CHAPTER I

INTRODUCTION

1.1 General introduction

Black tiger shrimp (*Penaeus monodon*), the most commonly found in coastal water of Southeast Asia and nearby regions, has become the most commercially important species in aquaculture and fishery industries. Because of its rapid growth rate and high value, farming of *P. monodon* has achieved a considerable economic and social importance in the region constituting a significant source of income and employment.

In Thailand, *P. monodon* have been intensively cultured for more than two decades. Approximately 60% of the total harvest shrimps has come from cultivation. Shrimp farms and hatcheries are scattered along the coastal areas of Thailand. Southern provinces such as Nakorn Sri Thammarat and Surat Thani account for the majority while those in the East such as Chanthaburi and Central region such as Samut Sakhon and Samut Songkhran comprise the minority in terms of production. Intensive farming system has been mainly used for farming activity resulting in the consistent increase in the outcome production making. Thailand has the leader of *P. monodon* production for nearly a decade.

The production of cultured *P. monodon* from Thailand in 1998 accounted for 33.6% of the Eastern hemisphere's production. In 2001, about 280,000 metric tons of the shrimps were produced in Thailand. Fresh and frozen *P. monodon* were exported to several countries including the Asian countries (Japan, China, Singapore etc.), the United State of America (U. S. A.), Canada, European countries (E. U.), Australia and New Zealand. The U. S. A. and Japan are the two major consumer markets. Approximately 68% of *P. monodon* from Thailand are exported to these countries. The remaining markets are Europe, Asian countries, Australia and others (Table 1.1).

Table 1.1 Thai Frozen Shrimps exported in 2002 and 2003

Country	Quantity (metric tons) year 2002	Amount (million baht) year 2002	Quantity (metric tons) year 2003	Amount (million baht) year 2003
Asia	1,515	24,540	64,625	21,108
- China	2,374	449	2,518	624
- Japan	2,427	16,891	42,220	15,450
Other	6,714	7,200	19,887	5,034
United States of America	9,784	36,251	120,622	37,736
Australia	6,156	1,736	7,462	1,115
Europe	5,583	1,404	4,246	1,875
Others	13,552	4,447	16,729	4,764
Total	**96,590**	**68,378**	**213,684**	**66,599**

Source: shrimp culture newsletter, January 2004

The increasing number of shrimp culture farms and hatcheries has created many problems. In 1993, total amount of cultured shrimps increases about 28% over production from previous year. After reaching its peak in the same year, shrimp production has declined. The excessive culture with unplanned development has caused major cases of environmental damage which led to the disastrous outbreak of diseases. Environmental factors and poor water quality, sometimes resulting from increased self-pollution due to effluent discharge and pathogen transfer via movements of aquatic organisms appear to be an important underlying cause of such epizootics. Among the infectious diseases, virus-caused diseases were the most significant. In Thailand, The cost of lost production in 1996 due to viruses was estimated to be 40% of total production (70,000 tons) valued at over US$ 500 million. Although, rapid and sensitive diagnostic methods have been developed and applied to penaeid shrimp diseases, searching for the cure of these virus-caused diseases has never been achieved. Regardless the uncertainty of the disease treatment, various numbers of antibiotics and chemical compounds were still used uncontrollably in shrimp farming, leading to antibiotic resistance in shrimp disease organisms.

Improper use of chemicals was also harmful to the aquatic organisms that live in the water into which shrimp farms discharged (Bachere *et al*, 1990). In addition, certain antibiotics and some chemical compounds have been banned by many shrimp importing countries. Failure to comply with such regulations can have serious economic consequences to all involved in the import chain. Good shrimp health management focuses on the prevention of disease rather than disease treatment with chemical compounds. Farms need to develop shrimp health management strategies that indicate procedures to avoid the introduction of disease, protocols to maintain water and soil quality in ponds, and shrimp health monitoring.

P. monodon is susceptible to disease at all stages of growth. Virus and bacteria can cause high mortality in growout farms and hatcheries and regular antibiotics use for their control can lead to resistance problems. Stress can exhaust natural defenses and activate stress hormones which may deplete nutrient and energy reseves.

A number of studies also indicated that disease resistance in shrimps can be induced by culturing in the temperature slightly higher than normal. This study was to find stress-related proteins and genes in *P. monodon* and to determine their expression activities in response to heat and pathogen stresses.

1.2 Objective of the thesis

The aims of this thesis were:

1. to determine the effect of thermal stress on the glucose level and the protein concentration of *P. monodon,*

2. to determine protein profiles from the haemocytes of thermal-induced shrimps by electrophoretic analysis,

3. to identify differentially expressed genes in shrimp during thermal induction using RAP-PCR techniques,

4. to determine the expression levels of differentially expressed genes, PO gene, and HSP genes in normal and induced shrimps in relation to *V. harveyi* challenge by semi-quantitative RT-PCR techniques.