



**The Hong Kong Polytechnic University  
Department of Applied Mathematics**

## **Colloquium**

**On**

**Resistance to Larvicides in Mosquito Populations and  
How It Could Benefit Malaria Control**

**by**

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### **Abstract**

We model larviciding of mosquitoes taking into account the evolution of resistance to the larvicides, the evolutionary costs of resistance and the implications for malaria control. There is evidence that resistance comes with various costs one of which is reduced adult longevity for resistant mutants. The mosquito adult lifespan is one of the most crucial parameters in malaria transmission due to a long developmental time for the malaria parasite in the insect. A possible malaria control strategy is therefore to shorten this adult lifespan by larviciding with a potent larvicide to which mosquitoes become resistant. This novel strategy is studied using a mathematical model for the wild type and resistant mutants and by incorporating the malaria disease dynamics using an SEI type model with standard incidence that incorporates the latency period of the parasite in wild type and resistant mosquitoes. We consider the linear stability of the malaria-free equilibrium in which the resistant strain is dominant and derive a condition for the global eradication of malaria. Numerical simulations are presented which offer further insights. The parameter to which the analysis is most sensitive is the per-capita death rate of adult resistant mosquitoes. Increasing this parameter dramatically reduces the basic reproduction number. However, increasing it too much causes the wild type to outcompete the resistant mutants and the control strategy fails. Exploitation of costs of resistance to larvicides thus offers a possible malaria control measure if the larvicide is sufficiently potent and costs of resistance are neither too great nor too small.

**Date : 23 April, 2014 (Wednesday)**

**Time : 1:30 p.m. – 2:30 p.m.**

**Venue : HJ610, The Hong Kong Polytechnic University**

**\* \* \* ALL ARE WELCOME \* \* \***