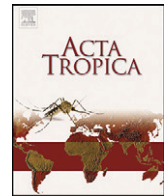




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Relationship between *Aedes aegypti* production and occurrence of *Escherichia coli* in domestic water storage containers in rural and sub-urban villages in Thailand and Laos

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ABSTRACT

In a cross-sectional survey in one rural and one suburban village each in Thailand and Laos the relationship between *Aedes aegypti* production and *Escherichia coli* contamination in household water storage containers was investigated. Entomological and microbiological surveys were conducted in 250 and 239 houses in Thailand and Laos, respectively. Entomological indices across all four villages were high, indicating a high risk for dengue transmission. Significantly more *Ae. aegypti* pupae were produced in containers contaminated with *E. coli* as compared to those that were not, with the odds of *Ae. aegypti* infested containers being contaminated with *E. coli* ranging from two to five. The level of *E. coli* contamination varied across container classes but contamination levels were not significantly associated with the number of pupae produced. We conclude that the observed relationship between *Ae. aegypti* production and presence of *E. coli* in household water storage containers suggests a causal relationship between dengue and diarrheal disease at these sites. How this relationship can be exploited for the combined and cost-effective control of dengue and diarrheal diseases requires further research.

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1. Introduction

Globally, over 783 million people, lack access to safe water (UNICEF and WHO, 2012; United Nations, 2012). Poor access to safe water, alongside poor sanitation and hygiene, have been implicated in many infectious diseases (Bartram and Cairncross, 2010; Cairncross and Valdmanis, 2006; Esrey et al., 1991; Pruss et al., 2002) which cause high morbidity and mortality globally (Yang et al., 2012). Some water-related infectious diseases, such as dengue and diarrheal diseases may be causally related. Dengue is an important arboviral disease resulting in an estimated 50 million cases and 30 000 deaths annually, with 2.5 billion people living in risk areas (Farrar et al., 2007; Garelli et al., 2011). It is transmitted mainly by the highly anthropophilic mosquito *Aedes aegypti*, which breeds mostly in domestic water containers in and around

human dwellings (Christophers, 1960; Scanlon, 1965), and less frequently by *Aedes albopictus*, which commonly breeds in natural water holding containers like leaf axils (Hawley, 1988). Diarrheal disease, one of the leading causes of child morbidity and mortality, is caused by a wide range of pathogenic organisms including bacteria, viruses and parasites (Guerrant et al., 1990). An estimated 2 billion cases occur each year, killing up to 1.5 million children (WHO, 2009). Diarrheal disease is most often transmitted via the fecal–oral route, with ingestion of faecally contaminated water as one major transmission pathway (Oswald et al., 2007).

Both dengue and diarrheal diseases are public health priorities worldwide. Domestic water storage containers serve as a common source for both diseases, and may also serve as a good target for combined control. Water collection and storage for domestic use is common in areas with water scarcity or in areas where traditional water storage practices exist, as is the case with traditional rainwater harvesting in many parts of Southeast Asia. Rainwater, a suitable alternative or supplement to other water sources, is usually collected and stored in large concrete jars-up to 2000 L capacity – in Thailand (Hewison and Tunyavanich, 1990), or smaller jars or drums, which is common in the investigated areas in Laos. Water from these containers is transferred into smaller containers such

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