Are some cuticular parts conserved for studying the life history of amphidromous shrimp *Caridina multidentata* (Decapoda: Caridea: Atyidae)?

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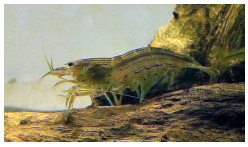
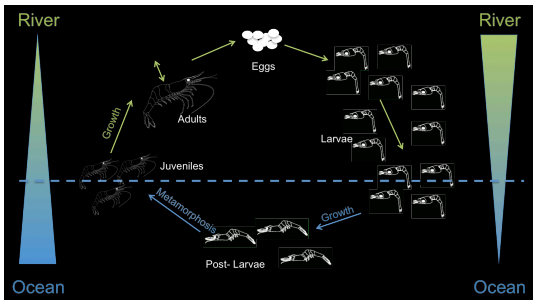
1. Introduction



Caridina multidentata

• *Caridina multidentata* is a species of freshwater shrimp from East Asia with an amphidromous life cycle, commonly found in the aquarium trade (formerly *C. japonica*).

• Amphidromy has been studied in fish and gastropods using sclerochronology. Perennial calcified parts like otoliths or operculae can be analyzed microchemically to obtain data on the environments they crossed at different stages of their life (see Shen *et al.*, 1998, for example).



Amphidromous life cycle of *Caridina* shrimps

• Such structure was thought to be lacking in crustaceans because of the molting process.

• Kilada et al. (2012) proposed a method to **determine the age of large decapods using growth bands in the endocuticle of the ocular peduncle and gastric ossicles**, implying that all or parts of these structures were **conserved through the molts**.

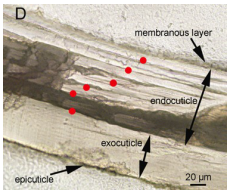
• If these elements were indeed conserved, it would allow to get valuable informations on the biology of amphidromous shrimps, such as the duration of the marine phase or chemical properties of the larval environment.

2. Validation of the method

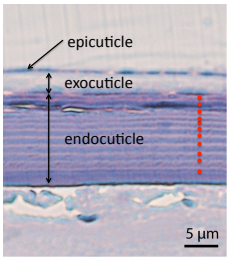
• When cutting sections of eyestalk cuticle of *Caridina multidentata*, striae were indeed visible, but not likely representing annual growth bands, since the number of encuticular layers is too high comparatively to the life span of the *Caridina* shrimps.

• To assess wether the eyestalk cuticle is preserved or not, live *C. multidentata* specimens were placed in aquaria containing calcein or alizarin during one molt cycle, then transferred to aquaria with water only, for another molt cycle. This method revealed inapplicable because of the retention of the colorant in other organs such as the muscles during several molting cycles.

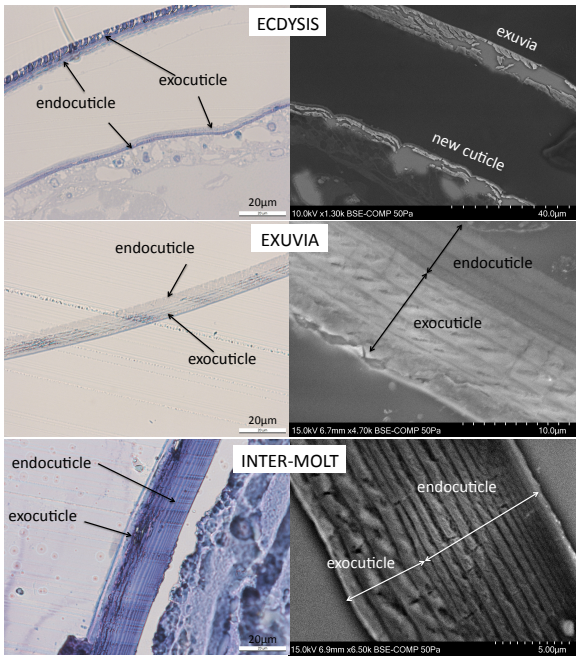
• We consequently chose to check the hypotheses of Kilada et al. (2012) by comparing the ultrastructure of the eyestalk cuticle at different moments of a molting cycle.



From Kilada et al. (2012)



Sections of ocular peduncle cuticle



Sections of ocular peduncle cuticle viewed in photonic microscopy (left) or back-scattered electron microscopy (right).

3. Ultrastructure study

• Thin sections of cuticle of ocular peduncles were made at different stages of the molt cycle (inter-molt, pre-molt, post-molt and ecdysis) and on the exuvia and observed in photonic microscopy and back-scattered electron microscopy.

• When ecdysis occurs, the exuvia shows the presence of the whole epi- and exocuticle and part of the endocuticle (the inner layers of the endocuticle have been digested during the pre-molt stage) as observed for the body cuticle of all crustaceans.

•The epi- and exocuticle of the new cuticle are already present. The endocuticle is synthesized after ecdysis, during the post-molt stage, concomitantly to the calcification of the exo and endocuticle.

•So it appears that no part of the old endocuticle is retained.

4. Conclusions

No part of the ocular peduncle cuticle is conserved during molting cycles.

- Age determination using growth bands count in the cuticle of the eyestalk does not seem applicable in *Caridina multidentata.*
- Validation using live staining was unsuccessful because of the retention of the stains in the body that are redistributed when producing the new cuticle.
- Accordingly, sclerochronology studies are impossible using this structure.

Only the eyestalk cuticle has been studied in this model. Gastric ossicles proposed also for age determination by Kilada et al. (2012), would also need to be tested for life traits study of *Caridina*.

References:

- Kilada, R., Sainte-Marie, B., Rochette, R., Davis, N., Vanier, C., & Campana, S. (2012). Direct determination of age in shrimps, crabs, and lobsters. *Canadian Journal of Fisheries and Aquatic Sciences*, 69(11): 1728-1733.

- Shen, K.-N., Lee, Y.-C., & Tzeng, W.-N. (1998). Use of Otolith Microchemistry to Investigate the Life History Pattern of Gobies in a Taiwanese Stream. *Zoological Studies* 37(4): 322-329.