# Vectors

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| **Vector / Reservoir** | **Pathogen(s)** | **Disease(s)** |
| **Mosquito (Anopheles)** | *Plasmodium spp.* (falciparum, vivax, malariae, ovale, knowlesi) | Malaria |
|  | *Wuchereria bancrofti, Brugia malayi, B. timori* | Lymphatic filariasis |
|  | *Dirofilaria immitis* | Human dirofilariasis |
|  | *Brachiola algerae* (Microsporidia) | Myositis |
| **Mosquito**  **(Aedes spp.)** | Dengue virus, Yellow fever virus, Zika virus, Chikungunya virus | Dengue, Yellow fever, Zika, Chikungunya |
|  | Arboviruses: Ross River, O’nyong-nyong, Mayaro, Barmah Forest | Polyarthritis/fever syndromes |
|  | Equine encephalitides (EEE, WEE, VEE) | Equine encephalitis |
|  | La Crosse encephalitis virus (LACV) | Encephalitis |
|  | Rift Valley fever virus (RVFV) | Rift Valley fever |
| **Mosquito**  **(Culex spp.)** | West Nile virus (WNV), Japanese encephalitis virus (JEV), St. Louis encephalitis virus (SLEV), Murray Valley encephalitis virus (MVEV) | Arboviral encephalitides |
|  | Severe fever with thrombocytopenia syndrome virus (SFTSV), California encephalitis virus | Encephalitis / haemorrhagic fever |
| **Tick (Ixodes spp.)** | *Borrelia burgdorferi* | Lyme disease |
|  | *Borrelia miyamotoi*, *B. lonestari*, relapsing fever borreliae (hermsii, parkeri, turicatae, duttonii) | Tick-borne relapsing fevers |
|  | *Babesia microti, B. venatorum* | Babesiosis |
|  | *Anaplasma phagocytophilum* | HGA |
|  | Tick-borne encephalitis virus (TBEV), Powassan virus | Tick-borne encephalitis |
| **Tick (Dermacentor, Rhipicephalus, Hyalomma)** | *Rickettsia rickettsii* (RMSF), *R. conorii* (boutonneuse), *R. africae*, *R. japonica*, *R. sibirica*, etc. | Spotted fever rickettsioses |
|  | *Ehrlichia chaffeensis, E. ewingii, E. muris*, *A. capra* | Ehrlichioses |
|  | Flaviviruses: Louping ill, Omsk HF, Kyasanur Forest disease, Alkhurma HF, Langat | Encephalitis / haemorrhagic fever |
|  | Coltiviruses: Colorado tick fever, Eyach virus | Tick fevers |
|  | *Coxiella burnetii* | Q fever (tick & aerosols) |
|  | Crimean–Congo haemorrhagic fever virus (CCHF), Heartland virus, SFTSV | Haemorrhagic fevers |
| **Soft tick (Ornithodoros spp.)** | *Borrelia spp.* (duttonii, parkeri, etc.) | Tick-borne relapsing fever |
| **Flea (Xenopsylla cheopis)** | *Yersinia pestis* | Plague |
|  | *Rickettsia typhi* | Murine typhus |
| **Flea (Ctenocephalides spp.)** | *Rickettsia felis* | Flea-borne spotted fever |
|  | *Bartonella henselae* | Cat scratch disease |
|  | *Dipylidium caninum*, *Hymenolepis diminuta* | Tapeworm infections |
| **Louse (Pediculus humanus corporis)** | *Rickettsia prowazekii* | Epidemic typhus |
|  | *Borrelia recurrentis* | Louse-borne relapsing fever |
|  | *Bartonella quintana* | Trench fever |
| **Mite (Leptotrombidium)** | *Orientia tsutsugamushi* | Scrub typhus |
| **Mite (Allodermanyssus / rodent mite)** | *Rickettsia akari* | Rickettsialpox |
| **Mite (Sarcoptes scabiei)** | Direct infestation | Scabies |
| **Sandfly (Phlebotomus, Lutzomyia)** | *Leishmania spp.* | Leishmaniasis (cutaneous, visceral, mucosal) |
|  | *Bartonella bacilliformis* | Carrion’s disease |
|  | Toscana virus, Sandfly fever viruses (Phleboviruses) | Sandfly fever |
| **Tsetse fly (Glossina spp.)** | *Trypanosoma brucei gambiense, rhodesiense* | African trypanosomiasis |
| **Other flies** | *Loa loa* (via Chrysops/Tabanid fly) | Loiasis |
|  | *Onchocerca volvulus* (Simulium blackfly) | Onchocerciasis |
|  | *Trypanosoma cruzi* (Triatoma “kissing bug”) | Chagas disease |
|  | Myiasis flies (*Cordylobia*, *Dermatobia*, *Cuterebra*) | Myiasis |
|  | Leeches with *Aeromonas spp.* | Wound infection |
| **Snails (Biomphalaria, Bulinus, Oncomelania)** | *Schistosoma mansoni, haematobium, japonicum* | Schistosomiasis |
| **Cyclops (copepods)** | *Dracunculus medinensis* | Guinea worm |
|  | *Diphyllobothrium latum* (fish tapeworm) | Diphyllobothriasis |
| **Freshwater crab / crayfish** | *Paragonimus westermani* | Paragonimiasis |
| **Vegetation (watercress)** | *Fasciola hepatica* | Fascioliasis |
| **Mechanical vectors (flies, cockroaches)** | Enteric bacteria, protozoan cysts, helminths | Gastroenteritis |
| **Rodents** | Arenaviruses (Lassa, Junin, Machupo, Guanarito, Sabia, Lujo, LCMV) | Haemorrhagic fevers, LCMV |
|  | Hantaviruses (Sin Nombre, Puumala, Hantaan, Seoul, Dobrava) | HPS, HFRS |
|  | *Leptospira spp.* | Leptospirosis |
| **Bats** | Filoviruses (Ebola, Marburg, Bundibugyo, Sudan, Tai Forest) | Viral haemorrhagic fevers |
|  | Rabies virus | Rabies |
| **Dogs** | Rabies virus | Rabies |
| **Cats** | *Toxoplasma gondii* | Toxoplasmosis |
| **Birds** | *Chlamydia psittaci* | Psittacosis |
|  | Arboviruses (WNV, JEV, SLEV reservoirs) | Arboviral encephalitis |
| **Cattle, goats, sheep** | *Coxiella burnetii* | Q fever |
| **Fish (raw)** | *Neorickettsia sennetsu* | Sennetsu fever |
| **Unpasteurised milk** | TBE virus, *Coxiella burnetii* | Encephalitis, Q fever |
| **Bushmeat / wild animals** | Ebola, Marburg, monkeypox, SARS-like CoVs, *Francisella tularensis* | Emerging zoonoses |

# **Vector-Borne Diseases**

## **1. Infections and Ticks**

* **General**: Hard and soft ticks transmit bacteria, viruses, and parasites. Transmission by bite, sometimes transovarial.
* **Bacterial**:
  + *Borrelia burgdorferi* → Lyme disease (erythema migrans, arthritis, neuroborreliosis).
  + *Borrelia miyamotoi*, *B. lonestari*, relapsing fever borreliae (*hermsii, parkeri, turicatae, duttonii*) → tick-borne relapsing fevers.
  + *Anaplasma phagocytophilum* → granulocytic anaplasmosis (HGA).
  + *Ehrlichia chaffeensis, E. ewingii, E. muris, A. capra* → ehrlichioses.
  + *Rickettsia rickettsii* (RMSF), *R. conorii* (boutonneuse), *R. africae*, *R. japonica*, *R. sibirica*, etc. → spotted fever group rickettsioses.
  + *Francisella tularensis* → tularemia.
  + *Coxiella burnetii* → Q fever (tick vector + aerosols).
* **Viral**:
  + Tick-borne encephalitis virus (TBEV), Powassan virus → tick-borne encephalitis.
  + Crimean–Congo haemorrhagic fever virus (CCHF).
  + Heartland virus, Severe fever with thrombocytopenia syndrome virus (SFTSV).
  + Flaviviruses: Louping ill, Omsk HF, Kyasanur Forest disease, Alkhurma HF, Langat virus.
  + Coltiviruses: Colorado tick fever, Eyach virus.
* **Parasitic**: *Babesia microti*, *B. divergens*, *B. venatorum* → babesiosis.
* **Other**: Tick paralysis (toxin-mediated neuropathy).
* **UK relevance**: *Ixodes ricinus* transmits Lyme, emerging TBEV.

## **2. Infections and Bats**

* **General**: Reservoirs of many emerging zoonoses; large colonies, long lifespan, wide range.
* **Viruses**:
  + *Rabies virus* & lyssaviruses (bat rabies, ABLV).
  + Filoviruses → Ebola, Marburg, Bundibugyo, Sudan, Tai Forest.
  + Coronaviruses → SARS, MERS, SARS-CoV-2.
  + Paramyxoviruses → Nipah (via pigs), Hendra (via horses).
* **Fungal**: *Histoplasma capsulatum* in bat guano.
* **Other**: Leptospirosis, cryptococcosis.
* **Key**: Asymptomatic carriers, pandemic potential.

## **3. Infections and Rats (Rodents)**

* **Bacterial**:
  + *Leptospira interrogans* → leptospirosis (Weil’s disease).
  + Rat-bite fever: *Streptobacillus moniliformis* (USA/Europe), *Spirillum minus* (Asia).
  + *Salmonella* spp. → foodborne outbreaks.
  + *Yersinia pestis* (via fleas) → plague.
* **Viral**:
  + Hantaviruses (Sin Nombre, Puumala, Hantaan, Seoul, Dobrava) → HPS, HFRS.
  + Arenaviruses (Lassa, Junin, Machupo, Guanarito, Sabia, Lujo, LCMV) → viral haemorrhagic fevers, LCMV.
* **Parasitic**:
  + *Hymenolepis diminuta* (rat tapeworm).
* **Public health**: Urban reservoirs, sanitation-linked outbreaks.

## **4. Infections and Mites**

* **Direct infestations**:
  + *Sarcoptes scabiei* → scabies (classical, crusted in immunocompromised).
  + *Demodex* spp. → rosacea, blepharitis.
* **Vector-borne**:
  + Scrub typhus (*Orientia tsutsugamushi*) → via chigger larvae (*Leptotrombidium* spp.), Asia-Pacific (tsutsugamushi triangle).
  + Rickettsialpox (*R. akari*) → via house mouse mite (*Liponyssoides sanguineus*).
* **Allergic role**:
  + Dust mites (*Dermatophagoides* spp.) → asthma, rhinitis, eczema.
  + Storage mites → occupational asthma.
* **Complications**: Secondary bacterial infections (GAS → impetigo, post-strep GN).

## **5. Infections and Lice**

* **Species**: *Pediculus humanus corporis* (body louse), *P. h. capitis* (head louse), *Pthirus pubis* (pubic louse).
* **Vector-borne diseases**:
  + *Rickettsia prowazekii* → epidemic typhus.
  + *Borrelia recurrentis* → louse-borne relapsing fever.
  + *Bartonella quintana* → trench fever.
* **Transmission**: Inoculation of infected louse faeces into bite sites.

## **6. Mosquitoes**

* **Anopheles**:
  + *Plasmodium* spp. (falciparum, vivax, malariae, ovale, knowlesi) → malaria.
  + *Wuchereria bancrofti*, *Brugia malayi*, *B. timori* → lymphatic filariasis.
  + *Dirofilaria immitis* → human dirofilariasis.
  + *Brachiola algerae* (Microsporidia) → myositis.
* **Aedes**:
  + Arboviruses: Dengue, Yellow fever, Zika, Chikungunya.
  + Other alphaviruses: Ross River, O’nyong-nyong, Mayaro, Barmah Forest.
  + Equine encephalitides: EEE, WEE, VEE.
  + La Crosse encephalitis virus (LACV).
  + Rift Valley fever virus (RVFV).
* **Culex**:
  + West Nile virus (WNV), Japanese encephalitis virus (JEV), St. Louis encephalitis virus (SLEV), Murray Valley encephalitis virus (MVEV).
  + Severe fever with thrombocytopenia syndrome virus (SFTSV), California encephalitis virus.

## **7. Sandflies**

* *Leishmania* spp. → cutaneous, mucocutaneous, visceral leishmaniasis.
* *Bartonella bacilliformis* → Carrion’s disease (Oroya fever, verruga peruana).
* Toscana virus, sandfly fever viruses (Phleboviruses) → sandfly fever/aseptic meningitis.

## **8. Tsetse flies**

* *Trypanosoma brucei gambiense, rhodesiense* → African trypanosomiasis (sleeping sickness).

## **9. Triatomine bugs (“kissing bugs”)**

* *Trypanosoma cruzi* → Chagas disease.

## **10. Other Flies**

* *Chrysops* (deer/horse flies): *Loa loa* → loiasis.
* *Simulium* (blackfly): *Onchocerca volvulus* → onchocerciasis.
* Myiasis flies (Cordylobia, Dermatobia, Cuterebra) → myiasis.
* Mechanical vectors (houseflies, cockroaches) → enteric bacteria, protozoa, helminths → gastroenteritis.

## **11. Fleas**

* *Xenopsylla cheopis* → *Yersinia pestis* (plague).
* *Rickettsia typhi* → murine typhus.
* *Ctenocephalides* spp. → *Rickettsia felis* (flea-borne spotted fever).
* Vector for *Bartonella henselae* (cat scratch disease).
* Tapeworms: *Dipylidium caninum*, *Hymenolepis diminuta*.

## **12. Snails and Aquatic Hosts**

* **Snails** (*Biomphalaria, Bulinus, Oncomelania*) → schistosomiasis (*S. mansoni, haematobium, japonicum*).
* **Cyclops (copepods)** → *Dracunculus medinensis* (Guinea worm).
* **Fish** → *Diphyllobothrium latum* (fish tapeworm) → diphyllobothriasis.
* **Freshwater crab/crayfish** → *Paragonimus westermani* → paragonimiasis.
* **Vegetation (watercress)** → *Fasciola hepatica* → fascioliasis.

## **13. Other Reservoirs**

* **Dogs**: rabies virus.
* **Cats**: *Toxoplasma gondii*.
* **Birds**: *Chlamydia psittaci* (psittacosis); arbovirus reservoirs (WNV, JEV, SLEV).
* **Cattle, goats, sheep**: *Coxiella burnetii* (Q fever).
* **Fish (raw)**: *Neorickettsia sennetsu* → Sennetsu fever.
* **Unpasteurised milk**: TBE virus, *Coxiella burnetii*.
* **Bushmeat/wild animals**: Ebola, Marburg, monkeypox, SARS-like coronaviruses, *Francisella tularensis*.
* **Leeches**: *Aeromonas* spp. → wound infections.

## **Exam Pearls**

* **Ticks**: Lyme, spotted fever rickettsioses, babesiosis, relapsing fevers, TBEV, CCHF, Colorado tick fever.
* **Mosquitoes**: Malaria, lymphatic filariasis, dengue, Zika, chikungunya, yellow fever, RVF, WNV, JEV, EEE/WEE/VEE.
* **Sandflies**: Leishmaniasis, Carrion’s disease, sandfly fever/Toscana virus.
* **Tsetse**: African trypanosomiasis.
* **Triatomine bugs**: Chagas disease.
* **Fleas**: Plague, murine typhus, flea-borne spotted fever, cat scratch disease, tapeworms.
* **Mites**: Scabies, scrub typhus, rickettsialpox, allergies.
* **Lice**: Epidemic typhus, trench fever, louse-borne relapsing fever.
* **Flies**: Loiasis, onchocerciasis, myiasis, mechanical transmission of enterics.
* **Snails/copepods/crustaceans/vegetation**: Schistosomiasis, dracunculiasis, diphyllobothriasis, paragonimiasis, fascioliasis.
* **Rodents/bats/birds/domestic animals**: hantaviruses, arenaviruses, leptospirosis, arenaviral haemorrhagic fevers, rabies, toxoplasmosis, psittacosis, Q fever.

Always link **vector/reservoir → pathogen → disease → geography** in exam answers, and mention **public health measures** (bed nets, repellents, vaccination, rodent control).