



Disease in Shrimp Culture & Control

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Abstract

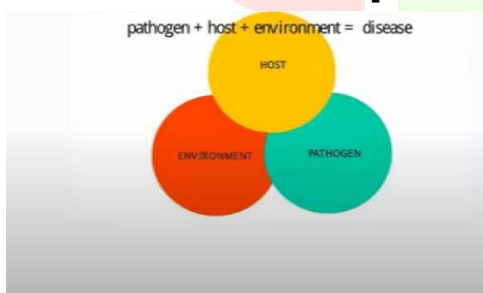
One of the main things of shrimps is changing their behaviour in any adverse condition & they will become moribund called disease.

Now day farmers are developing shrimp intensive culture for higher successful production. Occasionally shrimp are affected by various diseases. Disease is the major problem for shrimp industries. Every year farmer got huge loss from their project. Farmer has no maintain the high stocking densities infrastructure, high food inputs and other organic loads stimulate the opportunistic pathogens like Virus, Bacteria, fungi & Protozoa.

Biosecurity one of the key factor for successful shrimp farming, not only controlling farm for disease management, it will be good impact to ecosystem

Any kinds of disease has depended some biological influences. We found that all disease replication depend in common factor like- host, environment & opportunistic pathogen. Farmers are controlling shrimp disease improving some factors. It has required that shrimp couldn't face stress any biological changing condition. Proper guideline may be rescued from shrimp disease.

How Disease develop?



Shrimp body is covered by exoskeleton. In molting time they remove their outer molting shell (exoskeleton). They will be weakened due to lack of energy. They facing unfavourable condition, disease may be happened. Slowly decline the host's immunity in disease time. Any Shrimp have faced stress that time 3 factor influence Shrimp disease. These are Host (Shrimp), Environment & Pathogen (causing organism).

Many factor influence the disease?

1. Toxic Gases
2. Less water exchange.
3. Improper aeration as per biomass
4. Physical stress

5. Excessive feed.
6. Heavy algal bloom
7. Sudden water parameters change
8. Influence pathogenic organism
9. Any adverse environmental condition
10. Lack of proper nutrition
11. Sludge not remove
12. High stocking density, lack of knowledge for farm management

Host

Any disease causing organism not lives without host cell. Host cell require for replication of any kinds of shrimp disease. When shrimp immunity has not properly protected shrimp's cell, they will facing any kinds of disease.

Environment

In shrimp culture proper environmental condition impact for better production. The shrimps get from natural substances like good soil, water, oxygen, sunlight etc in culture time. Any environmental change of these factors will adversely affect by shrimps in the culture.

For environmental condition influence to shrimps disease like-Ammonium toxicity, Hydrogen sulphide toxicity, Nitrite toxicity, Low DO etc.

Pathogen

In shrimp culture various pathogenic organisms present in aquaculture system. When they present in large numbers, they may readily invade the injured tissues. They slowly damage the host cell & replicate into the others living cell. Maximum pathogens wait for replication by environmental influence like food source, low DO level, pH etc.

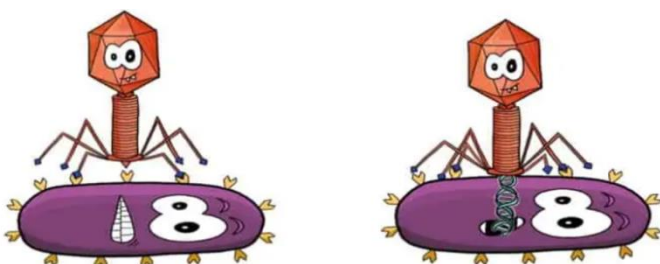
In crowded condition shrimps may be infected by the pinching or biting the shrimp. They injure occur that's time pathogen attack in deeper portion.

Basic concept for main pathogenic organism (Virus, Bacteria, Fungus), how create the shrimp disease.

Virus

Introduction- Virus is intra cellular pathogen. Virus lives inside of host cell. Only virus is smallest agent of infection diseases. We can watch by electron microscopic to virus is round shape & 20-200 nanometer dia. Virus are consist of genetically surround of protein coat & some are fatty envelop. Virus replication into host cell. All host cells must be provided to virus for necessary energy & synthetic machinery (ribosome, endoplasmic reticulum, amino acid) for synthesis of viral protein & nucleic acid. Virus cannot make their own protein. They composed genetic material DNA or RNA and protein. Viruses are prokaryotic & eukaryotic cells causing disease.

How virus infect to the shrimp –



Attachment – Virus's envelop or capsid attached on receptor of cell membrane.

Penetrate- Virus penetrates the animal cell membrane through the endocytosis process. Envelop & protein are fused in plasma membrane .Nucleic capsid enter the cell. For bacteriophages cannot penetrate capsid, only nucleic acid (DNA or RNA) inject there.

Uncoating- Virus outer cell remove due to lysosomal enzyme separate to capsid & nucleic acid .The nucleic acid release into cytoplasm.

Biosynthesis -Replication mechanism depends on the viral genome. Virus component are synthesized (Nucleic Acid, Capsid, protein). DNA virus enter the nucleus (Protein & enzyme to make additional Nucleic acid),then attack ribosome .RNA virus direct attack host cell ribosome present at cytoplasm .

Assemble & Release- DNA & RNA assemble all parts then create a new virus.The new mature virus will destroy the plasma membrane & cell lysis (destroy host cell) & release to outside.

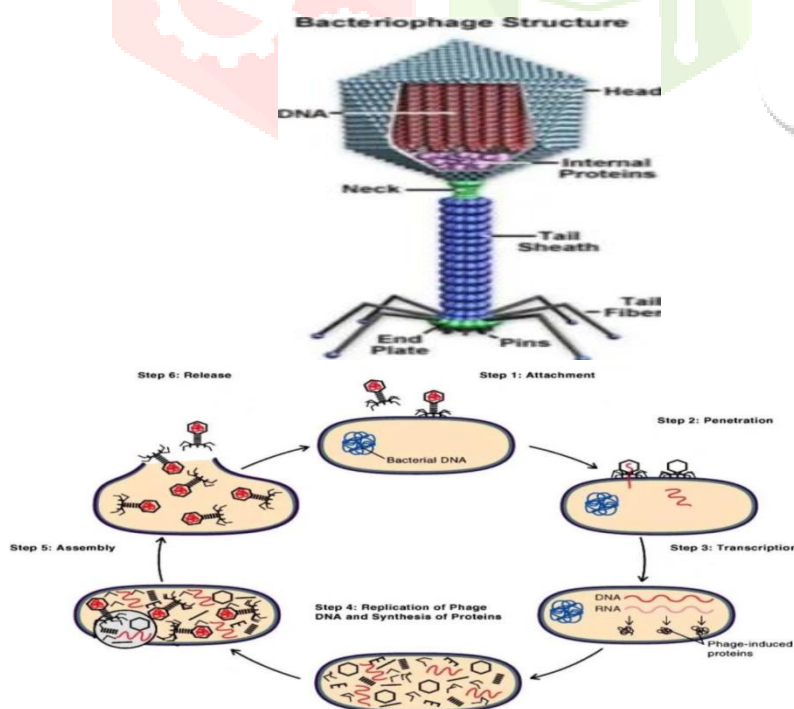
Significant- Virus absorbs cell energy & cell will be weak within few times later. Actual virus has damaged to stomach, hematopoietic tissue, antennal gland, gills, lymphoid organ, Uropod, cellular epithelium, several organs, and nucleus membranes.

- ✓ Virus are nonliving things without enter inside the living body
- ✓ Outside the living body – nonliving without host cell (like air, water etc)
- ✓ Inside the living body –living thing with host cell

Bacteria

Introduction-Bacteria inject to host cell & push the bacteriocin .Bacteria is 10 to 100 times larger than virus, length 1 to 3 micron .Most bacteria consist ring of DNA & all contained within fatty membrane. Bacteria take energy from host cell. We can watch by ultra-microscope .Some bacteria multiplying in environment, some multiplying living organism cell. Bacteria are infect inter cellular pathogen. Bacteria have a peptidoglycan cell wall. Bacteria are prokaryotic cell.

How Bacteria Replicate



Attachment-Pathogenic bacterial protein binds to specific host cell receptor.

Penetration- Bacteria first infects to the host cell membrane. They inject bacteriocin (toxin) to receptor cell & weaken the cell membrane. Lysozyme like enzyme found in weakens cell membrane. DNA moves from head via tube to the bacterial cytoplasm while the phage capsid remains the outside.

Replication- The phages genomes control the host cell metabolic machinery & host only produce viral product. Bacterial DNA disrupted and nucleotide is producing new phages. Phages DNA is transcribing to mRNA use host cell machinery. Translation of mRNA and capsid protein and viral enzyme are produce.

Assemble- Phages assemble in host cell cytoplasm & newly synthesize capsid, protein. dsDNA packed into the head. When DNA properly packs in head, each head attach with tail, tail fiber & infective phages develop.

Lysis & release –Lysozyme break down the bacterial cell wall. Phages infect other susceptible bacteria & new infection process start.

Significant- Bacteria injects bacteriocin (toxic) to host cell. They penetrate the cell membrane as virus. They collect energy from host cell & cell will be weakened. They replication within host cell & create new bacterial genome.

Fungus

Introduction- Generally fungus is nonliving component. It is the outer part of the cell provides mechanical support. Fungi are intra & extracellular parasite; they depend on complementary surface of host cell. Fungal spore can spread by air, water etc. This types of disease found in shrimp after molting, weaken or injury shrimp. If not treated quickly, they invade to other dead cell. Fungi like moist or slightly acidic environment. They can grow without oxygen or light. Fungus is 1.3 times larger than bacteria. Fungal can found in wet or hot (30°C to 37°C) environmental condition. Fungus replication slower than bacteria. Replication time requires more source of carbon. Fungus have eukaryotic cell.

Fungal component- The major component of cell wall of chitin, gulcan, glycoprotein.

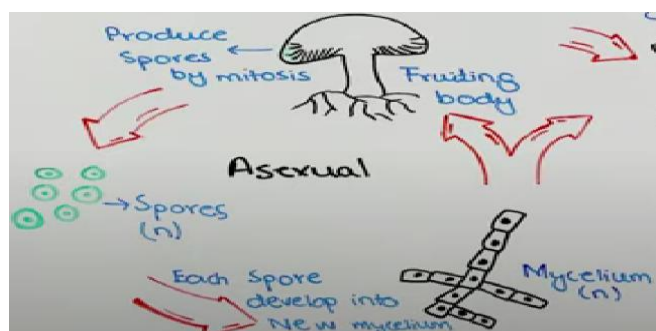
How Fungus infect to shrimp-

In shrimp culture fungus spread in asexual method-

Attachment- Fungus attaches outer cell wall of host cell for collect nutrient from food source.

Penetrate- Fungus secret micotoxin to host cell membrane. They collect nutrition through hyphae flagella.

Replication- Many fungus produce mycelium (combination of hyphae). Mycelium also haploid (n). Then mycelium slow grows. Then produce fruiting body grow on the mycelium. Spore produce under the fruiting body by mitosis process. In suitable environment condition spore (n) will release haploid spore. Each haploid spore develops new mycelium until in favourable condition. This mycelium creates new fungus.



Significant- Fungus works in two ways 1) release mycotoxin to cell membrane then cell will be damaged 2) hyphae collect nutrition through flagella from cell membrane then cell will be damaged. Fungus is heterotroph. Require organic compound for energy. They reproduce as asexually method in host cell.

How can understand shrimp disease?

- Reduce feed intake
- Shrimp gut colour
- Abnormal colour on body or organ
- Abnormal swimming
- Weakness
- Any spot on body
- Respiration problem
- Growth retardation

Major Diseases of Shrimp Culture

1. WFS
2. EHP
3. WSSV
4. White Gut Disease
5. White Muscle Disease
6. AHPND
7. Shrimp Hepatopancreatic Virus
8. RMS
9. LSS
10. Black Spot
11. Blister
12. Shell Hard
13. Gill Chocked
14. Brown Spot
15. IHHNV
16. Sudden Mortality But No sign of Disease

WFS (White Feces Syndrome)

Nature of Infection

Hepatopancreas is main organ of digestive system. ATM (Aggregated Transform Microvilli) has stayed in HP. When HP damage that's time found white faecal strings with fat content.

Some pathogen gathering in mid gut, then gut will change the colour to yellow-golden content. The faecal strings are examined that they consist of vermiform resembled gregarine.

More no of gregarine are infected to hepatopancreas & mid gut. More gregarine is lesion to culture shrimp. The gregarines are assimilation nutrient by villi, so shrimps are founding size variation.



Sign of WFS

- 1) Gut pH level (8-9)
- 2) pH level dis-balance in shrimp blood
- 3) Accumulation of vibrio sp.in gut
- 4) Indigestible feed problem
- 5) More amount of harmful toxic gas
- 6) Extra crude protein insists.
- 7) Huge mucus secretion.

Symptoms

- 1) White faeces are floating on surface of the pond
- 2) Affected shrimps are loss of appetite after few days later
- 3) Decrease feed consumption
- 4) Damage of Hepatopancreas
- 5) Damage of gut line
- 6) Mortality rate high
- 7) Every week growth rate 1.5gm less than normal.
- 8) Poor Growth, Size variation.

Causes

1. Harmful bacteria in shrimp digestion
2. Bacteria/Protozoa/algal toxicity due to BGA
3. Toxic gasses such as H_2S , NH_3 , NO_2
4. Moldy, spoiled & expired feed
5. Over feeding damage to hepatopancreas
6. Gregarine of hepatopancreas

Environmental treatment may be helped

- 1) Anti-bacterial product use in pond
- 2) Bacteria, fungal, protozoa, algae are eliminate
- 3) Parasites eliminate
- 4) Germs, microsporidian are eliminate

Use good probiotic

- 1) Probiotic help decompose organic load in pond
- 2) Probiotic reduce harmful toxic gas such as H_2S , NH_3 , NO_2
- 3) Probiotic stabilize pond environment.
- 4) Improve gut condition

How do control it?

- 1) Avoid over feeding, reduce damage chances of hepatopancreas.
- 2) Use disinfectant for reduce concentration of pathogen or inactive of pathogen.
- 3) BMP'S method (water exchange, good aeration, pond bottom chaining, sludge remove etc)
- 4) Use immunostimulant product with feed for recovery from disease/infection
- 5) Restore liver,pancreas,intestine & enhancing health resistance of shrimp
- 6) Probiotic can decompose toxic wastes and be useful improve of soil & water quality.
- 7) Use organic acid composition with feed (formic acid, propionic acid), Control gut pH level. Also use gut probiotic.
- 8) More aeration may be changed the pond environment

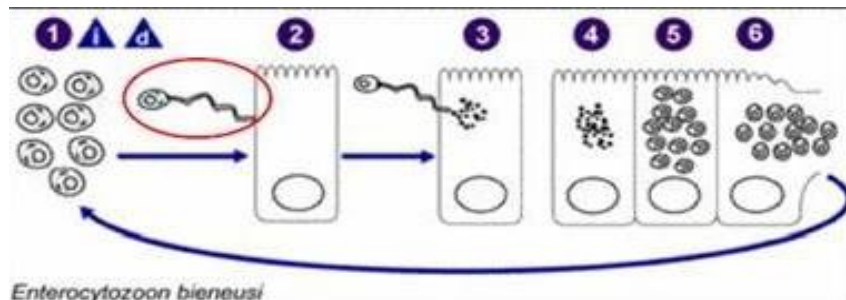
EHP (Enterocytozoon Hepato Penaei)

Nature of Infection

EHP is microsporidian intercellular parasite disease. EHP replicate in shrimp's hepatopancreas. Here is no signs & symptom observation of EHP disease. After spore maturation EHP release. EHP absorbs feed's ingredient nutrition.

Life cycle of EHP mainly 3 stages

- a) Mature stage (Infective Stage)
- b) Merogong (Multiplification Stage)
- c) Sporogong (Spore Production stage)

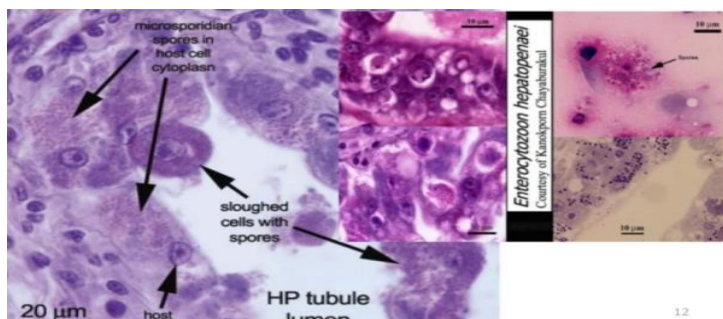


EHP spreading process

- 1) EHP Spore enter in shrimp body & replication in HP
- 2) Mature EHP spore release in pond
- 3) complete life cycle of EHP in shrimp body not require any secondary host
- 4) Shrimp develop for spore production factory

Symptom

- 1) Size variation depend on absorption of feed's nutrition
- 2) Chances of fecal syndrome
- 3) Poor growth
- 4) Loose cell
- 5) EHP effect impact connective tissue & infect muscle
- 6) Cotton shrimp disease.



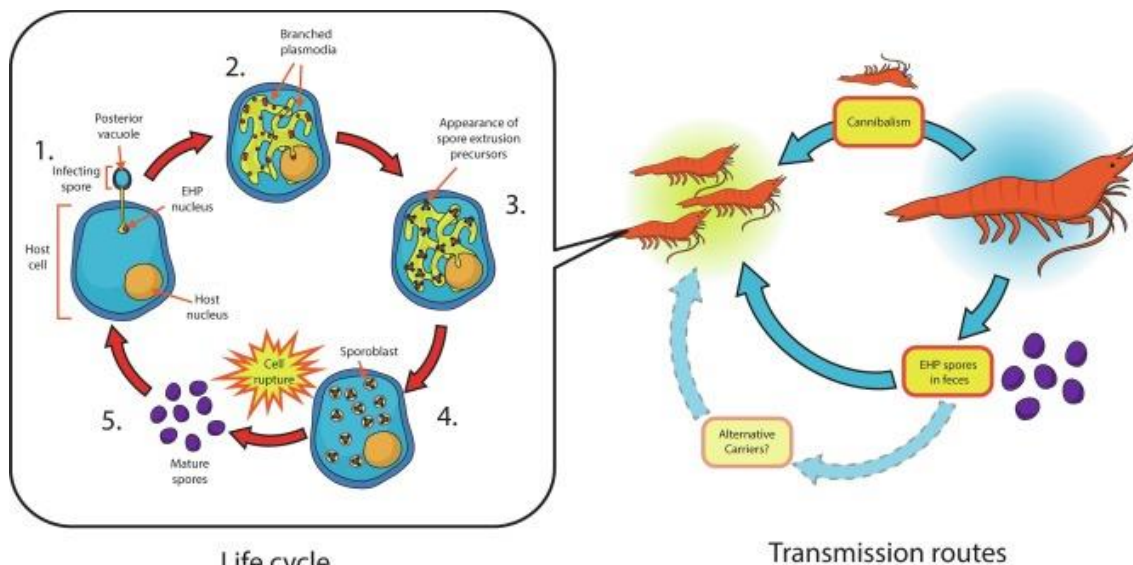
Impact in Shrimp Culture

- 1) EHP attack of shrimp gut & HP
- 2) EHP not promotes shrimp death.
- 3) EHP spore promotes to WFS
- 4) EHP multiplication in cytoplasm of HP cell

5) Depletion of nutrient result in cell death at HP & mature spore release.

EHP transmission route

- a) EHP contamination by Shrimp's feces & cannibalism
- b) EHP spread through another host in pond.
- c) EHP spread by Verticals & Horizontal.



EHP affected on salinity

30 ppt-87.7%

15 ppt- 30%

2ppt-33%

Spore germination increase is the intra spore osmoregulation pressure.

How do Control it?

Practically I rescued from EHP disease. First I used triple salt with water for resist EHP spore maturation & triple salt used with feed for resist feed ingredient absorption. It would be better result found for good bio Security, BMP's. Use good quality probiotic. Organic acid use for gut.

In pond preparation time- use CaO 600kg/1000 sqm. In water colour preparation use Chlorine 40 ppm or KMnO4 15 ppm

WSSV (White Spot Syndrome Virus)

Nature of Infection

WSSV is DNA virus. Acutely affected shrimps showed lethargy and anorexia. Infected shrimps with prominent white spots on the cephalothorax region of exoskeleton. This virulence of the disease was reached 100% mortality after the appearance of clinical signs. In most of the infected farms, within a period of 3-10 days due to maximum shrimps organs are damaged. WSSV disease rapidly spread in shrimp culture due to shrimp's host properly unable to resist this disease. Disease affected the shrimps of all ages and sizes, extensive to intensive farming conditions and all range of salinities. The most important fact about on WSD is its huge range of hosts. The moribund shrimp founded on the water surface and gathered on the edges of the pond.

Sign of Disease

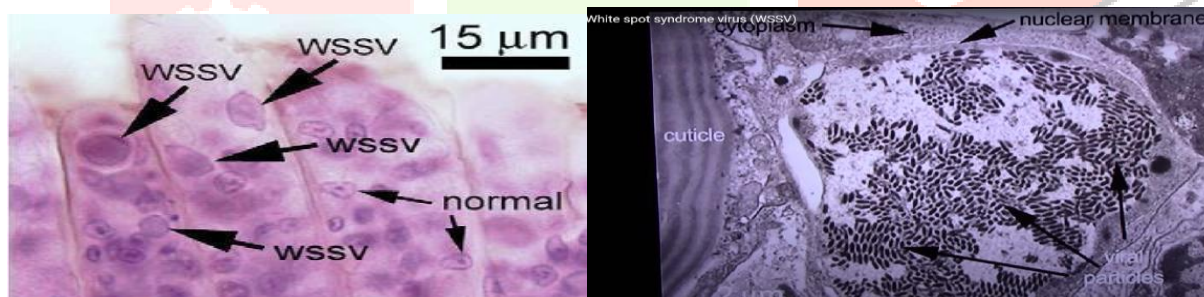
1. Redness of Body
2. Broken antennae
3. White spot on carapace
4. Shrimps come in pond side & also surfacing the pond.
5. Edema (Accumulation of water on head)
6. Anorexia (lack of appetite)
7. Mortality
8. Cannibalism



❖ **Need for confirmation lab test.**

Diagnosis

The causative agent of the WSD was found to be a rod-shaped virus, the white spot virus (WSSV). This virus infects shrimp tissues of ectodermal and mesodermal origin of cell. Clinical sign of WSSV disease infected to direct nucleus & the appearance of white spots or patches of 0.5 to 3mm diameter on the inner surface of the exoskeleton. In many cases of shrimps are moribund displayed reddish to pinkish coloration without any white spots.



Prevention

1. Stock SPF quality seed, CAA approved hatchery
2. Adaption of BMP's and Bio Security
3. Mainly zoo plankton in the pond & reservoir are host of WSSV
4. Higher temperature offer a nature protection against WSSV

Significant

WSSV damage to several organs at a time within few days–

1. Stomach
2. Haematopoietic tissue
3. Cuticular epithelium (Formation of outer exoskeleton)
4. Antennal tissue
5. Gills
6. Uropod
7. Lymphoid organs

How do control it?

Here is no treatment of WSD. Also maintain good Bio security. Use benzalkonium chloride and providing iodine (chemical disinfectants) at proper dosages has been found useful on inactivating the WSSV from the rearing systems.

White Gut Disease

Nature of Infection

Vibriosis & others pathogens are present these types of disease. Shrimp are apparently healthy and show normal growth. Often conditions such as high stocking density, poor water quality, and sudden changes in environmental factors influence diseases in shrimps. Become gut will be effected by micro flora preventing gut disease.



Cause

Six *Vibrio* spp.—*V. harveyi*, *V. parahaemolyticus*, *V. alginolyticus*, *V. anguillarum*, *V. vulnificus*, *V. splendidus* are involved, also protozoa gregarine are associated with the White gut disease of shrimp. Increase mortalities due to vibriosis occur when shrimps are stressed by factors such as- poor water quality, crowding, high water temperature, low DO and low water exchange.



Symptom

1. Gut pH 8 to 9
2. Microflora preventing the gut
3. Feed consumption goes to down day by day & nutrient absorption down.
4. More chances for WFS disease
5. Slowly damage HP
6. White Gut Disease associated with mortality.

How do control it?

1. Use mainly bacillus subtilis for protein utilisation, bacillus coagulant for increase digestibility, bacillus pumilas for fast colonization in gut. Pediococcus acidalciation for pathogen inhibition.
2. Use anti-bacterial product

3. Sludge control for improving environment.

4. Sufficient aeration require

5. Maintain gut pH (5 to 7) ,use organic acid reduce pH (propionic acid, formic acid etc)

White Muscle

Nature of Infection

White muscle depends on many factors. White muscle is coagulative muscle necrosis. White muscle diseases found of shrimp's tail whitish & whitish appear middle of back.



Figure 1 White muscle disease in Tiger size L. reticulata



Figure 2 White muscle disease in small size of L. reticulata



Cause

1. Mineral deficiency (Potassium & Magnesium deficiency)
2. Imbalance of minerals (Body cramp)
3. Low DO
4. Temperature fluctuation (<math><34^{\circ}\text{C}</math>)
5. Salinity fluctuation
6. Vibriosis (nonluminescent vibrio harvey)
7. Gill problem (less oxygen supply to hemolymph)
8. WSSV
9. IMNV

Symptom

1. Animal Body cramp/Bent(high temperature influence)
2. At the place of cramp the muscle become white
3. Juvenile are most susceptible
4. Ratio difference between the important mineral (Na, K & Mg)

How do control it?

1. Use calmag & Kmax

2. Periodically monitoring of mineral consumption in the pond water
3. Maintenance of proper rate of essential minerals nutrient.
4. Increase water depth, if water depth less than 4ft
5. Run aeration to break temperature stratification
6. Use Feed Supplement
7. Use disinfectant product, inactive of vibriosis & others pathogen

AHPND (Acute Hepatopancreatic Necrosis Disease)

Nature of Infection

AHPND is highly pandemic & devastating of shrimp culture. It is vibriosis disease, mainly *V.parahymolyticus*, *V.Harveyi* & etc. This disease associated with mortality.



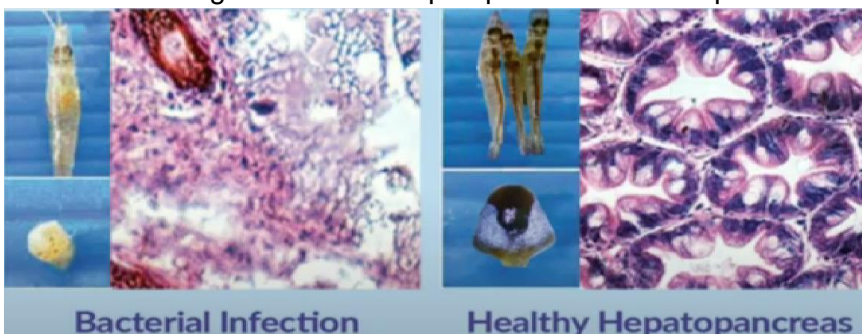
Nature of Sign

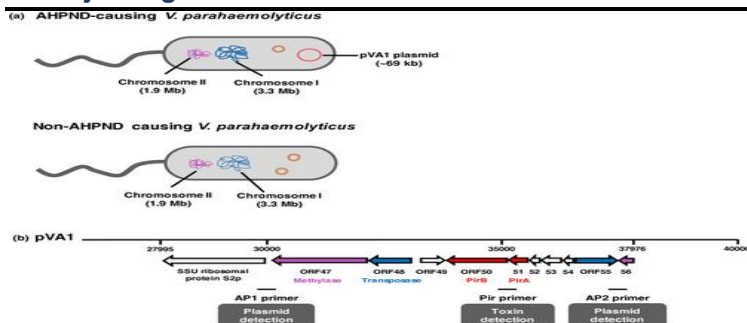
- Empty stomach
- Empty midgut
- Fully white of hepatopancreas
- Hepatopancreas size reduces.
- Hepatopancreas more hard than normal

Causes

The disease is currently active in shrimp culture-

1. *Vibrio parahaemolyticus* toxin release & damage to digestive organ.
2. The bacterial infection-Hepatopancreatic Necrosis Disease (AHPND) also called Early Mortality Syndrome
3. The Fungal infection –Hepatopancreatic Microsporidiosis caused by *Enterocytozoon hepatopenaei*





Symptom

- 1) Gut pH level 8.6-8.8
- 2) Erratic swimming behaviour
- 3) Infected during early culture period (10-50 DOC)
4. Mortality start from 3rd day of infection & something reaches to 100%
5. Often pale to white hepatopancreas due to pigment loss in the connective tissue capsule
6. Significant atrophy of hepatopancreas
7. Often soft shell
8. Gut with discontinuous contents or no contents
9. Black spot or steaks sometimes visible within the hepatopancreas
10. Hepatopancreas does not squash easily between thumb & finger
11. Moribund shrimp sink to bottom

How do control it?

1. Select EMS free/ healthy shrimp seed
2. Use Nursery protocol.
3. Follow strict Bio security measures
4. Maintain the pH 8.1 to 8.3
5. Control feeding during 1st month
6. Alkalinity should to be maintain, not lower than 100 ppm
7. Use organic acid for feed supplement.
8. Application of such probiotic to be avoided.

Shrimp Hepatopancreatic Virus

Causes

1. Affecting hepatopancreas, such as shrimp under stress
2. Sudden changes of water quality impact of pond environment.
3. Good hepatopancreas symptom for molting



Types of Virus

There are a number of viruses that affected to Hepatopancreas –

Monodon Baculo Virus (MBV)

Types of Baculo virus-

- a) Hepatopancreatic Parvo virus (HPV)
- b) Baculo virus Penaei (BP)

Symptom

1. The virus damage to hepatopancreas cell
2. The clinical symptom for infection.
3. Loss of colour on the surface of hepatopancreas
4. Empty stomach & gut
5. Slightly reddish body in one third abdomen
6. Soft shell in partially infected shrimp.

How do control it?

1. Good Biosecurity
2. One of the most important criteria for a successful culture.
3. Good environment can impact of shrimp health, growth & production.
4. Various organ good help for success of culture
5. Selection good SPF quality of PL
6. Maintain standard levels of physico chemical condition.
7. To avoid bacterial & viral pathogen entering from outside to closed culture.
8. Improve the pond bottom condition
9. Increase DO level
10. Best management practice.

RMS (Running Mortality Syndrome)

Nature of Infection

RMS such types of disease associated with mortality. Some reason has depended on diseases, haemolymph & hepatopancreas are infected by influensive situation. Infected shrimp has affected by higher load of vibrio sp, like vibrio parahaemolyticus and vibrio azureus.



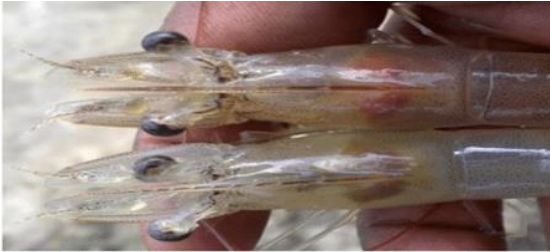
Cause

1. High toxic gases
2. Low Do level
3. Low salinity
4. High temperature
5. Vibriosis & other pathogen
6. Minerals imbalance
7. Bad bottom condition

8. Over feeding bad impact to hepatopancreas
9. Water parameter

Gross sign & symptom of RMS affected shrimp

1. Antennae are cut & uropod red colour. Hepatopancreatic colour reddish yellow, then whole body colour dark reddish colour.
2. Red tail, red walking legs
3. Continuous internal mortality found.
4. The dead shrimp settle at pond bottom, not come to surface or side.
5. Mortality notice internal moulting stage, mortality rate high found at low saline water.
6. White or yellow faecal matter notice in mid gut



Diagnosis

Water quality impact with pH, Ammonia, Nitrite, Hydrogen Sulphide, Low DO level & plankton.

1. **No specific diagnosis for RMS but based on clinical sign**
2. Microscopic observation pleopod found external fouling filamentous bacteria & protozoa.
3. The infected shrimp shows delayed hemolymph clotting time, bad impact to hemocyte's activity
4. Reddish yellow hepatopancreas
5. Empty & red stomach
6. Yellow & white fecal matter
7. High mortality in high vibrio load.

How do control RMS?

1. Water exchange reduces the concentration (high bloom, NH_3 , NO_2 , H_2S).
2. Probiotic use in right time
3. Increase aeration system. Maintain BOD & COD condition
4. Sludge remove
5. Removing dead pcs. from pond bottom due to not spread toxin, bacterial etc.
6. Reducing 30-40% feed for few days, so reduce mortality.
7. Improving culture practice like-stocking density, nursery management, feed management, and partial is harvesting. May be chances for reduce mortality.
8. Delayed hemolymph clotting time and expansion of chromatofores indicate stress.
9. Maintain minerals ratio. Mainly improve magnesium & potassium level
10. Use sanitizer for reduce vibriosis & other pathogenic concentration.
11. Reduce turbidity (dangerous for shrimp)
12. Check water parameter (pH, alkalinity etc)

LSS (Lose Shell Syndrome)

Nature of Infection

Shrimp shells are naturally gap between muscle & exoskeleton. LSS mainly depend on various factors like poor pond water quality, nutrition deficiency etc

Sign of LSS infection

1. Gap between muscle & exoskeleton
2. Pigmented of hepatopancreas
3. Fouling in the gill respiratory problem

4. Soft muscle
5. Lose of weight due to less feed intake



6. Lethargy, so reduce growth.
7. Impaired molting & Progressive mortality.
8. LSS infected shrimp has totally damaged of hepatopancreas, gill, muscle.

Causes of LSS

1. Deficiency of nutrition
2. Poor pond bottom & water quality.
3. LSS not infected for DO level, temperature, salinity, but pH major role play, pH raised infection start in culture pond, due to high organic load at bottom.
4. LSS caused by Fungi, protozoa, Bacterial infection.
5. Deposit suspended particle on shrimp appendage and exoskeleton.

How do control of LSS?

1. Use good nutritional feed
2. Less stocking density
3. Use probiotic maintain good water quality.
4. Water exchange controlling the water quality.
5. Use vitamin C for improve nerve system & feed consumption.
6. Use sanitizer for reduce pathogenic concentration.

Black Spot (Melanosis)

Nature of Infection

Black spot is melanized cuticular lesion disease. Black spot disease mainly comes due to shell damage then bacteria, fungus invade to shrimp shell. This disease involves mortality due to less molting.



Causes

1. Pseudomonas Bacteria
2. Minerals deficiency.
3. Weather fluctuation.
4. Pathogenic bacteria $>10^3$ cfu/ltr, Alkalinity <100 ppm/ltr, DO level <4 ppm/ltr
5. Fusarium solani is causative fungus disease for Black Spot disease & molting failure chances for mortality.
6. BSD is severing tissue lesions & high mortality.

Effect on Host

1. Infection start on damage tissue, Such as wounds, gills damage from chemical treatment or pollutant and lesions resulting other disease process.
2. Once infection established progressive with 30% remission rate.
3. Lesion is may also serve as route of entire for all disease.

Diagnosis

1. Based on gross symptom & isolation of bacteria.
2. Infection & isolation of pathogen

How do control it?

1. Vitamin use with feed.
2. Increase DO level.
3. Reducing stock & adequate nutrient
4. Check water parameter (pH, Alkalinity etc)
5. Water exchange (reduce toxic gas concentration)
6. Use Probiotic in periodical basis.
7. Use sanitizer for reduce pathogen concentration.
8. Control of nitrite, ammonia, hydrogen sulphate level.
9. Use Sodium sulphate

Nature of Infection

Blister found in bronchial chamber with high count of bacteria & cyanotic fluid. Blister hamper the respiratory function, then shrimp will die.

Cause-

1. Blister come due to low DO level, high ammonia, temperature fluctuate, salinity & other's stress.
2. Epithelium & subsequent blood in bronchial chamber.
3. Blister is filled by high count of bacterial & cyanotic fluid.
4. Blister come due to high osmotic pressure at stress condition.
5. Such cases haemolymph does not colt, at that time heamocytes are damage & mortality.
6. Blister Come post molting stage.



Types of Blister

1. Fluid filled Blister
2. Mucous filled Blister

Fluid Filled Blister (Unclotted)

- A. Fluid filled blister associated with mortality
- B. Very high no of vibrio & bacterial septicemia.
- C. Blister associated with melanization

Mucous Filled Blister

- A. Never associated with mortality
- B. Blister goes to next molting

How do control it?

1. Use disinfectant product reduces the vibrio count in pond environment.
2. Use soil & water probiotic
3. Proper feed management
4. Water exchange
5. More aeration
6. Sludge remove

Hardshell



Nature of Infection

Shrimps outer shell is converting normal too hard. Shrimps are not properly removing outer shell in molting time, they become stress then they will die.

Causes of Hardshell

1. Excess level of iron, alkalinity, calcium level.
2. Excess level of water hardness.

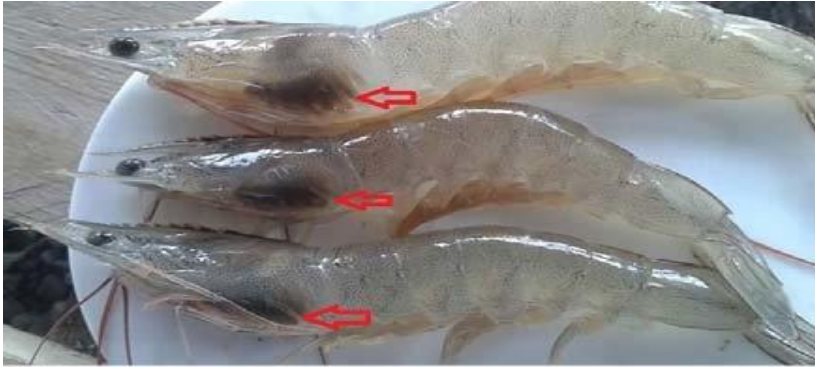
How do control Hardshell

Use water softener & molting introducer for control hardshell, then instant use mineral for proper molting. Water exchange. Check Calcium & Magnesium level.

Gill Chocked

Nature of infection-

Gills are discoloration called gill chocked. Gill chocked come due to heavy organic load, less DO level, poor water quality, fouling organism etc. Mainly breathing issue.



Cause

1. Vibriosis, fouling organism, fungus, ascorbic acid deficiency, cadmium, copper, oil etc
2. Unused feed get converted to organic matter.
3. Dead plankton, fecal matter & carbonaceous converted to organic matter
4. Turbid water, bottom quality, organic content in water
5. Algae crashing & foaming
6. Secondary infection of shrimp.
7. Ammonia, nitrite, Hydrogen sulphid, vibrio load increase & effect on shrimp health. Gill chocked problem mainly breathing issue.

How do Control it?

1. Use Vitamin C with feed
2. Periodically water exchange
3. Biotic & abiotic treatment.
4. Sediment organic content of water
5. Bio degradation of bottom & water.
6. Sludge remove
7. Control overfeeding
8. Increase aeration
9. Healthy algae in pond.
10. Use BKC, Iodine, and KMnO₄ for control bacterial load.

Brown Spot Disease (Rust Disease)



Nature of Infection

Brown spot disease is bacterial disease. These types of bacteria associated to shell disease. Affected animals show brown to black on body surface. Rust disease still extremely dangerous of shrimp due to infection direct contact to organs

Causes

1. Bacterial such as vibrio spp., aeromonas spp., pseudomonas spp. etc are involved this disease.
2. Direct Infect to the blood

Stages of Rust Disease

1. Incubation period
2. Shell degradation period
3. Internal organ damage

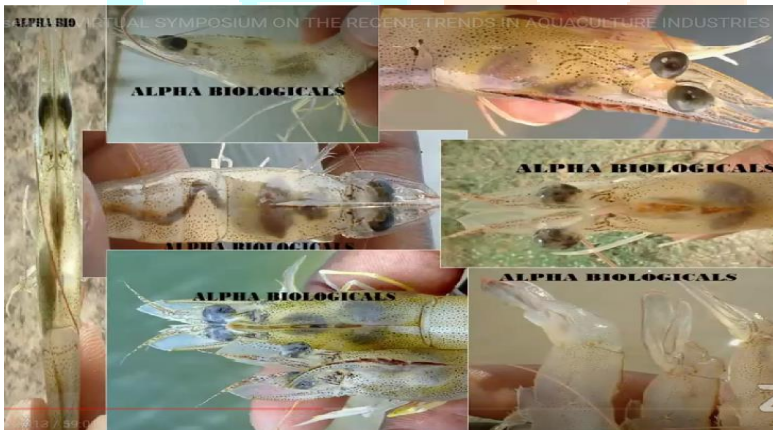
Prevention

Reduce organic load from pond bottom, water exchange, avoid unnecessary handling to minimize chances for infection & injury.

How do control it?

Use BKC, triple salt, Iodine for control the disease. Use H₂O₂ for improves water quality.

IHHNV (Infectious Hypodermal and Hematopoietic Necrosis Virus)



Nature of Infection

IHHNV is DNA virus, it affecting shrimp immune system & allowing other infection disease. IHHNV cumulative for high mortality rate. Virus size is 20-22 nm. IHHNV not related to digestive system.

Transmission

Transmission route in two way 1) Horizontal 2) Verticals method. Horizontal process cannibalism or contaminated water. Verticals process only depends on infected eggs.

Sign of disease

1. High size variation
2. Hepatopancreas stay one side
3. Deform of tail, mid gut, rostrum
4. Both eyes in one side
5. Poor growth of deformities bent rostrum but body colour is normal.
6. All deformities are not IHHNV due to endodermal provide to virus.
7. Shape of shrimp body uneven.

Prevention Management

1. Proper pond dry
2. Stock SPF quality seed
3. Proper way biosecurity
4. Best management practice

How do control it?

No treatment for IHHNV

Sudden Mortality But No Sign of Disease

Possible Causes

1. Lethargic behavior
2. Water colour change
3. Feed properly not intake
4. Sudden plankton crush
5. Benthic algae died
6. pH fault
7. DO problem (DO level >3 ppm at bottom)
8. Toxic gas (H₂S) form under liner pond bottom under damage
9. Alkalinity below 80 ppm

How do control it?

1. Water exchange
2. Probiotic use in right time
3. Improve nutrition deficiency
4. DO level >3 ppm
5. Reduce feed morning & evening time. Based on check tray
6. Ca(OH)₂ apply for pH
7. Sludge remove for reduce toxic gas
8. Use LSP for maintain pH >7.5

Improve immunity system for resist the maximum disease

Introduction- Immunity system can fight with foreign substance for protect all cell in their life. Immunity system requires to all species to resistance the disease. Immunity system has developed antibody against any kinds of antigen & kill the others substance. Immunity system can develop after exposers of microbes.

Require immunity two types-

- 1) T.Cell (Cellular immunity)-a) Helper T.cell b) Cytotoxic T.cell C) Memory cell
- 2) B.Cell (Humoral immunity) a) Plasma Cell b) Memory cell

How fight against with foreign substance?

When any kinds of substance enter through shrimp outer cell & reach in the blood vessel. First neutrophil kill the microbes. When neutrophil unable to kill microbes then macrophages try to kill them, when macrophage incapable to kill them, macrophage promote to dendritic cell. Dendrotic cell create the bridge to T.cell (lymphocyte).T.cell having three types .Helper T.cell activate to B.Cell for kill the other substance.Cytotoxic cell work on dead cell.Cytotoxic cell eat all dead cells that not create the damage to others cell.Memory cell not kill the other substance, keep it memory for types of pathogen.

B.Cell have one part of plasma cell,plasma cell produce protein & create a anti body (Y shape).Anti body goes to blood vessel & bind with all antigen.Macrophages comes & antibody work on foreign substance ,finally kill the all substance.

As per work immunity two types –

1. Active immunity -a) Natural immunity b) Artificial immunity
2. Passive immunity- a) Natural immunity b) Artificial immunity

Active immunity-

- a) Active immunity produces actively immunity system at host cell.
- b) Long period require for types of pathogen
- c) Not useful of individually improve of host cell.
- d) Memory cell present.

Natural Immunity-Naturally develop after exposer of microbial infection.

Artificial Immunity- Induce any kinds of useful bacteria.

Significant-

1. Immune cell defenses the pathogen.
2. Lymphocyte major role in immune system.
3. B.Lymphocyte produce special types of protein called antibody
4. T.Lymphocyte recognize pathogen (antigen)
5. Macrophage kill the pathogen by phagocytosis process
6. Cytotoxic cell eat all dead cell not create the other dead cell.
7. Dendritic cell act as messenger & activate immunity.

❖ **Use immunity booster for improving immune system.**

At a glance for successful farming

- Proper way biosecurity implement
- More aeration
- Everyday pH monitoring
- Alkalinity maintain 120-150 ppm
- Plankton population check
- Minerals ratio maintain
- Sludge remove
- Proper feed management
- Be aware of nutrition
- Growth retardation
- Probiotic use in right time
- Water exchange
- Periodically water parameter check in lab
- Check shrimp gut & hepatopancreas
- Be aware of molting
- Proper way of farm handling

❖ Conclusion-

- **Good pond management practice, Weather condition, Good water quality can control or prevent many disease.**