

SPIROCHAETES

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SPIROCHAETES

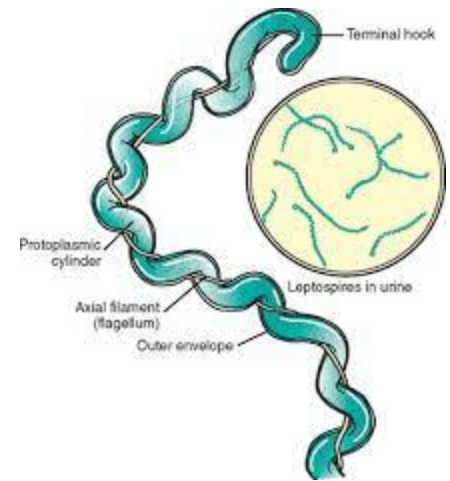
- The order Spirochaetales : Five families

Leptospiraceae

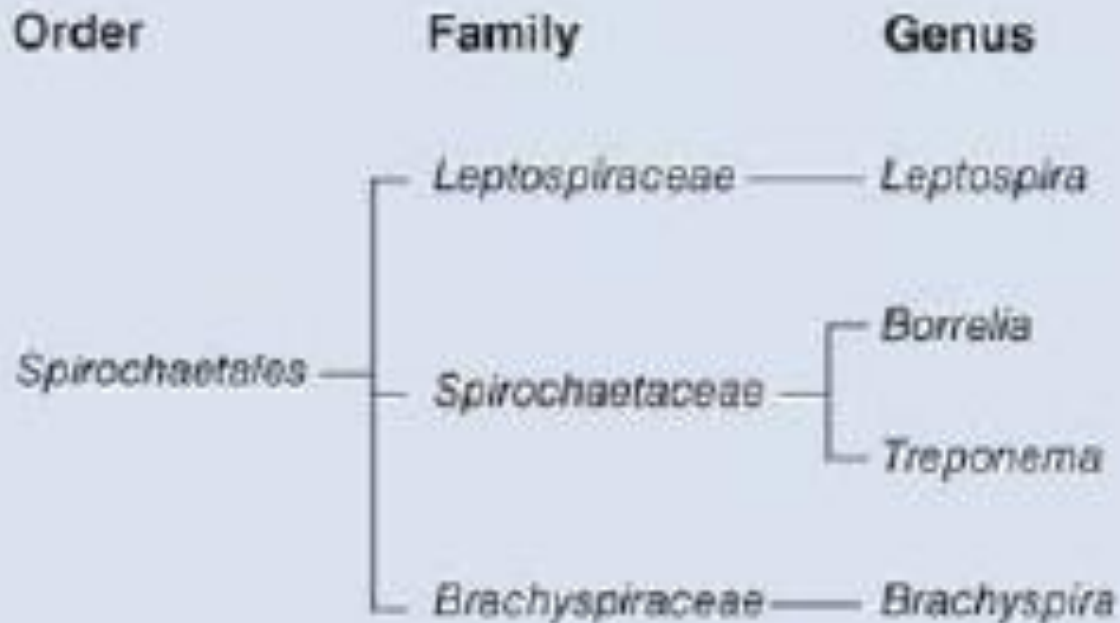
Spirochaetaceae

Brachyspiraceae

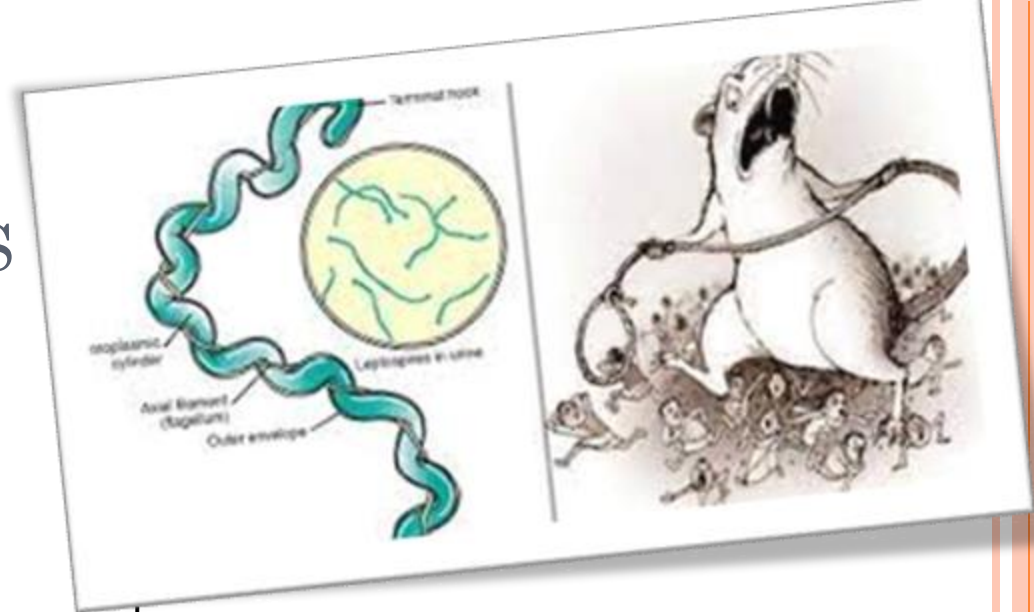
- Spiral or Helical bacteria
- Motile by means of endoflagella located within periplasm
- The genus **Leptospira**, **Borrelia**, **Brachyspira**, and **Treponema** contain human and animal pathogen
- Some grow only in liquid media (Korthof broth and Stuarts broth) and most require specialised media for growth
- Many produce zoonotic infections



CLASSIFICATION OF SPIROCHAETES OF VETERINARY IMPORTANCE



LEPTOSPIRA SPECIES



- Lepto means fine and spira means coils
- Leptospire are motile helical bacteria with hook shaped ends
- They have two circular chromosomes
- They are Gram negative, but do not stain well with bacteriological dyes
- microaerophilic
- They are visualized by Dark field microscopy
- Silver impregnation and immunological staining technique used to demonstrate leptospire in tissues.
- Leptospire can affect all domestic animals and humans
- Infection ranges from mild infections of the urinary and genital systems to serious systemic diseases.
- Labile in the environment and sensitive to desiccation



LEPTOSPIRA CONTD.

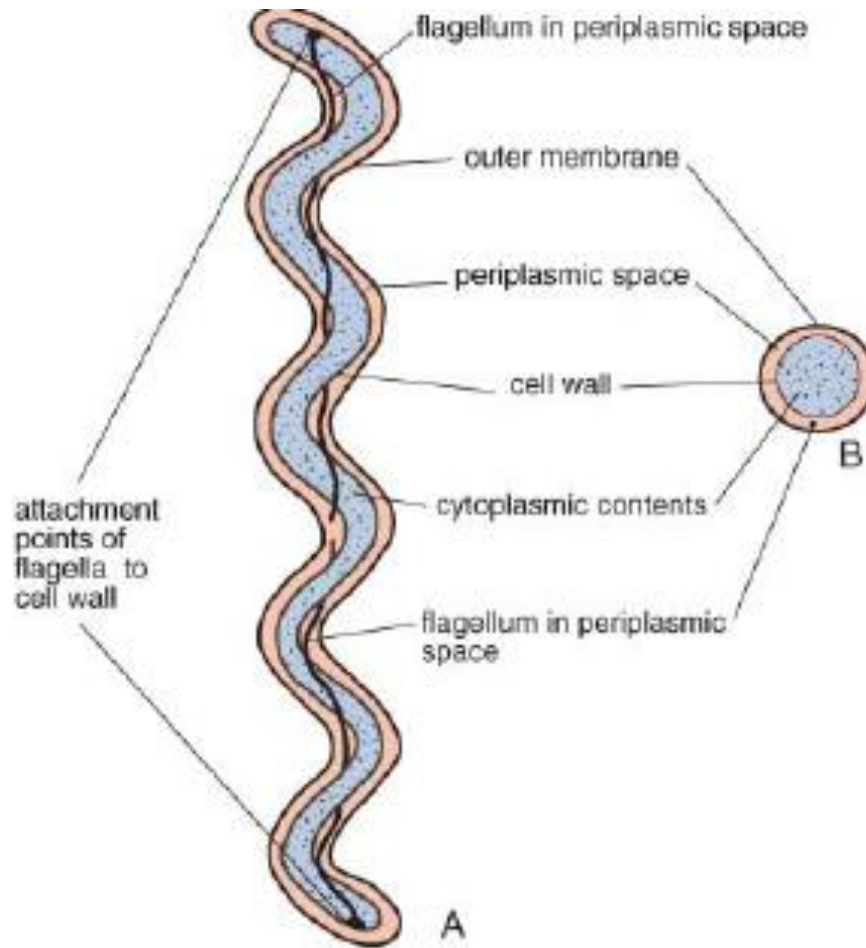
- Found in aquatic environments
- Produce systemic infections in many species
- The organism responsible for Weil's disease in human being
- Shed in urine of affected species
- Cultured in liquid media aerobically at 30°C
- Darkfield microscopy, Silver staining, Immunofluorescence and molecular techniques used for recognition.



- The organism are thin spiral and slender in size
- One or both ends hooked thus it have S or ? Shape
- It possess an axial filament or endoflagella
- Motility is referred as serpentine / boring/ undulating motility
- The media should be supplemented with 20% rabbit serum
- pH of medium 7.3-7.4
- Temperature of incubation is 30°C
- Growth occur after 6-14 day
- We have to incubate the media for eight weeks before declaring negative
- The growth in liquid media called shot silk growth
- In semisolid media : a ring of growth seen just below the surface and is called Dinger's ring because it is microaerophilic



STRUCTURE OF SPIROCHAETES

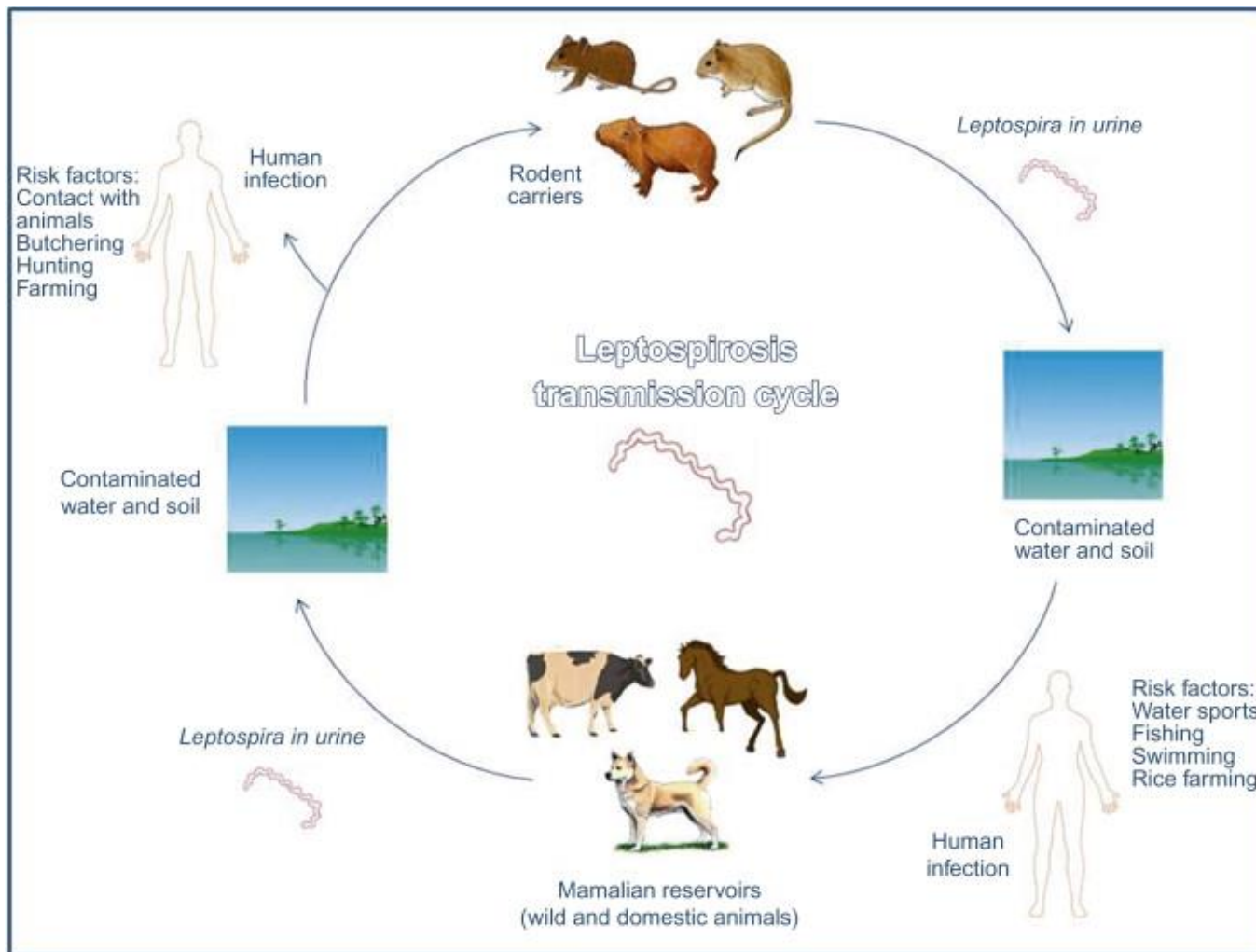


HABITAT

- Ponds, rivers, surface waters, moist soil and mud when environmental temperature is moderate
- Pathogenic leptospires can persist in the renal tubules and genital tract of carrier animals
- Indirect transmission occurs through exposure of susceptible animals to contaminated water sources, food or even bedding
- A suitable habitat for *Leptospira* is slow or stagnant water, resulting in outbreak during periods of flooding



LEPTOSPIROSIS TRANSMISSION CYCLE



LEPTOSPIRA SPECIES

- Formerly leptospire were differentiated by serological reactions
- There were two species
 - Leptospira interrogans* : containing pathogens
 - L. biflexa* : saprophytes
- Now the species of leptospira were classified by DNA homology and within each species various serovars are recognised by serological reactions
- Currently there are 20 leptospiral species:
- More than 250 pathogenic serovars in 24 serogroups
- Serovar Hardjo belongs to two species, *L. borgpetersenii* and *L. interrogans*.
- They share common surface antigen by these genetically distinct organism
- Serological classification remains clinically important because particular serovar tend to be associated with specific host animals and cross immunity between serovars is minimal



Serovar	hosts	Clinical conditions
<i>Leptospira borgpetersenii</i> serovar Hardjo	Cattle, Sheep	Abortion, still birth,agalactia
<i>Leptospira interrogans</i> Hardjo	Human	Infulenza like illness, occasionally liver and kidney disease
<i>Leptospira borgpetersenii</i> serovar Tarassovi	pigs	Reproductive failure, abortions and still birth
<i>Leptospira interrogans</i> serovar Bratislava	Pig, horses, dogs	Reproductive failure, abortion and still birth
<i>L. Interrogans</i> serovar Canicola	Dogs	Acute nephritis in pups. Chronic renal disease in adult animals
	pigs	Abortion, still birth and Renal disease I in young pigs

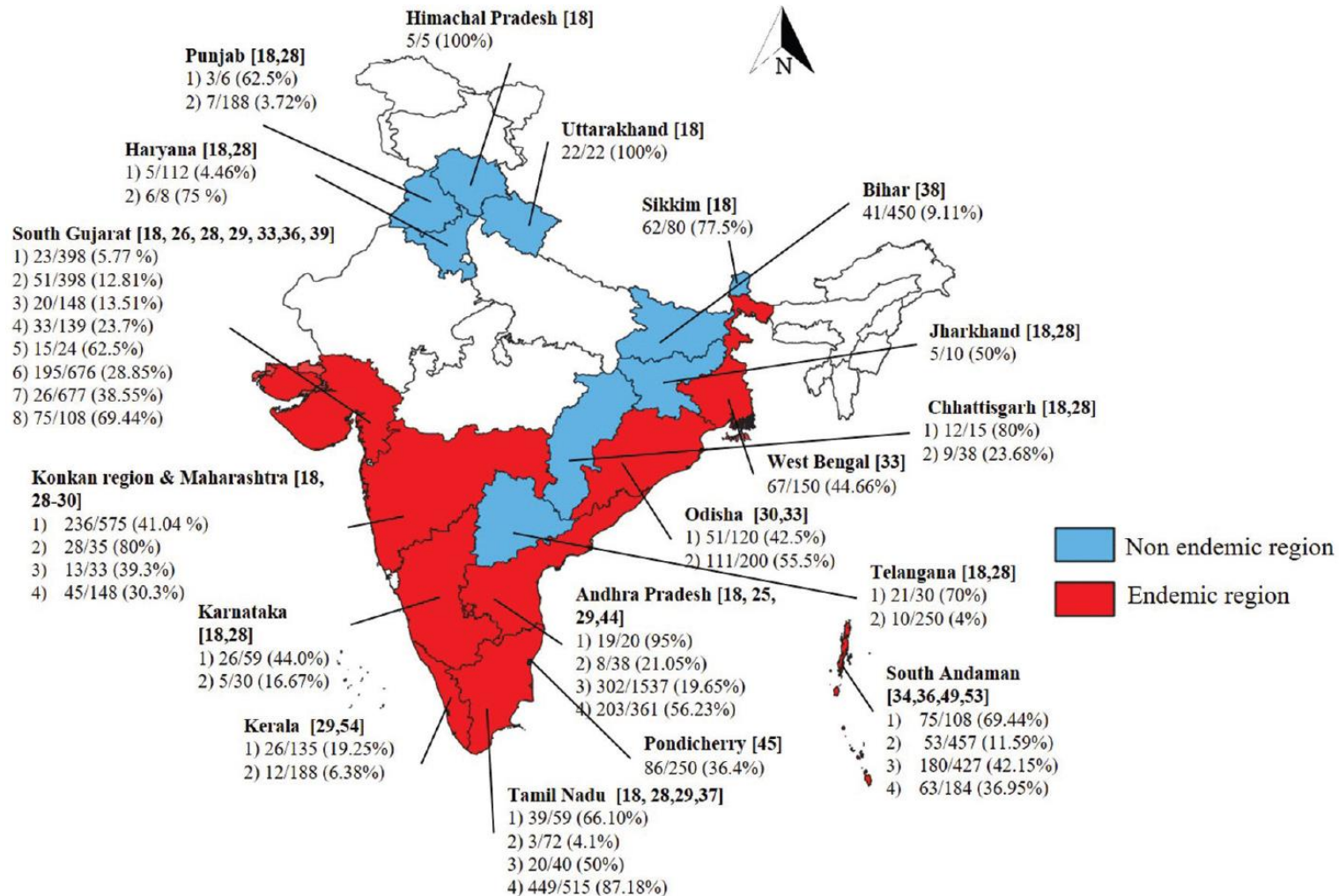
Serovar	Hosts	Clinical conditions
<i>L. Interrogans</i> serovar Grippotyphosa	Cattle, dogs, pigs	Septicaemic disease in young animals and abortion
<i>L. interrogans</i> serovar Icterohaemorrhagiae	Cattle, sheep, pigs	Acute septicaemic disease in calves, piglets and lambs, abortions
	Dogs and humans	Per acute haemorrhagic disease, acute hepatitis with jaundice
<i>L. interrogans</i> serovar Copenhageni	Domestic animals and humans	Per acute and acute disease ; abortion in animals
<i>L. Interrogans</i> serovar Pomona	Cattle, Sheep	Acute haemolytic disease in calves and lambs; abortions
	Pigs	Reproductive failure; septicaemia in pigs
	Horses	Abortions , periodic ophthalmia

EPIDEMIOLOGY

- Leptospire found world wide
- Some serovars appear to have limited geographical distribution
- Most serovars associated with a particular host species, their maintenance host
- Maintenance host readily acquire infection, usually cause mild or subclinical infection and often associated with prolonged excretion of leptospire in urine.
- MH is main source of contamination of the environment
- Incident host –low susceptibility to infection, develop severe disease and inefficient transmitters of leptospire to other animals
- *L. interrogans* shows prolonged survival in suitable habitats such as surface waters



EPIDEMIOLOGY IN INDIA



[Leptospirosis in Bikaner \(Rajasthan\). A case report - PubMed](#)

by RG Agarwal · 1971 — **Leptospirosis** in Bikaner (**Rajasthan**). A case report. J Assoc Physicians India. 1971 Jan;19(1):53-4. Authors. R G Agarwal, K D Gupta, T P Bharadwaj.

<https://www.youtube.com › watch> ⋮

[अब Leptospirosis ने बढ़ाई चिंता ! अब तक सामने आए 26 ... - YouTube](#)

4 days ago — #FirstIndiaNews #**Rajasthan** About this Video: Now **Leptospirosis** has increased the concern! 26 cases reported so far, 18 cases in Jaipur alone ...

<https://journals.sagepub.com › doi> ⋮

[Scrub typhus and leptospirosis in rural and urban settings of ...](#)

28-Nov-2019 — Scrub typhus and **leptospirosis** are bacterial zoonotic diseases reported from ... observational study during an outbreak in **Rajasthan**, India.

[Introduction](#) · [Material and methods](#) · [Results](#) · [Discussion](#)

https://www.researchgate.net › post › What_is_the_status_... ⋮

[What is the status of incidence of leptospirosis in India?](#)

05-Oct-2017 — In some states such as Madhya Pradesh , Chattisgarh , Jharkhand , Bihar , **Rajasthan** & most of states in N.E. India , except Assam , no published ...

<https://m.facebook.com › videos › अ...> · [Translate this page](#) ⋮

[अब Leptospirosis ने बढ़ाई चिंता ! अब तक सामने आए 26 केस, अकेले ...](#)

4 days ago — अब **Leptospirosis** ने बढ़ाई चिंता ! अब तक सामने ... First India News **Rajasthan** · 50 mins · [#FIINVideo](#) [#Leptospirosis](#)



SEROVARS OF VETERINARY IMPORTANCE IN LEPTOSPIRA

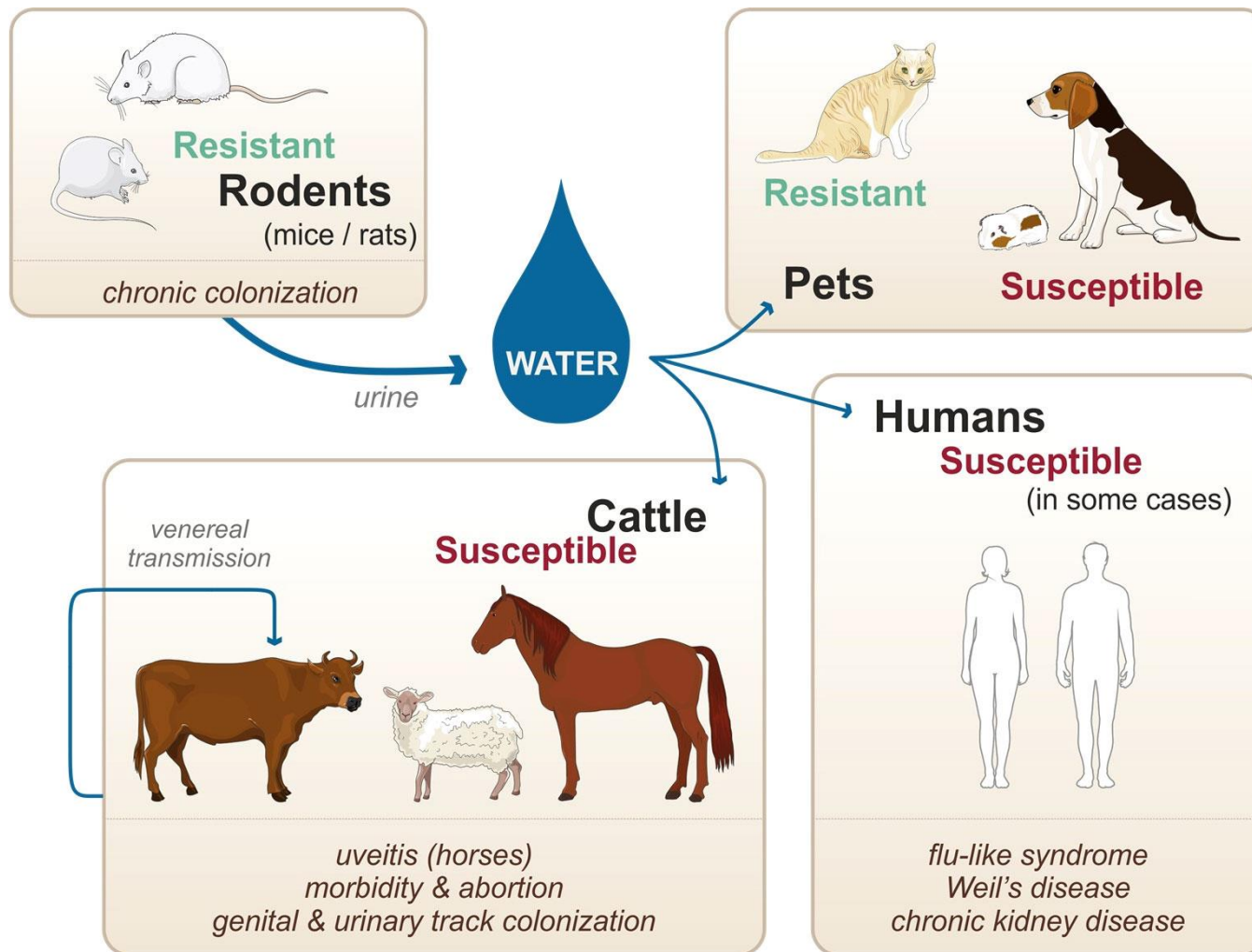
Serovar	Maintenance host	Incidental host
Bratislava	Pig, hedgehogs, horses	Dogs
Canicola	Dogs	Pigs, cattle
Grippotyphosa	Rodents	Cattle, pigs, horses, dogs
Hardjo	Cattle (sheep occasionally), deer	Humans
Icterohaemorrhagiae	Rats	Domestic animals
Pomona	Pigs, Cattle	Sheep, Horses, dogs



PATHOGENESIS AND PATHOGENICITY

- The pathogenicity depends upon **virulence of infecting serovar** and **susceptibility of host species**
- Disease may be severe in **immature maintenance host**, and serious disease occurs most commonly in **incidental hosts**
- Leptospire invade skin through moist , softened skin through mucous membrane, motility may aid tissue invasion
- They spread through body via blood stream , but following appearance of antibodies at about 10 days after infection, they are cleared from the circulation.





PATHOGENICITY

- The organism evade the immune response and persit in the body, principally in **the renal tubules, but also in the uterus, eye or meninges.**
- Toxic components are cell associated outer membrane proteins
- LPS is less endotoxic than other Gram negative bacteria
- Adherence to host cell surface through fibronectin binding protein
- Leptospire evade phagocytosis by inducing macrophage apoptosis
- The organism damage the cell membranes and endothelial cells along with hepato cellular injury produces haemolytic anaemia



DIAGNOSIS

- Diagnosis in maintenance host by screening of defined population by dark field microscopy or MAT
- Clinical signs along with a history suggestive of exposure to contaminated urine, suggest acute leptospirosis
- Organism can be detected in fresh urine by **darkfield microscopy**
- Leptospire may be isolated from blood in early days of infection and from urine approximately 2 weeks after initial infection
- Inoculation in liquid culture or by animal inoculation

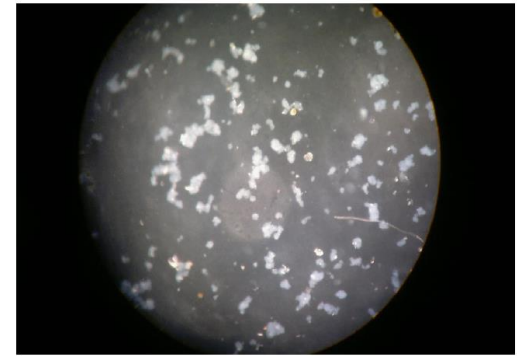
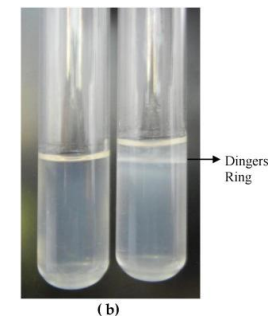
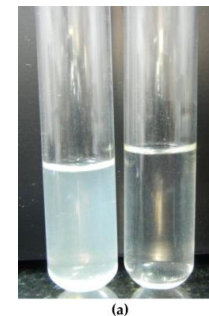
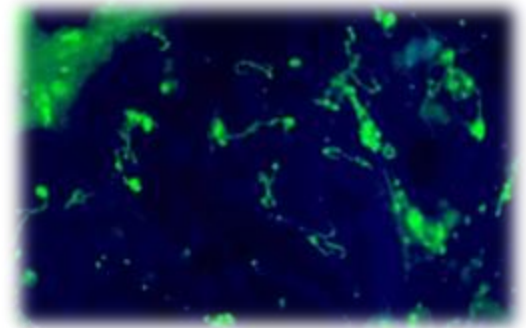


FIG. 4. A. Freshly voided urine from a patient with acute leptospirosis. B. Freshly voided urine from a patient with acute leptospirosis.



CONTD..

- Slow growing serovars such as Hardjo require 6 months in liquid media at 30° C.
- **EMJH** (Ellinghausen, McCullough, Johnson and Harris) medium, based on 1% bovine serum albumin and Tween 80.
- Tween provides long chain fatty acids as nutrients and albumin absorbs these compounds and release them slowly
- FAT for demonstration of leptospires in tissues such as kidney and liver
- Silver impregnation technique also used for demonstration of leptospires in tissues



- DNA hybridisation, PCR, Magnetic immunocapture PCR and immunomagnetic antigen capture system and Real time quantitative PCR
- The standard serological reference test is **microscopic agglutination test**
- Titres in excess of **1:400 or four fold rise in the titre of paired serum samples**
- Serological diagnosis of host adapted leptospirosis is difficult as titres will not develop
- serovar based ELISA



CLINICAL INFECTIONS CATTLE AND SHEEP

- Cattle, sheep and deer : maintenance host for *L. borgpetersenii* serovar Hardjo
- Cattle: *L. interrogans* serovar Hardjo
- These will not cause severe disease in cattle
- Infection with serovar Hardjo in sheep causes abortions and agalactia
- Infection with serovars pomona, Grippotyphosa and Icterohaemorrhagiae can cause serious disease in calves and lambs
- Infection usually accompanied by pyrexia, haemoglobinuria, (red water disease) jaundice and anorexia
- Extensive renal damage with resultant uraemia often precedes death.
- Vaccination is used for control of serovar Pomona which is important cause of bovine abortion in some countries.



LEPTOSPIROSIS IN HORSES



- Serovar **Bratislava** associated with abortion and still births in horses where horse is the maintenance host
- Clinical infection caused by incidental infection by Serovar **Pomona**
- Clinical signs include abortion in mares and renal disease in young horses
- **Equine recurrent uveitis (periodic ophthalmia, moon blindness)** is manifestation of chronic leptospirosis
- Cross reaction between leptospiral antigens and proteins from the cornea and lens suggest that autoimmune mechanism involved



LEPTOSPIROSIS IN PIGS

- Acute leptospirosis in pigs caused by rodent adapted serovars such as *Icterohaemorrhagiae* and *Copenhageni*
- These serovars sometime cause fatal infection in piglets
- Principal host adapted serovar is *Pomona* (Swine herd disease)
- Infection results in reproductive failure including abortion and still birth
- Pigs also serve as maintenance host for serovars *Tarassovi* and *Bratislava*



LEPTOSPIROSIS IN DOGS AND CATS



- Serovar **Canicola** and **Icterohaemorrhagiae** (Stuttgart's disease)
- **Grippotyphosa**, **Bratislava**, **Pomona** are emerging as important pathogen for dogs
- Hunting dogs are prone to infection
- Linked to season like heavy rain fall and late summer and early autumn
- Serovar Canicola cause renal disease in pups
- Animals that survive acute phase there will be chronic uremic syndrome
- Incidental canine infections caused by **Icterohaemorrhagiae**, Copenhageni, signs of renal involvement usually predominate



Signs of Leptospirosis in Dogs



CONTROL

- Vaccination
- As immunity is serovar specific, the vaccine should contain the prevalent serovars

