

pure morphs was found in the two sampling areas. However, both pure morphs mated at random with the hybrid morph. A female hybrid sexual disadvantage also contributed to the incipient reproductive isolation between both pure morphs, but no such trend was found in males. The assortative mating behaviour and the female sexual selection components were probably caused by different biological phenomena.

These results confirm the conspecific status of the *L. saxatilis* Galician morphs, but also suggest the possibility of a further evolving towards complete speciation. The division of mating behaviour in three independent components represents a useful tool for the study of the reproductive isolation between incipient species.

#### REFERENCES

- SPIETH, H.T. & J.M. Ringo, 1983. In M. ASHBURNER, H.L. CARSON & J.N. THOMPSON (eds). *The genetics and biology of Drosophila*. Vol 3c. Academic press, London.
- JOHANNESSEN, K., B. JOHANNESSEN & E. ROLAN-ALVAREZ. *Evolution*, in press.
- JOHANNESSEN, K., E. ROLAN-ALVAREZ & A. EKENDAHL, (in preparation).

## Phylogenetic reconstruction of the genus *Littorina* using mitochondrial DNA sequence data

E. Rumbak, D.G. Reid & R.H. Thomas

Department of Zoology, The Natural History Museum, London SW7 5BD, UK

A gene phylogeny of eighteen of the nineteen known species of *Littorina* was reconstructed using sequence data from three mitochondrial genes (small ribosomal RNA gene, large ribosomal RNA gene and cytochrome *b* gene). Using the sister genus *Nodilittorina* as the outgroup, the monophyly of the genus *Littorina* was supported. The problematical species *L. striata* was resolved in a basal position within *Littorina*, supporting classification in this genus. Data from one species of the enigmatic tropical genus *Mainwaringia* showed that it was not closely related to *Littorina*. Within *Littorina*, the terminal pairings of *L. brevicula* and *L. mandshurica*, *L. squalida* and *L. littorea*, *L. sitkana* and *L. horikawai* were resolved, as was the monophyly of the species of the subgenus *Neritrema* in the Atlantic. However, the branching sequence in the middle region of the tree was poorly resolved, suggesting that perhaps a short period of rapid cladogenesis may have taken place at this point in the phylogenetic history of the group. The phylogenetic trees generated from the sequence data are consistent with a revised morphological cladogram for the genus (Reid, 1990a and in prep.). The molecular phylogeny shows that the northern Atlantic species were derived from a minimum of two Pacific ancestors, supporting the hypothesis of trans-Arctic migration of this genus (Reid, 1990b).

#### REFERENCES

- REID, D.G., 1990a. *Hydrobiologia*, 193 : 1-19.
- REID, D.G., 1990b. *Bull. Mar. Sci.*, 47 : 35-49.

## Researches on the demecology of two species of Pacific *Littoraria* (Gastr. Pros.)

Cesare F. Sacchi

Dip.to di Genetica, sez. Ecologia ; Università di Pavia. Piazza Botta, 10. I-27100 Pavia (Italia)

In Rosewater's (1970) systematic revision, *L. undulata* (Gray, 1839) and *L. coccinea* (Gmelin, 1791) are considered as closely related species. Both are placed by Reid (1986) in genus (formerly sub-genus) *Littoraria*. We were allowed to study a lot of samples from two South-Pacific islands. *L.u.* was collected in Laing Island, a coral bank off the North-East coast of Papua-New Guinea (Claereboudt *et alii*, 1990) while *L.c.* comes from the shores of Oponohu Bay (Mo'orea, Society Islands). The results of this study may be summarized in the following points :

- a) *sex-ratio*. In Littorinids, females are often in excess (Sacchi, 1984). However in both *L.u.* and *L.c.* the excess is particularly important.
- b) *sex dimorphism in shells*. Both *Littoraria* confirm the general trend in Littorinids -not always statistically significant- toward larger and more globose shells in females.
- c) *size variations and habitat*. *L.u.* from habitats more exposed to waves shows smaller sizes. In Oponohu Bay *L.c.* local relations between size and habitat variations may also be found.
- d) *colour polymorphism in L.u.*. Colour morphs were classed into three groups. Mottleds are always prevailing. No significant difference was found according to sex or habitat in Laing Island.
- e) *trophic spectra*. The gut content of both species, analyzed by the usual methods (Voltolina & Sacchi, 1990) revealed microphagous traits, related to the typical situations of these *Littoraria* in macroscopically "bare" substrata (coral and basalt rocks ; roots and logs) in the intertidal zone.

Data are added concerning mollusc species found with *L.u.* and *L.c.* at the same levels : they are mainly other *Littoraria*, of the *L. scabra* (L.) group, and a few species of *Nerita*, s.l.

I am grateful to Directors and staffs of the Station biologique Léopold I (Laing Island) and the Centre de l'Environnement d'Oponohu, for providing practical support. Thanks are due to Professor D. Voltolina (Cicese, Ensenada, B.C., Mexico), M. M. Verhaeghe (Société malacologique belge) and Professor F. Boero (Università di Lecce, Italy) for ensuring scientific cooperation.

#### REFERENCES

- CLAERBOUDT, M., C. MASSIN & J. BOUILLON, 1990. *Indo-Malayan L. Zool.*, 6 : 1-23.
- REID, D.G., 1986. The Littorinid molluscs of the mangrove forests in the Indo-Pacific region. *London, British Mus. (N.H.)* : I-XV ; 1-228.
- ROSEWATER, J., 1970. Indo-Pacific Mollusca, *Greenville, Delaware Mus. of N.H.*; 2 (11) : 436-441.
- SACCHI, C.F, 1984. *Atti Soc. it. Sc. nat. Milano*, 125 : 209-232.
- VOLTOLINA, D. & C.F., SACCHI, 1990. *Hydrobiologia*, 193 : 147-154.

## Variations in uric acid concentration and xanthine dehydrogenase activity in *Littorina saxatilis* (Olivi) and *Littorina arcana* (Hannaford Ellis)

Delmont C. Smith

Department of Biological Sciences, State University of New York, Brockport, New York 14420 USA

The nature of the end-products of nitrogen metabolism has long been recognized to be a function of the toxicity of ammonia and the water available for its excretion, aquatic species