



**Review Article : Potential of Plants for Fish Disease Prevention**

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**ABSTRACT**

Disease attack is the biggest obstacle in fish farming activities and is very detrimental to cultivators. Disease control is an important factor to be recognized. Various types of antibiotics and chemicals have been used for the treatment and prevention of disease. The use of antibiotics and chemicals in cultivation can cause resistance to pathogenic microorganisms and pollute the environment. The use of herbal ingredients as an alternative to antibiotics and chemical drugs needs to be done. Plants are rich in secondary metabolites and phytochemical compounds that have effects against viruses, bacteria and parasitic diseases in fish. The main advantage of herbal ingredients does not threaten human health, fish and the environment. The purpose of this article is to present information on the treatment and prevention of viral, bacterial and parasitic diseases in fish using medicinal plants. Several studies have shown that medicinal plants can have the potential to treat and prevent fish infected by pathogenic microorganisms.

Keywords: medicinal plants, disease, treatment, prevention.

**1. INTRODUCTION**

The use of medicinal plants as natural ingredients for disease management is increasingly in demand by the community because it is cost effective, environmentally friendly and has relatively small side effects compared to synthetic chemicals (Shrestha PM, Dhillion 2013). So far, herbal medicine has been used for thousands of years to treat several types of diseases in humans, including medicine for wounds, coughs, itching, stomach aches and other digestive problems, rheumatism, fever, vaginal discharge, and even cancer and several other diseases. (Mydeen AK and Haniffa 2011; Turker et al. 2009). However, many studies have succeeded in using plants as medicinal ingredients to overcome several types of diseases that attack fish (Pandey & Madhuri 2010, Ravikumar et al. 2010). As according to (Yin et al. 2008) medicinal plants have been used in Mexico, India, Thailand and Japan to control shrimp and fish diseases with good results. The parts of the plants used are quite varied, from the leaves, flowers, fruit, bark to the roots in extract or fresh form. The ability of medicinal plants in overcoming fish diseases is based on the content of metabo compounds; the secondary ite possesses. Based on the results of phytochemical tests, the content of secondary metabolites consists of several compounds, namely flavonoids, saponins, tannins, terpenoids, phenols and steroids, which can function to replace antibiotics, because The invitro test of

these compounds has an antimicrobial effect, namely antibacterial, antiviral (Kolkovski and Kolkovski, 2011), antifungal, antiparasitic, antioxidant. In addition, secondary metabolite compounds can also be used as immunostimulants that can trigger non-specific body resistance in fish, so that fish can be resistant to disease (Pandey and Madhuri, 2010; Kolkovski and Kolkovski, 2011). Herbal medicine can not only be used to cure disease, it can also be used as an anti-stressor, to stimulate growth and increase fish resistance to disease (Stratev et al. 2018)

Disease is one of the obstacles in fish farming (Luis 2017). Disease attack not only causes slow fish growth, it even impacts mass fish mortality (80 -100%) (Austin 2016) and is economically very detrimental to farmers, because bacterial infection is considered the main cause of fish mortality in aquaculture (Ravikumar et al. . 2010). Diseases in fish can be caused by bacteria, viruses, fungi and parasites. Bacteria that often infect cultured fish are *Aeromonas hydrophila* (Jun et al. 2013), *Sreptococcus innae* (Berridge et al 2009), *Sreptococcus agalactiae* (Taukhid and purwaningsih 2011), *Pseudomonas anguilliseptica*, *Plesiomonas shigelloides*, *Micrococcus* sp. (Rahayu et al. 2019), *vibrio* sp., *Flavobacterium columnare* (Dong et al. 2017), *Mycobacterium fortuitum*, *Mycobacterium marinum*, *Edwardsiella tarda* (Kusuda and Salati 1999). Some viruses that can attack freshwater fish are koi herpesvirus, haematopoietic virus necrosis, hemorrhagic septicemia virus and others (Walker and Winton 2010), while the fungus that often attacks freshwater fish is *Saprolegnia* sp. which can attack fish eggs and seeds, *Argulus* sp (Farika 2014), *Ichthyophthirius multiphilis* (Ikele 2018). Disease symptoms that are raised by each disease agent are quite varied, starting from the slow movement of fish. response to low feed even lost, excessive mucus secretion, bleeding in the skin and ultimately death.

Efforts to control various fish diseases by using antibiotics continuously in inappropriate doses have resulted in more resistant strains of bacteria and this is also a problem in aquaculture. Therefore, the use of antibiotics in cultivation activities must be reduced and replaced with alternative antibiotics from herbal ingredients to avoid bacterial resistance, as well as safer for the environment and consumers (Mydeen AK and Haniffa, 2011). This article aims to describe the potential of plants for disease prevention in fish.

## 2. EFFECTS OF MEDICINAL PLANTS TO TREAT DISEASE IN FISH

Dayak anions (*Eleutherine palmifolia*) and Turmeric (*Curcuma domestica*) Turmeric contains medicinal compounds, called curcuminoids consisting of curcumin, desmetoxicumin as much as 10% and bisdesmetoxicurcumin as much as 1-5% and other beneficial substances such as essential oils consisting of sesquiterpenes ketones , turmerons, 60% tumeon, 25% Zingiberen, felandren, sabinen, borneol and cineil. Turmeric also contains. Fat as much as 1-3%, Carbohydrate as much as 3%, Protein 30%, Starch 8%, Vitamin C 45-55%, and mineral salts, namely iron, phosphorus, and calcium (Sastrahidayat 2016). Previous studies of turmeric include Simatupang (2013) turmeric containing curkominoids which play an active role as antimicrobials. The results of previous studies conducted at the Bogor Institute of Agriculture showed that the bulbs of Dayak onion (*Eleutherine palmifolia*) contained Nophtoquinonens compounds and their derivatives such as elecanacine, eleutherine, eleutherol, eleuthernon. Nophtoquinonensare known as antimicrobial, antifungal, antivirial and antiparasitic. In addition, nophtoquinonenshas bioactivity as an anticancer and antioxidant that is usually present in vacuole cells in the form of glycosides (Utami and Puspaningtyas 2013). Ardiansyah (2016) in his research gave the result that in the rough extract of Dayak onions

there were flavonoid compounds, tannins and saponins. A concentration of 70 ppm Dayak onion gave the best results on the MIC *Aeromonas hydrophilla* test.

The results of research conducted by Nur et al (2020) show that various variations in the comparison between *Eleutherine palmifolia* and *Curcuma domestica* can be used to treat catfish infected with *A. hydrophilla* bacteria through immersion for 36 hours. Resulted in a higher survival range (76.67% - 86.67%) compared to negative controls (50%). Hematocrit value at the end of the observation 17.0 to 20.67, leukocrit value at the end of the observation 2.67 to 8.67, the value of blood plasma at the end of the observation was 72.33 to 78.33 and the hemoglobin value at the end of the observation was between 5.33 to 6.27. Treatment of catfish infected with *Aeromonas hydrophilla* bacteria using a variety of natural ingredients turmeric extract (*Curcuma domestica*) and dayak onion extract (*Eleutherine palmifolia*) with 25 ppm dayak onion extract and 75 ppm turmeric extract is the best treatment.

### *Piper betle* L

*Piper betle* L. is a piperaceae family that has long been known and used as a medicinal plant, because it contains essential oils consisting of phenol compounds, phenol propenyl derivatives (up to 60%). The main components are eugenol (up to 42.5%), carvacrol, chavicol, cavibetol, allylpirokatechol, cavibetol acetate, allylpyrochatechol acetate, synoel, estragol, eugenol, methyl ether, p-cime, karyophylene, cadinen, and sesquiterpen compounds (1991), these compounds are efficacious as antioxidants, antiseptics, fungicides and bactericides, especially in leaves (Widarto 1990). According to Ningrum (2009), betel extract has been identified to contain flavonoids, tannins, steroids and triterpenoids which are antibacterial. The results of research by Mulia and Maryanto (2012) show that betel leaf extract can inhibit the growth of *A. hydrophilla* bacteria in vitro, and function as an antimicrobial against *Rhizoctonia* sp. (Achmad and Suryana 2009). In the antibacterial test using the diffusion method, boiled betel leaf water can inhibit the growth of *Staphylococcus aureus* at a concentration of 60% (Irmasari, 2002).

### *Psidium guajava*

*Psidium guajava* belongs to the family Myrtaceae, which is considered to have originated in tropical South America (Mani et al. 2011). According to Hasuki (2008), *Psidium guajava* plants are shrubs, up to 10 meters high, can grow in all kinds of climates and land at an altitude between 5-1200 meters above sea level. *Psidium guajava* has green fruit with white or red flesh and sweet-sour taste, contains lots of vitamin C. This plant has been used for a long time for traditional treatment to manage conditions such as malaria, gastroenteritis, vomiting, diarrhea, dysentery, wounds, ulcers, toothache, coughs, sorethroat, inflamed gums, and a number of other conditions (Abdelrahim et al. 2002). The leaves of guava contain an essential oil rich in cineol, tannins, triterpenes, flavonoids, resin, eugenol, malic acid, fat, cellulose, chlorophyll, mineral salts, and a number of other fixed substances (Nadkarni and Nadkarni 1999, Burkill 1997). Several antibacterial active ingredients from guava leaf plants have been tested, which contain tannins, flavonoids, saponins and alkaloid compounds (Lozaya et al. 1994). According to Akiyama et al. (2001) tannins are antibacterial by precipitating proteins. Antimicrobial effects of tannins through reaction with cell membranes, enzyme inactivation, destruction or inactivation of genetic material. Tannin, alkaloids and flavonoids can inhibit the growth of *Staphylococcus aureus* bacteria (Othman et al. 2019). Saponins, including triterpenoid compounds, can be used as antimicrobials (Cowan 1999). According to several studies, guava leaves have been shown to have various pharmacological

effects of anti-diarrhea (Lutterodt 1992), anticough (Jalaraj et al. 1999), antibacterial (dental anti-plaque) (Razak et al. 2006), antidiabetic (Ojewale 2006, Karawya et al 1999), anti-inflammatory and anti-tumor generation (Qian and Nihorimbers 2004) and antioxidants (Chen et al 2007).

Application of guava leaf extract at a dose of 5250 ppm as feed additives reduce *Vibrio harveyi* in the intestines of vaname shrimp. Provision of guava leaf extract at a dose of 5250 ppm through feed can increase the immune response of vaname shrimp by observing total hemocytes, hyalin cells and granular cells. Administration of guava leaf extract at a dose of 5250 ppm through feed can increase the relative survival of vaname shrimp (Nur et al. 2019).

### *Zingiber officinale*

*Zingiber officinale* is one type of plant that belongs to the Zingiberaceae family. The name "Zingiber" comes from the Sanskrit "Singabera" and Greek "Zingiberi" which means horn, because the shape of the ginger rhizome is similar to deer horns. *Officinale* is the Latin word for "Officina" which means used in pharmacy or medicine (Darwis 1991).

The extract from the root of the rhizome of *Z. officinale* contains polyphenol compounds (6-gingerol and its derivatives), which have high antioxidant activity. Use of *Z. officinale* 0.5g / 110g feed reduced mortality by up to 0% compared with controls (64%). In addition, there was a significant increase in growth, feed conversion and protein efficiency. The compounds contained in ginger can also increase the body's resistance of fish, proven to have proliferation in the number of neutrophils, macrophages and lymphocytes and lysozymes and phagocytosis compared to controls (Hemapriya 1997).

### Kecombrang (*Etilingera elatior*)

*Etilingera elatior* is a perennial shrub with a height of 1-3 m. This plant has a pseudo-stem, upright and frond and green. Leaves about 20-30 cm long with a width of 5-15 cm. Kecombrang flower is a hump-shaped flower with a stalk length of 40-80 cm (Syamsul et al. 2015). The flowers have several groups of active compounds, namely tannins, flavonoids, alkaloids, phenols, saponins, (Lingga 2012). On the leaves, stems and flowers of *Etilingera elatior*, there are saponins, tannins and flavonoids, *Etilingera elatior* also contains essential oils (Naufalin et al. 2005). Based on test results, 25 grams of *Etilingera elatior* flowers contained a tannin content of 4.306%. Based on the results of research conducted by Naufalin (2005), *Etilingera elatior* flowers contain 17% essential oil compounds. The essential oil content in kecombrang flowers is very high when compared to other types that are still in the same family (Zingiberaceae), the essential oil content in ginger is 1.9-3.9% and temu putih rhizome has 1-2.5% essential oil content. Essential oils act as antibacterials by disrupting the process of forming membranes or cell walls so they don't form completely. Essential oils that are active as antibacterials generally contain hydroxyl functional groups (Parwata et al. 2008). Apart from being an antibacterial, *Etilingera elatior* also acts as an anti-fungal, to prevent eggs from being infected by fungi. As the results of research conducted by Rosidah et.al (2017), *Etilingera elatior* flower extract with a concentration of 60 ppm was able to prevent the attack of the fungus *Saprolegnia* sp. catfish eggs through immersion for 20 minutes.

## Efek Tanaman Obat untuk Mencegah Penyakit Pada Ikan

### *Andrographis paniculata*

The benefits of *A. paniculata* have been widely recognized since ancient times by almost all nations in the world (Prapanza and Marianto 2003). *A. paniculata* can grow in all types of soil so that the distribution of this plant is quite wide in the hemisphere. All parts of the sambiloto plant, such as leaves, stems, flowers, and roots, taste very bitter if eaten or boiled to drink. It is suspected that this comes from the andrographolide it contains. Actually, all parts of the sambiloto plant can be used as medicine, including the flowers and fruit. However, the parts most often used as ingredients in traditional medicinal herbs are the leaves and stems (Prapanza and Marianto 2003).

Chemically *A. paniculata* contains flavonoids and lactones. In lactone, the main component is andrographolide, which is also the main active substance of this plant. Lactones have anti-inflammatory (anti-inflammatory), antipireutic, antiparasitic, and antibacterial effects. Andrographolide can increase the flow of bile, bile salts, and bile acids. In addition, it also functions as an anti-poison (detoxification), hepatoprotector (Sugiyanti 2005; Maryani and Rosita 2006; Kadar 2009). These plants are also able to increase the production of antibodies (immunostimulant), and stimulate cellular resistance (phagocytosis). As according to Kumar et al. in Elfahmi (2006) the active components of *A. paniculata*, namely andrographolide, 14-deoxyandrographolide and 14-deoxy-11,12-didehydroandrographolide isolated from methanol extract have immunomodulatory effects. The function of flavonoid components that are immunomodulatory is the flavonoid group, the flavonoid group is able to increase the immune system so that it is able to ward off attacks by viruses, bacteria or other microbes. The results of in vitro tests showed that the flavonoids and flavonols of the flavonols showed an immune response (Hollman et al. 1996).

This plant has been tried to control Koi Herpes Virus (KHV) in goldfish (*Cyprinus carpio*) in vitro with unlimited immersion time, the best dose is 0.4 g / l with a survival rate of 42.22% (Tauhid et al. 2005).

The active substances contained in Sambiloto are beneficial for health, such as andrographolid, essential oils and flavonoids which function to prevent blood clots, inhibit and destroy cancer cells, are antibacterial, anti-toxic, and anti-infection. So *Andrographis paniculata* can be used as a substitute for antibiotics to fight bacterial and viral attacks (Sudewo 2004). *Andrographis paniculata* solution proved to be effective in inhibiting the growth of *E. tarda* at a concentration of 4 g-L with an average zone of inhibition of 4.6 mm. The LD50 test results of catfish immersed in *Andrographis paniculata* solution occurred at a concentration of 7.30 g-L. The results showed that the best concentration of *Andrographis paniculata* to increase the immunity of *Pangasius hypophthalmus* fish against *E. tarda* attacks was found at a dose of 4g-L with a hematocrit value of 22.67% and a total leucocyte of 31.70 thousand / mm<sup>3</sup> and phagocytosis activity of 55.50 % (Lukistyowati 2012).

### *Moringa oleifera* L

*M. oleifera* is a plant in the lowlands and highlands to an altitude of  $\pm$  1000 m. These plants are widely planted as a boundary or fence in the yard or field. The leaves of *M. oleifera* can be harvested after the plant has grown 1.5 - 2 m which usually takes three to six months. (Kurniasih 2013).

The results of the phytochemical screening of *M. oleifera* leaves contain secondary metabolite compounds of flavonoids, alkaloids, phenols which can inhibit bacterial activity

(Pandey et al. 2012), while the results of screening conducted by Ni Nyoman and Desmira (2015) *M. oleifera* leaves contain alkaloids, flavonoids and , tannins, saponins, and terpenoids. The composition and concentration of phytochemical compounds changes during plant growth. Younger leaves have the highest phytochemical content (Bergquist et al. 2005), this is related to the function of these secondary metabolites, namely for defense against pathogens, insects, bacteria, fungi and viruses (Saffan and ElMousallamy 2008).

According to Utami and Puspanigtyas (2013) the roots, stems and bark of *M. oleifera* contain saponins and polyphenols and contain alkaloids, tannins, steroids, flavonoids, reduced sugars and essential oils, while the seeds contain oils and fats.

In addition to containing secondary metabolite compounds, *M. oleifera* leaves contain several vitamins, namely vitamins A, C, E, K, B1, B2, B3, B6 (Kurniasih 2013). According to Sohne et al. (2000) and Galeotti (1998) vitamins A, B and vitamin C can be used as immunostimulants. Compounds that can increase the immune system are flavonoids, curcumin, limonoids, vitamin E (tocopherols), catechins (Suhirman 2007), as well as polisaccharida, terpenoids, alkaloids and poly-phenols (Wagner 1985).

The results showed that giving 150 ppm of *M. oleifera* leaf extract through feed was able to increase the resistance of the catfish (*Clarias gariepinus*) seed body to the attack of the bacterium *Aeromonas hydrophila*. Indications of an increase in endurance can be seen from an increase in the number of white blood cells by  $23.16 \pm 6.46\%$  (Rosidah et al. 2018).

### 3. Meniran (*Phyllanthus niruri* L)

*Phyllanthus niruri* is a wild plant originating from tropical Asia that is spread throughout mainland Asia, the continent of Africa, America and Australia (Kardinan and Kusuma 2004). Meniran is a non-woody plant, commonly found in damp and rocky places, up to 1000 m high. The plant reaches 50 cm in height, has scattered branches and a slightly woody base, and the stems are pale green. Leaves are compound, oval, even pinnate, flat edge, blunt tip and base, pinnate, smooth surface,  $\pm 1.5$  cm long,  $\pm 0.7$  cm wide, reddish green in color. The lower leaf surface is mottled. The flowers are alternating, in one plant there are male flowers under the axillary leaves and female flowers that come out above the axillary leaves. The fruit is round, 2 mm to 2.5 mm in diameter, three locus and purplish green. The seeds are kidney-shaped, hard and brown and the roots are taproots (Hutapea 1994; Wijayakusuma and Dalimartha 2001; Sastroamidjojo 2001)

*Phyllanthus niruri* is empirically used as a medicine for several types of diseases in humans, such as fever, stomachache, toothache, diabetes and dysentery and others. According to Bagalkotkar et al, (2006) the chemical content of meniran is lignans, terpenes, saponins, flavonoids, alkaloids, coumarin and tannins. Empirically and clinically, meniran herbs function as antibacterial, antihepatotoxic, antipyretic, anti-inflammatory, antiviral, diuretic, expectorant, hypoglycemic, as well as immunostimulant (Kardinan & Kusuma, 2004). Components that are immunomodulators are from the flavonoid group, the flavonoid group is able to increase the immune system so that it is able to ward off attacks by viruses, bacteria or other microbes. The results of the research by Tjandrawinata et al. (2005) proved that *P. niruri* secretion of several specific cytokines such as interferon-gamma, tumor necrosis factor-alpha and some interleukins, activation of the complement system, activation of phagocytic cells such as macrophages, and monocytes. In addition, *P. niruri* extract can increase the activity and function of immune system components, both humoral and cellular. So *P. niruri* extract works as an immunomodulator that can be used as adjuvant therapy (support) for several infectious diseases. Meniran with an amount of 10 grams / kg of feed

can be used to prevent bacterial disease in fish. The method is to mash or blend the branches and leaves of meniran, then dry it in the oven with a temperature of 50o C, when dry, mash it and mix it into the beaten chicken eggs first, then mix it into the feed or pellets.

#### 4. *Allium sativum*

*Allium sativum* is a plant that forms a layered tuber. This plant grows in clumps and stands upright to a height of 30-75 cm. The stem includes a green pseudo stem. The leaves are green ribbon-shaped elongated with pointed ends. The length of the leaves is approximately 60 cm, at the bottom there are white tubers in the shape of clustered cloves. The tuber is covered with a fairly thin skin. Tubers when cut give a distinctive smell. Garlic generally grows in the highlands with sufficient sunlight, certain varieties can grow in the lowlands. A good medium for garlic plants is clay, sandy or dusty loam with a neutral pH (Santoso 2000).

The chemical content of garlic which has biological activity and is useful as a medicinal ingredient is an organosulfur compound (Martinez, 2007). The content of these organosulfur compounds includes S-ak (en) -il-L-cysteine sulfoxide (ACSOs) compounds, for example alliin, this compound which is the most abundant in garlic. The distinctive smell of garlic is due to the compound alliin, a sulfur-containing amino acid used as a precursor to allicin. Alliin will immediately turn into allicin compounds, with the help of the alliinase enzyme when fresh garlic is chopped, chopped, or chewed directly (Amagase 2006). Alliin has the potential as a broad spectrum antimicrobial, besides that allin can also act as an immunostimulant which can increase the body's resistance to disease attacks. The results of research conducted by Nuryati et. al. (2008) garlic extract as much as 50 gr / 100 ml can increase the body's resistance of goldfish to KHV attacks.

#### 5. Daun beluntas (*Pluchea indica* Less)

*Pluchea indica* is an upright, woody, multi-branched shrub with a height of up to two meters. The leaves are single, ovate, pointed tip, downy, young leaves are yellowish green and dark green leaves are dark green. Beluntas is a wild plant, requiring high moisture soil (Utami 2012).

The compounds contained in *Pluchea indica* leaves include essential oils, quercetin, saponins, polyphenols, flavonoids, alkaloids and tannins (Utami 2012). The compounds suspected of being antimicrobials in beluntas leaf extract are phenols, tannins and alkaloids (Ardiansyah et al. 2003). According to Rahayu et al. (2009), apart from being antimicrobial, they also have the potential to be immunostimulants. The results of research conducted by Ayuningtyas (2016) extract of *Pluchea indica* leaves with a concentration of 125 ppm given through effective feed to prevent *Aeromonas hydrophila* bacteria attack on *Cyprinus carpio* fish seeds with a survival rate of 100%.

#### 6. *Aloe vera*

*Aloe vera* is a succulent plant in the form of a rosette with a height of 30-60 cm and a crown diameter of up to 60 cm. *Aloe vera* consists of stems, leaves, flowers and roots. The tongue grows with thick flesh, so it can grow in dry areas and in cold climates (Furmawathi 2002).

*Aloe vera* leaves and roots contain several kinds of vitamins and minerals, including vitamins A, B and C also contain iron and phosphorus. Besides containing saponin and flavonoid compounds, besides that the leaves also contain tannins and polyphenols. The other ingredients are barbaloin, iso barbaloin, aloe-emodin, alloenin, aloesin, aloin, aloe emodin, anthraquinone, resin, polysaccharides (Sudarsono et al. 1996), and chromium and inositol (Duke 2002). The content of vitamins and compounds possessed by *Aloe vera*, then this plant

has several benefits to improve human and animal health, including as an antimicrobial it also has the potential as an immunostimulant that can increase the body's resistance to disease attacks. In use, it can be externally, that is, by applying it or externally, that is, eaten or orally.

According to Alishahi et al. (2010) giving Aloe vera orally to *Cyprinus carpio* can increase some specific and non-specific immune responses, indicated by an increase in lysozyme activity, bactericidal serum power and total protein and IgM levels. Aloe vera supplementation of 0.5% of the total feed can increase resistance to *Aeromonas hydrophila*. In addition, the percentage of relatively living (RPS) has also increased. The results of research conducted by Faridah (2010) that Aloe vera extract can improve the immune system of African catfish (*Clarias sp.*) Infected with *A. hydrophila* bacteria. Aloe vera extract has a positive effect on reducing fish mortality. The dose of 5 ppt is an effective dose to prevent *A. hydrophila* infection in African catfish (*Clarias sp.*).

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