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# The external larval morphology of aquatic and terrestrial Luciolinae fireflies (Coleoptera: Lampyridae)

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## Table of contents



## Abstract

The external morphology of aquatic, semiaquatic and terrestrial lucioline larvae was investigated in order to provide an overview of what traits constitute the extremely ecologically diverse Luciolinae (Coleoptera: Lampyridae). The aquatic species, *Aquatica ficta* (Olivier), *A. leii* (Fu *et* Ballantyne), *A. hydrophila* (Jeng *et al*.), *A. lateralis* (Motschulsky), *A. wuhana* Fu *et* Ballantyne, *Luciola cruciata* Motschulsky and *L. owadai* Satô *et* Kimura cannot swim, but instead crawl on the substrate. They have soft bodies, lateral abdominal tracheal gills and glands on eversible structures that secrete repellent substances. The back-swimming species, *Luciola substriata* Gorham and *L. aquatilis* Thancharoen, which inhabit the surface of ponds, have hardened exoskeletons, and lack gills and eversible glands. Unlike the crawling species, the back-swimmers have sense organs along the ventral surface of the apical maxillary and labial palpomeres, and are metapneustic in their later instars. The larval morphology of the aquatic species is contrasted with *Pygoluciola qingyu* Fu *et* Ballantyne, whose larvae are semiaquatic and lack gills, and with the terrestrial larvae of *Asymmetricata circumdata* (Motsch.) (newly

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