

## A Potential Biocide for Control of the Golden Mussel, *Limnoperna fortunei*

### ABSTRACT

We assessed to response of larvae of the golden mussel (*Limnoperna fortunei*) to different concentrations of a quaternary ammonium polymer (Bulab 6002 ®) in order to estimate its effectiveness in controlling this invasive mussel. Mussels were collected along the coast of the Río de la Plata, Argentina, and were tested in two laboratory trials. The estimated median lethal concentration for these 24-h exposures were 9.6 mg/L and 4.6 mg/L, indicating that this biocide may be suitable as a control agent for this mussel.

Since its arrival in Río de la Plata basin in Argentina in 1991 (Pastorino et al. 1993), *Limnoperna fortunei* (Dunker, 1857) or golden mussel, has become the only serious macrofouling organism in South American freshwater systems. Its impact may be as significant as that of the invasive zebra mussel (*Dreissena polymorpha*) in North America (Claudi and Mackie 1994). The rapid dispersion of *L. fortunei* can be attributed to several biological features that it has in common with the zebra mussel, namely its free-swimming planktonic larval stage, a byssal filament for attachment to hard substrates, a high resistance to air exposure, and a high reproductive potential. Knowledge of the effect of biocides on *L. fortunei* is scarce, whether on larvae or adults (Darrigran and Damborenea 2001, Cataldo et al. 2003, Morton et al. 1976). Such a situation renders difficult any decision-making in the establishment of prevention measures or controls to mitigate economic losses caused by the golden mussel. Thus, the aim of our study was to test the toxicity of a non-oxidizable biocide commercially known as Bulab 6002® on larvae of the golden mussel. Previous tests with this biocide were carried out on adults of this bivalve (Darrigran and Damborenea 2001) and on larvae and adults of other bivalves such as *C. fluminea* and *D. polymorpha* (e.g. McMahon et al. 1993).

Larvae of *L. fortunei* were collected in Río de la Plata estuary (34°48'S-57°59'W), Argentina, with a 30µ mesh plankton net. Under magnification, umbonate veliger larvae (237.5 – 287.5 µm) were removed with a micropipette, and about 10 larvae were placed in aged tap water in each of several 50 mm diameter plastic Petri dishes. The exposure concentrations of the quaternary ammonium polymer Bulab 6002 ® were 1, 2, 4, 8 and 16 mg/L of active substance. A control without biocide was observed simultaneously, and two separate exposures trials were conducted, both at 18 ±2 °C. At the end of 24 hours, larvae were examined microscopically, and mortality was noted. Larvae assumed to be dead if there was no apparent mobility, either gross or microscopic (e.g. ciliary movement). The estimated LC<sub>50</sub>s for the two trials, determined by probit analysis, were 9.6 mg/L and 4.65 mg/L (Fig. 1).

Both mortality and sub-lethal effects were absent in the controls. After hours of exposure, the molluscicide did not render a 100% mortality in any of the test concentrations, but larvae exposed to 16 mg/L showed mortality of 70-80%. However, the golden mussel larvae is very sensitive to Bulab 6002 ®, as the lowest concentration of 1 mg/L rendered all larvae inactive after 24 hours. Thus, this biocide, used in low concentrations, may be effective in preventing larval settlement, for inactive larvae do not secrete the byssus, which they need to attach securely to the substrate. Thus, Bulab 6002 ® may be effective in the control of the golden mussel.

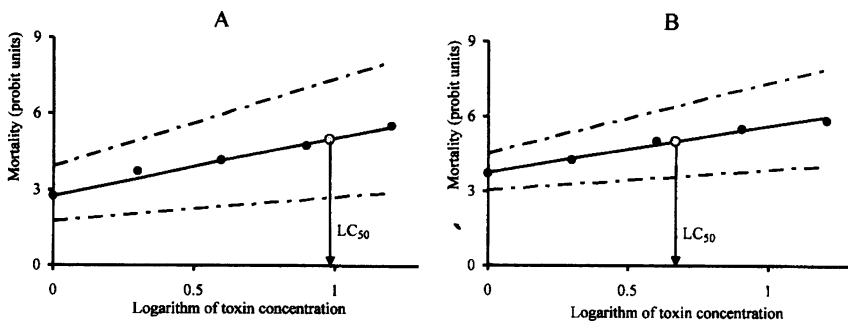


Figure 1. Graphic determination of the toxicity ( $LC_{50}$ ) of Bulab 6002® to larvae of the golden mussel, *Limnoperna fortunei*, in two trials (A and B) at 18 °C.

#### ACKNOWLEDGEMENTS

We thank P. Carriquiriborde for his advice and M. Lagreca (CIC, Argentina) for the technical assistance, and to J. Kawatski for the thoughtful review. This study was funded by the BID 1728/OC-AR PICT 25621, PIP N°6370 and Facultad de Ciencias Naturales y Museo (UNLP). We thank Buckman Laboratories for providing the biocide.

#### LITERATURE CITED

- Cataldo, D., D. Boltovskoy, and M. Pose. 2003. Toxicity of chlorine and three nonoxidizing molluscicides to the pest mussel *Limnoperna fortunei*. *Journal AWWA* 95:66-76.
- Claudi, R. and G.L.Mackie. 1994. *Practical Manual for Zebra Mussel Monitoring and Control*. Lewis Publishers, Boca Ratón. 227 pp.
- Darrigran, G. and C. Damborenea 2001. Concentraciones letales de un biocida para adultos del molusco invasor *Limnoperna fortunei* (Mytilidae). Pages 119-123. *In: Actas Seminario Internacional sobre Gestión Ambiental e Hidroelectricidad*. Salto Grande. Argentina.
- McMahon, R. F., B. N. Shipman and D. P. Long. 1993. Laboratory efficacies of nonoxidizing molluscicides on the zebra mussel (*Dreissena polymorpha*) and the asian clam (*Corbicula fluminea*). Pages 575-598. *In: Nalepa T. F. and D. W. Schloesser (eds.). Zebra mussels. Biology, impacts, and control*. Lewis Publications. Boca Ratón. 787 pp.
- Morton, B. S., C. S. Au and W. W. Law. 1976. Control of *Limnoperna fortunei*. *J. Inst. Water Eng. and Sci.* 30:147-156.
- Pastorino, G., G. Darrigran, S. M. Martin and L. Lunaschi. 1993. *Limnoperna fortunei* (Dunker, 1857) (Mytilidae), nuevo Bivalvo invasor en aguas del Río de la Plata. *Neotropica* 39:34.

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