B (Pl. 25, fig. 34) from the king crab fishing ground off western Kamchatka (ТОКИОКА, 1960). As the appearance of this Polycitoridae form B resembles exactly that of the No. 1 colony deprived of the soft distal portion of cormidia, it may be accepted very safely that the Polycitoridae form B is nothing but the resting stage of *S. clavata*. OKA must notice this when he made the description of *S. clavata* as seen in some lines of his paper (p. 79)—"Die Einzeltiere sind auf die Köpfe beschränkt, während der Stiel derselben

vollkommen entbehrt und nur hier und da zerstreut eingebettete kugelige Larvenknospen durchschimmern lässt". The Polycitoridae form A shown in TOKIOKA's same paper probably belongs to another species, as the branching feature and the appearance of branch tips are unique.

HUUS (1937) treated the polyclinid referable to *Sigillinaria* OKA, 1933 under the genus *Ritterella* HARANT, 1931 which was defined as "Polycliniden mit frei ausmündenden Atrialöffnungen. Magen mit Längsfalten. Kieme mit 8 Kiemenspaltzonen, sonst wie *Pseudodistoma*" (pp. 667-668), with the type species *Amaroucium aequali-siphonis* RITTER & FORSYTH, 1917. And VAN NAME (1945) applied the genus *Sigillinaria* for *Distoma pulchra* RITTER, 1901 and *Amaroucium aequali-siphonis* (pp. 73-75). I combined the opinions of HUUS and VAN NAME and showed *S. clavata* as *Ritterella clavata* (OKA) on the list of Japanese ascidians (TOKIOKA, 1963).

Really *Distoma pulchra*, *Amaroucium aequali-siphonis*, and *Ritterella pedunculata* TOKIOKA, 1953 from the northern North Pacific are provided with the stomach with very distinct longitudinal plications and thus they are properly referable to the genus *Ritterella*. However, this is very questionable about *Sigillinaria clavata*. One problem is whether or not the stomach of *S. clavata* can be regarded as longitudinally plicated. As shown in the description given above, the stomach of *S. clavata* is crescent-shaped in cross section, with two angles; otherwise the surface is quite smooth. These two angles are hardly regarded as longitudinal plications.

The other problem concerns the phylogenetic significance of the surface appearance of the ascidian stomach. As seen in series of species in genera *Distaplia*, *Clavelina*, and *Ecteinascidia* for instances, the feature of the stomach wall may differ considerably in the range from smooth to plicated even in the same genus. However, in the family Synoicidae the structure of the stomach wall is admitted as a very important criterion to separate the genus *Synoicum* from the genus *Amaroucium*. It cannot be judged easily whether this generic distinction is phylogenetic or arbitrary. Even if the latter is the case, the generic separation may be very useful in some cases for convenience's sake. Then, in the family Synoicidae, it might be recommendable to treat *S. clavata* separately from the group including *D. pulchra*, *Am. aequali-siphonis*, and *R. pedunculata*. For this reason, it is proposed here that the genus *Sigillinaria* is defined as follows and retained as a valid genus distinct from *Ritterella*.

*Sigillinaria*: The stomach without longitudinal plications. Stigmatal rows more than 11 (as is seen in the known species). Otherwise quite like *Ritterella* and *Pseudodistoma*. Single species known; *S. clavata* which is distributed widely in the western subarctic region of the North Pacific, around Karahuto (Sakhalin), the Tisima (Kurile) Islands, and Kamchatka.

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