

## Description of pleural defensive organs in three species of firefly larvae (Coleoptera, Lampyridae)

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### Abstract

Although reflex bleeding as a defence mechanism is well characterised in the adult lampyrid little is known of the defensive mechanisms of immature bioluminescent beetles. A detailed comparative examination of the morphology and microstructure of the pleural defensive organs of *Lampyris noctiluca* L., *Luciola cruciata* Motschulsky and a *Nyctophila* species obtained from Amol forest, Iran, using light microscopy and epifluorescent imaging, revealed vesicles continuous with the pleural organ membrane and held in place by a disc structure. Structural differences were apparent between species. We speculate on the function and evolution of these organs among the Lampyridae.

**Key words.** Lampyridae, Coleoptera, aposematism, defence, *Lampyris noctiluca*, *Luciola cruciata*, *Nyctophila* species

### Introduction

The presence of luminescent organs in many species of Lampyridae (Coleoptera) might be expected to make them conspicuous targets for both vertebrate and invertebrate predation. However, adult fireflies appear to be protected against predation and are known to be unpalatable to a number of vertebrate species (Blum & Sannasi, 1974; Eisner et al., 1978; Lloyd, 1973; Sydow & Lloyd, 1975). Furthermore, in some animals, ingestion of fireflies can lead to toxicosis and ultimately death (Knight et al., 1999). Steroidal pyrones, found in a range of adult firefly species, appear to be the primary component of this unpalatability (Eisner et al., 1978; Goetz et al., 1981; Goetz et al., 1979; Meinwald et al., 1979). As a result of a close structural relationship to the cardiotoxic steroids found in venomous toads (e.g. bufalin) these firefly compounds were named lucibufagins (Eisner et al., 1978). When disturbed or attacked fireflies emit droplets of haemolymph, primarily from the