For Vet Professionals Only

INTAS ANIMAL HEALTH

Face2Vet
A Clinical Update

Wishing you a Happy New Year

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Bovine Theileriosis

Tick-Borne Trouble Needs Timely Veterinary Action

Dear Vets,

In India, animal husbandry constitutes a key pillar of rural economy and serves as a major source of livelihood and income for many households. Hemoprotozoan diseases represent a major constraint to livestock productivity, as they are associated with high morbidity, mortality and significantly impact bovine health, reproduction and milk production. These diseases are caused by blood-borne protozoan parasites that invade and proliferate within erythrocytes, lymphocytes and other hematopoietic cells leading to widespread systemic pathology and clinical illness in affected animals. The most prevalent hemoprotozoan diseases affecting bovine in India include theileriosis, babesiosis, trypanosomiasis and anaplasmosis, each associated with distinct epidemiology, vector dynamics and clinical outcomes.

Bovine theileriosis is a major tick-borne hemoprotozoan disease primarily caused by *Theileria annulata*, the etiological agent of tropical theileriosis and transmitted through ixodid tick *Hyalomma*. The disease is widely prevalent across diverse agro-climatic regions of India and is recognised as one of the most economically significant parasitic diseases of bovines.

This issue of Face2Vet focuses on bovine theileriosis, a significant hemoprotozoan disease affecting Indian dairy animals. The aim of this issue is to provide comprehensive and structured insights into disease, strengthen understanding of its clinical and diagnostic aspects. Highlight effective treatment, prevention and control strategies.

We invite you to read this issue and share your valuable feedback/thoughts by scanning the below QR code or reaching us *via* email at face2vet@intaspharma.com.

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Introduction

Theileriosis is a widely prevalent protozoan parasitic disease affecting bovine in India. Breedspecific susceptibility plays a crucial role in epidemiology and clinical outcomes of disease. The expansion of India's dairy industry, particularly through extensive adoption of high-producing crossbred cattle breeds including Holstein-Friesian and Jersey, has played a pivotal role in enhancing national milk production. However, these breeds exhibit limited innate resistance to tick infestation and pathogenic effects of *Theileria annulata*. Consequently, they frequently develop acute and severe disease manifestations with high case fatality rates in absence of early therapeutic intervention. In contrast, indigenous *Bos indicus* breeds exhibit superior innate defense mechanisms and stronger immunological resilience, which generally result in milder clinical manifestations or subclinical infections.

The extent and persistence of theileriosis in India are strongly influenced by climatic and ecological factors favoring *Hyalomma* tick proliferation. Warm and humid climatic conditions, poor pasture management, inadequate farm level biosecurity and expansion of organized dairy farming systems collectively favour transmission of disease. Seasonal peaks occur predominantly during late summer, monsoon and post-monsoon periods. Overall, tropical theileriosis continues to be a high-priority disease within India's livestock sector due to its economic, epidemiological and productivity-related impact. To mitigate its persistent and evolving burden on national dairy industry, a multi-dimensional approach is imperative.

Etiology

Bovine theileriosis is caused by protozoan parasites of the genus Theileria, which belong to phylum *Apicomplexa* and order *Piroplasmida*. At least 15 species of Theileria are known to infect domestic ruminants. Among these, *Theileria annulata* (the causative agent of tropical theileriosis) and *T. parva* (responsible for East Coast Fever) are the most pathogenic in cattle. Other species reported in bovine include *T. velifera, T. taurotragi, T. mutans, T. buffeli* and *T. orientalis*.

T. orientalis complex is associated with a condition known as Theileria associated bovine anemia (TABA) or oriental theileriosis. This complex includes at least 11 genotypes (types 1–8 and N1–N3). Among these, Chitose (type 1), Ikeda (type 2) and Buffeli (type 3) are most extensively studied. Recent outbreaks of oriental theileriosis have been predominantly linked to Ikeda (type 2) genotype.

Theileria orientalis has been increasingly reported across various Indian states, with molecular studies confirming its presence in both cattle and buffalo populations. In Uttar Pradesh (2023), a novel genotype of *T. orientalis* was identified in buffalo calves, marking the first clinical outbreak in Indian buffaloes attributed to this new strain. In Kerala (2015 and 2024), fatal infections in water buffaloes were linked to N2 genotype, while subsequent molecular studies detected pathogenic Ikeda and Chitose genotypes in *Rhipicephalus annulatus* ticks, highlighting role of tick vectors in transmission. Karnataka (2024) reported outbreaks in both crossbred and indigenous cattle, with multiple genotypes-including pathogenic genotype 7 and Chitose B-demonstrating high genetic diversity among isolates. In Assam (2023), molecular characterization confirmed the presence of pathogenic Chitose strain in crossbred cattle. Earlier, Himachal Pradesh (2017) experienced an outbreak in a Holstein-Friesian breeding farm, where 93.3% of blood samples tested positive for *T. orientalis*. More recently, Mizoram (2024) reported molecular detection of *T. orientalis* in slaughtered bovine, indicating the parasite's spread into northeastern regions of India.

Prevalence of Theileriosis in India

Prevalence of bovine theileriosis was observed to be highest in Central zone (24%) and lowest in Eastern zone (15%). These regional differences may be attributed to variations in agro-climatic conditions, animal rearing systems, management and husbandry practices as well as the predominant cattle and buffalo breeds maintained within each geographical area. The zone-wise and state-wise theileriosis prevalence in India is presented in Fig. 1.

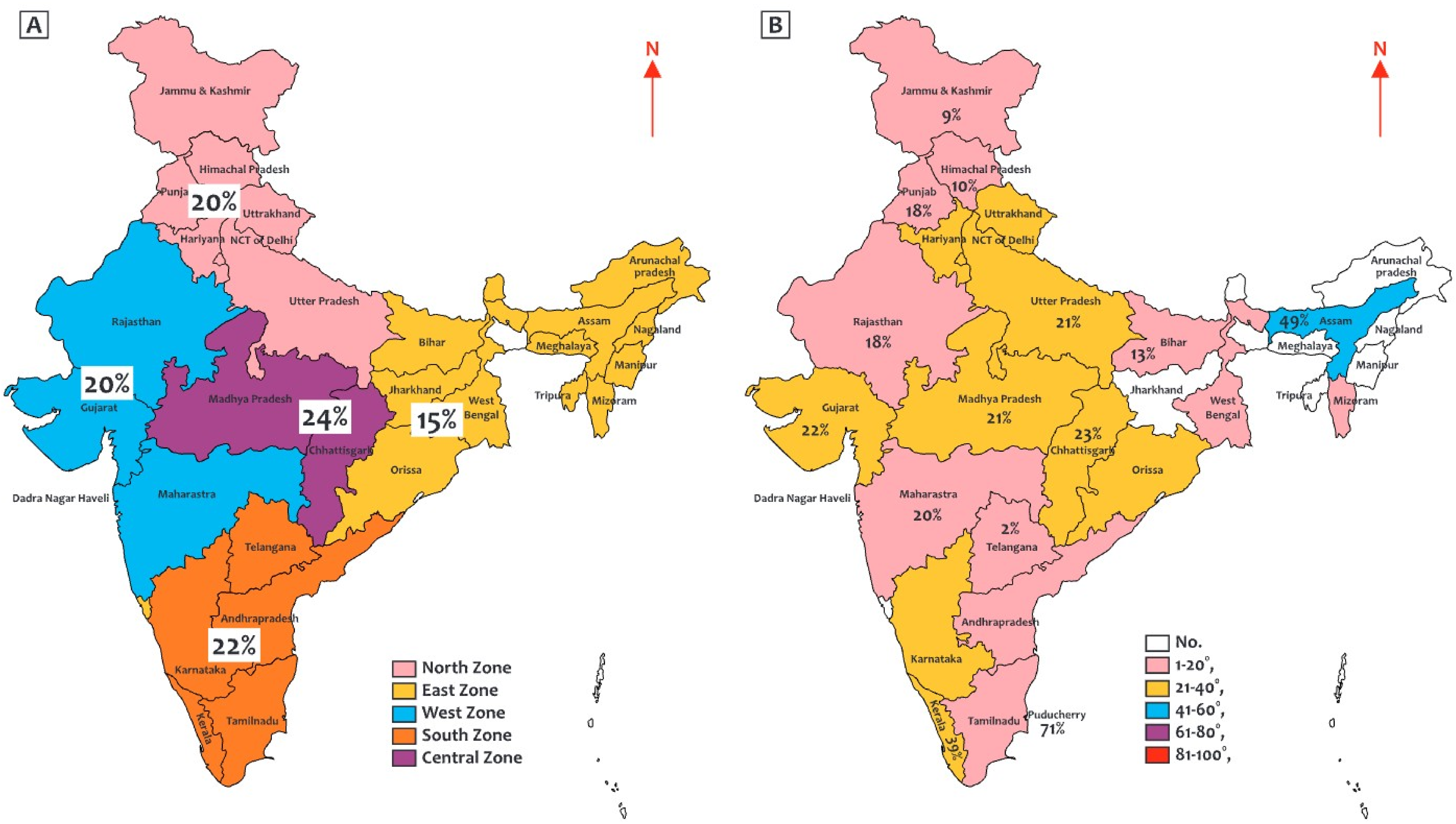

Fig. 1: Zone-wise (A) and State Wise (B) Prevalence of Theileriosis in India
(Source: Krishnamoorthy *et al.*, 2021)

Prevalence of bovine theileriosis in India exhibits marked regional heterogeneity. The highest prevalence rates have been reported from Puducherry (71%), followed by Assam (49%), Haryana (39%), Kerala (39%), Odisha (31%), Karnataka (26%), Chhattisgarh (23%), Uttarakhand (23%), Gujarat (22%), Uttar Pradesh (21%), Maharashtra (20%), Tamil Nadu (20%), Rajasthan (18%), Madhya Pradesh (21%) and Punjab (18%). Lower prevalence levels were noted in Bihar (13%), Mizoram (11%), Himachal Pradesh (10%), Jammu & Kashmir (9%), Andhra Pradesh (8%), West Bengal (7%), with the lowest in Telangana (2%).

The host-wise assessment indicated a higher prevalence in cattle (22%) than in buffaloes (14%). This variation may be attributed to predominance of epidemiological investigations conducted in cattle, their recognised role as primary host for *Theileria annulata* and likelihood that buffaloes may serve as subclinical carriers due to relatively lower tick infestation, stronger innate resistance or greater adaptation to local agro-climatic conditions.

Theileria- Its Biology and Transmission

Theileria species were first identified by Dr. Arnold Theiler. These protozoan parasites enter host cells using specialised structures called rhoptries, which are part of apical complex. Theileria infects both leukocytes (white blood cells) and erythrocytes (red blood cells). Transmission occurs through ixodid ticks which act as biological vectors. Primary mode of transmission is transstadial, meaning the parasite survives through tick's life stages. Transovarial transmission (from adult tick to eggs) does not occur.

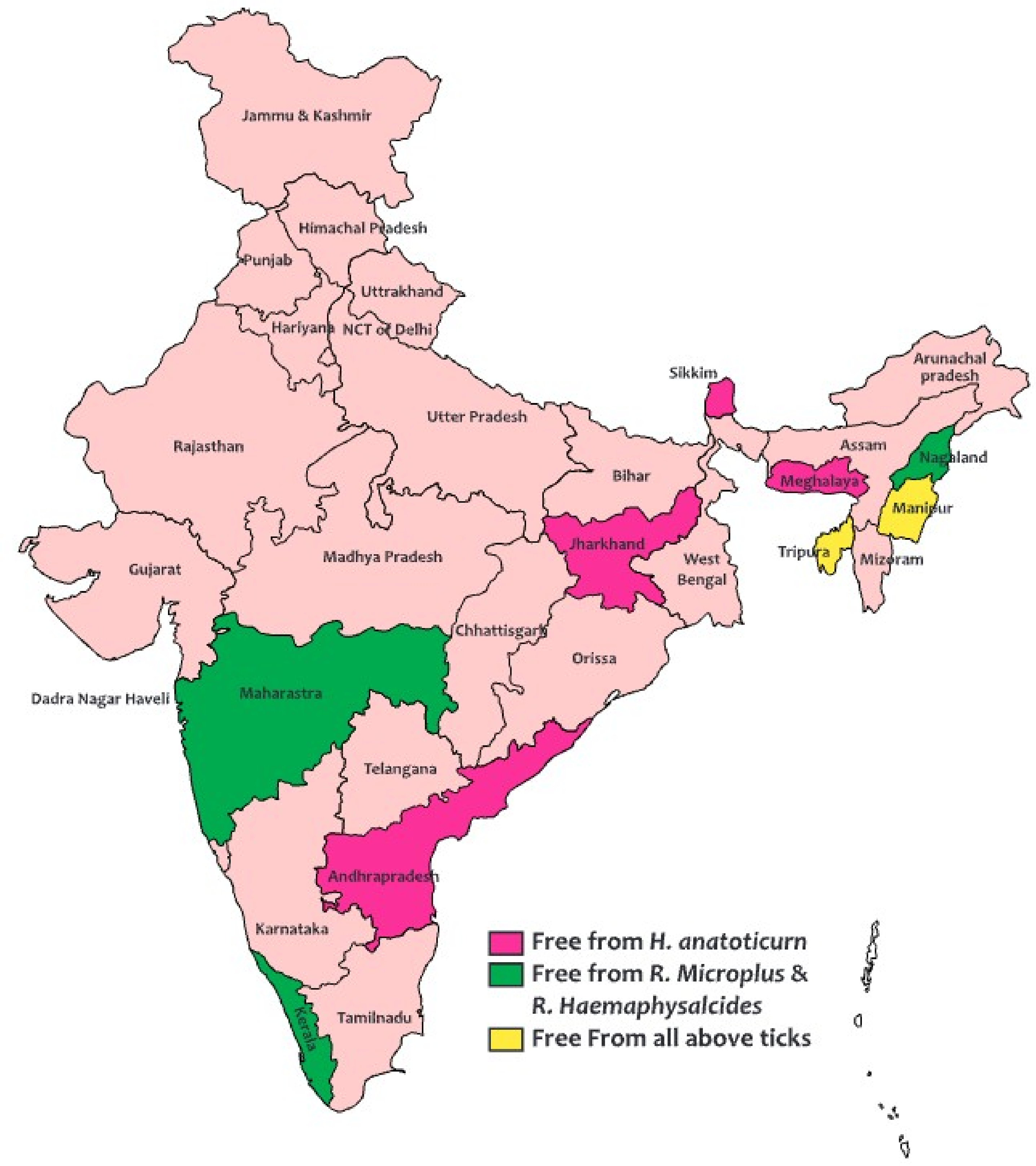

Fig. 2: Distribution of Theileria ticks across India
(Source: Ram *et al.*, 2025)

Several tick genera are involved in spreading Theileria:

- Rhipicephalus transmits *T. parva, T. taurotragi, T. ovis and T. lestoquardi*
- Hyalomma transmits *T. annulata, T. lestoquardi and T. separata*
- Haemaphysalis transmits *T. orientalis, T. uilenbergi and T. luwenshuni*
- Amblyomma transmits *T. mutans and T. velifera*

In India, three-host tick *Hyalomma anatolicum* is the main vector responsible for transmission of tropical theileriosis. The distribution of major theileria transmitting tick species across different Indian states is shown in Fig. 2.

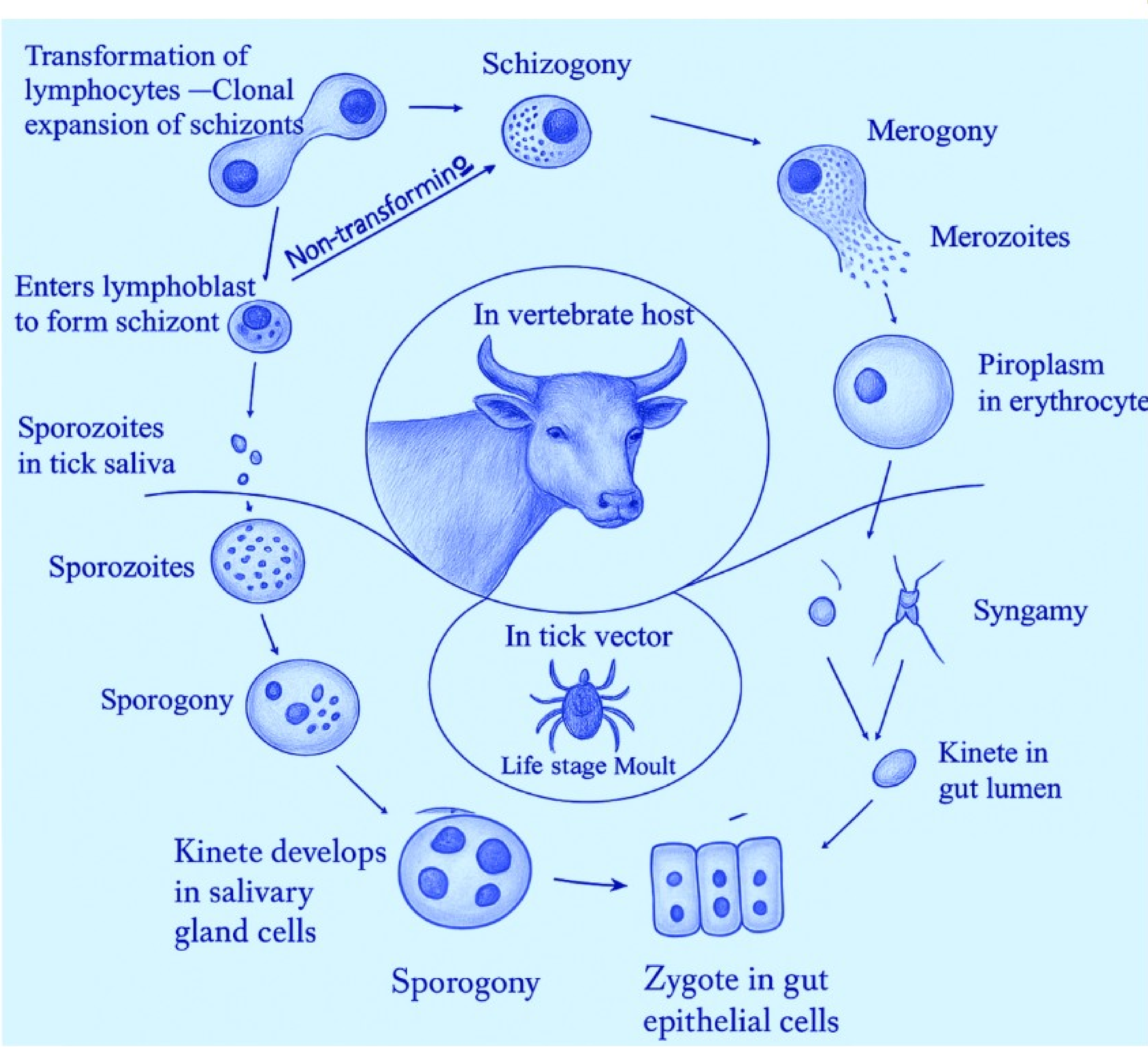

Fig. 3: Lifecycle of *Theileria* spp.
(Source: Mans *et al.*, 2015)

Life Cycle

Life cycle of *Theileria annulata* is complex (Fig. 3), involving both bovine hosts and Ixodid ticks, mainly species of the genus Hyalomma. Infection begins when an infected tick introduces sporozoites into bovine host during blood feeding. These sporozoites quickly invade lymphocytes and monocytes where they develop into schizonts. Schizont stage undergoes clonal expansion and later differentiates into merozoites, which are released and invade erythrocytes, forming piroplasms — the stage most closely associated with clinical symptoms of disease.

When ticks feed on infected animal, they ingest erythrocytes containing piroplasms. Inside tick's gut, the parasites undergo gametogenesis and sexual reproduction, forming motile kinetes. These kinetes migrate to tick's salivary glands, where they develop into infective sporozoites. The cycle continues when tick, in its next feeding stage transmits these sporozoites to a new susceptible host.

Pathogenesis

Life cycle of theileriosis begins when ticks transmit Theileria sporozoites into host during blood feeding. These sporozoites invade lymphocytes and monocytes primarily in regional lymph nodes where they differentiate into schizonts. This stage triggers cellular transformation, characterized by uncontrolled proliferation of infected leukocytes and inhibition of apoptosis. The result is marked lymphadenopathy due to excessive multiplication of parasitized immune cells and associated inflammation. Additionally, pro-inflammatory cytokines such as TNF-α, IL-1 and IL-6 contribute to fever and tissue damage. Immunosuppression caused by progressive immune dysfunction increases animal's susceptibility to secondary infections.

As schizonts mature, they produce merozoites that invade red blood cells and develop into piroplasms leading to intravascular and immune-mediated haemolysis. This destruction of erythrocytes results in anemia, jaundice and general weakness. Clinically, affected animals exhibit high fever, enlarged superficial lymph nodes, pale mucous membranes, icterus, reduced milk production, anorexia and respiratory distress.

Tick bite (Host: Bovine)

↓

Transmission of sporozoites during blood feeding

↓

Entry of sporozoites into lymphocytes and monocytes (WBCs)

↓

Development of schizonts in regional lymph nodes

↓

Schizonts induce rapid multiplication of infected WBCs and inhibition of apoptosis

↓

Lymphoid hyperplasia and local inflammation result in swelling of superficial lymph nodes (pre-scapular, pre-femoral)

↓

Release of cytokines (TNF-α, IL-1 and IL-6) leads to fever and tissue damage

↓

Immunosuppression results in increased susceptibility to secondary infections

↓

Merozoite formation and release into blood

↓

Development of piroplasm stage in RBCs

↓

Damage to RBCs and immune-mediated haemolysis, leads to anaemia and jaundice

↓

Clinical Theileriosis (Fever, lymphadenopathy, dyspnoea and weight loss)

Clinical Signs

- Clinical manifestations of bovine theileriosis typically develop 7–15 days post-infestation following blood-feeding by ticks.
- Acute pyrexia is the earliest clinical sign and rectal temperatures often reach up to 41.0°C or more.
- Fever is accompanied by anorexia, dullness, weakness, reduced feed intake and marked decline in milk production often observed in 50–70% of cases.
- In theileriosis, parasite causes abnormal multiplication of animal's lymphocytes and induces inflammation within lymph nodes leading to noticeable swelling, especially in prescapular and prefemoral lymph nodes Fig. 4 (A).
- Initially, affected lymph nodes are warm, enlarged and painful on palpation but as disease progresses, they become firm and non-painful due to lymphoid hyperplasia and proliferation of parasitised cells.
- Progressive hemolytic anemia causes marked hematological and systemic alterations.
- Clinically, affected animals exhibit pale to icteric mucous membranes, dehydration, sunken eyes, ocular discharge and corneal opacity Fig. 4 (B).
- Compromised respiratory and cardiovascular systems lead to dyspnoea, persistent tachycardia, laboured breathing and serous to mucopurulent nasal discharge.
- In advanced cases, pulmonary involvement is a common manifestation associated with severe respiratory distress. During the schizont stage of infection, *T. annulata* or *T. parva* invade and transform bovine lymphocytes, inducing uncontrolled proliferation followed by cellular lysis. The disintegration of these parasitized lymphocytes leads to release of vasoactive substances such as histamine, serotonin and prostaglandins, along with pro-inflammatory cytokines including TNF-α, IL-1 and IL-6. These mediators exert a direct injurious effect on pulmonary vascular endothelium, resulting in increased capillary permeability. Consequently, exudation of plasma and proteins into alveolar and interstitial spaces leads to pulmonary oedema. Clinically, affected animals exhibit nasal discharge, coughing, dyspnoea and severe respiratory distress, reflecting compromised pulmonary function. This condition is generally regarded as a grave prognostic indicator.

Fig. 4. (A) Enlargement of Prescapular Lymph Node
(Source: Madkour *et al.*, 2023)

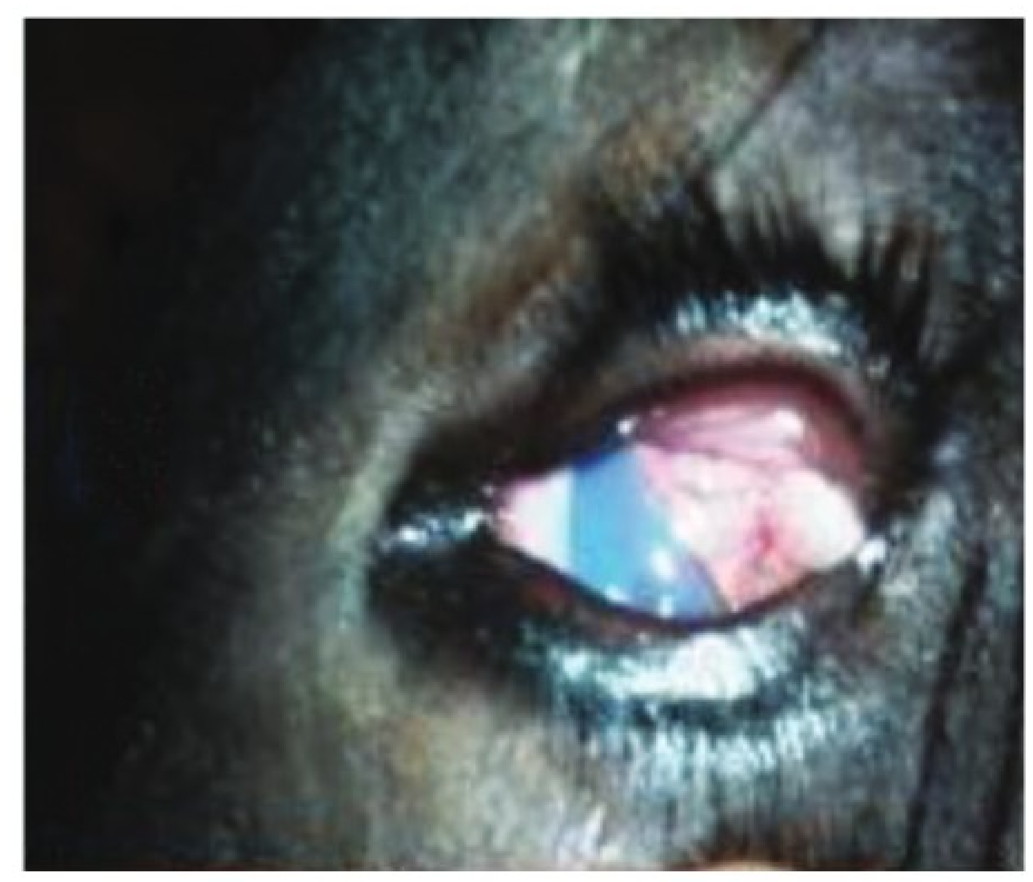

Fig. 4. (B) Corneal Opacity in Infected Animal
(Source: Madkour *et al.*, 2023)

- Bovine theileriosis can also cause digestive and metabolic disturbances where affected animals may develop diarrhea or constipation, loss of body weight and decreased rumen motility which can lead to ruminal atony.
- In some rare cases, parasite may affect the brain, a condition known as cerebral theileriosis where affected animals exhibit ataxia, circling, aimless walking, head pressing, changes in behaviour (aggression or depression), nystagmus, muscle tremors, convulsions and eventual coma. Once nervous signs appear the chances of recovery are very poor.
- Reproductive health is often compromised in affected animals, with temporary infertility, anestrus and embryonic death being observed.
- High fever and systemic illness can lead to abortion in pregnant animals.
- Breeding bulls may show reduced libido and poor semen quality which negatively impacts fertility.

Diagnosis

A. Clinical diagnosis

Clinical diagnosis relies on assessing tick exposure, typical clinical signs and physical findings in affected animals.

B. Confirmative diagnosis

Microscopic examination

Microscopic examination remains a fundamental and widely used approach for confirming bovine theileriosis, particularly in field and laboratory settings with limited access to advanced molecular diagnostics. Lymph node aspiration smears (preferably from prescapular or prefemoral nodes) stained with Giemsa are highly useful during the early schizont stage of infection, typically revealing large, intracytoplasmic schizonts (**"Koch's blue bodies"**) within lymphocytes and macrophages. Giemsa-stained thin blood smears prepared from blood demonstrate intraerythrocytic piroplasm's (Fig. 5).

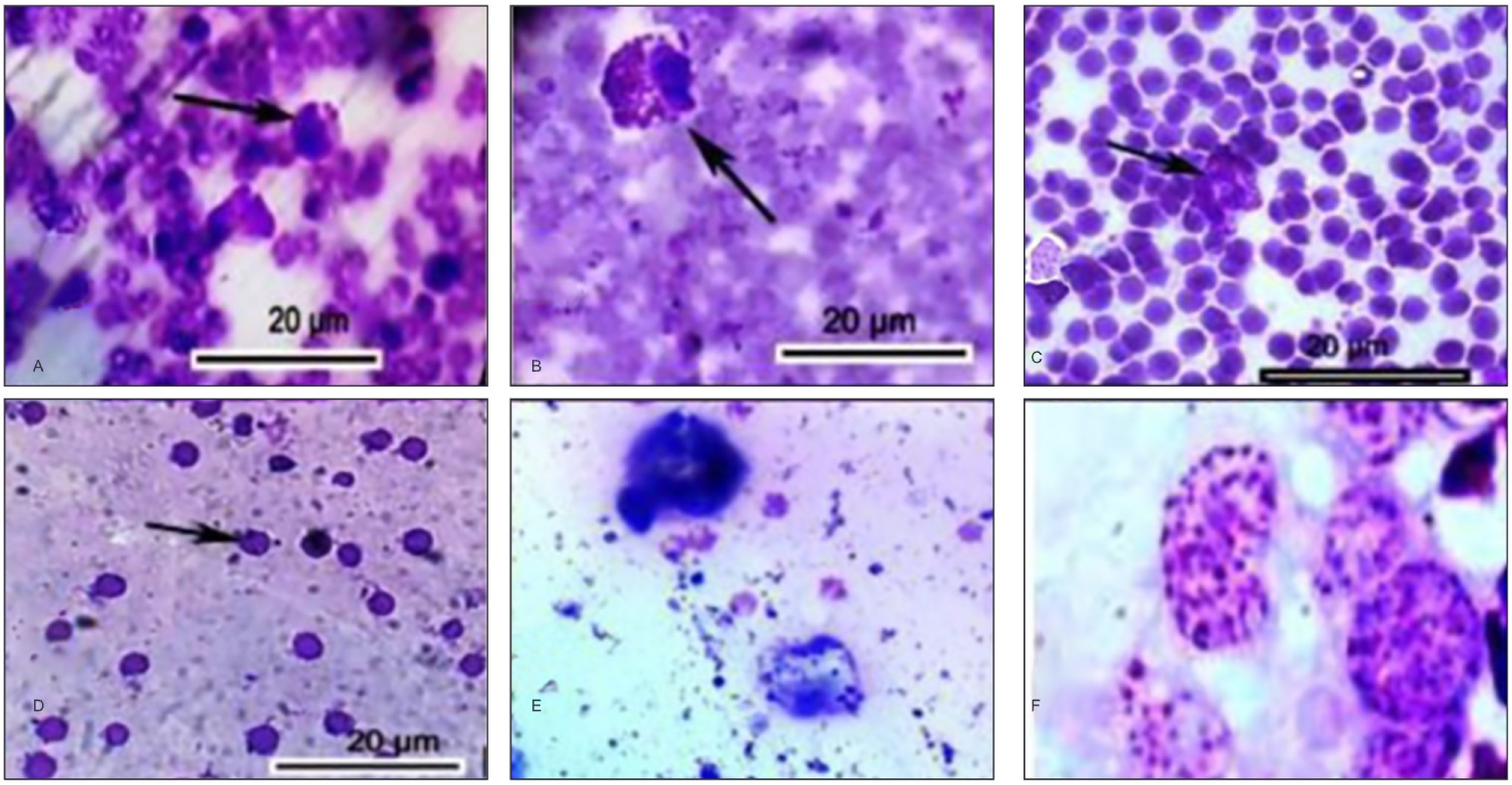

Fig. 5. Blood and lymph smears of *Theileria annulata* infected Cattle
A. Macro-schizont inside Lymphocyte (Koch's blue bodies) B. Micro-schizont inside Lymphocyte C. Raptured schizont D. *Theileria* annulata piroplasms inside RBCs E. and F. Schizonts of *Theileria* (koch's blue bodies) in lymph smears
(Source: Madkour *et al.*, 2023)

Hematological and Biochemical changes

Hematological alterations in theileriosis include reduced hemoglobin, PCV, RBCs, WBCs and platelets. Biochemically, increased bilirubin and elevated liver enzymes (AST, ALT, LDH, ALP) are typical, along with altered serum proteins - low albumin with high globulin. In advanced cases, BUN and creatinine may rise due to dehydration or stress.

Polymerase Chain Reaction (PCR) Technique

PCR tests targeting genes like 18S rRNA, MPSP (major piroplasm surface protein) and 28S rRNA are highly reliable for detecting bovine theileriosis because they are more sensitive and specific and can clearly differentiate between *Theileria* species and strains.

Serological Methods

Indirect Fluorescent Antibody Test (IFAT) and ELISA are key serological assays for detecting antibodies against *Theileria* spp.; IFAT serves as reference method due to high sensitivity and specificity. ELISA is preferred for large-scale screening, epidemiological studies and herd-level surveillance.

Treatment

Treatment of bovine theileriosis involves a combination of specific anti-protozoal therapy and supportive care to address systemic complications.

Antiprotozoal Therapy (Specific Treatment)

- Buparvaquone **(Inj. Zubion)** is the drug of choice, administered at 2.5 mg/kg body weight *via* IM injection as a single dose; a second dose may be repeated after 48–72 hours in severe cases.
- Buparvaquone with Furosemide **(Zubion-F)** can be advocated at 1 ml/20 kg body weight *via* IM Route in cases with pulmonary oedema.

Antibiotic Therapy (To Control Secondary Bacterial Infections)

- Inj. Oxytetracycline is recommended at 20 mg / kg body weight *via* IM / IV route daily for 3–5 days.

Anti-inflammatory and Antipyretic Therapy

- NSAIDs are used to reduce fever, relieve pain and control inflammation.
- Inj. Meloxicam with Paracetamol **(Inj. MeloneX Plus)** can be given at 30 ml / 400 kg body weight *via* IM, IV / SC route.

Supportive and Symptomatic Care

- Fluid therapy using Normal Saline, Ringer's Lactate or Dextrose-Saline helps to correct dehydration, electrolyte imbalance and shock.
- **Inj. Intalyte (Electrolytes)** can be administered at a total dose of 500–2000 ml *via* IV route depending on severity.
- **Inj. Plasmup (Hydroxyethyl Starch)** can be given at 8–10 ml/kg body weight per day *via* IV route.
- Hematinics such as vitamin B-complex, iron and folic acid to support red blood cell regeneration.
- **Bolus Feritas (Ferrous Fumarate, Vit. B12 and Folic acid)** can be given at 2 boli daily for 10–15 days.
- **Inj. Tribivet (Vit. B1, Vit. B6 and Vit. B12)** at 5–10 ml *via* IM / IV route and **Bolus Tribivet** at 2 boli daily will assist metabolic activity and liver functions.

Prevention and Control

- Effective prevention of bovine theileriosis requires a comprehensive and integrated disease management strategy focused on tick control, vaccination, early detection and sound farm management practices.
- Systemic ectoparasiticides play a critical role in breaking the transmission cycle of Theileria spp.
- Macrocyclic lactones such as ivermectin **(Inj. Neomec)** / Inj. Doramectin **(Inj. Dorashot)** can be given at 1 ml / 50 kg body weight *via* SC route.
- Routine application of topical acaricides is essential for reducing tick burden on animals and within farm.
- Acaricides should be applied at 3–4-week intervals for effective tick control and Periodic rotation of acaricide classes is essential to minimize the development of tick resistance.
- Vaccination is a key preventive strategy for controlling bovine theileriosis. The most widely used vaccine in India is live attenuated schizont vaccine (*T. annulata* cell culture vaccine) which induces protective immunity by stimulating both humoral and cell-mediated responses.
- Vaccination is recommended for calves between 3 and 6 months of age or before the onset of tick season. Immunity typically develops within 3–4 weeks and lasts for up to 1–2 years.

Conclusion

Bovine theileriosis is caused by protozoan parasites of the genus Theileria and transmitted primarily by *Ixodid* ticks *Hyalomma*. Seasonal peaks occur during late summer, monsoon and post-monsoon periods. Theileria sporozoites cause abnormal proliferation of animal's lymphocytes and induce inflammation within lymph nodes, leading to noticeable swelling of prescapular and prefemoral lymph nodes and high fever. Intravascular and immune-mediated haemolysis results in anemia, while damage to pulmonary epithelium increases capillary permeability and leads to pulmonary edema. Intracytoplasmic schizonts **("Koch's blue bodies")** within lymphocytes and macrophages in Giemsa-stained smears represent the diagnostic gold standard. Buparvaquone is the drug of choice, supported by Oxytetracycline and NSAIDs such as Meloxicam with Paracetamol. Integrated vector control, vaccination and improved farm management are essential to reduce disease burden and sustain long-term dairy productivity.

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