

RESEARCH NOTE

ECOLOGY OF *CLOSTRIDIUM BOTULINUM* CAUSING FOOD-BORNE BOTULISM IN THAILAND

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Abstract. The objective of this study was to determine ecology of *Clostridium botulinum* from previous reported outbreaks. Geographical parameters and their corresponding settings were collected and analyzed. The averages (mean \pm SD) for % soil moisture, % humus and pH were $0.6 \pm 0.1\%$ (range 0.5-0.7), $3.0 \pm 0.2\%$ (range 3-3.2) and 5.2 ± 0.1 (range 5.1-5.4), respectively. All outbreak settings shared the same sandy loam soil type. It can imply that provinces with this type of ecology may have sites harboring *C. botulinum*.

INTRODUCTION

Botulism is an infectious disease caused by *Clostridium botulinum*. The two main forms of this infection are food-borne and wound botulism (Horowitz, 2005). Food-borne botulism is an important food-borne infectious disease with high mortality (Bohnel and Gessler, 2005). Food-borne botulism is reported in many developing countries (Obana, 1999; Robinson and Nahata, 2003). In Thailand, epidemics of food-borne botulism have been documented for years. The causative bacterium is a contaminant in roots and shoots of many plants. However, there have been no reports regarding contamination with this organism in the soils of Thailand. This study was performed to document the ecology of the organism in Thailand based on data from previous epidemics.

MATERIALS AND METHODS

This was a retrospective study. A literature review of the papers concerning botulism in Thailand was performed using the database of published works cited in the Index Medicus and Science Citation Index. The author also reviewed the published works of all 256 local Thai journals not included in the international citation index. The key word for searching was "botulism." The environmental settings for each epidemic were recorded and used for further analysis of the ecology including type of soil, % soil moisture, % humus and pH determined from basic reference documents (Senanarong and Ngamnisai, 1986). Descriptive statistics was performed where appropriate.

RESULTS

The averages (mean \pm SD) for % soil moisture, % humus and pH were $0.6 \pm 0.1\%$ (range 0.5-0.7), $3.0 \pm 0.2\%$ (range 2.8-3.2) and 5.2 ± 0.1 (range 5.1-5.4), respectively. All the epidemic settings occurred where there was sandy loam soil. There were 4 reports of epidemics of food-bone botulism in Thailand

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Table 1
Geographical setting and parameters of food-borne botulism epidemics in Thailand.

Reference	Setting	Parameters			
		Type of soil	Soil moisture (%)	Humus (%)	Soil pH
Wongwatcharapaiboon <i>et al</i> , 1998	Nan	Sandy loam	0.6	2.8	5.2
Chotechuang <i>et al</i> , 2005	Tak	Sandy loam	0.7	3.2	5.4
Swaddiwudhipong and Wongwatcharapaiboon, 2000	Lampang	Sandy loam	0.5	3.0	5.1
Bhosiri, 2006	Nan	Sandy loam	0.6	2.8	5.2

(Wongwatcharapaiboon *et al*, 1998; Swaddiwudhipong and Wongwatcharapaiboon, 2000; Chotechuang *et al*, 2005; Bhosiri, 2006). The ecological parameters are presented in Table 1.

DISCUSSION

Food-borne botulism may be fatal. The contamination of home-canned food is the most common cause of outbreak (Todd, 1997). The causative agent, *C. botulinum*, is a rod-shaped bacterium producing subterminal endospores. This pathogen grows best in low oxygen conditions. However, knowledge of the ecology of this bacteria is limited. Diagnosis of infected cases by identification of botulinum toxin in the blood or body fluids is the gold standard. For treatment, specific antitoxin is recommended.

Although the causative agent is a contaminant in soil, knowledge of the epidemiology of this bacterium in Thailand is limited. Unlike *Burkholderia* (formerly *Pseudomonas pseudomallei*), another important soil contaminant in Thailand, only a few medical laboratories in Thailand can isolate *C. botulinum*, resulting in little data regarding this organism. Wiwanitkit (2006, in press) recently reported the ecology of this pathogen in Thailand. The average (mean \pm SD) temperature, rainfall and humidity levels needed are $30.0 \pm 1.6^\circ\text{C}$ (range

28-32), $1,125.0 \pm 95.7$ mm (range 1,000-1,200), $75.0 \pm 4.1\%$ (range 70-80), respectively.

Here, we describe the ecology where outbreaks of this organism have occurred in Thailand. There are specific ranges for the organism. This might be the optimal condition for this pathogen. This implies that any province with these ecological parameters might be silently harboring *C. botulinum*. The provinces within the range described are those in the eastern and western part of the Northern Region and those in the Western Region.

Some limitations of this study should be noted. An actual comparative survey of soil contamination in different provinces should be done. Since the proposed hypothesis may change the present knowledge of this pathogen; further studies are needed. The occurrence of this disease also depends on other factors, such as the eating habits of the local population, especially eating canned preserved food. The generalization of these results must be made with caution.

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