

Herbal Anti Virals In Aquaculture ; The Phytotherapy Way

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Aquaculture industry apart from many other problems faced is under a continuous threat due to viral infections, these have led to the collapse of this sector in many areas. Viral infections are complex and with no proper medication available, prevention and control are the only strategies that can restrict these.

Viral disease occurs when an organism is invaded by pathogenic viruses and infectious viral particles, the virions, attach, attack and enter the susceptible organs and cells of the body. Both DNA and RNA virus affect aquaculture, these again may be enveloped or non- enveloped causing commercially disastrous diseases in fish and shrimp.

Some important fish viral infections are Infectious hematopoietic necrosis, viral hemorrhagic septicemia,

Lymphocystis, Abdominal dropsy and the important viral outbreaks in shrimp are Infectious necrosis, Yellow head disease, White spot disease etc. These viruses continue to mutate and develop resistance, causing great losses both functionally and commercially, thus are the focus now.

Since there are no effective anti virals, use of our age old tradition and yester year's knowledge, the wealth of the herbs, their phyto chemicals are efficient agents in this viral combat.

Using this herbal treasure an efficient, multi-faceted formulation that works on the virus in many ways, right from its mode of attachment to its reproduction and virulence has emerged, a result of relentless work in this arena.



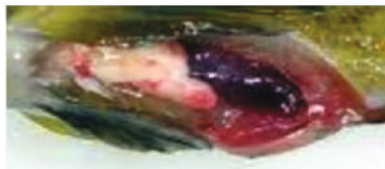
Herpes Viral Infection



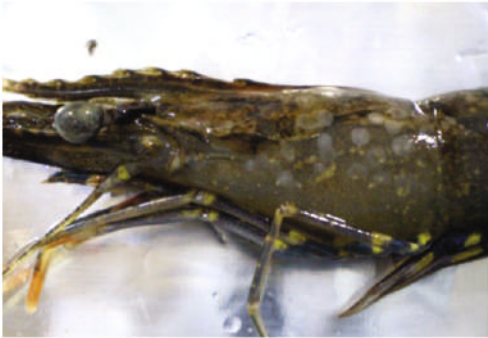
Lymphocystis



Infectious Haematopoietic Necrosis



VIRAL HAEMORRHAGIC SEPTICEMIA



White Spot Disease



Infectious Necrosis

Phytotherapy or herbalism, is defined as the usage of plants or herbs as medication to treat or prevent diseases and infections. This usage is gaining more attention, as antiviral agents apart from being a safer and cheaper alternative. These effectively reduce the incidence of drug resistance and may modulate the immune system in preventing viral incidences. Their antiviral effect and the mechanism of action is targeted to the viral replication and the effects on the host.

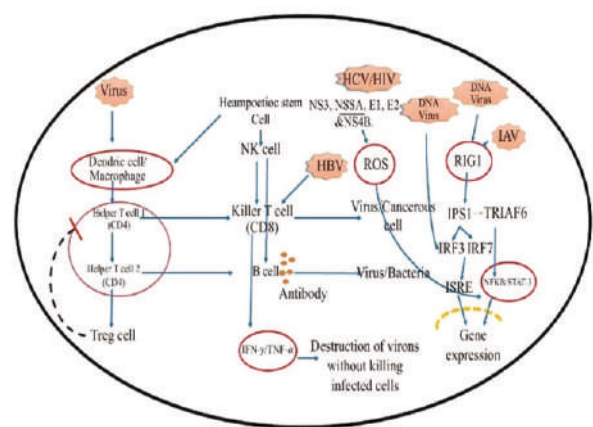
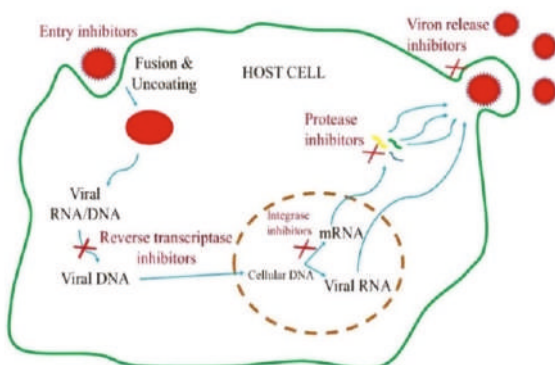
The formulation of this viral effective special is inclusive of *Andrographis paniculata*, *Allium sativum*, *Azadirachta indica*, *Curcuma longa* & Lauric acid as the active inclusions.

Andrographis paniculata

Andrographis paniculata used in traditional medicine since time immemorial due to its active phytochemical and andrographolide and its analogs, in this case much interest is assigned for its potential against several many viral infections. The mechanisms of action being regulating the viral entry, preventing its spread and transmission to neighboring cells by interfering with the different cell signaling pathways of the cell, the gene replication and in the formation of functional proteins.

It suppresses viral production by up regulating heme oxygenase, inhibit protein synthesis and RNA replication and protection from oxidative stress. As Cytoprotective agent inhibits protease activity, thus preventing from viral replicating.

Virulence and antiviral activity



Inhibitory effect of Andrographolide on inflammation involving multiple pathway

Allium sativum

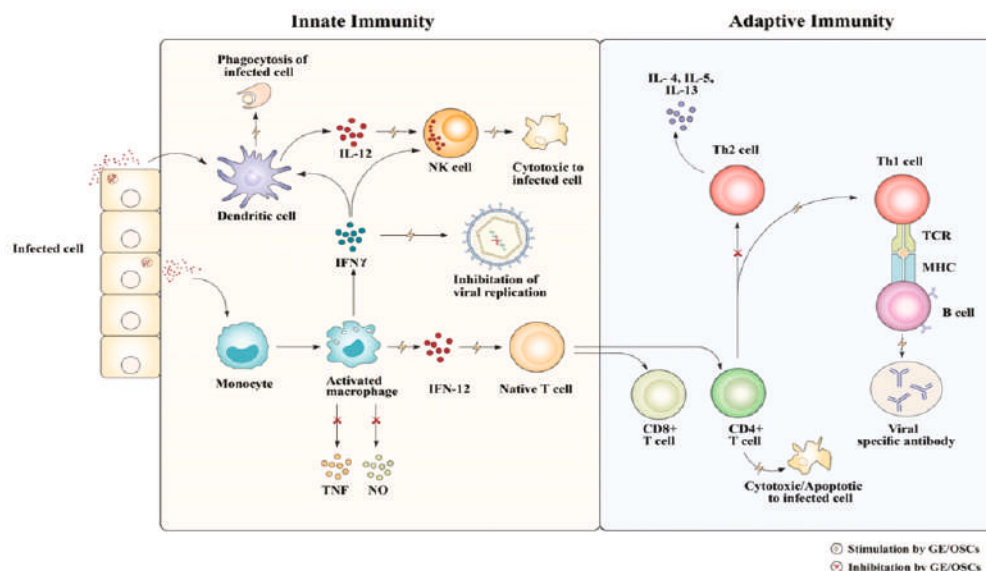
Garlic (*Allium sativum* L.) is a common herb, functional food and traditional remedy for the prevention of infectious diseases. Garlic and its active organo sulfur compounds have been reported to alleviate a number of viral infections with immuno modulatory effects.

Its antiviral activity is through interaction with the viral cell surface charged particles, inhibiting viral replication by inhibiting or blocking the viral fusion into the cells, causing detrimental structural changes of pathogen's proteins and by inhibiting the synthesis of viral nucleoprotein and polymerase activity making it viricidal.

The induction of cytokines and chemokines lead to vascular leakage and endothelial permeability of the host cell. Crucial role in alleviation of oxidative stress and inflammation.

Curcuma longa

Turmeric consists of three main compounds include, Curcumin, demethoxycurcumin, and bisdemethoxycurcumin. Curcumin (diferuloylmethane) is the primary curcuminoid, with anti-



inflammatory, antioxidant and anti-microbial properties that limit the viral replication.

Curcumin exerts antiviral activity by mechanisms like the direct interaction with the proteins of viral envelope and their disruption, inhibition of viral proteases crucial for viral replication. Inhibits inflammatory cytokines, reduces virus attachment to host cell, inhibited viral protease activity and binds to and inhibit the action of surface glycoproteins on the virus also leading to actin filament disorganization, which prevents virus entry and replication in host cell.

Azadirachta indica

Azadirachta indica, recognized for its medicinal properties due to the different phytochemicals such as quercetin, azadirachtin, number of liminoids and nimbosterol like nimbin, nimbanene, nimbolidae, nimbandiol etc, while all of which are considered anti-viral.

Neem is vericidal, it extensively blocks viral entry into the host cell by the revention and modulation of host cellular pathways and by interfering with viral reproductive cycle, by the suppression of the viral cell viability leading to cell cycle arrest with cytotoxic effect.

Lauric acid

Lauric acid and its monoglyceride derivative, monolaurin, have been demonstrated to possess anti-microbial properties against gram positive bacteria and many viruses. Lauric acid has great antiviral properties, a broad spectrum antibacterial that boosts the immune system too.

Lauric acid inhibits the virus via its inhibitory mechanism during the maturation stage of the viral replication cycle. Supported by its amphiphilic properties modifies the viral cell membrane characteristics.

It changes the cell membrane characteristics by disrupting its phospholipid layers, preventing the binding of viral membrane M protein to the host cells and by the direct inactivation of virion particles of the virus. All these disintegrate the viral membrane causing its rupture and leading to its eradication. Through the indirect mechanism as a protectant due to its anti- retroviral agents, increasing its antiviral activity.

This special Herbal Anti-Viral combination is an assured, true herbal anti-viral adjuvant for aquaculture tested yet again from the house of Advance Aqua Biotechnologies whose Phytotherapy of each individual component had a unique way of working against virals and their infections, the activity of each proved and assessed. Significant reduction in the viral load due to the phyto chemicals like alkaloids, flavonoids, saponins, tannins, terpenoids, hydrolysable tannin and glycosides found in here which are considered novel antivirals having the capability to control viral outbreaks in aquaculture while also the drug resistance and drug residue problems of synthetic drug usage minimized with assured efficacy and safety.

A safe and economical alternative with many other beneficial effects apart from its antiviral activity – like enhanced body weight, improved feed efficiency, appetite and digestion stimulating, anti-bacterial and hepato-protective. Herbal usage has shown profound anti-viral activity, however the total viral elimination is possible and dependent on the biosecurity and good management practice of the farms.

