



Use of veterinary medicines, feed additives and probiotics in four major internationally traded aquaculture species farmed in Asia



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ARTICLE INFO

Article history:

Received 10 May 2013

Received in revised form 11 July 2013

Accepted 15 July 2013

Available online 24 July 2013

Keywords:

Aquaculture
Veterinary medicines
Shrimp
Pangasius
Tilapia
Asia

ABSTRACT

Antimicrobials, parasiticides, feed additives and probiotics are used in Asian aquaculture to improve the health status of the cultured organisms and to prevent or treat disease outbreaks. Detailed information on the use of such chemicals in Asian aquaculture is limited, but of crucial importance for the evaluation of their potential human health and environmental risks. This study reports the outcomes of a survey on the use of chemical and biological products in 252 grow-out aquaculture farms and 56 farm supply shops in four countries in Asia. The survey was conducted between 2011 and 2012, and included nine aquaculture farm groups: Penaeid shrimp farms in Bangladesh, China, Thailand and Vietnam; *Macrobrachium* prawn farms, and farms producing both Penaeid shrimps and *Macrobrachium* prawns in Bangladesh; tilapia farms in China and Thailand; and *Pangasius* catfish farms in Vietnam. Results were analysed with regard to the frequencies of use of active ingredients and chemical classes, reported dosages, and calculated applied mass relative to production. A range of farm management and farm characteristics were used as independent variables to explain observed chemical use patterns reported by farmers within each group. Sixty different veterinary medicinal ingredients were recorded (26 antibiotics, 19 disinfectants, and 15 parasiticides). The use of antibiotic treatments was found to be significantly higher in the Vietnamese *Pangasius* farms. However, total quantities of antibiotics, relative to production, applied by the *Pangasius* farmers were comparable or even lower than those reported for other animal production commodities. Semi-intensive and intensive shrimp farms in China, Thailand and Vietnam showed a decrease in the use of antibiotic treatments. These farm groups utilised the largest amount of chemicals relative to production, with feed additives and plant extracts, probiotics, and disinfectants, being the most used chemical classes, mainly for disease prevention. The surveyed farmers generally did not exceed recommended dosages of veterinary medicines, and nationally or internationally banned compounds were (with one exception) reported neither by the surveyed farmers, nor by the surveyed chemical sellers. Factors underlying the observed differences in chemical use patterns differed widely amongst farm groups, and geographical location was found to be the only factor influencing chemical ingredient application patterns in the majority of the studied farm groups.

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1. Introduction

The Asian aquaculture sector has grown at a rapid pace during recent decades, and nowadays accounts for nearly 90% of the global aquaculture production (FAO, 2012a). Intensification of aquaculture practices in Asian aquaculture has often been accompanied by more frequent

outbreaks of infectious diseases that require therapeutic treatment (Bondad-Reantaso et al., 2005). Natural and synthetic chemicals such as antibiotics, disinfectants, parasiticides, probiotics, and other feed additives have become indispensable inputs to treat and prevent bacterial and parasitic diseases, to improve water quality, and/or as growth promoters. The use of these substances has contributed to the productivity and growth of the Asian aquaculture sector, but has also attracted criticism. Chemical residues in the cultured organisms constitute a potential hazard for human consumers (Heuer et al., 2009; Sapkota

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et al., 2008), and indicate the fallibility of national and international food safety controls when they exceed food safety standards (Love et al., 2011). Moreover, the continued application of compounds such as antibiotics has been associated with the development of drug-resistant bacteria both inside and outside of aquaculture facilities (Le et al., 2005), and environmental residues of highly toxic substances, such as disinfectants or parasiticides, can exert toxic effects on non-target organisms, contributing to a potential degradation of ecosystems receiving aquaculture effluents (Rico et al., 2012).

The current information on the use of chemicals and biological products applied by Asian farmers is very limited, or even unavailable for some important aquaculture species (Rico et al., 2012). The Food and Agriculture Organization (FAO) reports the outcomes of a survey performed during 2009 on the use of aquaculture medicinal products on 12 different aquatic species groups, with special focus on four major aquaculture-producing countries in Asia (China, Philippines, Thailand and Vietnam) (Alday-Sanz et al., 2012). The outcomes of this survey show high frequencies of use for some Asian species groups (e.g. *Pangasius*, shrimp), and a greater availability of veterinary medicinal products in Asian markets compared to other regions (Alday-Sanz et al., 2012). However, with some exceptions, these data and other published data (see review by Rico et al., 2012) have limited scope for species and country-specific comparisons, since information was collected from different sources and actors in different years, and fail to provide detailed descriptions of dosages and volumes applied. The collection of detailed information on the use of antimicrobials and other chemical inputs in Asian aquaculture is of crucial importance to evaluate their potential risks for human health and for the environment, as well as to evaluate the prudent use of such compounds, and their effectiveness for preventing and treating disease outbreaks.

In the current study we assessed the use of veterinary compounds, feed additives and probiotics for four internationally traded aquatic species based on a systematic survey of 252 grow-out farms and 56 farm supply shops. The survey covered nine aquaculture farm groups with different levels of production intensity, thus potentially showing different chemical use patterns. These were: i) Penaeid shrimps in Bangladesh, China, Thailand and Vietnam, ii) *Macrobrachium* prawns, and concurrent shrimp and prawn production systems, in Bangladesh,

iii) tilapia in China and Thailand, and iv) *Pangasius* catfish in Vietnam. This mix of countries and species was selected mainly due to their recent great increase in production and trade, both by volume and value (Fig. 1). The objective of the present study was two-fold. First, to quantitatively assess the current use of veterinary compounds, feed additives and probiotics in the aforementioned aquaculture farm groups and to compare them in terms of active ingredients used, actual vs recommended application dosages, and mass of chemicals applied relative to production. The second objective was to try to explain the differences in chemical use patterns observed in each of the studied aquaculture farm groups, in order to identify a potential relationship between the chemical use patterns and management characteristics of each aquaculture farm group. This was done by correlating data on farm-level aquaculture management practices and farm characteristics, with the data on chemicals and active ingredients used in the farms. The dataset provided by the current study offers the most extensive source of quantitative information on volumes and dosages of chemicals applied in Asian aquaculture, and constitutes a basis for on-going studies aimed at: i) assessing the appropriateness of the chemical use practices to treat and prevent disease outbreaks, ii) identifying occupational health hazards, and iii) performing human health and environmental risk assessments in each of the studied farm groups.

2. Materials and methods

2.1. Chemical use interviews

Information on the application of veterinary compounds, feed additives and probiotics was collected between 2011 and 2012 through structured interviews conducted with farm owners, managers or technical staff of 252 aquaculture grow-out farms (Table 1). These farms were selected as a sub-sample of more than 1,600 farms for which baseline data on aquaculture management practices, social and economic aspects had previously been collected in the SEAT project Primary Survey (Murray et al., 2013). The studied sub-set of aquaculture farms was selected taking into account species group, farm-scale and geographical location as selection variables (see Murray et al., 2013 for rationale). This farm selection was directed towards a wide

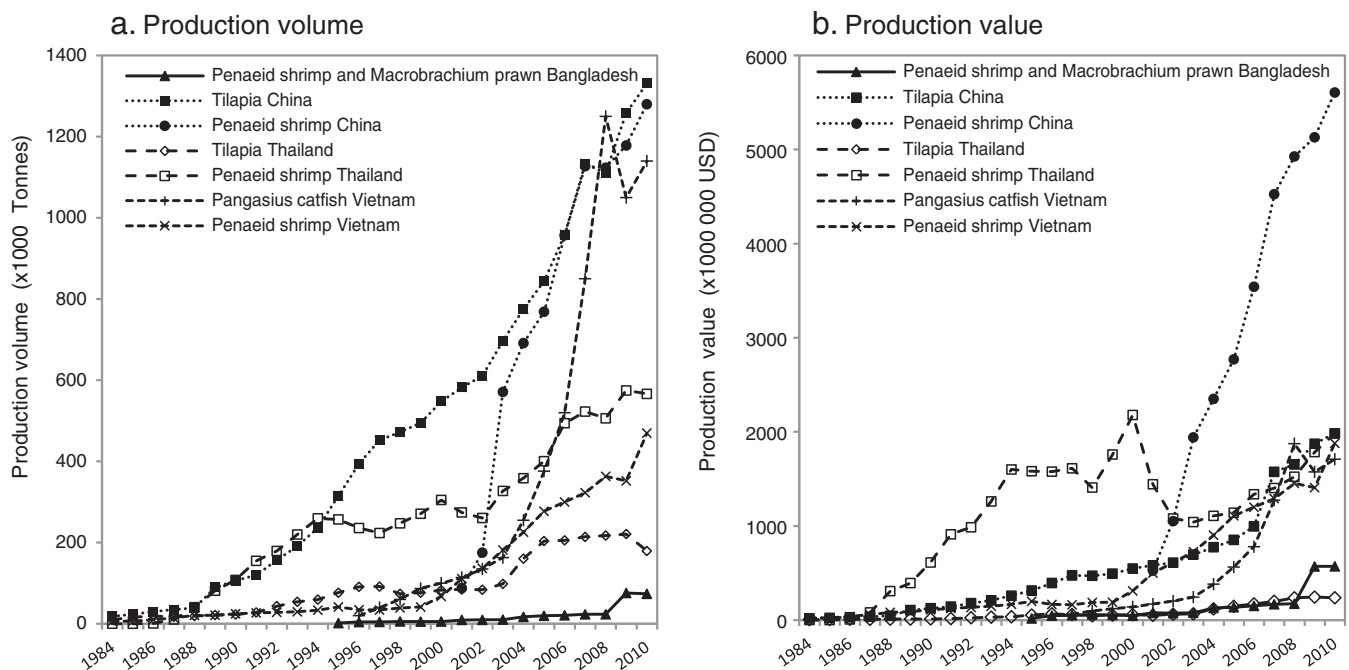


Fig. 1. Trends of (a) production volume and (b) production value over the last decades for the aquaculture species included in the present study (Data source: FAO, 2012b).

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