

Asexual Reproduction in the Colonial Polychaete
Spiochaetopterus costarum costarum
(Claparède, 1868) (Annelida: Chaetopteridae)
in Okinawa, Japan

Eijiroh Nishi

Natural History Museum and Institute, Chiba
955-2 Aoba-cho, Chuo-ku, Chiba 260, Japan

Abstract Asexual reproduction of *Spiochaetopterus costarum costarum* (Claparède, 1868) (Polychaeta: Chaetopteridae) was first observed during rearing in the laboratory in Okinawa. An individual cut off their posterior abdomen and is separated into two parts. Each part of body regenerated the lost part within two weeks. Tube was branched after first or second asexual reproductions. This kind of asexual reproduction is strongly related to colony formation, and occurred simultaneously with sexual reproduction.

Key words: Chaetopterid polychaete, asexual reproduction, colony formation.

Spiochaetopterus costarum costarum (Claparède, 1868) and *Phyllochaetopterus* sp. (Annelida, Polychaeta) were collected from a sandy beach of Bise in the northern part of Okinawa, at about 1 to 2 meters in depth. These two species are aggregated and 20 worms of *S. costarum* forming 4 colonies were collected in November and December, 1994.

S. costarum costarum is a small chaetopterid, with only 5 to 20 mm in length. The thorax and head is creamy white, and the abdomen is dark green or black. Palps are long with a slightly orange ciliated path. Tubes are transparent and the motile worms in the tube are seen from outside. The tubes are 40 to 150 mm in length, usually surpassing in length of the body. They are so fragile and aggregated that the complete tubes were not collected easily.

Among 20 worms, 2 tubes are each occupied with 2 worms, and others are each occupied with only 1 worm. In order to observe asexual reproduction, rearing was done in laboratory in a circular plastic container, 10 cm in diameter, 5 cm height, under ambient light, 20-22°C, and weakly aerated.

Some worms were fixed with 2% glutaraldehyde and dehydrated through alcohol series, dried with a critical point-drier, coated with

gold-paradium and then viewed with a scanning electron microscope (Hitachi S-530). Figure 1A-C are illustrated on the basis of the photographs. Ten worms with tubes were fixed and preserved in 75% alcohol, and deposited in Natural History Museum and Institute, Chiba (CBM-ZW-70-75).

Observations

Among 20 worms, two worms had already reproduced asexually before collection. One worm consisting of head and thorax had 10 abdominal segments which were probably regenerated. On the other hand, in the worm consisting only of abdominal segments, the first thorax segment and small palps appeared after one week. The two separated worms which originally form one individual were placed in the same tube during observation of 2 weeks. Another worm that had cut off its posterior abdomen had 8 abdominal segments, and the individual composed only of posterior part of abdomen have 16 abdominal segments. These worms lived in branched tubes.

Within 1 week, another two worms commenced asexual reproduction. One series of worms were produced by asexual reproduction within 2 weeks as noted below.



Fig. 1. Three worms resulting from asexual reproduction in *Spiochaetopterus costarum costarum*. The first worm (A) has complete head and thorax but lacks posterior parts of abdomen. The second worm (B) has the regenerated incomplete head and thoracic segments with short. The third worm (C) lacks head and anterior part of thorax, but has complete posterior abdomen.

On the second day of rearing, one worm (first or original worm) cut its abdomen in the middle, into two worms, one with head, thorax, middle and short 6 abdominal segments (Fig. 1A) and one (second worm) with only 18 abdominal segments. After 2 days, a dorsal lip appeared on the second worm, and on the 4th day, the first thorax or middle segment appeared. Seven days later, the 4th thorax segment appeared, and the posterior abdominal part was again cut off its posterior part, creating a

third worm found in the tube. At this time, the second worm had 6 abdominal segments and the third worm had 15 ones. Two days after the second incident of asexual reproduction, the third worm had dorsal lips and the first thorax segment (Fig. 1C). Two weeks after the first incident of asexual reproduction, palps, dorsal lips, and 7 thorax segments appeared on the second worm (Fig. 1B). The first worm regenerated 3 abdominal segments within two weeks. The thorax and head region of the

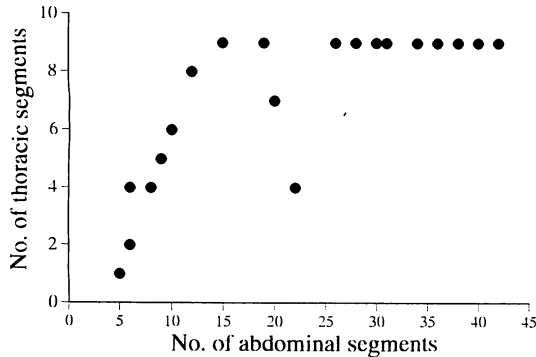


Fig. 2. Relationship between the number of abdominal segments and the one of thoracic segments in *Spiochaetopterus costarum costarum*.

second worm were narrower than the mature one (Fig. 1A, B), and the palps of the second worm were about half the length of the mature one. The ciliary path of dorsal side appeared and have probably become functional 2 weeks after the first reproduction. When fixed by glutaraldehyde, the first worm expelled abundant sperm.

The tube was branched when occupied by a single worm, or two or three worms. The third worm occupied separate branch, but was also frequently found to occupy the same section of tube as the others. Thus the three worms were frequently contact with one another. The three worms were observed in a single branched tube during 1 month, even though the tube has increased in length. Tri-branched tube with two worms have also been found in nature, and therefore the relationship between the number of worms contained and the number of tube branch does not seem to be necessarily correlated in *Spiochaetopterus costarum*.

The number of thorax and abdominal segments were noted in Figure 2, and this result shows that they reproduced asexually by cutting their abdomen.

Discussion

Phyllochaetopterus prolifica is known to reproduce asexually (Abbott and Reish, 1980), but they noted that the immature worms reproduce asexually by repeated fission and regeneration, and as many as six juvenile worms occupy the same tube. New tubes started as

branches arising from the walls of older tubes. To a large but unknown degree, clusters of tubes represent clones of worms (Abbott and Reish, 1980). Pott (1914) also reported asexual reproduction of *Phyllochaetopterus* spp.

This is the first record of asexual reproduction in *Spiochaetopterus* spp. The asexual reproduction of *Spiochaetopterus* is similar to that of *Phyllochaetopterus* as reported by Potts (1914). *Phyllochaetopterus* sp. collected from Bise also have branched tubes and I rarely observed regenerated worms, suggesting that this species also reproduced asexually.

Spiochaetopterus costarum form very small colonies, containing small number (5–20) of worms. The tubes among colony members are easily separated during the procedure of collecting because the connection between tubes is not tight. However, these colony members are rarely connected by tubes so that they are considered to be produced asexually. These conditions are similar to those of *Phyllochaetopterus socialis* (Potts, 1914), and, in the latter case, the individuals of each colony (=tube mass) are of the same sex (Pott, 1914). Asexually reproducing *Dodecaceria* also form colonies through asexual reproduction, and their colony contained worms of the same sex (Berkeley and Berkeley, 1954). However, in my study of *Spiochaetopterus*, it was not determined as to whether the colony members has the same sex or not because the sexual reproduction is difficult to observe under the rearing condition.

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沖縄本島備瀬の海岸で採集されたツバサゴカイ科
の1種 *Spiochaetopterus costarum costarum*
(Claparède, 1868) の無性生殖について

西 栄二郎

千葉県立中央博物館
〒260 千葉市中央区青葉町 955-2

沖縄本島備瀬の海岸でツバサゴカイ科の1種 *Spiochaetopterus costarum costarum* (Claparède, 1868) を採集し、室内で無性生殖の経過を観察した。虫体は体の後半部を切り離し、それぞれ失った部分を2週間以内に再生した。それに伴い棲管も2又し、各個虫がそれぞれの棲管に分かれて入った。このような無性生殖方法はこの種の群体形成にとって重要であろう。