Proc. Arthropod. Embryol. Soc. Jpn. 50, 17 (2016)

ISSN 1341–1527

Embryology of a "Living fossil" Beetle, *Tenomerga mucida* (Chevrolat, 1829) (Archostemata, Cupedidae)*

Kazuki KOJIMA and Ryuichiro MACHIDA

Sugadaira Montane Research Center, University of Tsukuba, Sugadaira Kogen, Ueda, Nagano 386–2204, Japan
E-mail: s1521002@u.tsukuba.ac.jp (KK)

The order Coleoptera, the most species-rich lineage of Holometabola, comprises about 40% of the described species in Hexapoda. The order is divided into four suborders, *i.e*., Archostemata, Myxophaga, Adephaga and Polyphaga, but their phylogenetic relationships have been variously discussed. Archostemata, which include the oldest fossil record of Coleoptera, have been often regarded as being the basalmost lineage of the order from morphological and molecular evidence (Friedrich *et al*., 2009; Bocak *et al*., 2014). Thus, Archostemata are the most significant coleopteran subgroup in understanding Coleoptera, especially in the reconstruction of its groundplan and phylogeny. Although comparative embryology is one of the most useful approaches in phylogenetic discussions, no embryological study has been conducted for Archostemata. In such background, we have started an embryological study, aiming at the reconstruction of groundplan and phylogeny of Coleoptera, using *Tenomerga mucida* (Chevrolat, 1829) as material. In the present talk, we report the outline of embryogenesis of *T. mucida* as well as the embryological technique established.

We collected the rotten logs including *T. mucida* larvae and brought back them to our laboratory to obtain adults. Mating is of tail-to-tail type. Females laid eggs, 100 in average, maximum ca. 130 per one female, on the surface of sliced pieces of logs. Eggs are orange-brown in color and long-oval-shaped with about 1.5mm length and 0.4 mm width. A knob-like projection with micropyles or the micropylar projection is at the anterior pole of the egg. The micropylar projection closely resembles those found in aquatic Adephaga (Komatsu and Kobayashi, 2012) and raphidiodean Neuroptera (Tsutsumi and Machida, 2006). Close resemblance in micropylar structures between Coleoptera and Neuroptera should be noteworthy, their affinity being strongly suggested in recent molecular analyses (*cf*. Misof *et al*., 2014). We stained with DAPI and observed embryos under a fluorescence stereomicroscope and grasped the outline of *T. mucida* embryonic development. It was revealed that *T. mucida* embryo completely sinks deep into the yolk in the middle stage of embryonic development. The complete immersion of the embryo into the yolk may be the first example in Coleoptera. After the embryonic development of about 10 days (under the room temperature), larvae hatched out from near the anterior pole of the egg. The first instar larva walked around in the rearing case to seek for residence, and in several days they burrowed among rotten logs.

References

Bocak, L., C. Barton, A. Crampton-Platt, D. Chesters, D. Ahrens and A. P. Vogler (2014) Building the Coleoptera tree-of-life for >8000 species: Composition of public DNA data and fit with Linnaean classification. *Systematic Entomology,* **39**, 97–110.

Friedrich, F., B. D. Farrel and R. G. Beutel (2009) The thoracic morphology of Archostemata and the relationships of the extant suborders of Coleoptera (Hexapoda). *Cladistics*, **25**, 1–37.

Komatsu, S. and Y. Kobayashi (2012) Embryonic development of a whirligig beetle, *Dineutus mellyi*, with special reference to external morphology (Insecta: Coleoptera, Gyrinidae). *Journal of Morphology*, **273**, 541–560.

Misof, B., S. Liu, K. Meusemann and 98 other authors (2014) Phylogenomics resolves the timing and pattern of insect evolution. *Science*, **346**, 763–767.

Tsutsumi, K. and R. Machida (2006) Embryonic development of a snakefly *Inocellia japonica* Okamoto: An outline (Insecta: Neuroptera, Raphidiodea). *Proceeding of the Arthropodan Embryological Society of Japan*, **41**, 37–45.

* Abstract of paper read at the 51st Annual Meeting of the Arthropodan Embryological Society of Japan, June 12–13, 2015 (Urabandai, Fukushima).