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## Note

# Use of chemical and biological products in modern shrimp farming in Northern Tamil Nadu, India

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## ABSRACT

Chemical and biological (CB) products are extensively used in present day aquaculture. Though some of these products help to improve the quantity and quality of aquaculture production, their indiscriminate use could lead to deleterious effects on the production system. To assess the use of commercial CB products in shrimp aquaculture, data were collected from 103 shrimp farmers in two districts in northern Tamil Nadu, *viz*., Kanchipuram and Tiruvallur. Based on the study, it was found that many manufacturers and retailers of these products provided farmers with information and relevant instructions for their safe and effective use. Availability of 110 different CB products in the market was documented. Farmers from Kanchipuram and Tiruvallur districts used 27 and 51 different types of CB products respectively and among the two districts, the farmers in Tiruvallur District used larger number of CB products. On an average 5 to 17 CB products were used by each farmer in the study area. Disinfectants, soil and water treatment formulations/probiotics, feed probiotics, feed additives and immunostimulants were the most commonly used CB products. Neither the age of the farmer nor their experience in farming had influence on selection, use and continuance of CB products. The deciding factor on the use of CB products was found to be technician's advice. The main rationale for use of a CB product was for improvement of soil quality. The present investigation identified the market profile of CB products, usage pattern and the expenditure incurred in their use. Notably none of the farmers in the study area used antibiotics.

Keywords: Biological products, Chemical products, Commercial, Shrimp farming, Tamil Nadu

Fish production in the country has shown remarkable growth, increasing from 0.752 million t in 1950-51 to 8 million t in the year 2010-11. Exports of marine products from India during the financial year 2010-11 touched the $ 2.67-billion mark, growing 10.96% in quantity and 20.42% in rupee value over the previous year. Shrimp exports increased considerably during the year due to production of 10,000 t of the whiteleg shrimp *Litopenaeus vannamei*, in addition to the higher production of tiger shrimp *Penaeus monodon* (Ponniah *et al*., 2011). In the past decade, incidences of viral and bacterial diseases in shrimp aquaculture world-wide have been on the rise causing severe loss to the sector. Repeated incidence of diseases has led to increased use of chemicals, drugs and biological products as a measure to prevent disease. Indiscriminate use of the chemical and biological (CB) products is one of the major concerns, considering the potential negative impacts on the environment and human health. Grasslund and Bengtsson (2001) documented the use of various CB products by shrimp farmers of South-east Asian countries. Though CB products are very widely used in Indian shrimp farming, there is lack of reliable field level data on the usage of these products.

Several studies have been conducted worldwide since 1990s on the use of CB products: Philippines (Primavera *et al*., 1993); Thailand (Graslund *et al*., 2003) and North-west Mexico (Lyle-Fritch *et al*., 2006). Except for a general review on use of chemicals in shrimp farming (Pathak *et al*., 1996), no detailed study on the use of CB products has been carried out in India. The present study was carried out as a field level survey in two districts of Tamil Nadu, with the aim to study the market profile of CB products, their usage pattern, the level of expenditure incurred by the farmers in such usage, and on the experience of farmers in the use of these products.

Tamil Nadu (TN) was selected for the present investigation considering the State's leading position in aquaculture productivity per hectare ($ha^{-1}$) shrimp production. Two districts *viz*., Tiruvallur and Kancheepuram were chosen as the study areas. The survey was conducted at two levels. In the first level, market survey of CB products available in the study area was conducted and also collected information on the claim made by the manufacturer regarding the use of the products, and the level of information provided with the product. At the second level, survey was conducted among shrimp farmers through a structured and tested questionnaire.

The total population of the shrimp farmers in the study area was 143 in Tiruvallur and 53 in Kancheepuram District. Out of this, 77 respondents from Tiruvallur District and 26 from Kancheepuram District were surveyed. The interview schedule was designed to collect data on the socio-economic profile of the farmers, and the chemical and biological products used by the shrimp farmers, quantity applied, expenditure incurred and reasons for application. CB products used by the farmers were categorised into the following groups: disinfectants, soil and water probiotics, feed additives, immunostimulants, shrimp probiotics and uncertain/unidentifiable group of compounds.

A total of 110 CB products were available in the market during the period of study. The market profiles of the products are presented in Table 1. More than 26 different companies were documented as manufacturers of these products of which 6.4% were overseas manufacturers. The addresses of the distributors in India have been indicated clearly in the overseas products. Though attractive brand names were used for almost all the products, only 84.5% of the products had indicated the quality and quantity of the active ingredient contained in the product. Information leaflets indicating the usage (85.4%), dosage (80%), package (70%) and MRP rate details (60%) were available with the products. One of the important observations was the absence of antibiotic products in the market. This is clearly an improvement over the earlier reports on use of antibiotics in Asia (Poh Sze, 2000). The ban on the use of twenty antibiotics in aquaculture by Ministry of Agriculture and the Coastal Aquaculture Authority as well as the awareness camps conducted by Marine Products Export Development Authority (MPEDA), actually annulled the use of antibiotics (MPEDA, 2011) in shrimp farming.

Table 1. Profile of the Chemical and Biological Products

| Parameters | Number | Percentage to total |
|---|---|---|
| Total no. of products | 110 | 100.00 |
| Total no. of manufactures | 26 | 100.00 |
| Overseas manufacturers | 7 | 6.36 |
| Indian manufacturers | 103 | 93.63 |
| Products with mention of active ingredient /composition | 93 | 84.54 |
| Products with out mention of active ingredient /composition | 17 | 15.45 |
| Products with usage details | 94 | 85.45 |
| Products without usage details | 16 | 14.54 |
| Products with dosage details | 88 | 80.00 |
| Products without dosage details | 22 | 20.00 |
| Products with package details | 77 | 70.00 |
| Products without package details | 33 | 30.00 |
| Products with MRP rate details | 66 | 60.00 |
| Products without MRP rate details | 44 | 40.00 |
| Products with/use of antibiotics | 0 | 0.00 |

MRP = Maximum Retail Price

Majority of the respondents were middle aged and more than half of the shrimp farmers (53.3%) were graduates or had a degree or education above high school level. About three fourth of the farmers (73.3%) were also engaged in occupations like agriculture or business in addition to shrimp farming. Majority of the respondents were small farmers holding a farm size of < 2 ha (45.4%), while 46.6% of the farmers possessed 2-5 ha farms. Only 7.9% of the farmers had holdings >5 ha.

Experience in shrimp farming ranged from 1-15 years and most of them did not evince active interest in the affairs of local institutions. More than half of the farmers (79%) had regular contact with extension personnel of the State Department of Fisheries (DoF) for obtaining licenses and subsidies. The mode of communication channels of farmers about the CB products was through technicians (90%), feed dealers (80%), fellow farmers (58%) and DoF personnel (12%). Analysis showed that most of the farmers were high-risk takers and obtained inputs on a credit basis from local traders through buy back arrangements.

Out of the available 110 CB products in the market, 54 were used by farmers of both districts. About 47% of CB products used by farmers in both the districts were same. All the farmers interviewed, used same kind of disinfectant (9.7%) in pond management. Among the CB products, agricultural lime or shell lime is applied by most of the farmers at the rate of 100 - 1000 kg $ha^{-1}$ as a basal dose with 150 kg of dolomite and 25 kg of zeolite to adjust the pH. Over all, liming is practiced more widely and intensively and so also the use of zeolite. To improve the plankton growth, some farmers applied dolomite as substitute to lime at the rate of 750 kg $ha^{-1}$ as basal dose and as per need, top-dressed with 50 kg $ha^{-1}$ once in 10-15 days to neutralise pH fluctuations. Most of the farmers used zeolite to decrease turbidity, whereas only a few used it to remove ammonia.

In both the districts, source water and pond effluents discharge point were the same, the Pulicat Lake in Tiruvallur District and Buckingham Canal in Kanchipuram District and hence the likelihood of disease outbreak is high whenever water quality deteriorates. Therefore, management of water quality is of primary consideration particularly in ponds with higher stocking rates of 20-30 no. $m^{-2}$. Since most of the farmers in the area are small land holders, without any reservoir or treatment ponds, the use of bleaching powder is quite low compared to other areas with treatment reservoirs. Bleaching powder is widely applied during pond preparation by few farmers, for treatment of intake water as well as for disinfection of implements. The application rate of bleaching powder varied based on the purpose of application and the quantity applied ranged between 100 to 1000 kg $ha^{-1}$ $crop^{-1}$.

Many shrimp farmers in the study area complained about poor water quality in coastal areas, which causes stress and increases the susceptibility of farmed shrimps to disease. About half of the farmers (45.6%) gave importance for soil and water probiotics as well as feed probiotics (9.7%). When the prevalence of white spot virus (WSV) is suspected, a common procedure for preparing pond soils prior to stocking has been evolved by the farmers. The black soil accumulated in the pond bottom was removed and soil probiotics were applied as a basal application. Nearly 45.6% of farmers applied soil and water probiotics in combination. Similarly, commercially available feed probiotics were mixed with feed and applied 2-5 times during the culture period by 9.7% of farmers. Use of some of the probiotics have been reported to have beneficial effects like prevention of swollen gills, red gills, tail rot and broken appendages, control of bacterial, viral, fungal and protozoan pathogens.

A small segment of farmers (8.7%) added different products to the feed in order to improve the nutritional value of the feed. Six different brands and or forms of vitamin C were found to be used in the study area. Fish oil was used as feed attractant (GESAMP, 1997). Farmers used vitamin C as a strategy to manage possible nutritional deficiencies. Addition of vitamin C to shrimp feed has also been reported to be common in the Phillipines (Primavera *et al*., 1993).

About 7.4% of farmers in the survey area used immunostimulants. The products were fed mixed with shrimp feeds with the expectation to provide resistance and to boost the immune system of shrimp during disease outbreak. The contents of two different brands used in the study were herbal based without proper labeling. Immunostimulants mainly act by increasing the proper bactericidal activities of the phagocytic cells. Treatment with immunostimulants has been shown to have an immunostimulating effect or an improved resistance against infections by *Vibrio* and YHV in *P. monodon* (Rukyani *et al*., 1999; Sakai, 1999; Sunarto *et al.,* 1999). Immunostimulants are used prophylactically, but, the response is likely to be of short duration (Sakai, 1999).

Majority of the farmers (53.4%) used a range of 11-15 CB products per crop whereas the rest (41.7%) used 6-10 CB products (Fig. 1). Only 2.9% of the respondents used less than 5 products and 1.9% of the farmers used up to 17 products (Table 2). About 30% farmers rationalised their applications based on the satisfactory results of the previous use of the product. All the farmers had confidence in the use of probiotics which they felt would be an immediate solution to their problems (Moriarty, 1998; 1999). Selection of CB products is based on the nature and intensity of the problem as perceived by

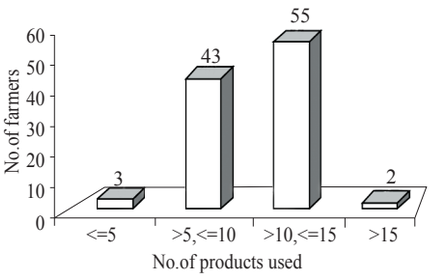


Fig. 1. Usage pattern of chemical and biological products

Table 2. Usage pattern of CB products in shrimp culture from two districts of Tamil Nadu

| CB products | Kanchipuram District (n=26) | Tiruvallur District (n=77) | Total (n=103) |
|---|---|---|---|
| Disinfectants | 5 (18.51) | 5(9.8) | 10 (9.70) |
| Soil &water probiotics | 15 (55.56) | 32(62.75) | 47 ( 45.63) |
| Feed probiotics | 2 (7.40) | 8(15.69) | 10 ( 9.70) |
| Feed additives | 3(11.11) | 6(11.76) | 9 ( 8.73) |
| Immunostimulants | 2(7.40) | - | 2 ( 1.94) |
| Total | 27(100.00) | 51 (100.00) | 103.00 ( 100.00) |

Figures in parentheses are percentage of column totals

the farmer and as per the advice of the technician (100%) or the consultant connected with the farm. The use of CB products depends on trial and error method (76.7%), based on the previous experience of the farmer (42.7%), as per experiences and advice of fellow farmers (11.6%) or as directed by the technician (100%).

From the results of the present study, it is evident that the age and experience had no influence on the farmers decision to use CB products. This indicates that the influence and 'advice' of technicians who adopted personal 'face to face' contact with farmers as part of aggressive marketing tactics have made more impact on farmers decision. In the present case, farmers have had a long experience in shrimp culture and they were also enthusiastic to learn and practice advanced technologies. They had new ideas for development or modification and eager to run the operations with new information which were readily made available by technicians in the form of advice.

On an average 9% of the gross expenditure in production was incurred on chemical and biological products colloquially termed as "medicines" (Fig. 2). It was the third largest cost component after feed (55%) and electricity charges (13%). The higher expenditure outlay for CB products clearly underscores the importance farmers attach to usage of these products as a measure to obtain better crop.

Results of the study indicates that there is a rampant and extensive use of CB products in shrimp aquaculture. However, these products were used in an unsystematic manner with no scientific reasoning or guidance. This can be attributed to the lack of knowledge and expertise

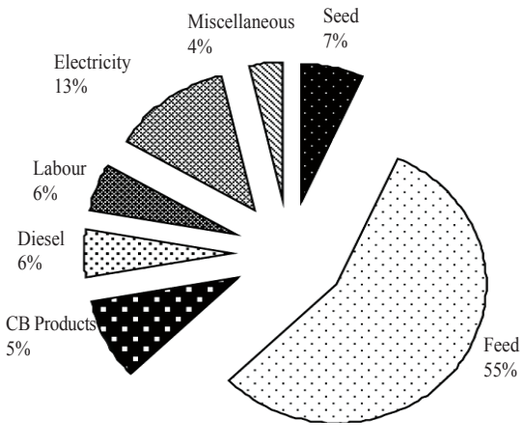


Fig. 2. Share of expenditure on CB products in shrimp farming

in their use and the lack of details and comprehensive "instructions/directions for use" supplied along with the commercial products. Obscure information on the active ingredients and composition of the commercial products also do not allow for their scientific and economical use. The absence of a scientific/regulatory body which authenticates and regularise these products allows for spurious/low quality and unscientific preparations to be marketed as CB products that are expected to enhance shrimp production. It is necessary to educate the farmers on the use of chemical and biological products in shrimp farming in a rational and systematic manner for better aquatic animal health, for sustainable aquaculture production and to safeguard the environment. Rational and scientific use of chemical and biological products will help to reduce the cost of production, ensure safety to the environment as well as better human health.

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