Proc. Arthropod. Embryol. Soc. Jpn. 44, 29–32 (2009)

ISSN 1341–1527

[SHORT COMMUNICATION]

Eggs and Their Deposition and Care of a Primitive Earwig *Diplatys flavicollis* (Shiraki) (Dermaptera: Diplatyidae)

Shota SHIMIZU and Ryuichiro MACHIDA

Graduate School of Life and Environmental Sciences, University of Tsukuba, Tsukuba, Ibaraki 305–8572, Japan
Current address: Sugadaira Montane Research Center, University of Tsukuba, Sugadaira Kogen, Ueda, Nagano 386–2204, Japan
E-mail: ooarikui@sugadaira.tsukuba.ac.jp (SS)

Dermaptera have been assigned various positions in "Polyneoptera," and their closer affinity to Acercaria (=Paraneoptera) or Endopterygota has often been suggested (cf. Klass, 2003). Dermaptera are therefore a significant group in reconstructing the phylogeny and groundplan of "Polyneoptera" and Neoptera. The comparative embryological approach is one of the most useful methods for elucidating phylogenetic issues. In spite of several studies by Heymons (1895, 1912), Hagan (1951), Fuse and Ando (1983), Kusakari and Machida (2005) and Kusakari (2006), our knowledge of embryology on Dermaptera remains scanty and fragmented.

Against such a background, we planned a comparative embryological study of Dermaptera. We succeeded in collecting a primitive dermapteran, *Diplatys flavicollis* (Shiraki), rearing them and obtaining their eggs. Here we give a brief note on eggs and their deposition and care.

Diplatys flavicollis is characterized by a pair of filamentous, annulated cerci about twice as long as the body length in larval stages (Fig. 1), although adult cerci are modified into forceps as in other dermapterans (Figs. 2, 3). Through field surveys on Ishigaki Island in April and October 2007 and April 2008, we collected 150 juveniles, six females and two males of *Diplatys flavicollis* from a beach of Sokobaru River. The collected dermapterans were separately reared in a 30 mm×100 mm×100 mm plastic case with a moistened soil bottom, on which a 5-mm thick, 60-mm square glass plate was placed as a refuge as well as a moistened tissue as a hydrator and a dried anchovy as food on aluminum foil (Fig. 4).

For mating, a pair collected from the field or a pair raised to adults in the laboratory was kept in a single rearing case for several days. The pair mated repeatedly, and each copulation lasted several hours. After mating, the male was taken away from the case. The mated female made a nest under the glass plate (Fig. 5) to lay her eggs. Over several days, the female deposited about 30 eggs, which were 1 mm×0.6 mm ivory ellipsoids since the yellowish yolk was visible through the translucent chorion (Fig. 6). An adhesive stalk of about 250 μm length was seen in the posterior pole of the egg (AS in Fig. 6), and the deposited eggs were stuck to the soil or glass plate by this adhesive stalk (Fig. 10), which initially remained sticky so we rarely observed the female moving the eggs by taking them in her mouth, for one day the egg stalk lacked viscosity, thereafter, the eggs could not be moved. Maternal care of the eggs was not intensive; the female merely sat near the eggs (Fig. 10) and less frequently touched them with her mouthparts.

The egg period was about three weeks. The eggs increased in volume with progressive development (Fig. 6 *vs* Fig. 7, same magnification). An egg tooth was observed to develop on the embryonic cuticle at the frons of full-grown embryos (ET in Fig. 8): the first instar larvae lacked the egg tooth (Fig. 9, arrowhead), because the embryonic cuticle was shed just after hatching.

Matzke and Klass (2005) observed egg deposition, care and structure of a pygidicranid *Tagalina papua* as well as supplementary materials, *i.e.*, two pygidicranids *Tagalina burri* and *Paracranophygia siamensis* and a diplatyid unidentified species. Unlike in the higher dermapterans, in which the deposited eggs lack any adhesive materials to be deposited as a form of egg mass and maternal care is intensive (Matzke and Klass, 2005), in these primitive dermapterans, 1) eggs are deposited separately, 2) eggs have adhesive material to stick to the substratum, and 3) maternal care is not intensive.

These features of egg deposition, care and structure revealed by Matzke and Klass (2005) for pygidicranids (and supplementally a diplatyid) are shared by *Diplatys flavicollis* (herein); thus, these features may be a groundplan of the primitive dermapterans. *Diplatys flavicollis* is in good agreement with an unidentified

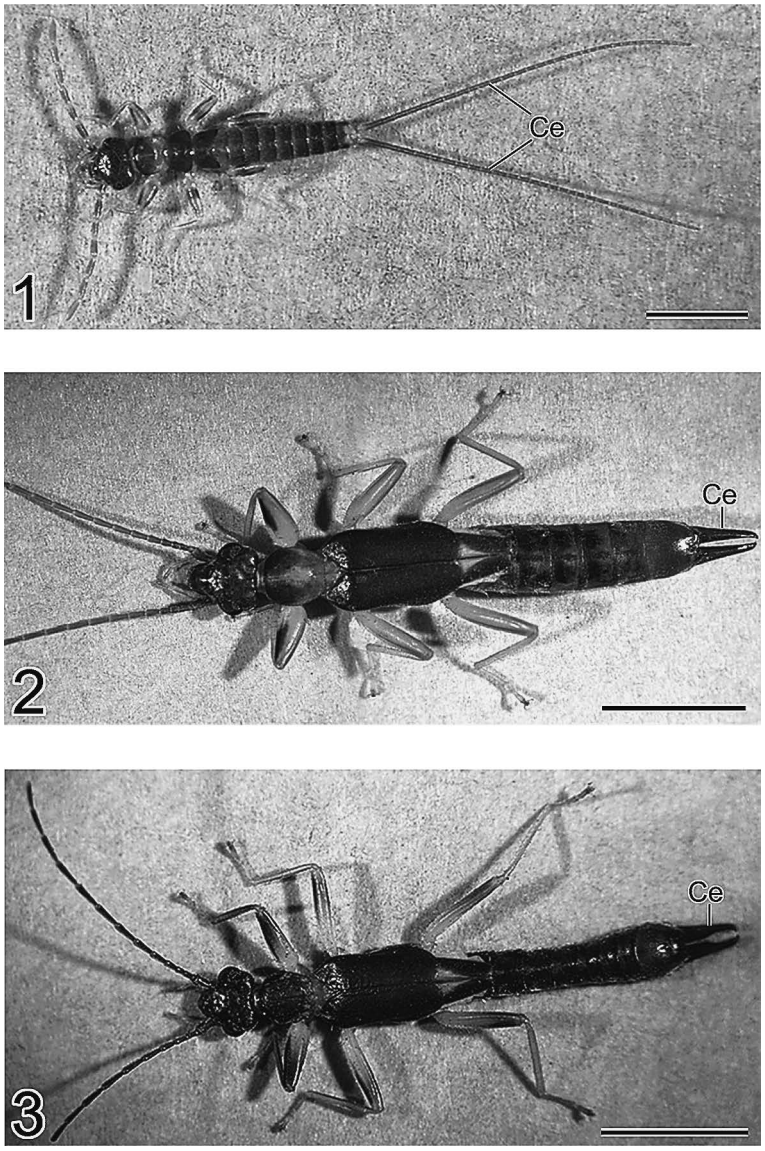

Fig. 1 First instar larva of *Diplatys flavicollis*, dorsal view. Ce: cerci. Scale = 1 mm.
Fig. 2 Adult female, dorsal view. Ce: cercus (forceps). Scale = 5 mm.
Fig. 3 Adult male, dorsal view. Ce: cercus (forceps). Scale = 5 mm.

diplatyid species observed by Matzke and Klass (2005) to possess an adhesive stalk, but pygidicranids do not develop such structures; thus, the adhesive stalk may be a characteristic of diplatyids.

Acknowledgments: We thank Drs. K. Katsuyuki and M. Nishikawa, and Messrs. K. Kimura and M. Sugimoto for their valuable information about collecting materials, and the staff of the Sugadaira Montane Research Center, University of Tsukuba for valuable advice and support. This is contribution No. 215 from the Sugadaira Montane Research Center, University of Tsukuba.

References

Fuse, Y. and H. Ando (1983) Embryonic development of the earwig, *Anisolabis maritima* (Dermaptera) by external observation. *New Entomologist*, **32**, 31–38. (in Japanese).

Hagan, H.R. (1951) *Embryology of the Viviparous Insects*. Ronald Press, New York.

Heymons, R. (1895) *Die Embryonalentwicklung von Dermapteren und Orthopteren unter Besonderer Berücksichtigung der Keimblätterbidung*. Gustav Fischer, Jena.

Heymons, R. (1912) Über den Genitalapparat und die Entwicklung von *Hemimerus taploides* Walk. *Zoologische Jahrbücher Supplementum*, **15**, 141–184.

Klass, K.-D. (2003) The female genitalic region in basal earwigs (Insecta: Dermaptera: Pygidicranidae *s. l.*). *Entomologische Abhandlungen*, **61**, 173–225.

Kusakari, M. (2006) *Embryological Study of* Anisolabis maritima *Gené (Insecta: Dermaptera: Anisolabididae): Revaluation of the Germ Band Formation*

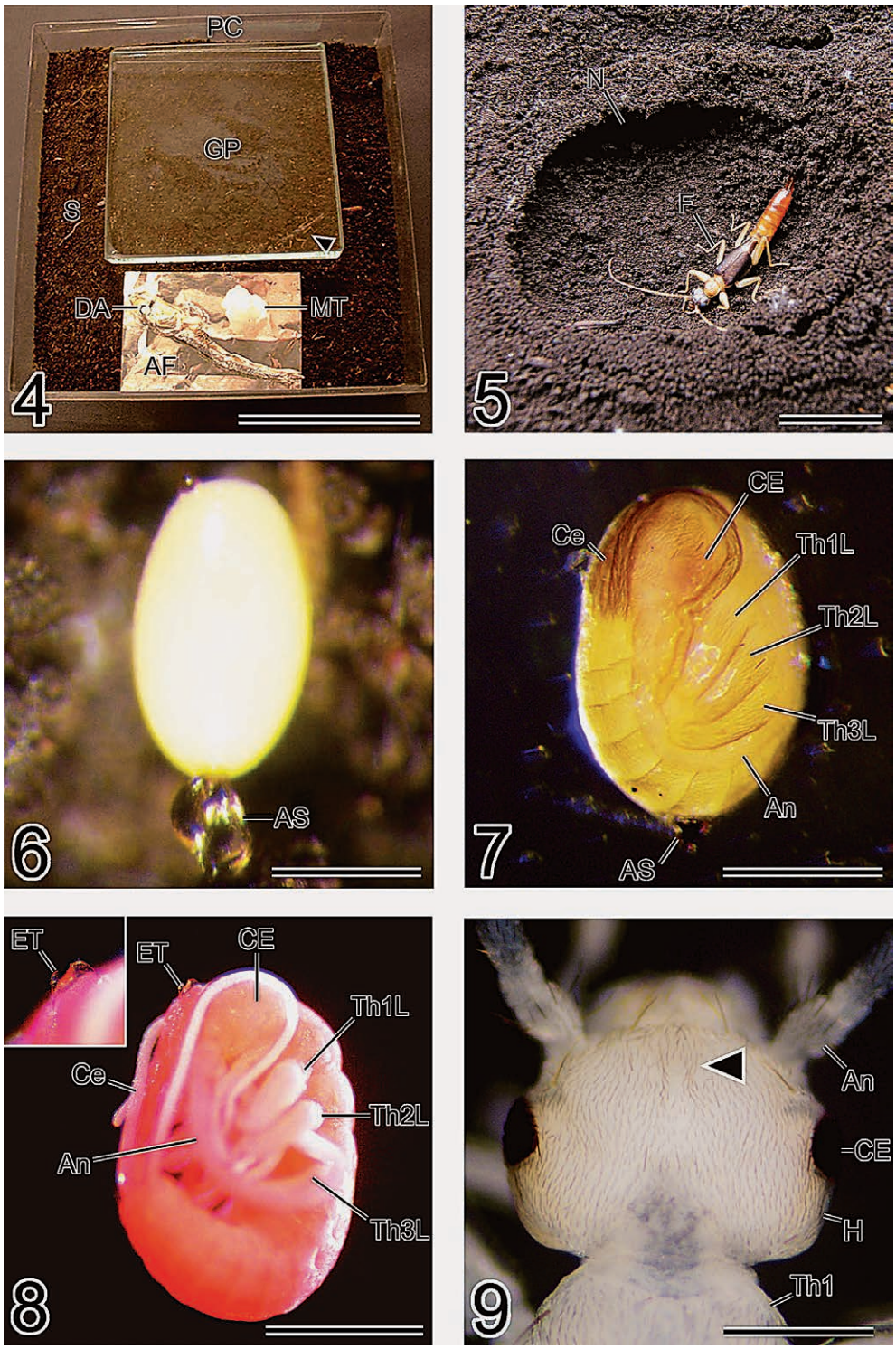

Fig. 4 Rearing case. Arrowhead shows an adult female under a glass plate. AF: aluminum foil, DA: dried anchovy, GP: glass plate, MT: moistened tissue, PC: plastic case, S: soil. Scale = 50 mm.

Fig. 5 Female in a nest, the glass plate removed. F: female, N: nest. Scale = 10 mm.

Fig. 6 Egg deposited and stuck to soil, the anterior pole to the top. AS: adhesive stalk. Scale = 0.5 mm.

Fig. 7 Egg with full grown embryo, lateral view, anterior pole to the top. An: antenna, AS: adhesive stalk, CE: compound eye, Ce: cercus, Th1L–3L: prothoracic, mesothoracic and metathoracic legs. Scale = 0.5 mm.

Fig. 8 Full-grown embryo, dissected out of the egg, lateral view. An: antenna, CE: compound eye, Ce: cercus, ET: egg tooth, Th1L–3L: prothoracic, mesothoracic and metathoracic legs. Scale = 0.5 mm.

Fig. 9 Head of a newly hatched 1st instar larva, eosin staining, dorsal view, anterior to the top. Arrowhead shows the position where an egg tooth existed in the later embryonic period. An: antenna, CE: compound eye, H: head, Th1: prothorax. Scale = 0.25 mm.

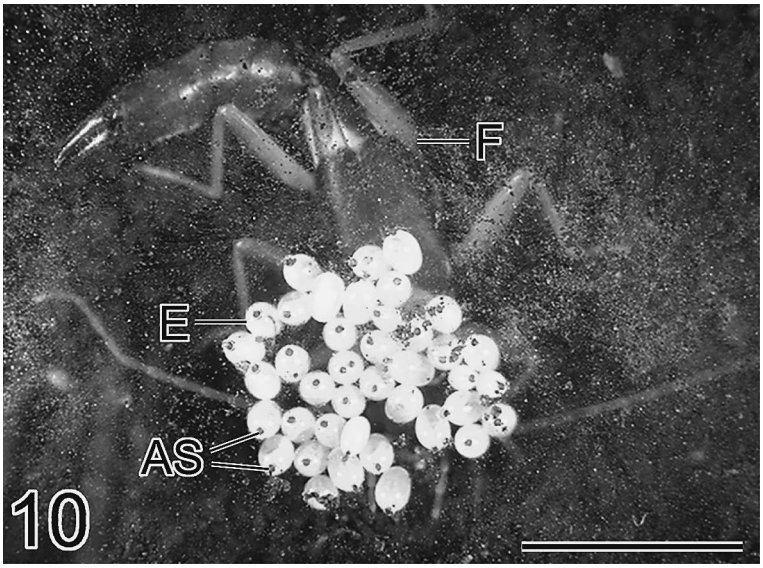

Fig. 10 Female and her eggs, which are stuck to the glass plate by adhesive stalks. AS: adhesive stalk, E: egg, F: female. Scale = 5 mm.

Pattern. Master's thesis, University of Tsukuba. (in Japanese).

Kusakari, M. and R. Machida (2005) Germ band type of Dermaptera: A reference to some early embryos of *Anisolabis maritima* Gené (Insecta). *Proceedings of Arthropodan Embryological Society of Japan*, **40**, 27–29.

Matzke, D. and K.-D. Klass (2005) Reproductive biology and nymphal development in the basal earwig *Tagalina papua* (Insecta: Dermaptera: Pygidicranidae), with a comparison of brood care in Dermaptera and Embioptera. *Entomologische Abhandlungen*, **62**, 99–116.