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[SHORT COMMUNICATION]

Germ Band Formation of a Centipede *Scolopendra subspinipes* L. Koch (Chilopoda: Scolopendromorpha)

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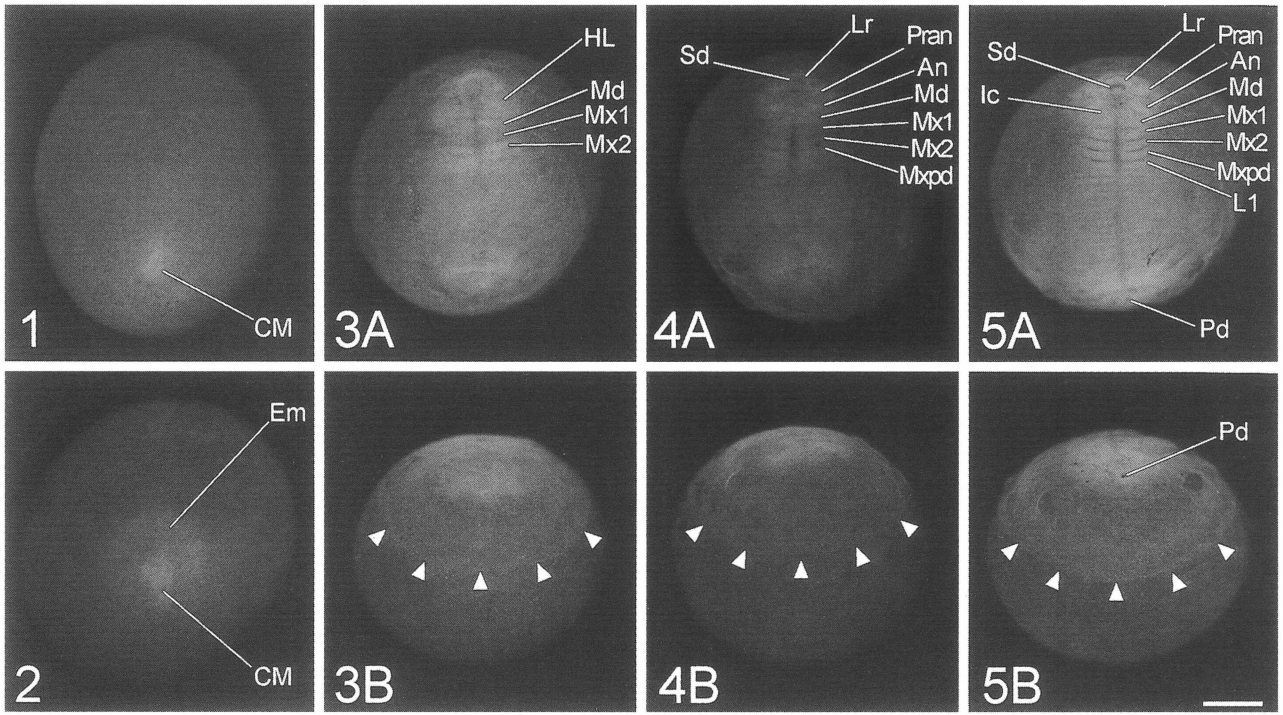
Heymons (1901) described, for *Scolopendra cingulata* embryogenesis (Scolopendridae, Scolopendromorpha), that the middle trunk segments differentiate the first, the following segments the next, and the cephalic segments the last. However, based on our embryological observation on a cryptopid, *Scolopocryptops rubiginosus*, we generalized that the germ band formation in chilopods proceeds sequentially from the anterior, and suggested a possibility that Heymons should have misleadingly described the germ band formation of *Scolopendra cingulata* with its anteroposterior axis reversed (Sakuma and Machida, 2002). Recently, we obtained a series of eggs different in developmental stage of a Japanese scolopendrid, *Scolopendra subspinipes*, and here test our interpretation on Heymons' observation.

With the developmental rate deviated between individual eggs, the embryogenesis of *Scolopendra subspinipes* takes 16–18 days at room temperature (about 20℃). The developmental process here illustrated occures about in two days from 10 days after oviposition. First, cells are densified into a small circular mass, about 500 μm in diamiter, in the ventral surface of the blastoderm (Fig. 1). This corresponds to the "cellular mass" in *Scolopocryptops rubiginosus* (Sakuma and Machida, 2002). Soon after this, the region anteriorly and laterally surrounding the cellular mass is densely cellulated, to be the embryonic area (Fig. 2). Then, whereas the cellular mass disappears, the embryonic area rapidly expands and elongates. Consequently, its anterior end attains near the anterior egg pole (Fig. 3A), and its posterior end reaches the posterior egg one (Fig. 3B). The embryo is at the posterior region twice as wide as at the anterior one. In the anterior region of embryo, the mandibular, and first and second maxillary segments are visible (Fig. 3A). The posterior region of embryonic area is low in cellular density, but its medial region is as high in cellular density as the anterior region of embryo, which includes the trunk segments yet to develop and the precursor of telson (Fig. 3B). In the next step of development, the labrum, preantennal, antennal and maxillipedal segments, and stomodaeum are clearly distinguished in the anterior region of embryo (Fig. 4A), but in the posterior one, no change is observed (Fig. 4B). Soon after a while, the intercalary and the following some trunk segments differentiate (Fig. 5A). The proctodaeum appears in the presumptive telson at the posterior end of the above-mentioned densely cellulated area (Fig. 5B). The segmentation in the trunk further proceeds sequentially from the anterior up to the 21st trunk segment, and the embryo further elongates to occupy a half of egg circumference (Fig. 6A–C). Then posterior region of embryo, which has been thinly spread, condenses, to be narrow and well defined (Fig. 6B, C). The telson with the proctodaeum in its center becomes obvious, and takes its position at the caudal end of embryo (Fig. 6C).

The present study reveals that, in *Scolopendra subspinipes*, the cephalic segments differentiate the first and the trunk segment the next, that is, the segmentation proceeds sequentially from the anterior to the posterior. Hence, we would conclude that Heymons (1901) should have described the segmentation process for *Scolopendra cingulata* with



Figs. 1–5 Eggs of *Scolopendra subspinipes*, observed under a fluorescence stereomicroscope (Leica, MZ FL III, UV-excitation). The eggs incubated at room temperature (about 20℃), were fixed and dechorionated in Karnovsky's fixative, and stained with DAPI (4',6-diamidino-2-phenylindole dihydrochloride, diluted about a million times with PBS). Arrowheads show the posterior limit of embryonic area. See the text.

Fig. 1 An egg 10 days after oviposition, from the same butch as the egg shown in Fig. 2.

Fig. 2 An egg 11 days after oviposition.

Fig. 3 An egg 11 days after oviposition, from the same butch as the eggs shown in Figs. 4, 5. A. Ventral view. B. Posterior view.

Fig. 4 An egg 11 days after oviposition. A. Ventral view. B. Posterior view.

Fig. 5 An egg 11 days after oviposition. A. Ventral view. B. Posterior view.

An: antennal segment, CM: cellular mass, Em: embryo or germ band, HL: head lobe, Ic: intercalary segment, L1: 1st leg-bearing segment, Lr: labrum, Md: mandibular segment, Mx1, 2: first and second maxillary segments, Mxpd: maxillipedal segment, Pd: proctodaeum, Pran: preantennal segment, Sd: stomodaeum. Scale = 1 mm.

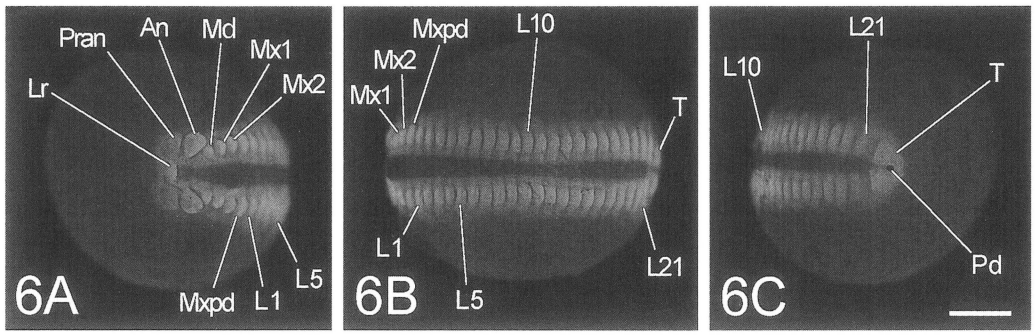


Fig. 6 An egg of *Scolopendra subspinipes*, 12 days after oviposition. The technique used is the same as in Figs. 1–5. A. Anterior view. B. Ventral view. C. Posterior view. An: antennal segment, L1, 5, 10, 21: 1st, 5th, 10th and 21st leg-bearing segments, Lr: labrum, Md: mandibular segment, Mx1, 2: first and second maxillary segments, Mxpd: maxillipedal segment, Pd: proctodaeum, Pran: preantennal segment, T: telson. Scale = 1 mm.

the anteroposterior axis of embryos reversed, as previously suggested by us (Sakuma and Machida, 2002): our Figures 3 and 4 for *Scolopendra subspinipes* may respectively correspond with Heymons' Figures 12 and 8 for *Scolopendra cingulata*, with reversing their orientations. In this respect, it may be significant that in another scolopendrid, *Rhysida immarginata*, the segmentation proceeds sequentially from the anterior as well (Ivanov, 1940).

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