

VOLUME 9

ISSUE 2

2023

ISSN 2454 – 3055



**INTERNATIONAL
JOURNAL OF
ZOOLOGICAL
INVESTIGATIONS**

***Forum for Biological and
Environmental Sciences***

Published by Saran Publications, India



International Journal of Zoological Investigations

Contents available at Journals Home Page: www.ijzi.net

Editor-in-Chief: Prof. Ajai Kumar Srivastav

Published by: Saran Publications, Gorakhpur, India



ISSN: 2454-3055

Herbal Fish Feed: An Alternative of Conventional Medicines and Growth Stimulators Used in Different Fish Farms of Nagaon District, Assam, India

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Received: 27th July, 2023; **Accepted:** 2nd September, 2023; **Published online:** 3rd October, 2023

<https://doi.org/10.33745/ijzi.2023.v09i02.087>

Abstract: Aquaculture has grown rapidly for food production around the world. However, outbreaks of infectious diseases have also increased in aquaculture causing serious economic losses. Antibiotics play an important role in the diseases management of aquaculture practices; however, antibiotic resistance develops rapidly in pathogens following antibiotic treatment. Herbal food or medicinal herbs play an alternative role to antibiotics or other chemical modes of treatment. The herbal food or plant derived compounds such as plant extract or essential oils have been used as an efficient treatment to control the fish diseases. Herbs and herbal products can be used not only against diseases but even so as growth promoters, stress resistant, preventives of infections, appetisers, immunity booster tonic etc. The herbs can also act as immune-stimulants, conferring the non-specific defence mechanisms of fish and elevating the specific immune responses. The use of herbal products as drugs in disease management in aquaculture is going popular. These are better than various antibiotics and vaccines used in the treatment of diseases. In the present study we gathered information regarding wide range of medicinal plant or plant-based components in different formulations like crude, extract and in mixed form used as immune-stimulant, growth promoter of disease controller by the farmers of study area. According to them the use of local plants provide enhancement in the immune system of fish which controls or prevents many ailments.

Keywords: Herbal Food Additives, Immune stimulator, Growth stimulators, Alternative medicines

Citation: Sultana Armin, Mahanta Bhagyashree and Ahmed Rijuana: Herbal fish feed: An alternative of conventional medicines and growth stimulators used in different fish farms of Nagaon District, Assam, India. Intern. J. Zool. Invest. 9(2): 781-787, 2023.

<https://doi.org/10.33745/ijzi.2023.v09i02.087>



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Introduction

In recent few years aquaculture industry has been grown significantly. The annual production rate has increased by 6.1% upto 2012. In 2002 it was 36.8 million tonnes and in 2012 it was 66.6 million

tonnes (FAO, 2014, Syahidah *et al.*, 2014). But fish diseases are the only cause which leads to the loss of yield per year. Many of the fishes could not reach marketable size due to fish disease. Because

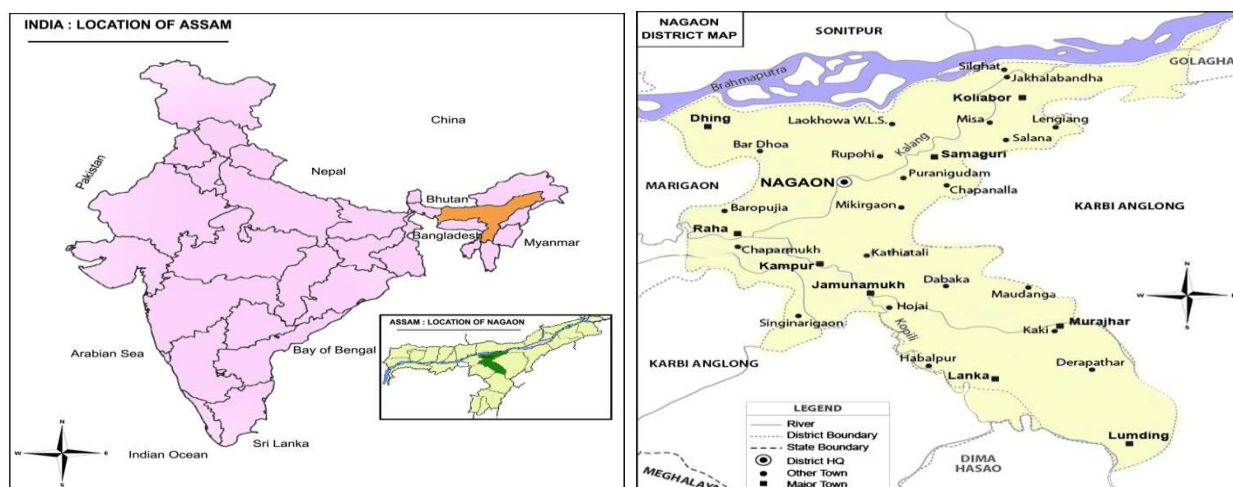


Fig. 1: Location of Nagaon district.

of fish disease every year farmers facing considerable economic loss. Mortality, morbidity, poor growth rate, low quality of flesh etc. are the major factors caused by fish disease which results reduced profit margins (Smith *et al.*, 2003). The farmers generally use various chemotherapeutic agents such as antibiotics and disinfectants to treat and prevent fish disease in fish farms (Ringo *et al.*, 2010). But antibiotic resistance in fish, environmental pollution and biomagnification are the concerning subjects in respect to farmers and public health. For these reasons, the interest of the aquaculture industry in plant resources is increasing day by day (Dikel, 2015). In recent years, the use of herbal feed additives in fish feeds has been noticed to be very popular among the village fish farmers. The additives added to feeds increase the digestibility of the feed while reducing the effects of anti-nutritional factors. In addition, it plays a role in fish gaining resistance of diseases (Yildirim *et al.*, 2014). Therefore, in present time deep research and efforts are made by researchers on the use of plants and herbs in producing alternative supplements as food, growth promoter, immune booster in farmed fish in the place of chemotherapeutic agents (Syahidah *et al.*, 2013, Sahandi *et al.*, 2023). In the present study we gathered information regarding wide range of medicinal plant or plant-based

components in different formulations like crude, extract and in mixed form used as immune-stimulant, growth promoter of disease controller by the farmers of study area.

Materials and Methods

Study area:

To getting information about the use of herbal fish feed by local farmers, different locations of Nagaon district were taken as study area. Selection of study area was conducted by considering the large fish market of Nagaon district and numbers of local fish farmers in nearby villages. Nagaon district (Fig. 1) is situated at 121 kilometres east of Guwahati city. In the North the district is bounded by Sonitpur District and Brahmaputra River, in South, Karbi Anglong and North Cachar Hills and in east, East Karbi Anglong and Golaghat district is situated and having the population of 1,892,550.

Survey methodology:

An extensive and intensive field study was undertaken using the methodology of Jain and Rao (1976) covering the area of Nagaon town and some villages near the Nagaon town from May 2022 to July 2022. During this period, the informants (villagers, fish farmers,) in this area were repeatedly interviewed. Structured

questionnaires were given to them having certain questions. The questionnaires did not include any reference as to disease concepts, plant parts or preparation. In contrast, the participants were asked simple questions along the lines "What is the plant used for, which part, what quantity, how is it prepared, are any other plants added to the mixture, would you recommend the product to another fish farmers, is the product harmful to people." The villages were selected on the basis of the following consideration: (i) areas where fisheries and fish farmers are found more; (ii) areas where people are economically weak.

Meticulous efforts were made in this direction so as to gather as much as information on each and every plant species. The general procedures for collection of data regarding use of medicinal plants for different ailments of fishes were followed. The information was collected from local people and they were also requested to go with the authors to the field for proper plant identification and understand their use.

Results and Discussion

In the enumeration, plants are arranged with local name (in Assamese language), scientific name along with family, mode of administration or application and its effect on fishes. In the present study 25 number of plant species from different families were documented and identified as herbal feed additives as an alternative to commercial medicine for different fish diseases, growth improvement and immuno-stimulants (Table 1). The herbal feed additives are used in both therapeutic and prophylactic means. Mostly used plant species were from the family Lamiaceae, Zingiberaceae, Piperaceae, Meliaceae, Amaryllidaceae, Anacardaceae, Fabaceae, Poaceae, Lauraceae, Myristicaceae, Myrtaceae, Apiaceae, Solanaceae, Caricaceae, Brassicaceae, Ranunculaceae, Combretaceae, Rutaceae, Theaceae and Punicaceae. In this study the authors have documented plants in different ailments like bacterial, viral, fungal and parasitic diseases under different headings (Table 1). Plants those are used as growth promoters, disease

preventive and longevity promoters are tabulated as well (Table 1). The Disease preventive plants are considered as immune stimulators and longevity promoter plants are considered as having antioxidant properties as per the information given by the local farmers. Among the 25 plants, the highest percentage (27%) of plants were used as growth promoters and lowest percentage (6%) of plants were used to treat fungal disease (Fig. 1A). Among the plants the frequently used plant for different ailments is Ginger (*Zingiber officinale*) (Fig. 1B).

As a therapeutic agent, medicinal plants have been popularly used among human since ancient times in India. But not only in human, nowadays these are also being used in different bacterial, viral, fungal, parasitic disease in farm animals, especially fishes. Plants are also used as growth promoter, appetite stimulator and immuno-stimulator of fish by different fish farmers. The defence mechanism of plant extract is non-specific against pathogens and by that way they may create specific immune response in fish body (Pandey *et al.*, 2012). Many secondary metabolites like alkaloid, flavonoid, saponin etc. and different micronutrient like calcium, magnesium, zinc etc. are generally found in plants which may be responsible for their effect on building immunity on fishes. But scientific research to investigate the exact mechanism of action of plant extract against different fish disease is not as abundant as in case of human. Therefore, in present time the research on plant metabolites and micronutrient and their effect on fish health and fish productivity is highly in demand. In many recent works it has been found that the efficacy of medicinal plants against different fish disease is due to the presence of metabolites likely alkaloids, terpenoids, tannins, saponins, glycosides, flavonoids, phenolics, steroids, and essential oils (Reverter *et al.*, 2017). Harikrishnan *et al.* (2011), have found that the metabolites like alkaloid, tannins, terpenoid, flavonoid etc. can enhance fish immune response by both specific and non-specific way. Many investigations have been carried out to establish the antimicrobial potential of medicinal plants and

Table 1: Medicinal plants used in different ailments and as growth promoters in fish

S. No.	Plants local name	Plants scientific name	Plant parts used	Mode of application
Medicinal plants with antiviral effects				
1	Dalim	<i>Punica granatum</i>	Leaves	Bath
2	Kola Tulsi	<i>Ocimum sanctum</i> (red)	Leaves	Feed additive
3	BogaTulsi	<i>Ocimum sanctum</i> (white)	Leaves	Feed additive
4	Modhuriaam	<i>Psidium guajava</i>	Leaves, Bark	Feed additive
5	Dubori bon	<i>Cynodon dactylon</i>	Whole plant	Feed additive
6	Ashwagandha	<i>Withania somnifera</i>	Leaves, Bark, Flower	Feed additive
7	Ada	<i>Zingiber officinale</i>	Rhizome, Leaves	Feed additive
8	Tej paat	<i>Laurus nobilis</i>	Leaves	Feed additive
9	Nahoru	<i>Allium sativum</i>	Cloves	Feed additive, Bath
10	Neem	<i>Azadirachta indica</i>	Leaves, Bark	Feed additive
11	Halodhi	<i>Curcuma longa</i>	Rhizome, Leaves	Feed additive
Medicinal plants having anti-bacterial effect				
1	Halodhi	<i>Curcuma longa</i>	Rhizome	Feed additive
2	Aam	<i>Mangifera indica</i>	Leaves	Feed additive
3	Teteli	<i>Tamarindus indica</i>	Leaves	Feed additive
4	Dubori bon	<i>Cynodon dactylon</i>	Whole plant	Feed additive
5	Tulsi (Kola/Boga)	<i>Ocimum sanctum/Ocimum tenuiflorum</i>	Leaves	Feed additive
6	Kola soriyoh	<i>Brassica nigra</i>	Seed, Kholihoi	Feed additive
7	Ada	<i>Zingiber officinale</i>	Rhizome	Feed additive
8	Ashwagandha	<i>Withania somnifera</i>	Leaves	Feed additive
9	Neem	<i>Azadirachta indica</i>	Leaves	Feed additive
10	Saalkuwori	<i>Aloe vera</i>	Whole plant	Feed additive
11	Tej paat	<i>Laurus nobilis</i>	Leaves	Feed additive
12	Pan	<i>Piper betle</i>	Leaves, Flower(pipli)	Feed additive
Medicinal plants having anti-fungal effect				
1	Piyaj	<i>Allium cepa</i>	Bulb	Feed additive
2	Daalseni	<i>Cinnamomum cassia</i>	Bark	Feed additive
3	Long	<i>Syzygium aromaticum</i>	Seed	Feed additive
4	Soriyoh	<i>Brassica nigra</i>	Seed paste	Feed additive
Medicinal plants as an antioxidant agent				
	Nohoru	<i>Allium sativum</i>	Clove	Feed additive
2	Ada	<i>Zingiber officinale</i>	Leaves	Feed additive
3	Dubori bon	<i>Cynodon dactylon</i>	Whole plant	Feed additive
4	Ashwagandha	<i>Withania somnifera</i>	Flower	Feed additive
5	Aaam	<i>Mangifera indica</i>	Bark	Feed additive
6	Sah paat	<i>Camellia sinensis</i>	Leaves	Feed additive
Medicinal plants with immuno-stimulatory effects				
1	Tulsi	<i>Ocimum santum</i>	Whole plant	Feed additive
2	Ashwagandha	<i>Withania somnifera</i>	Leaves	Feed additive
3	Ada	<i>Zingiber officinale</i>	Leaves	Feed additive

4	Halodhi	<i>Curcuma longa</i>	Leaves	Feed additive
5	Dubori bon	<i>Cynodon dactylon</i>	Whole plant	Feed additive
6	Dalim	<i>Punica granatum</i>	Leaves, outer covering of fruit	Bath

Medicinal plants with growth promoting effects

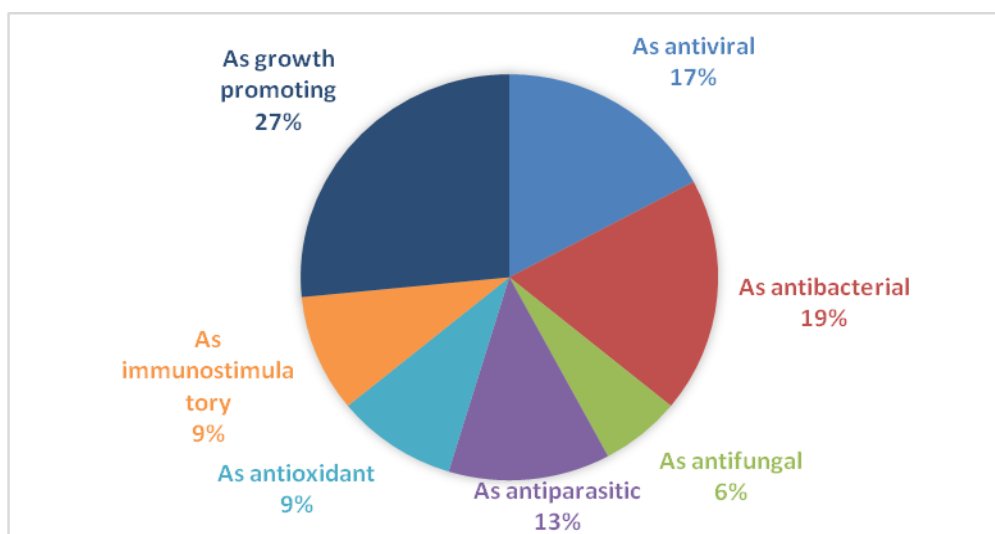
1	Halodhi	<i>Curcuma longa</i>	Rhizome	Feed additive
2	Aam	<i>Mangifera indica</i>	Leaves, power of dried seed.	Feed additive
3	Teteli	<i>Tamarindus indica</i>	Leaves	Feed additive
4	Nohoru	<i>Allium sativum</i>	Cloves	Feed additive, bath
5	Ada	<i>Zingiber officinale</i>	Rhizome	Feed additive
6	Kal jeera	<i>Nigella sativa</i>	Seed	Feed additive
7	Saal kuwori	<i>Aloe vera</i>	Whole plant	Feed additive
8	Sah paat	<i>Camellia sinensis</i>	Leaves	Feed additive, bath
9	Modhuriaam	<i>Psidium guajava</i>	Leaves	Feed additive
10	Ashwagandha	<i>Withania somnifera</i>	Leaves	Feed additive
11	Neem	<i>Azadirachta indica</i>		Feed additive
12	Pipoli	<i>Mentha piperita</i>	Flower	Feed additive
13	Nemu	<i>Citrus lemon</i>	Dried peel, leaves	Feed additive
14	Piyaj	<i>Allium cepa</i>	Bulb	Feed additive
15	Dubori bon	<i>Cynodon dactylon</i>	Leaves	Feed additive
16	Dalseni	<i>Cinnamomum cassia</i>	Bark	Bath
17	Sauf	<i>Trigonella foenumgraecum</i>	Seed	Feed additive

Medicinal plants with antiparasitic effect

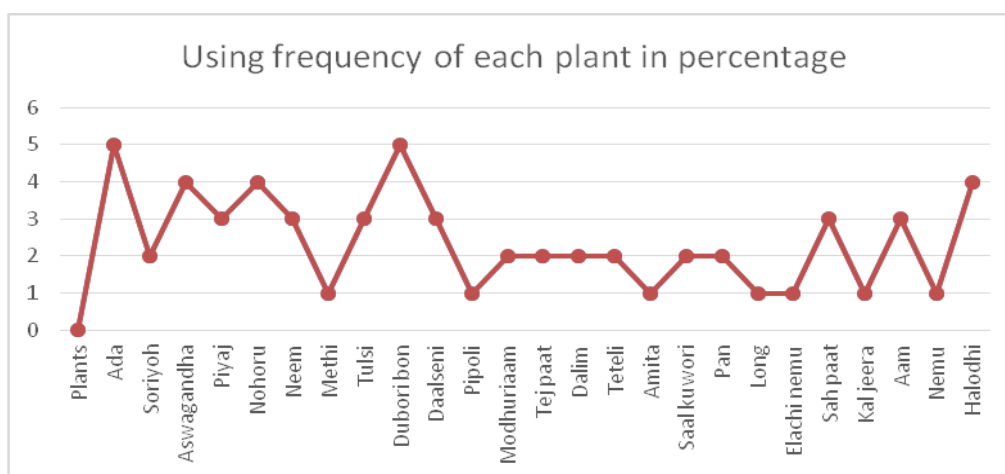
1	Pan	<i>Piper betle</i>	Leaves	Feed additive
2	Nohoru	<i>Allium sativum</i>	Clove	Feed additive, bath
3	Piyaj	<i>Allium cepa</i>	Bulb	Feed additive
4	Daalseni	<i>Cinnamomum cassia</i>	Bark, leaves	Bath
5	Sah paat	<i>Camellia sinensis</i>	Green leaves	Bath
6	Elachi nemu	<i>Citrus medica</i>	Leaves	Bath
7	Kath badam	<i>Terminalia catappa</i>	Leaves	Bath
8	Amita	<i>Carica papaya</i>	Leaves	Bath

must be used as alternative biomedicine for pisciculture (Zheng *et al.*, 2009). The plant biocomponents may either extracted to essential oil or crude extract using many processes like hot or cold water or any solvents extraction method. Whatever the extraction process carried out, the antimicrobial properties remain intact and can inhibit various tested microorganisms. In an *in vitro* study, Direkbusarakom *et al.* (2004) has investigated antiviral activity of *Ocimum sanctum* (red) and *Ocimum sanctum* (white), against different viruses having hematopoietic necrosis and pancreatic necrosis effect and established the inhibitory effect of these plants. Syahidah *et al.* (2014), have reported that plant's antiviral effect

is due to the inhibitory property of plant extracts on viral transcription and replication in the host cells. Harikrishnan *et al.* (2010) have investigated antiviral activity of *Punica granatum* against Lymphocystis Disease virus (LDV) in *Paralichthys olivaceus*. Balasubramanian *et al.* (2007) have conducted experiments using petroleum ether, benzene, diethyl ether, chloroform, ethyl acetate, methanol and ethanol extract of different Indian traditional medicinal plants like *C. dactylon*, which showed antiviral activity against White Spot Syndrome virus. There are many studies which documented about the use of plant extracts against different bacterial and other microbial disease. Bulfon *et al.* (2014) and Duyen *et al.*



(A)



(B)

Fig. 1: (A) Percentage of plants used in different health benefits; (B) Using frequency of different plants in different health benefits of fishes.

(2022) have documented research on antibacterial activity of different plants extracts against fish bacterial pathogens. Antimicrobial activity of different plant extracts and essential oils against many pathogenic fish microorganisms was conducted and gave useful result. It was found that plants may act as a cheaper source of medication to treat fish disease by fish farmers (Sharma *et al.*, 2012; Kluga *et al.*, 2021).

Conclusion

Due to intensive aquaculture practice, stress factors are produced which may create different

infectious disease and that restricts the aquaculture industry. To overcome this constrains, chemo-therapeutants and antibiotics are used to control fish diseases. But it leads to create adverse effect like development of antibiotic resistant strains and bioaccumulation of those compounds in environment as well as fish tissue which ultimately imitate on human health. Therefore, medicinal plants mainly come as a promising and alternative safer and cheap method for prevention and/or control of fish diseases in aquaculture. Normally natural products are considered as safer or sometimes found as less

toxic than chemical agents. Therefore, in this current time, using of natural products such as plant extracts as an alternative for disease control and growth promotion in aquatic industries are highly considered. Plants and their derivatives like plant extract or their active compounds are rich with many components such as alkaloids, steroids, phenolics, tannins, terpenoids, saponins and flavonoids which possess various beneficial biological activities.

Acknowledgements

The authors are highly grateful of those fish farmers of Nagaon district who actively participated in the survey process as informants. Special thanks to the faculty members of Deptment of Botany, Morigaon College for proper identification of plants.

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