POTENTIAL OF ORGANIC IMMUNOSTIMULANTS AS FEED ADDITIVES IN FISH PRODUCTION

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Abstract

Fish is an essential part of protein supply to every household in developing countries. Most of the fish species produced are reduced in number due to the adverse effect of fish diseases of pathogenic origin. Safety of fish consumed at household level should be of public health concern too. The use of synthetic immunostimulants such as antibiotics and chemicals are serious threat to the consumers of such fish fed with them. The use of organic immunostimulants such as plant extracts as feed additives are great assets in aquaculture due to their economically friendly and biodegradability in aquatic environment. Therefore, the paper reviewed sources of immunostimulants, plant extracts used as organic immunostimulants, probiotics and prebiotics used as immunostimulants, and mode of administration of immunostimulants in aquaculture.

Keywords: Fish, Organic Immunostimulants, feed additives, fish disease, aquaculture

Introduction

Fish constitutes the fastest growing source of food in the developing world (Asimi and Sahu, 2012). Fish consumption will have a significant impact on the food security, nutrition, diets, and income of poor people in developing countries during the next two decades. The use of antibiotics in fish feed leads to consumer concern regarding their safety which has motivated to search for natural alternatives. The main cause of the decrease in fish production is the occurrence of diseases caused by different pathogens (Asimi and Sahu, 2012). Intensification of aquaculture has led to gradual and chronic environmental degradation, loss of biodiversity and eventually loss of productivity. The use of chemicals and antibiotics is an easy solution but not without drastic consequences on sustainability and the health of consumers of aquatic products (Fotedar et al., 2011). Recently, the use of environmentally friendly feed additives, namely probiotics and prebiotics, has become popular in aquaculture industry (Vine et al.2006; Soltanian et al.2007 ; Fotedaret al.2011).These specialised feed additives act as immunostimulants, which either enhance innate defence responses prior to exposure to pathogen, or improve survival after the actual infection by pathogen(Bricknell and Dalmo,2005).An immunostimulant is a naturally occurring compound that modulates the immune system by increasing the host's resistance against diseases that in most circumstances are caused by pathogens(Ringeet al.2012). The role of immunostimulants in aquaculture cannot be over-emphasized, and the moment they are from organic sources; consumption of fish from such origin is safe and environmentally friendly. Therefore, the paper reviewed sources of immunostimulants; plant extracts used as organic immunostimulants, probiotics and prebiotics used as immunostimulants, and mode of administration of immunostimulants in aquaculture.

Sources of Immunostimulants use in Aquaculture

Immunostimulants are obtained from various sources such as bacteria, brown and red algae and terrestrial fungi(Bricknell and Dalmo,2005),bacteria from aquatic habitats(Rengpipat *et al.*1998) and marine yeast(Sajeevan *et al.*2006).Immunostimulants can be divided into several groups, depending on their original sources such as bacteria, algae derived, nutritional factors and hormones or cytokines(Sakai,1999).

Plant extracts use as Organic Immunostimulants in Aquaculture

Some immunostimulants cannot be used because of various disadvantages, such as high cost and limited effectiveness upon parenteral administration.Numerous plants had on the other hand long been used in traditional medicine for the treatment and control of several diseases (Ringeet al.2012).As herbs, have little side effects and are easily degradable and abundantly available in farm

areas.

Probiotics and Prebiotics as Immunostimulants in Aquaculture

Probiotics are define as 'live microorganisms which when administered in adequate amounts confer a health benefit to the host' (FAO/WHO, 2002; Hai *et al*.2011) and prebiotics are defined as' non-digestible food ingredients that beneficially affect the growth and health of the host' (Gibson and Roberfroid, 1995; Hai *et al*.2011). Peptidoglycan and lipopolysaccharides are examples of probiotics (Hai *et al*.2011).Probiotics can be applied directly into the rearing water or supplemented with feed or live feeds(Skjermo and Vadstein,1999 ;Hai *et al*.2009;2011);and it can be used singly or a combination(Gatesoupe,2002; Kesarcodi-Watson,2008).Prebiotics include ß-glucan and mannan oligosaccharides(Bio-Mos) and it enhances the immune responses in prawn (Hai *et al*.2009; 2011). Prebiotics are seen as means of influencing the gut microbiota and risk of allergy (Reid, 2008).

Mode of Administration of Immunostimulants in Aquaculture

To use immunostimulants effectively, the timing, dosages, methods of administration and physiological conditions need to be considered properly (Sakai, 1999).Immunostimulants should be administered into the culture systems before disease outbreaks occur, to reduce disease-related losses (Anderson,1992). Short duration feeding of immunostimulants, followed by a period of control diet feeding, produces optimal effects on immune response and disease resistance (Begni et al.2000;Hai et al.2011).There are various ways to introduce immunostimulants such as supplement with feed, immersion, submersion, oral administration and intramuscular or intra-arterial/intral peritoneal injections, of which the supplement with feed or in-feed route is considered more productive and practical than the others (Azad et al.2005;Hai et al.2009; 2011).

Conclusions and Recommendations

The use of organic immunostimulants as feed additives in aquaculture will definitely improve aquatic ecosystem due to their sustainability in terms of biodegradability and eco-friendly principles. This will go a long way in promoting organic aquaculture due to their cost-effectiveness, eco- friendly and biodegradability activities in aquatic environment. The dosages to be administered must be well established and serve as a baseline that will not be toxic to the fish. The length of administration of dosages must be established also to avoid chronic toxic effect on organs and tissues of fish.

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Table 1: Main herbal plant extracts and their multiple therapeutic properties in aquaculture

English name	Scientific name	Useful part	Active substances	Therapeutic properties
AROMATIC SPECIES				
Nutmeg	*Myristicaflagrans*	Seed	Sabinene	Digestion stimulant, antidiarrhotic
Cinnamon	*Cinnamomum zeylanicum*	Bark	Ammameldehyde	Appetite and digestion stimulant, antiseptic
Clove	*Syzygium aromaticum*	Cloves	Eugenol	Appetite and digestion
Cardamom	*Elettaria caramomum*	Seed	Cinook	Appetite and digestion stimulant
PUNGENT SPECIES				
Capsicum	*Capsicum annum longum*	Fruit	Capsaicin	Antidiarrhoic, stimulant tonic, anti-inflammatory
Ginger	*Zingiber officinale*	Rhizom	Zingerole	Gastric Stimulant
Pepper	*Piper nigrum*	Fruit	Piperine	Digestion stimulant
AROMATIC HERBS AND SPICES				
Garlic	*Allium tuberosum*	Bulb	Allicin	Digestion stimulant, antiseptic
Rosemary	*Anibarosaeodora*	Leaves	Cineole	Digestion Stimulant, antiseptic, antioxidant
Thyme	*Thymus vulgaris*	Whole plant	Thymol	Digestion stimulant, antiseptic, antioxidant
Sage	*Salvia apiana*	Leaves	Cineole	Digestion stimulant
Peppermint	*Mentha piperita*	Leaves	Menthol	Appetite and digestion stimulant, antiseptic
Neem	*Azadirachta indica*	Leaves, bark	Azadirachtin, salaninnumbin	Antiviral, antiseptic, fungicidal

Source: (Coutteau *et al.* 2011; Asimi and Sahu, 2012)