



Medical herbs – a safe alternative to antibiotics in aquaculture



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Aquaculture growth and diseases

Aquaculture is one of the fastest-growing food production sectors in the world with an annual growth rate of 7.5%. In 2020, the world fisheries and aquaculture production has attained 177.8 million tonnes, with a contribution of 90.3 million tonnes from inland and marine capture fisheries and 87.5 million tonnes from the inland and marine aquaculture (FAO, 2022). The development and expansion of aquaculture is negatively affected due to the outbreak of several diseases which not only affect the production but also serious economic losses in aquaculture operations. Increasing disease incidence in aquaculture has resulted in the adoption of chemotherapy for the control and prevention of diseases (Murray and Peeler, 2005). The use of antibiotics and chemicals in aquaculture is widely criticized because it is often very expensive and leads to the selection of antibiotic-resistant bacterial strains, immunosuppression, environmental pollution and the accumulation of residues in edible fish which can be potentially harmful to the health of consumers. On the other hand, though vaccination is the most effective and safe method of protection against diseases, the production of effective formulations for a number of pathogens is often hindered by high production costs and the antigenic heterogeneity of the microbial strains (Toranzo et al., 2009). In recent days, herbal medicines have attracted much attention as a promising alternative to chemical drugs for aquaculture disease management as they are considered safe, easily available and cost-effective.

Herbal plants for fish diseases

According to the World Health Organization (WHO, 2005), about 80% of the people in the world rely on traditional medicine for their primary health care in developing countries. About 85% of such medicines involve the use of phytochemical extracts from medicinal plants which are a cheap source of antimicrobial agents without any side effects. Phytochemicals are bioactive molecules regarded as secondary metabolites like tannins, alkaloids, carbohydrates, terpenoids, steroids and flavonoids with numerous pharmacological benefits (Wang et al., 2018). Any part of the plant body like stem, root etc. may contain active components which make them rich sources of different types of phytochemicals.

These bioactive compounds play an important role in disease control because they exhibit antioxidant, antimicrobial, antistress, growth promotion, appetite stimulation, immunostimulation and aphrodisiac properties. The various identified advantages of these phytochemicals are they are available in plenty, cheap with no adverse effects on the natural ecosystem. They could be used for the control of fish diseases by administering through feed or the rearing medium. A large number of phytochemicals belonging to several chemical classes have been shown to have inhibitory effects in vitro on all types of microorganisms like bacteria, viruses, fungi and parasites (Cowan, 1999).

Some of the traditional herbal plants that could be used for the control and treatment of various fish disease are listed below.

Scientific Name	Common Name	Identified activity
<i>Acalypha indica</i>	Indian copperleaf	Anthelmintic, anti-inflammatory, anti-bacterial, anti-cancer, anti-diabetes, anti-hyperlipidemic, anti-obesity, anti-venom, hepatoprotective, hypoxia and wound healing properties
<i>Azadirachta indica</i>	Neem	Immunomodulatory, antiulcer, anti-inflammatory, antihyperglycaemic, antimalarial, antimicrobial, antioxidant, antimutagenic and anticarcinogenic properties.
<i>Cantheranthus roseus</i>	Periwinkle	Antioxidant, antimicrobial, antidiabetic and anticancer properties.
<i>Clitoria ternatea</i>	Butterfly pea	Memory enhancer, antistress, anxiolytic, antidepressant, anticonvulsant, tranquilizing and sedative properties
<i>Curculigo orchiodes</i>	Golden eye-grass	Adaptive, immunostimulatory, antioxidant, antihistaminic, antiasthmatic, hepatoprotective and neuroprotective activity.
<i>Curcuma longa</i>	Turmeric	Anti-inflammatory, antioxidant, anticarcinogenic, antimutagenic, anticoagulant, antidiabetic, antimicrobial, antifibrotic, antivenom, antiulcer, hypotensive and hypocholesteremic activities
<i>Cynodon dactylon sp</i>	Bermuda grass	Anti-inflammatory, antidiabetic, anticonvulsive, anticancer, diuretic, immunomodulatory, antiviral and antimicrobial activity
<i>Enicoste maaxillare</i>	Indian whitehead	Hypolipidemic, antioxidant, hepato-protective, anti-nociceptive and antimicrobial properties
<i>Euphorbia hirta</i>	Asthma plant	Antimalarial, antifertility, antispasmodic, sedative, antiasthmatic, anthelmintic, anticancer and antimicrobial properties
<i>Gloriosa superba</i>	Glory lily	Antioxidant, antitumor, anti-inflammatory, antiviral, antiallergic, anticancer activities
<i>Justicia adhathoda</i>	Malabar nut	Antibacterial, antifungal, anti-asthmatic, antihistaminic, anti-inflammatory, anti-ulcer, antioxidative, antitubercular, antitussive, larvicidal, anti-Alzheimer, and hepatoprotective effects.
<i>Mimosa pudica</i>	Touch me not	Antibacterial, antivenom, antifertility, anticonvulsant, antidepressant, aphrodisiac activities.
<i>Oxalis corniculata</i>	Creeping woodsorrel	Anti-inflammatory, anxiolytic, anticonvulsant, antifungal, antiulcer, antinociceptive, anticancer, antidiabetic, hepatoprotective, hypolipidemic, abortifacient, antimicrobial and wound healing properties.
<i>Pyllanthus niruri</i>	Gale of the wind	Hepatoprotective, antimicrobial, analgesic, hypolipidaemic, hypoglycaemic, anti-inflammatory, cardioprotective, anti-urolithiatic and antihyperuricaemic properties
<i>Senna auriculata</i>	Tanner's Cassia	Antibacterial, antioxidant, anti-inflammatory, anti-diabetic, and wound healing activity
<i>Tridax procumbens</i>	Coat buttons	Anti-hyperglycemic, hepatoprotective activities, anti-inflammatory, antioxidant, anticoagulant, anti-hepetic, antibacterial activities



The various parts of the herbs, methods followed for the extraction of phytochemicals and their concentrations contribute to the varied and significant effects on the health, growth and reproductive performance of fishes.

Several studies have reported the versatile functions of phytochemical extracts from medicinal herbs such as improved fish immunity, antimicrobial activity against the pathogens, growth stimulation and increased feed conversion in fish, which therefore makes it a promising potential alternative to replace the antibiotics used in fish health management. phytochemicals belonging to several chemical classes have been shown to have inhibitory effects in vitro on all types of microorganisms like bacteria, viruses, fungi and parasites (Cowan, 1999).