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Learning by Doing: Conducting a Mosquito Larval Survey in Rural Thailand as a Global Health Education Activity

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Introduction

Dengue fever is the most common and widespread mosquito-borne arboviral disease in the world; in Thailand, an average of 50,000 to 100,000 cases are reported every year. Dengue arbovirus is transmitted by bites from the female *Aedes* mosquito, which are anthropophilic, and breed in a variety of natural and artificial water containers. As such, the cleaning and removal of breeding containers is an important public health intervention to support vector control. In Thailand, the Department of Disease Control (DDC) collects data from visual larval surveys carried out by village health volunteers, who play an important role in entomological surveillance and community health education activities (1).

Accelerating urbanisation, connectivity and climate change are expected to contribute to an increase in dengue cases and its distribution globally in the future (2). Thus, knowledge on dengue vectors and surveillance is important among healthcare professionals to contribute to global control and communication efforts. Experiential learning, 'learning by doing', has been demonstrated as an important tool in public health education (3). Therefore, this study's aims were:

- To describe an *Aedes* mosquito larval survey educational activity carried out by a group of doctors completing the Diploma in Tropical Medicine in Thailand; and
- To explore *Aedes* mosquito breeding habits and analyse larval indices to assist in the planning and prevention of mosquito breeding and disease outbreaks in a village in North-East Thailand.

Methods

Site:
Kusi Jae village, Dong Rak sub district, Phu Sing, Sisaket province, North-Eastern Thailand on the heavily forested southern border with Cambodia (Fig 1).

Fig 1. Map of Sisaket Province, Thailand. Green shaded areas indicate forested areas [Roh *et al. Malaria Journal* (2021) 20:458]

Methods:
Twenty houses were surveyed in the Dong Rak sub district of Phu Sing on the 22nd October 2024 (Rainy season), by a team of international doctors studying towards the Diploma of Tropical Medicine, with local public health professionals and village health volunteers.

Internal and external containers were examined and positive findings recorded on a score sheet. Container type, cleaning, presence of larvae, pupae and abate sand were also noted after discussion with the homeowner. When larvae were present, containers were emptied where permission was given from homeowners. House, Container and Breteau indices were calculated as per standard WHO larval survey methods (4):

- House (premise) index: percentage of houses infested with larvae and/or pupae.

$$\frac{\text{Infested houses X 100}}{\text{Houses inspected (HI)}}$$

- Container index: percentage of water-holding containers infested with larvae or pupae.

$$\frac{\text{Containers positive X 100}}{\text{Containers inspected (CI)}}$$

- Breteau index: percentage of positive containers in inspected houses.

$$\frac{\text{Number of positive containers X 100}}{\text{Houses inspected (BI)}}$$

Results

Of the 20 houses surveyed, 75% were positive for *Aedes* larvae. In total, 126 containers were inspected across the 20 houses. Of these, 35 were positive for *Aedes* larvae. Discarded containers (28.6%) and containers containing utilised water i.e rain water for household use (20%) were the highest recorded type of positive container (Fig 2.). House, Container and Breteau indices (Table 1) were all above the normal range. The use of abate sand was noted in 9 containers, one was positive for larvae. Homeowners often reported that they did not know when abate was added or that it was added over 12 months ago.

Table 1: House, Container and Breteau index for 20 houses surveyed in Phu Sing village

Dengue vector indices	Normal range	Index value
House index (n=20)	1-10	**75**
Container Index	<5	**27.8**
Breteau Index	5-50	**175**

References

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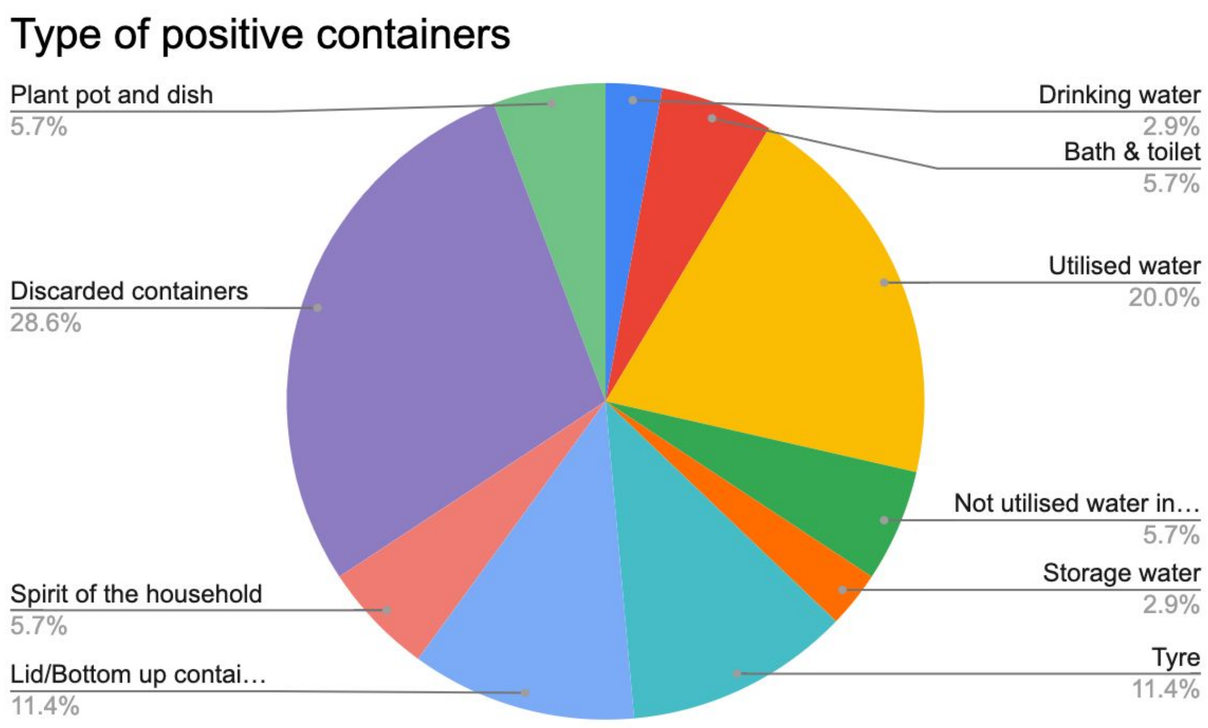

Fig 2. Type of positive containers (35 containers were positive for *Aedes* larva)

Discussion

In Thailand, the DDC considers a village to be at very high risk of dengue transmission when the house index is greater than 20.0 and container index greater than 10.0. In our study, house index was 75.0 and container index 27.8, suggesting that the village is at very high risk of dengue transmission. Additionally, the container index reported in our survey (27.8) was significantly higher than the average container index reported during rainy season in other studies (8.04 across thailand during the period 2017-19) (1).

'Discarded containers' and 'Utilised containers' with rain water were most frequently reported as being positive for *Aedes* larvae. Given the very high larval indices calculated, findings were summarised and shared with the local public health team and appropriate local interventions discussed: covering containers and discarding/ emptying and storing unused containers, regular cleaning, education regarding the use of larvicides by adding abate sand and biological control (adding small fish to the water). The correct use of abate sand among homeowners in our study was highly variable. Failed reapplication of abate sand at correct intervals has been reported as a barrier to effective larvae control in other studies (5) and education on correct larvicide use should be prioritised.

Limitations of the study include the small sample size, only 20 houses were surveyed at one site and on one occasion, therefore, the results are not necessarily representative of wider trends in the area and region. Additionally, larval surveys are often crude, simple tools and their findings are not necessarily correlated with disease outbreaks (4). Repeated, sequential larger surveys are required to draw statistically significant conclusions. However, the project provided a unique opportunity for an international cohort of doctors to actively learn about mosquito surveillance and direct public health intervention, 'learning by doing': recording the presence of larvae, emptying larvae positive containers and discussing the need for regular cleaning/emptying with households to reinforce and reflect on principles described in the classroom.

Conclusion

- House, Container and Breteau indices were all within the 'very high' range and the area surveyed is considered to be **very high risk** for dengue transmission. Local public health interventions should be prioritised to target larval breeding sites.
- Despite the small sample size, the activity provided a valuable learning opportunity for doctors studying tropical medicine to reflect on the social and behavioural challenges associated with mosquito control through experiential learning.

Experiential learning: both larvae surveillance and active public health interventions (container emptying and education) were carried out during the project