



Back to the sea? First ontogenetic data of limnic slugs (Acochlidia, Heterobranchia)

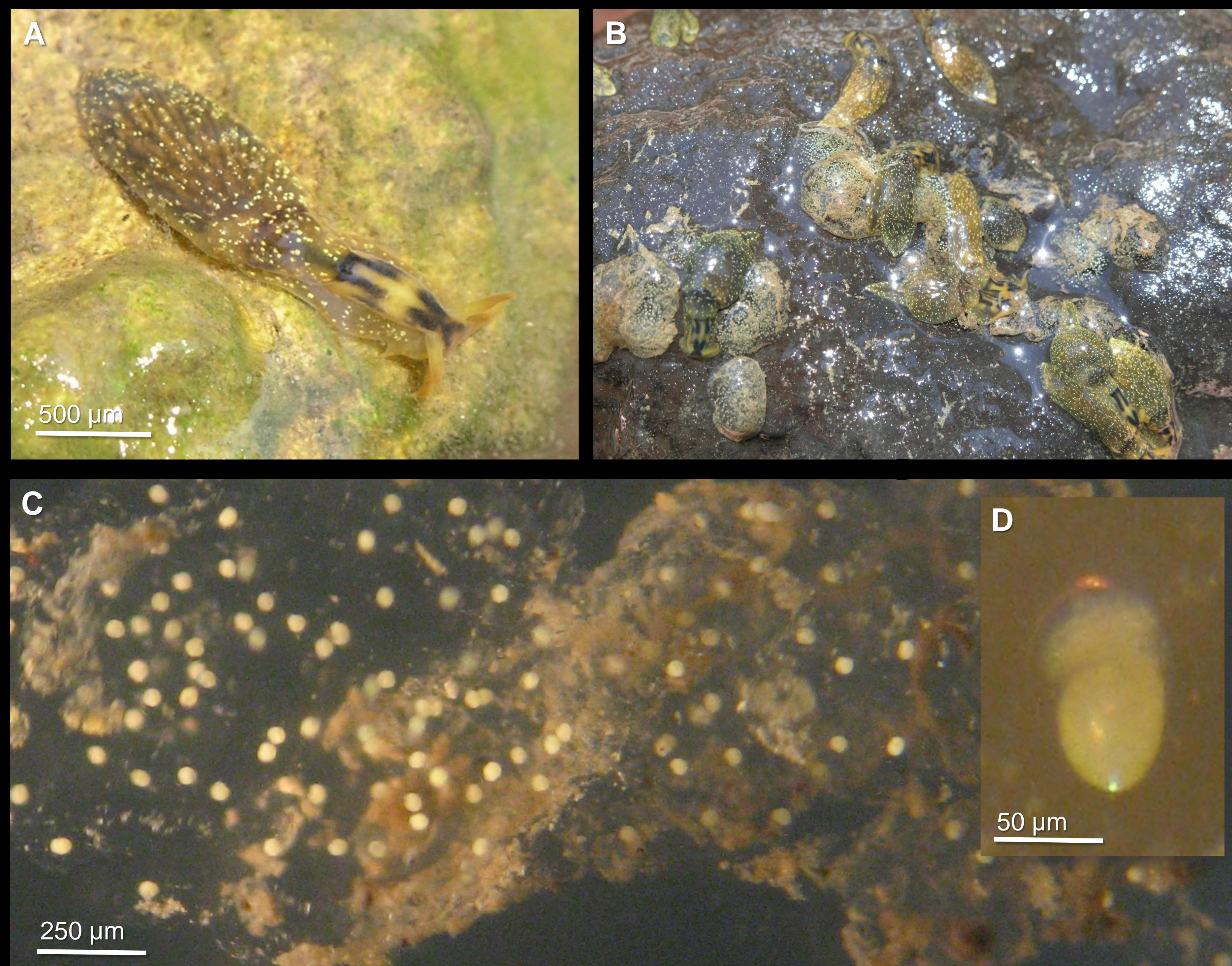
Jörger, Katharina; Schrödl, Michael;
Brenzinger, Bastian; Neusser, Timea

Zoologische Staatssammlung München, Sektion Mollusca, Münchhausenstr. 21, 81247 München, Germany
and BioZentrum LMU, Department Biologie II, Großhaderner Str. 2, 82152 Planegg-Martinsried, Germany
Email: Katharina.Joerger@zsm.mwn.de, Michael.Schroedl@zsm.mwn.de, bbmail@arcor.de, neusser@bio.lmu.de

INTRODUCTION

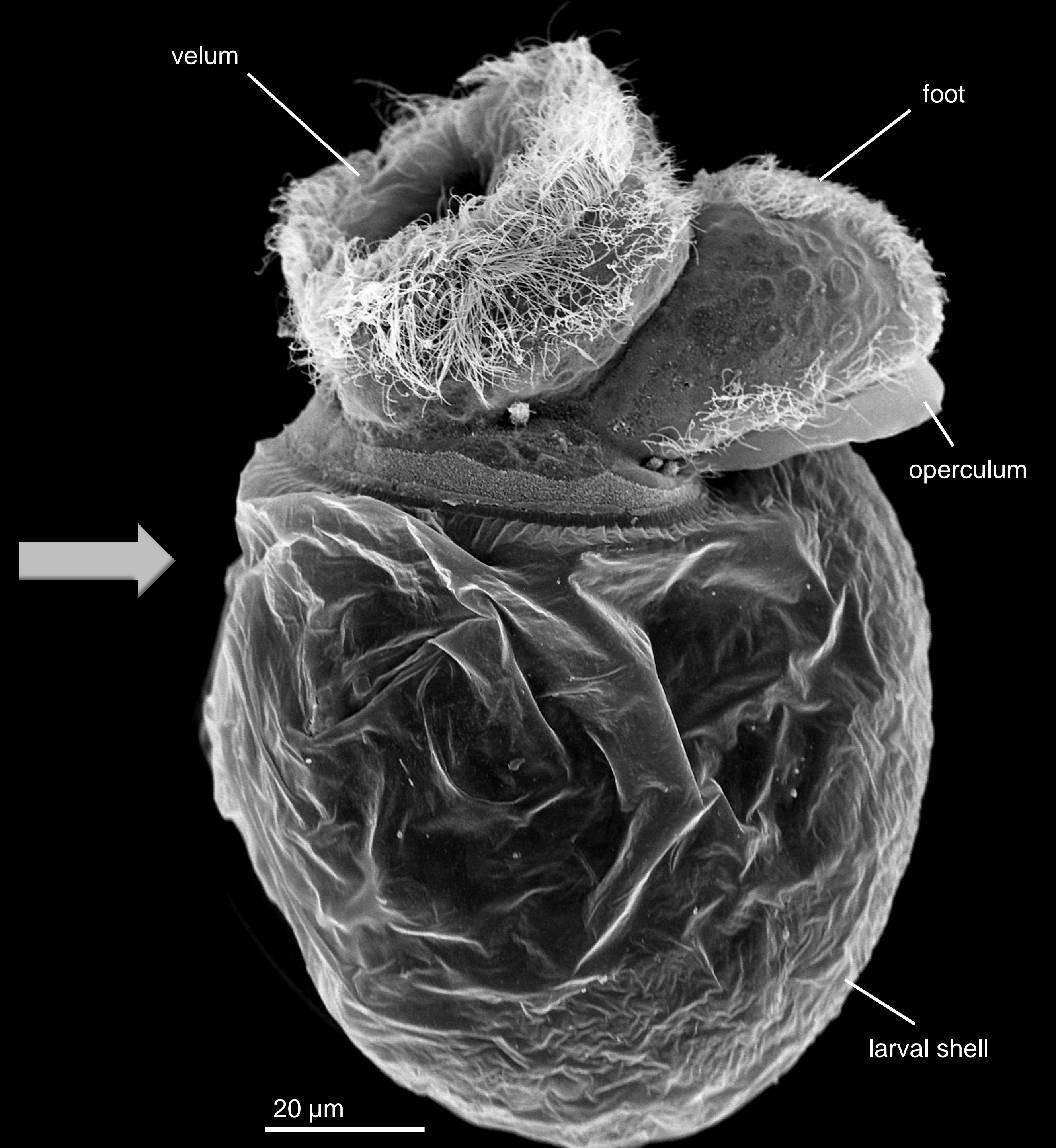
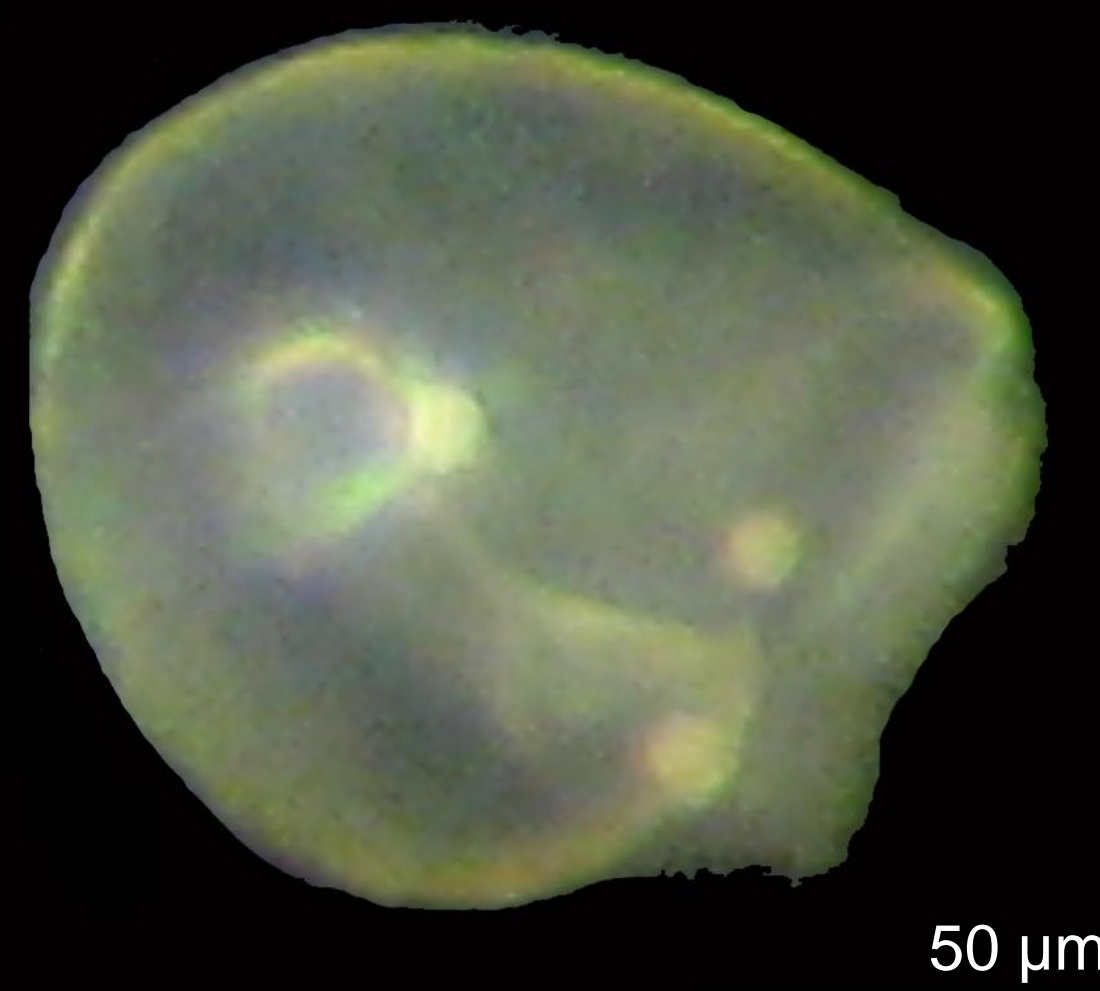
To current knowledge, Acochlidia (Heterobranchia, Panpulmonata) are the only group of slugs with representatives in limnic systems. Based on our molecular phylogenetic hypotheses (Jörger *et al.* 2010), the transition to fresh water occurred at least twice independently within the evolution of Acochlidia. The major radiation refers to the Acochliidae, which are unique limnic slugs found in rivers and streams on Indo-Pacific islands. They have evolved a benthic life style on the underside of submerged stones and can occur upstream, even several kilometers inland from the river mouth. We observed Acochliidae feeding on eggs of syntopic neritid gastropods (Brenzinger *et al.* 2011). No reports on the ontogeny of acochliids exist, hindering conclusions on dispersal abilities and interpretation of biogeographic patterns.

RESULTS



We collected *Acochlidium sutteri* Wawra, 1979 slugs (A) together with their egg masses (B) from streams, near Boleng Bay, Flores Island (Indonesia). Conspecificity with specimens collected from the type locality on Sumba Island and between egg masses and adults were confirmed via DNA-Barcoding. Egg masses are gelatinous and amorphous, having a varying amount of up to several hundred oval egg capsules loosely embedded (C,D).

„Adhesive larva“ 36 days after hatching, after two days transferred to sea water.



Scanning electron micrograph of a free-swimming veliger larva of *A. sutteri* 24 hours after hatching in fresh water.

Hatching veliger larvae were actively swimming for up to two days, but died after this period when kept in fresh water. Larvae are comparably small (approx. 95 µm), but lecithotrophy is likely, as suggested by histology, SEM and light-microscopy. Experimentally transferred to sea water, they stopped swimming, closed the larval shell and attached to the substratum. Externally inactive they survived for several weeks glued to the bottom of the petri-dish or a sand grain. When removed these 'adhesive larvae' reattached themselves to the substrate.

CONCLUSION

We conclude that after an initial limnic phase acochliid larvae need marine conditions for further development and that soon after hatching larvae are flushed into the sea. Here, after short pelagic phase, larvae will attach to a certain substrate where they metamorphose into a long term resting stage. On one hand, the observed long-lived 'adhesive larva' may inhibit uncontrolled drift into the open ocean, far away from potential adult habitats. On the other hand, it could serve as a dispersal stage by using larger mobile organisms as vectors. If we hypothesize that such vectors are neritids, acochliid larvae would benefit from neritid migration up to the rivers and such transient epibiosis would even transport acochliids to suitable spawning and feeding habitats, i.e. those with neritid eggs. Acochliid amphidromy thus might have coevolved with neritid migration patterns.

REFERENCES

- Brenzinger, B.; Neusser, T.P.; Jörger, K.M.; Schrödl, M. 2011. Integrating 3D microanatomy and molecules: Natural history of the Pacific freshwater slug *Strubellia* Odhner, 1937 (Heterobranchia, Acochlidia), with description of a new species. *Journal of Molluscan Studies* 77, 351-374.
- Jörger, K.M.; Stöger, I.; Kano, Y.; Fukuda, H.; Kneibelsberger, T.; Schrödl, M. 2010. On the origin of Acochlidia and other enigmatic euthyneuran gastropods, with implications for the systematics of Heterobranchia. *BMC Evolutionary Biology* 10, 323.
- Wawra, E. 1979. *Acochlidium sutteri* nov.spec. (Gastropoda, Opisthobranchia, Acochliidae) von Sumba, Indonesien. *Annalen des Naturhistorischen Museums Wien*, B 82, 595-604.

ACKNOWLEDGEMENTS

This study received financial support by a PhD-scholarship of the "Volkswagenstiftung" to KJ and by the "Universität Bayern" to BB. Dr. Gustav Mamangkey is thanked for support in field work and with arranging permits. Thanks to Heidi Gensler for sectioning embedded egg masses.