BACTERIAL DISEASES OF SHRIMP

Bacterial diseases

- Vibriosis
- Necrotizing hepatopancreatitis
- Mycobacteriosis
- Rickettsial infection

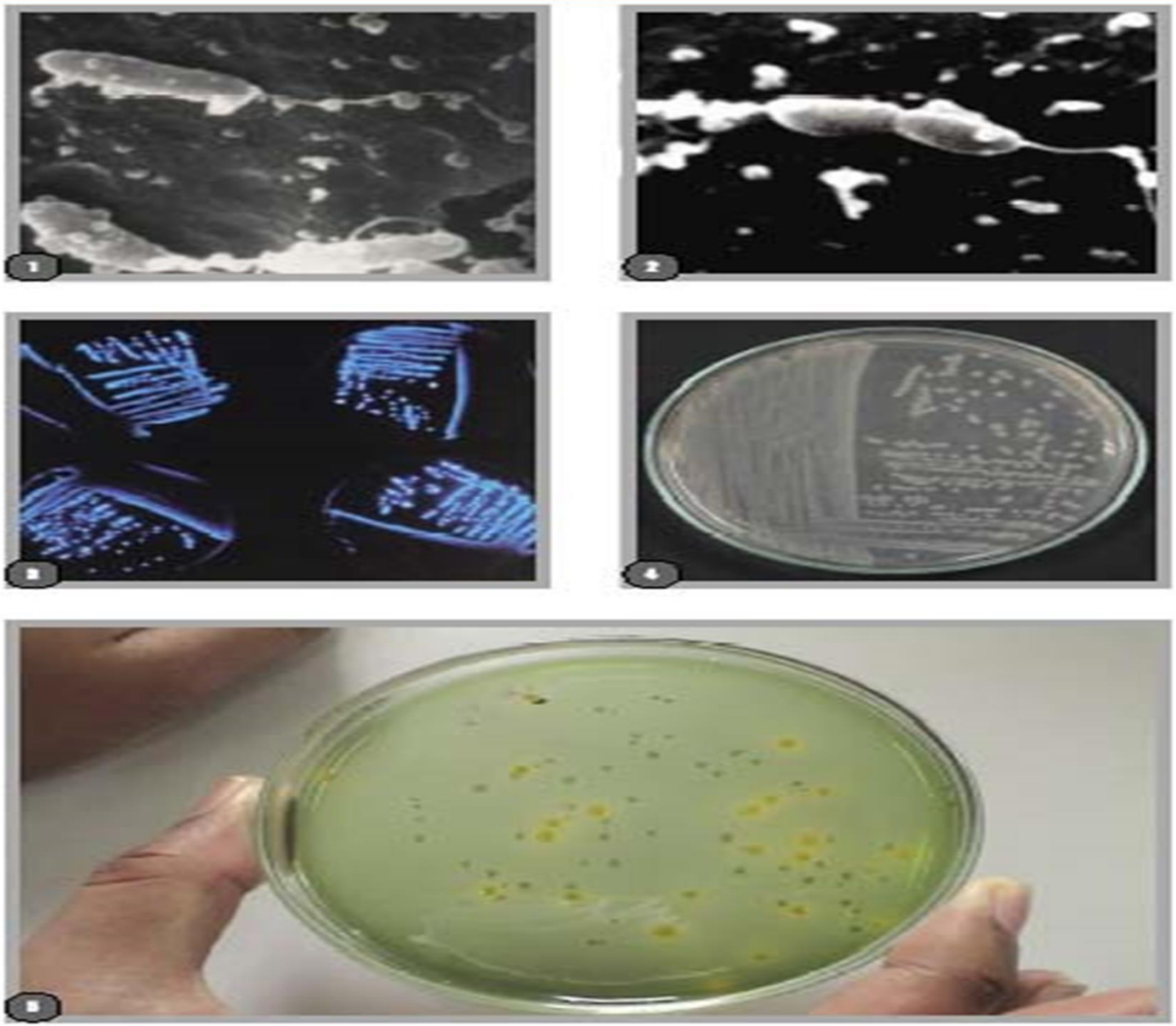
INTRODUCTION

- Bacteria – natural microflora of seawater
- Accumulation of unutilized feed & metabolites of shrimp with organic matter supports multiplication of bacteria
- Bacterial infections – primarily stress related
- Adverse environmental conditions or mechanical injuries - important factors of bacterial infections
- The expansion and intensification of shrimp farming industry impose stress on shrimps and making them susceptible to disease

VIBRIOSIS

- **Common name :** Vibrio disease of shrimp, syndroma gaviota or seagull syndrome, summer syndrome, syndrome 93, luminiscent vibriosis and penaeid bacterial septicemia
- **Species affected** : All penaeid sp
- **Causative agent** : G(-)ve,motile,rod shaped bacteria belonging to the genus vibrio includes Vibrio parahaemolyticus, V.alginolyticus, V.harveyi, V.penaeicida,V.anguillarum, V.splendidus,V.vulnificus and V.damsela

  other sp isolated responsible are Pseudomonas sp ,Flavobacterium sp and Aeromonas sp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- **Geographic distribution** : Ubiquitous

- **Route of infection** : Vibrio spp – chitinoclastic bacteria may enter through wounds in exoskeleton or pores.

  - Gills - covered by thin exoskeleton.

  - Midgut (DG+MGT) is not lined by exoskeleton

  - Transmission - water or through ingestion of infective material

- **Effect on host :** Mortalities upto 100 %

- **Biology and epizootiology :** Majority are secondary infections,occuring as a result of other primary conditions.

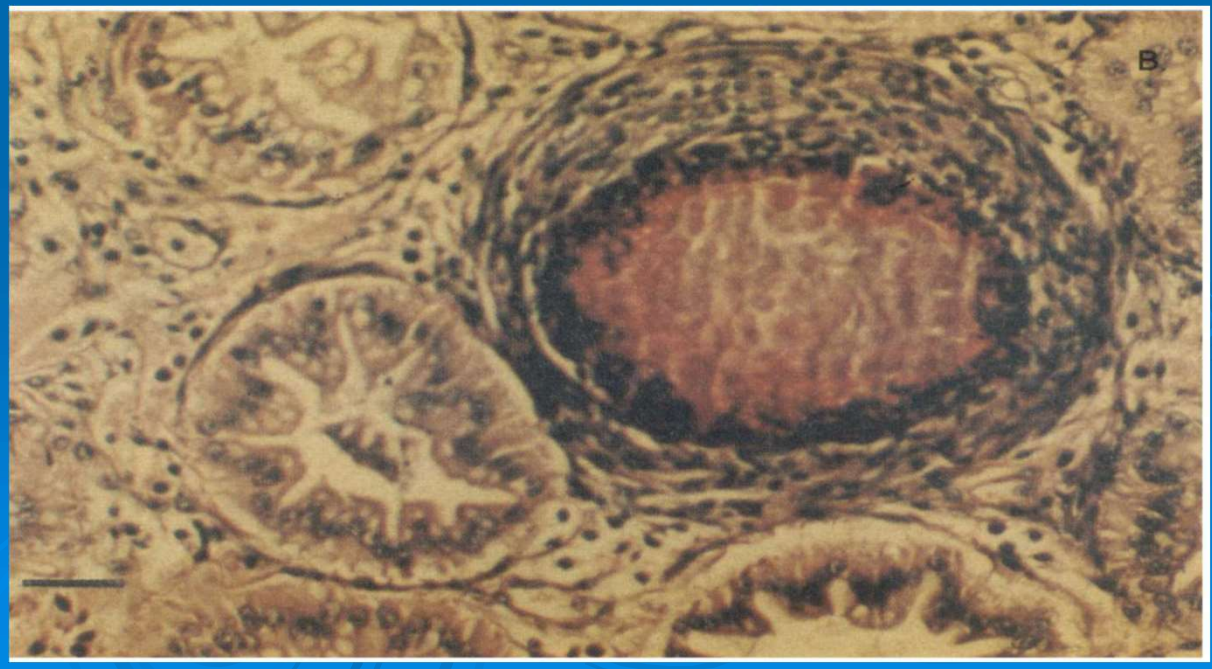
  - Vibriosis – multitude of infections

  - known as blackshell disease,septic hepatopancreatic necrosis,tail rot,brown gill disease,swollen hindgut syndrome and luminous bacterial disease.

- **Gross signs :**

- Erratic and disoriented swimming and lethargy.
- Black to brown colouration on gills,cuticle,appendages due to melanin production.
- Opaqueness of abdominal muscle,anorexia.
- Expansion of chromatophores on the dorsal surface,periopods,pleopods and appendages giving red colouration.

- Larval and PL signs of vibriosis includes melanisation and necrosis of appendages tips.
- Affected shrimp shows off-feed and empty guts.
- The gills,lymphoid organ and DG shows degenerative changes
- Detachment of epithelium from the midgut trunk.
- Specific morphological changes to the DG includes tissue necrosis, loss of epithelium and infiltration of hemocytes.
- Hemolymph clots very slowly
- Hemocytes number drastically reduced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- **Method of diagnosis :**

  - Isolation of Vibrio sp from tissue or hemolymph of moribund shrimp

  - Media – TCBS agar, Tryptic-soy agar and Zobell's marine agar(0.5 to 3 % Nacl is added)

  - Yellow colonies on TCBS

- **Prevention :**
  - Adequate water quality
  - Nutritionally adequate feed
  - Sterilization and filtration of incoming water
  - Reduction of stress
  - Vaccination with killed Vibrio sp
  - Terrestrial Lactic acid bacteria as dietary probiotic

- **Treatment :**

- Formalin at 10 to 25 ppm
- Malachite green at 5 to 10 ppb
- EDTA at 10 to 50 ppm
- Furanace at 1 ppm
- Chloramphenicol at 1 to 10 ppm
- OTC at 1 to 10 ppm

- **Present status of vibriosis :**

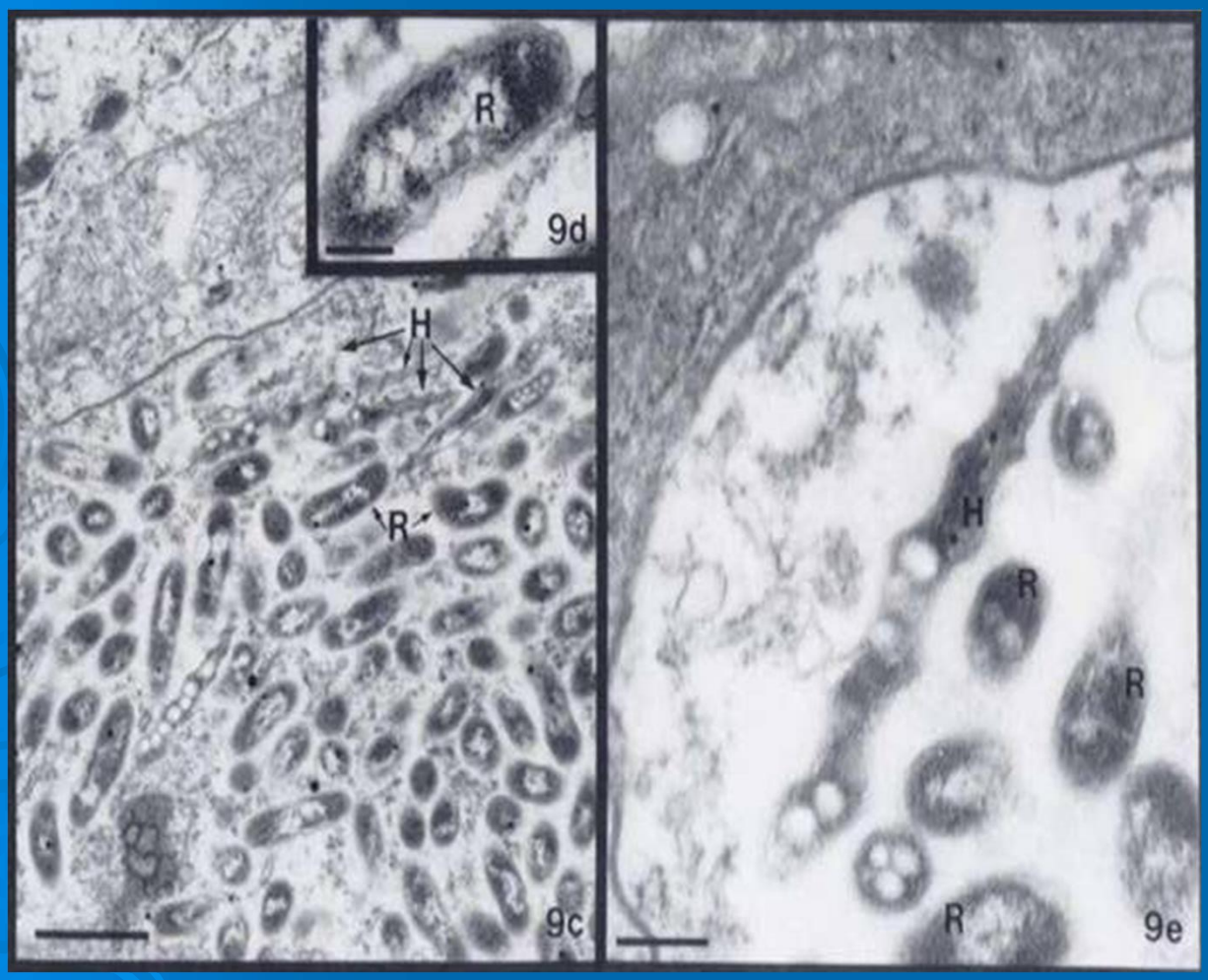
  - Common problem particularly in the India
  - V.harveyi – chronic mortalities upto 30 % among the Australian P.monodon larval and PL stages
  - Highly pathogenic strain of Vibrio sp (AM 23), recently identified with Syndrome 93 from New caledonia among P.stylirostris
  - Heavy mortalities in P.vannamei observed in nellore district
  - An active research programme is underway to develop cost effective immunodiagnostic for Vibriosis using polyclonal antisera

NECROTIZING HEPATOPANCREATITIS

- **Common name :** Texas Necrotizing Hepatopancreatitis (TNHP),Granulamatous hepatopancreatitis, Texas Pond Mortality Syndrome (TPMS), Peru Necrotizing Hepatopancreatitis (PNHP)
- **Species affected :** Litopenaeus vannamei, L.stylirostris, L.setiferus, Farfentepenaeus aztecus and F.californiensis

- **Causative agent**: Two or three types of bacteria

  - Pleomorphic,rod shaped,rickettsia-like bacteria of 0.3 to 0.9 micron
  - A helical form mollicute-like bacteria of 0.3 to 0.9 micron
  - A filamentous mollicute-like bacteria
  - Recent studies - causative agents are G(-)ve bacteria and are mostly rod and helical forms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- **Distribution** : Geographically limited.

  - Western hemisphere includes Panama,Columbia, Mexico,Ecuador,Brazil,Costa Rica,Nicaragua,Peru and Venezuela

- **Route of infection** :

  - Horizontal transmission

  - via contaminated water and by cannibalism

- **Effect on host :**

➢Reduced feed intake,reduced growth,soft shells and black gills

➢ Lethargy and mortality.If untreated losses upto 50 to 99 %

➢Elevated salinity(30-38 ppt) and elevated temperature(30-35 C)- factors associated with disease outbreak

- **Biology and epizootiology :**

➢ First observed in Texas shrimp farm during 1985

➢ Principal lesion- inflammation and necrosis (TNHPS)

- **Gross signs :**

  - Large cytoplasmic masses of basophilic bacteria in HP
  - HP is necrotic,non-functional and having granulomatous lesions
  - Empty gut and pale-white colouration of atrophied HP
  - Secondary invasion


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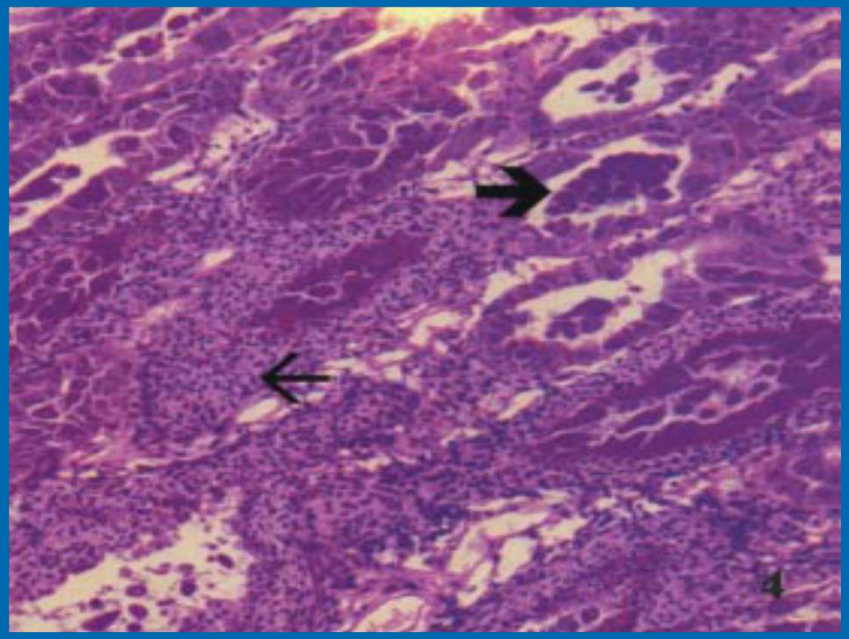
Healthy shrimp
Shrimp HPs
NHP-infected shrimp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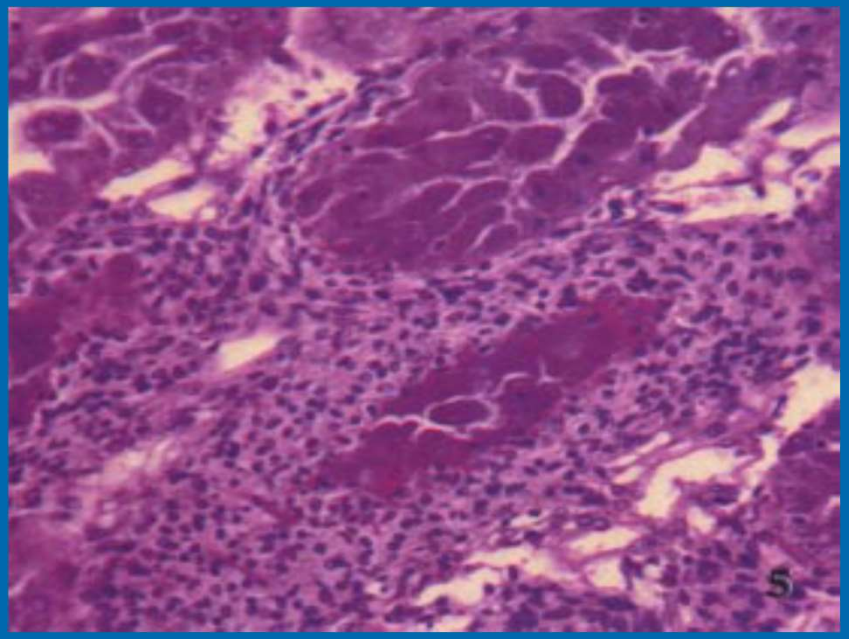
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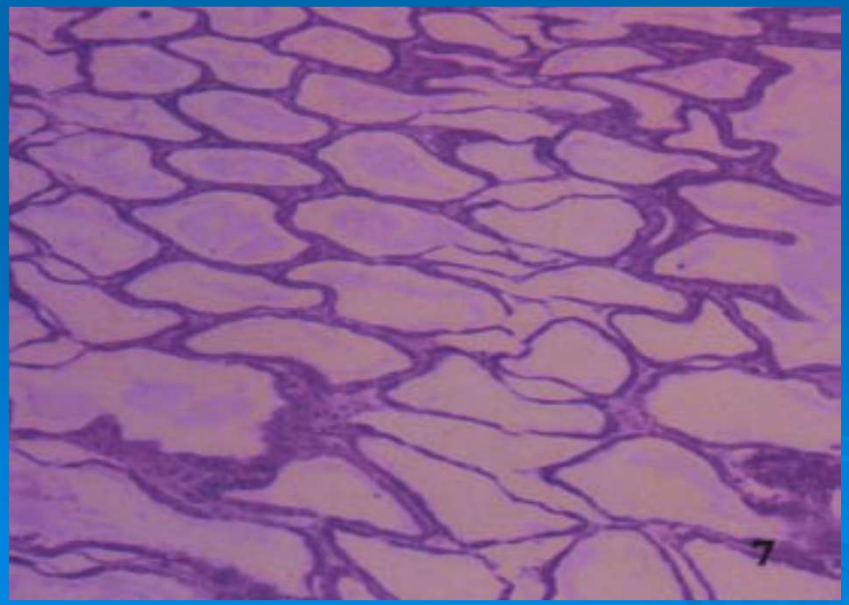
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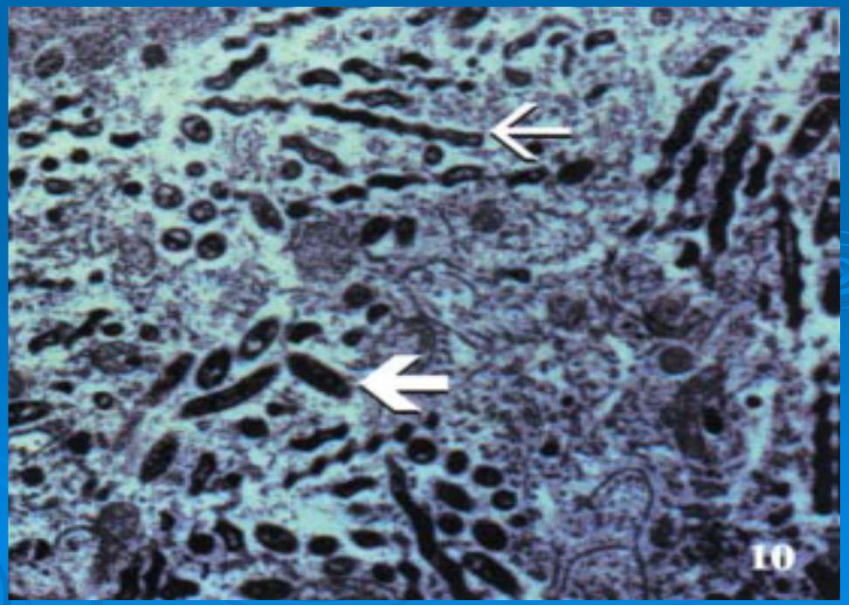
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- **Method of diagnosis :** 3 methods
  - Routine histological analysis
  - Insitu Hybridisation(ISH) with NHP-specific gene probes
  - PCR using NHP-specific oligonucleotide primers

- **Prevention :** Avoid high temperature and elevated salinity

- **Treatment :**
  - OTC at 0.5 to 2 kg per 1000 kg of feed
  - Metaphalatic therapy- effective treatment scheme

- **Present status of NHP :**

  - NHPB - unculturable through invitro methods
  - Method for continuous development of NHPB in SPF stock of L.vannamei recently developed by GCRL
  - Dr.Donald V.Lightner and Farming Intelligene Tech Corporation developed – IQ 2000 NHPB Detection and Prevention system
  - Adopted the Nested PCR and differentiate infected shrimps into 4 levels: severe,moderate,light and very light

MYCOBACTERIOSIS

- **Common name :** Mycobacterium infection of shrimp and shrimp tuberculosis
- **Species affected :** All penaeid species
- **Causative agent :** Gram(+)ve,rod shaped,acid fast bacteria **-** Mycobacterium marinum and M.fortuitum
- **Distribution :** Ubiquitous

- **Route of infection :**

  - Unknown.
  - Probably by ingestion or wound contamination

- **Effect on host :**

  - Abnormally dark pigmentation having multifocal melanised hemocytic nodules
  - Larger prominent melanised granulamatous lesions composed of multiple nodules

- **Biology and epizootiology :**
  - Infected shrimp creates a problem to marketing
  - Accidental infections of shrimp farm workers produce nodular skin lesions – difficult to treat
- **Gross signs :**
  - Lesions in lymphoid organ,heart,cuticle,loose connective tissues of muscle,HP,antennal gland,ovary and gills
  - These lesions containing cellular debris,acid fast bacterial rods surrounded by multiple concentric layers of flattened hemocytes

- **Method of diagnosis :**

  - **Gross observations -**

  - **Histology -**

Palely basophilic rod shaped bacteria with hemocytic nodules

  - **Smears -**

Impression smears with Zeihl-Neelsen stain

- **Prevention :**
  - Good husbandry practice
  - Avoid diseased fish
  - Use treated water
  - Destroy the diseased stock
- **Treatment :**
  - No known method of treatment

- **Present status of Mycobacteriosis :**

  - Mycobacterium sp – not reported in cultured Penaeids of indiaa,reported only in captive M.rosenbergii
  - Wild adult P.vannamei – Panama and Ecuador
  - Cultured juvenile P.vannamei – Mississippi
  - Fish Mycobacteriosis as zoonosis – scientific report shows that 76 % associated with aquatic environment
  - Prolonged use of a combination of antimicrobials thought to be effective

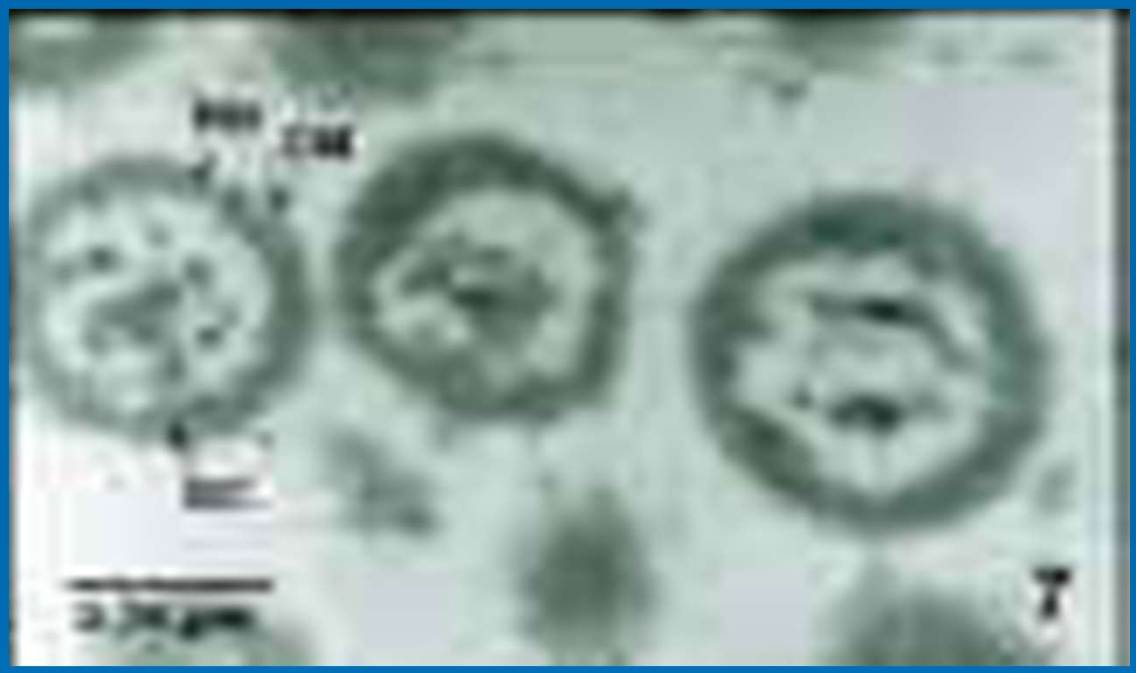
RICKETTSIAL INFECTION

- **Common name :** Rickettsial infection of Penaeid shrimp
- **Species affected :** P.monodon,P.marginatus,P.merguiensis and P.stylirostris
- **Causative agent :**

➢ Rickettsia or Rickettsia like microorganisms with a size range of 0.2 to 0.7 x 0.8 to 1.6 micron

➢ Order – Rickettsiales

➢ Family – Rickettsiaceae



- **Distribution :**
  - Wild caught juveniles of P.marginatus – Hawaii
  - Cage cultured P.monodon- Singapore,Malaysia and Indonesia
- **Route of transmission :** Horizontal
- **Effect on host :**
  - Host target cells- Hepatopancreatic epithelium in P.merguiensis and P.marginatus
  - Impaired function of HP

- Impaired digestion and absorption
- In P.monodon fixed phagocytes,connective tissue cells,antennal gland and Y- organ are affected
- Inflammatory lesions and intravascular aggregations of hemocytes in gills
- Slow growth rate and eventual death

• Biology and epizootiology :

- P.marginatus – natural reservoir of Rickettsia
- Rickettsia of P.marginatus cause high mortality disease syndrome in juvenile P.stylirostris

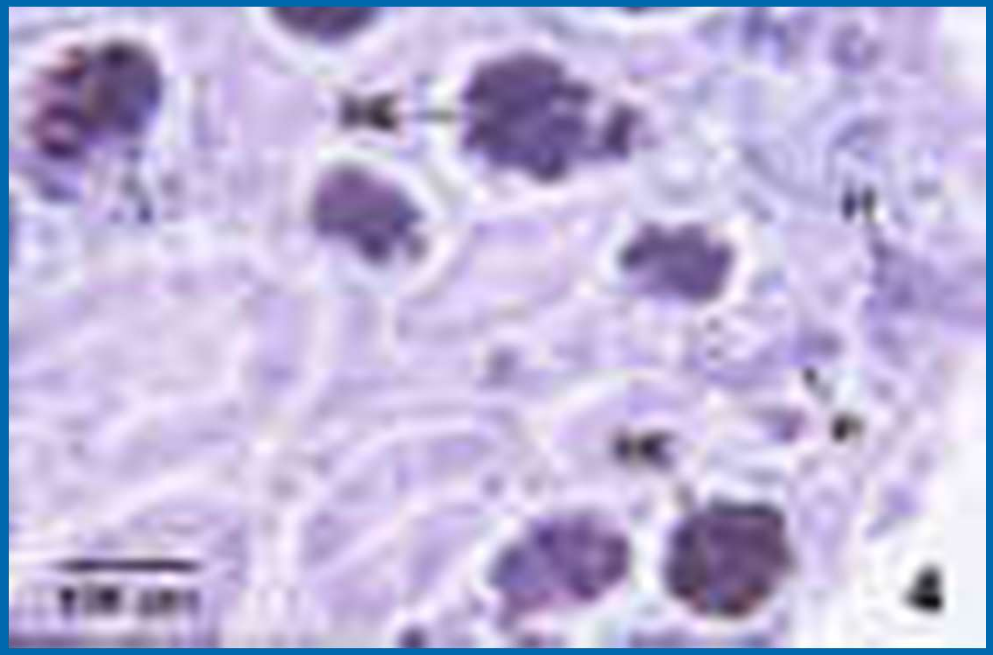
- **Gross signs :**

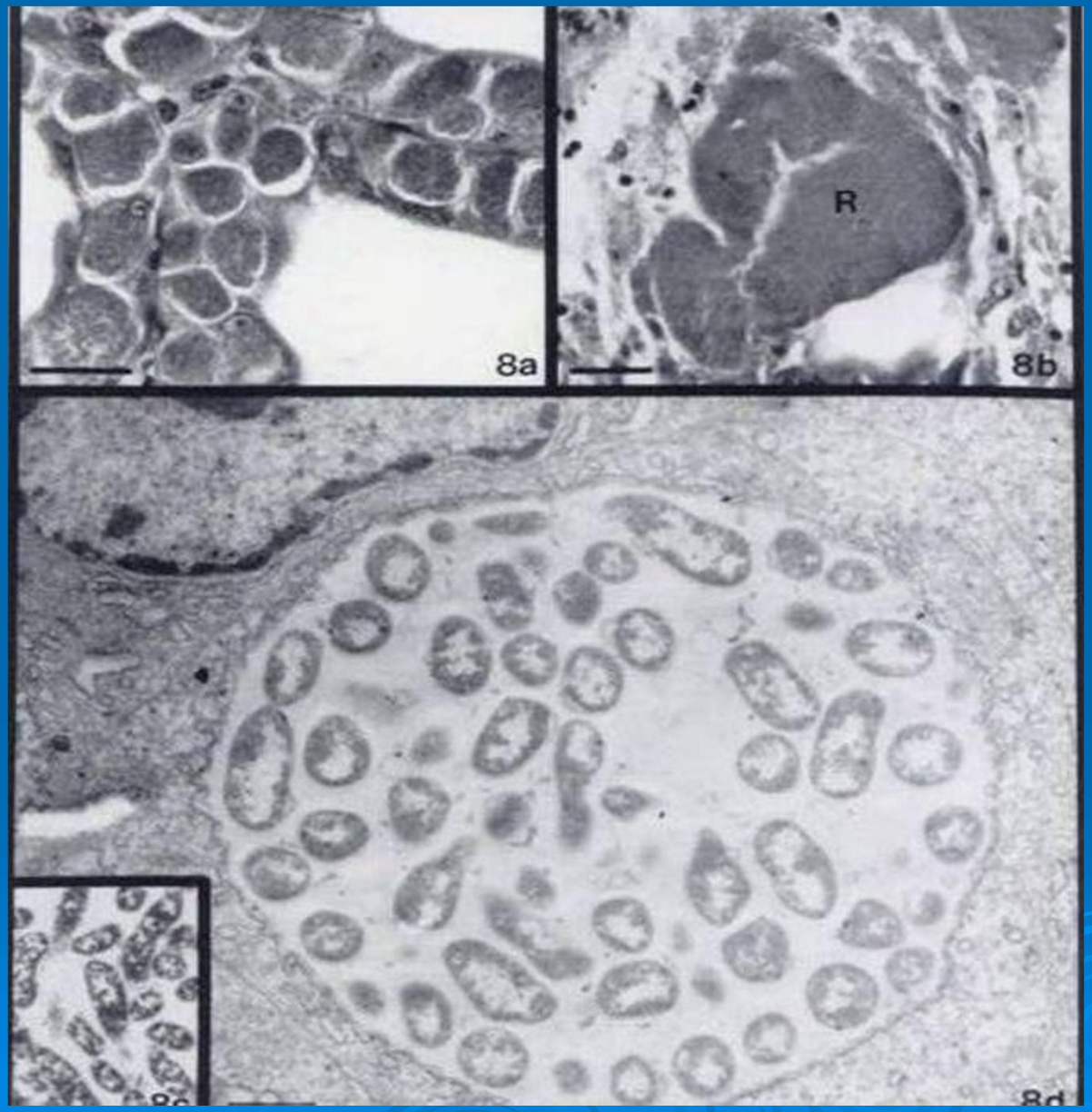
➢ **Hepatopancreatic infection –** Heavily infected shrimp

- Lethargic
- Off -feed
- Atrophy and pale colouration of HP

➢ **Systemic infection**

- Congregated in shallow pond edges
- Brown discoloured gills
- Opaque abdominal muscle
- Mushy texture of HP

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- **Method of diagnosis :**

➢ Histologic demonstration

- Large granular, rickettsia- filled cytoplasmic vacuoles

- Microcolonies size – 5 to 50 microns

- Stained basophilic

- Fuelgen (+)

- Gram (-)

- **Prevention :**
  - Quarantine
  - Sreening of potential carriers
  - Destruction of infected stock
  - Disinfection
- **Treatment :**
  - None reported
  - Tetracycline

CONCLUSION

- G(-) bacteria causes epizootics
- Concentration of farming activities and release of untreated effluents into water source
- Poor pond management avoided by improved practices
- Therapeutants approved by FDA is limited
- Replacement of antibiotics by probiotics is needed

THANK YOU