

## THE DEVELOPMENT OF BIOINDICATOR SYSTEM FOR THE MONITORING OF WATER QUALITY

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### Introduction

On the basis of long term experiments, mussels aquatic snails, tadpoles and fishes are the most convenient aquatic animals used both in monitoring heavy metal and pesticides in the aquatic environment. They are also used both in laboratory studies for revealing the conditions and mechanisms of pollution uptake and accumulation, as well as the physiological consequences of pollution. Benthic macroinvertebrates such as snails are frequently used as environmental indicators of biological integrity because of their advantages. They are abundant in most aquatic habitats, have limited mobility, relatively long life cycle and sampling and subsequent identification are easy and inexpensive. The objective of this project was to investigate the responses of aquatic organisms to pollutants that are normally discharged into the river system. Ultimately a pollution monitoring system can be developed using these organisms as biological indicators.

### Materials and Methods

**Toxicity studies:** Tadpoles of *Polypedates leucomystax* and *Kalaola pulchra*, fresh water gastropods, *Filopaludina martensi martensi* and *Brotia costula* were tested for its sensitivity to environmental pollutants such as pesticides, industrial as well as agricultural effluents. The responses by these organisms to these pollutants were analysed and expressed as  $LT_{50}$ , and  $LD_{50}$  values. *B. costula* collected from clean water were caged and placed in several points of Langat river and the mortality were recorded daily. Some physical deformities of tadpoles exposed to pesticides were also recorded. **Pesticide uptake studies:** The uptake of pesticide by snail was studied in *Pomacea* using  $^{14}C$  Lindane of 5  $\mu Ci$ . The gill, lung, intestine, head mass and foot parts of snail were analysed after the snail being exposed to the pesticide. Concentrations of residual pesticide in tissues were determined by

the use of Liquid Scintillation Counter (BECKMAN model LS 6000E). **The population growth study:** The population growth study of *B. costula* in Langat River. Snails were classified into size groups and the population structure deduced.

### Results and Discussion

**Aquatic organisms sensitivity:** *Brotia costula* (snail) was sensitive to effluents from industries and agricultural activities. The  $LT_{50}$  for this snail in Langat River ranged from 2.9 to 8.4 days depending on the locality of analysis. Long term exposure also causing cracking and pitting and finally erosion of periostracal layer of the shell. Snails and tadpoles were also susceptible to pesticides such as Carbofuran and Saponin. The  $LC_{50}$  values for these pesticides were 95 35 mg/L respectively (acute tests for 24 h exposure). Longer exposure to these pesticides at lower concentration (5 to 10 ppm) to larvae of *K. pulchra* had caused deformities in its tails. Some tail deflection to the side and upward were detected. The deformities could cause larvae being more prone to exposure to enemies like predators because it could not easily escape from them. **Pesticide uptake studies:** The concentrations of Lindane in tissues were highest in the gill followed by the intestine, head mass, foot and lung in the first hour of exposure. The trend shifted slightly 4 hours later with the following order of concentration: intestine, gill, head mass foot and lung. The trend uptake 10 days exposure was that gill accumulated the highest followed by the intestine, heads mass and lung. **The population growth of *Brotia costula*:** The work on the population study is still in progress. Generally the trend of the population was stable where the number of recruits were exceedingly high as compared to the adult breeders. The information on the trend of population dynamics of this snail is useful for the future test on establishment of *Brotia* population in rivers.

### Conclusions

Frog tadpoles were susceptible to pesticide. In low concentration, pesticide had caused drop in body weight, length and survival rate. The long exposure had also caused anomalies in larval development of frog. Freshwater snails are found to be sensitive to effluent from industries and agriculture. The behavior of pesticide uptake by snail was demonstrated by accumulation in certain organs of snail. *B. costula* is a good biological indicator of river water quality.