ROLE OF BAY LAUREL (*LAURUS NOBILIS*) AS FEED ADDITIVES IN FISH CULTURE.

Comment [CV1]: The subject of the manuscript is important to aquaculture development. Despite of this, there aren't clear the objectives of the study, there isn't a methodology for the review and is not clear that is a review article, besides of have many things about another groups of animals (like humans and chicken).

I suggest a deep review, including as main points:
- Objectives of the study: why is it important? Why did this review do?
- Methodology: what kind of studies were used? How many manuscripts about this topic were found?
- Results and discussion: get more information about the results and only using fish information;
- Conclusion: after all the information, what is possible to conclude (the bay laurel is good or not good for this and this)?
- Only after that, rewrite the abstract

Abstract

Herbs and herbal products are added in animal feeds instead of chemical products in order to stimulate or promote the effective use of feed nutrients which result in more rapid gain, higher production and better feed efficiency. Moreover, herbs contain active substances that can improve digestion and metabolism and possess bacterial and immunostimulant action of animals. Bay laurel (*Laurus nobilis*) is a plant of industrial importance, used in foods, drugs and cosmetics. The dried leaves and essential oils are used extensively in the food industry for seasoning of meat products, soups and fishes.Bay leaves having antidiarrheal, antiinflammatory, and antidiabetic activity are used for the improvement of the immune system. The present review paper indicated that the role of bay laurel as a feed additive in fish culture.

Keypoints: Bay laurel, Growth promoter, Immunostimulant, Antioxidant

Introduction

Many studies show that inclusion of herbs in fish diet has a positive effect on growth and disease free fishes. Excess use of various antibiotics, hormones and other synthetic drugs to control diseases and improve fish growth in aquaculture is the reason behind the emergence of drug resistant bacteria and production of toxic substances harmful to the

environment and human health (Esiobu *et al*., 2002). Nowadays, huge attention is focused on herbal therapy scenarios by applying photochemicals and herbal extracts as a promising, environmentally friendly and sustainable alternative to chemotherapeutic drugs to achieve "green aquaculture" goal through strengthening fish immune system (Wang *et al*., 2017;Chakraborty *et al*., 2014). In addition, herbal extracts are more accessible, cost-effective, and environmentally safe compared to chemotherapeutic agents (Reverter *et al*., 2017).

During past decade a plethora of studies have been evaluated a great range of herbal extracts on farmed fish species with promising beneficial effects that mainly attributed to their bioactive constituents including essential oils, phytoandrogens, triterpenoids, alkaloids, saponins, phenols, flavonoids and polysaccharides among the others (Chakraborty *et al*., 2014). In this sense, herbal extracts have been highly recommended as an additive in aquaculture due to the bioactive components and secondary metabolites that have broad-spectrum medicinal properties such as immunostimulation (Zanuzzo *et al.*, 2015;Yilmaz *et al*., 2019), growth promoter and antioxidant effects (Zhang *et al*., 2011; Hoseinifar *et al*., 2020).

The bay laurel, *L. nobilis(Linnaeus),* is a plant belonging to the *Lauraceae* family, also known as laurel, sweet bay, true laurel, Grecian laurel, Roman laurel, noble laurel, daphne, bay tree, or laurel tree. *Laurus nobilis* is a multibranched shrub or tree with up to 10m high (Ross, 2001). The bark is smooth with an olive green to black color. This species is an evergreen plant with leaves that are dark green, lanceolate, acuminate at both ends, about 10cm long, and alternated in the branch (Ross, 2001). The genus *Laurus* has a range of 24,00 to 25,00 species, and their varieties are native to the Southern Mediterranean region, the subtropics and tropics of Eastern Asia, South and North America, the Balkans, and Asia Minor. Two laurel species are traditionally found: *Laurus azorica* and *L. nobilis.*There are

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number of plants outside the genus *Laurus* with the common name bay laurel, including bay rum tree, or simply bay (*Pimentaracemosa*). *L. nobilis* is known by different names. In English, it is typically called bay leaf or sweet bay. In Arabic, it is known as waraq ghaar. In India, specifically in Hindi, it is called teejpatta.

Uses

The leaves of *L. nobilis* L. (*Lauraceae*) are usually used to treat gastrointestinal disorders, an in the cosmetics and food industry as a fragrance component. Laurel essential oil is generally dominated by the monoterpene compound 1,8-cineole. This species is used as a food flavouring agent, and in the pharmaceutical industry for drug formulations. Laurel essential oils are recognized for their antimicrobial activity against a wide panel of tested foodborne spoilage and pathogenic bacteria and fungi, antiviral and antibiofilm activities (Merghni *et al*., 2016 & Chmit *et al*., 2014).

Bay leaves having antidiarrheal, antiinflammatory, and antidiabetic activity are used for the improvement of the immune system. Antioxidants such as vitamin C, vitamin E and carotenoids are used in many dietary sources and are used to lower blood cholesterol and uric acid level. Bay leaves have many sesquiterpene lactones that are responsible for inhibition of NO production, i.e., antiinflammatory, inhibition of alcohol absorption, and may improve liver glutathione S-transferase activity (Fang *et al.*, 2005). Essential oil of this leaf also has analgesic and many antiinflammatory activities (Barla *et al*., 2007).Many polar compounds such as flavones, flavonol and phenols are present in the methanolic extract of bay leaf and show antioxidative activity.It is used with warm water for drinking to treat internal ailments; as a result, excess water is removed by body by urination and acts as an emetic to induce vomiting. Fresh, mature leaves are used to treat blood dysentery, inflammation and congestion of kidney. Bay leaf is also used to treat arthritis, headache, fungal diseases,

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I suggest reviewing and to including comments about what kind of compounds have a good effect for fish, which species of fish we have studies for, or something like this.

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anorexia, colds, cataracts, diarrhea, colic ulcer, appetizer, neuralgia and digestive stimulant traditionally (Parthasarathy *et al.*, 2008). Bay is found effective against many infections from fungi, viruses, bacteria, and protozoa. Bay is also helpful in inhibiting growth of carcinogenic cells. The leaves of bay are specific for many fevers, cough, flu, bronchitis, asthma, influenza, cough, cold, lowering blood cholesterol level, chicken pox, diarrhea and antistress agents. Bay juice is an effective medication for sore eyes and night blindness, which is generally caused by deficit of vitamin A. Bay seeds are mucilaginous and relieve indigestion, sore throat, constipation, and diarrhea.

Act as growth promoter

Funda Turan *et al.* (2016) evaluated ~~that~~ the effect of bay l~~L~~aurel (*Laurus nobilis)* extract on growth of the African Catfish, *Clarias gariepınus.* Results revealed that the efficacy of bay laurel extract feed additives as a growth promoter in *C. gariepinus.* Weight gain significantly increased in catfish fed with bay laurel extract-supplemented diets in comparison with the control groups (Funda Turan *et al*., 2016). Among the bay laurel extract-supplemented groups, the fish fed diet with 1.5% bay laurel extract exhibited significantly higher growth than fish fed diets with 0.5, 1% and control groups (Funda Turan *et al*., 2016). Majid *et al*. (2018) reported that the effect of bay laurel (*Laurus nobilis*) extract as prebiotic on growth and food conversion of common carp (*Cyprinus carpio*). Results revealed that the highest daily growth rate (0.099 g/day) and highest specific growth rate (0.975 %/day) was achieved fish fed diet 2% bay laurel extract than fish fed with 1%, 3% and control groups.

Bozkurt *et al*. (2012) reported that the dietary addition of herbal EOM contained laurel leaf oil was a viable alternative to AGP in layer hen nutrition. Alcicek *et al*. (2003) reported that the EOC mix contained laurel leaf oil (*Laurus nobilis* L.) may be used as a potential growth promoter in broiler production. Cristea *et al*. (2012) suggested that various

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Comment [CV9]: This result is very important. The authors revealed the ideal rate, because when was used 3% of extract we didn't have higher rates than when only 2% was used. I suggest discuss more about this and it use additional references about the theme.

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The title of this manuscript say: "fish culture", and then we need to put information about fish. Animals can have different results for the use of a unique nutrient.

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types of feed additives enhance the digestibility and utilization efficiency of nutrients in aquaculture. Protein contents of the all bay laurel extract supplemented groups were significantly higher than protein content of the control (Funda Turan *et al*., 2016). Similarly, Cagıltay *et al*. (2011) reported that parallel to the concentration of bay leaf (*Laurus nobilis L.)* in fed has increased amount of crude protein and crude lipid in rainbow trout. The dietary supplementation of 5g/kg *Elephantopus scaber* significantly improved the weight gain, survivility and SGR in Nile tilapia, while concurrently decreasing FCR(Hien *et al*., 2019). The Chinese herbal medicine mixture (CHMM) could significantly improve Japanese sea bassgrowth performance increase at 20g/kg CHMM group (Anle Xu *et al*., 2020).

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Act as immunostimulant activity

Immunostimulant effects of laurel powder were investigated by dietary intake on rainbow trout. After 14 days of adaptation on a control diet 3 groups of rainbow trout were fed the experimental diets containing 0.5 and 1% laurel leaf powder for 21 days. The fish were then switched back to the control diet. Non-specific immunity was investigated at the end of the 21 day experimental feeding period and then again 42nd, 63rd days later. The nonspecific immune parameters, extracellular and intracellular respiratory burst activities, phagocytosis in blood leukocytes, lysozyme and total plasma protein level were evaluated. *Laurus nobilis*~~is not having~~did not actas an immunostimulant.

Phagocytic activity was higher in *Oncorhynchus mykiss* fed with b~~B~~ay laurel powder incorporated diets at the rate of 0.5 and 1% (Soner bilen *et al.,* 2010). Changes in serum lysozyme activity after fed the fish laurel leaf powder supplemented diet were not shown any significant differences groups any time of the research. Total serum protein levels in all plasma was not shown significant differences in all groups Extracellular oxidative radical production was not shown any effects on day 21st compared to the control group. But on day 42nd extracellular activity of laurel 0.5% group was significantly higher than laurel 1% and

control group. Phagocytosis of blood leukocytes increased in all groups and this increase respectively was fed with 0.5 and 1% laurel group on 21st day. (Soner *et al.*, 2010). Phagocytic ability was considerably enhanced by the dietary administration of 5 and 10 g/kg gotu kola powder in contrast to the control treatment (Naphakorn *et. al.*, 2020).

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Act as antioxidant Activity

The antioxidant activity, reducing power, free radical scavenging, superoxide anion radical scavenging, hydrogen peroxide scavenging and metal chelating activities were evaluated to determine the total antioxidant capacity of both extracts.Both extracts shown strong total antioxidant activity in linoleic acid emulsion. The hydrophilic extracts of turmeric and bay laurel potently suppressed the incidence of atherosclerosis via a strong antioxidant potential, prevention of apolipoprotein A-I glycation and LDL phagocytosis and inhibition of CETP zebra fish model (Seori Jin *et al.*, 2011). Consumption of turmeric and laurel extracts exhibited hypolipidemic and antioxidant activities in a hypercholesterolemia in zebra fish model (Seori Jin *et al.*, 2011). *Laurus nobilis, Zingiber officinale and Anethum graveolens* essential oils can be used as a good natural preservative in fish food due to their antioxidant and antibacterial activities (Mejdi Snuossi *et al.*,2016). The combination of vacuum packing and 2% laurel EO delays microbial spoilage in rainbow trout fillets and extends shelf-life for approximately 4 days (Aksem Aksoy *et al*., 2019).

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