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Morphogenesis of the Larval 'Gill-like' Abdominal Protrusive Structures in a Damselfly, *Euphaea yeyeyamana* Oguma (Insecta: Odonata, Euphaeidae)*

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Insects account for half of all recorded species. They are the most diversified creatures at present on the earth in terms of the large number of species. A key factor causing this diversity is assumed to be the acquisition of wings, as more than 99 percent of insects are of the wing-acquired type or the Pterygota.

The origin of insect wings remains uncertain, although there have been various arguments for the origin of wings. Above all, the best supported hypothesis is the 'gill theory' (*e. g.*, Kukalová-Peck, 1978; Averof and Cohen, 1997) that wings are serially homologous to gills (tracheal gills as the respiratory organ in water). This hypothesis is merely a guess based on palaeontological studies. Obviously the studies using living insects must play a very important role in resolving the origin of wings.

As one way to verify this hypothesis, primitive Pterygota (Ephemeroptera, Odonata and Plecoptera) are very significant groups which retain many ancestral characteristics, including primitive wing structures. Therefore, research on the wing morphogenesis in these insects is desirable. Actually, Ephemeroptera and Plecoptera have segmental gills which are very important characteristics, and the gills have been studied and discussed, broadly in relation to the subject of wing development (*e. g.*, Kukalová-Peck, 1978, 1991; Marden and Thomas, 2003). On the other hand, it was not noted with respect to morphogenesis in the discussion of wing origin that Odonata do not have segmental gills on their abdominal segment, despite a fact being worthy of remark when considering the other taxa.

However, in two odonatoid families Euphaeidae and Polythoridae, the segmental 'gill-like' protrusive structures are clearly recognized on larval abdomen. In a euphaeid damselfly, *Epallage fatime* Charp, Norling (1982) has also confirmed the morphology and the function of their gill-like strucutures. In Japan, two euphaeid damselflies *Euphaea yayeyamana* Oguma and *Bayadera brevicauda ishigakiana* Asahina are distributed as the endemic species to Yaeyama islands (Ishigaki and Iriomote islands, Okinawa Prefecture). We noticed gill-like structures of the euphaeid larvae and have started a comparative embryological study using *Euphaea yayeyamana* as materials.

As for the key characteristic 'gill-like abdominal protrusive structures', we revealed that four pairs (from the 4th to the 7th abdominal projection) are formed in embryogenesis, and the other pairs (the 2nd, 3rd and 8th abdominal projections) are formed in the early stages of postembryogenesis. In the future, we will observe the morphogenesis in detail, and verify the serial homology of the appendages or the related appendage structures.

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