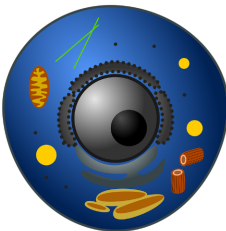


Parasite:

A being that needs to live in or on another being, called a host, on which it is metabolically dependent, causing it (at least potential) harm without providing comparable or equivalent compensation



Parasites



Protozoa

First animal aka unicellular animal

Amoebae; flagellates, ciliates; sporozoans

Asexual reproduction by bipartition

Sexual reproduction by isogamete or conjugation

Trophozoite: active, nutrition, reproduction, locomotion organelles.

Cyst: inactive, resistant, nuclear division, infective (transmission)

Helmintes



Nematodes

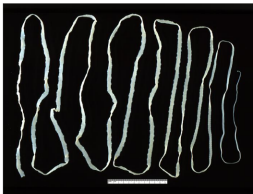
Round Worms, typical roundworms

Dioecious, female bigger than male

Digestive tract

Eggs → Larvae L1, L2, L3 & L4

Heteroxenous life cycle



Belt shape

Cestodes

Dorso-ventrally flattened body with segments

Scolex with suction cups and hooks

No digestive tract

Hermaphrodites on each ring

Heteroxenous life cycle

Plathelmintes

Flat worms

Trematodes > Digenea

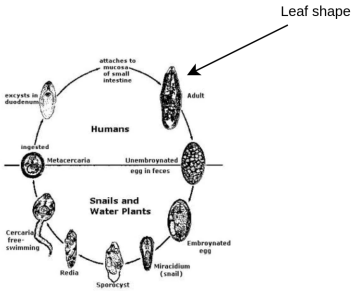
Unsegmented flattened body

2 suction cups for attachment

Minimum digestive tract

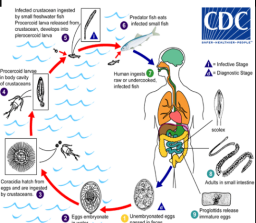
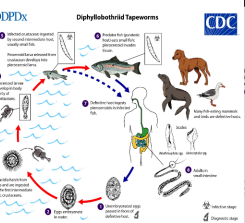
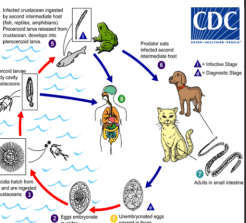
Usually hermaphrodites

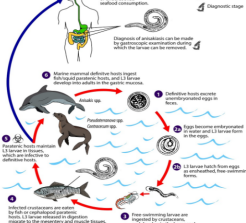
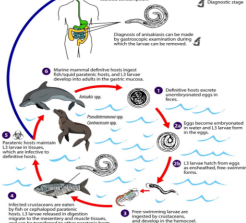
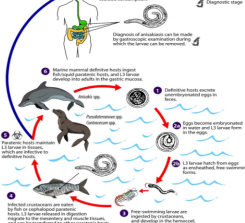
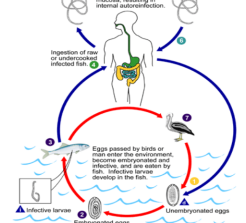
Heteroxenous life cycle

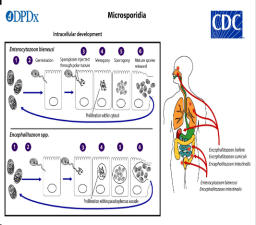
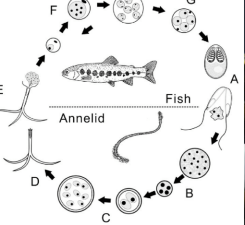


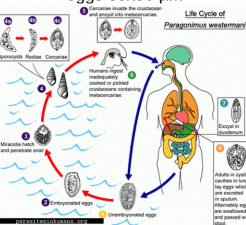
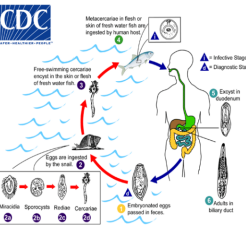
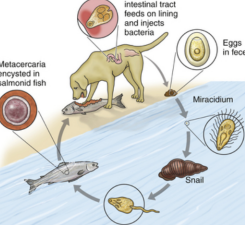
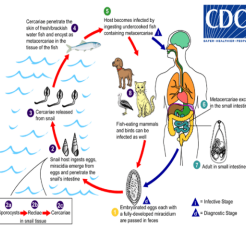
Fishery-associated parasites

Parasite
General characteristics
Life cycle
Epidemiology
Pathogenesis
Diagnosis
Treatment
Prophylaxis

Plathelminthes > Cestodes		
Diphyllobothrium latum	Diphyllobothrium pacificum	Spirometra mansonioides
3 to 10m, 2K rings, 1M eggs	same as previous	same as previous
Immature/mature/pregnant rings. Cyclops and Diaptomus are intermediate hosts	same as previous	same as previous
		
Shores of large lakes	Pacific coast of South America. Peru 2% prevalence.	Shores of large lakes
Obstruction, Digestive disorders	same as previous	same as previous
Coprolology → eggs in faeces	same as previous	same as previous
Vit.B12, Praziquantel, Purgatives	same as previous	same as previous
Cooking >60°C, Freezing -20°C, Water, fish and	same as previous	same as previous

Nematodes			
Anisakis	Pseudoterranova	Contracaecum	Capillaria philippinensis
5-10 cm, mouth with 3 lips, dioecious, 4 larvae, Digestion			Females with stichosome 4mm Males with spicule sheath 3mm
			
Japan and Spain → Raw Fish	same as previous	same as previous	In the Philippines
Severe gastrointestinal pain and Allergic reactions	same as previous	same as previous	intestinal disorders, absorption ↓ K ⁺ and proteins
Serology or Endoscopy	same as previous	same as previous	Coprolology → eggs in faeces
Albendazole or worm removal	same as previous	same as previous	Albendazole and Praziquantel
Cooking >60°C, Freezing -20°C,	same as previous	same as previous	Cooking >60°C, Freezing -20°C,

Protozoa		
Phylum Microsporidia	Kudoa	Bivalve Molluscs
1-3 x 1.5-4 µm. Looks like an egg with layers Spirally coiled tube Intracellular obligated, the spore is the infective form.	same as previous but with double spirally coiled tube same as previous. Depends on the amount of ingested spores	they filter 20-200L of water a day each one. They store the filtered pathogens in their digestive tract, they are water related parasites
		
Everywhere, especially in tropical areas. Diarrhoea. Diseases (AIDS): gastrointestinal and systemic Coprolology, Biopsy or sputum, PCR, Serology (ELISA) Hydroelectrolytic support Albendazol and fumaquilin Be careful with food and drink, wash your hands, AIDS caution	same as previous Diarrhoea and vomiting 2-20h Coprolology → eggs in feces same as previous Cooking >60°C, Freezing -20°C,	everywhere where you can eat molluscs Japan, Korea, Africa Discussed in the water related parasites - - Cooking >60°C, Freezing -20°C, Water control, water

Plathelminthes > Trematodes > Digenea			
Paragonimus westermani	Clonorchis and Opisthorchis	Nanophyetus salmincola	Heterophyes heterophyes
12 x 6 x 5 mm, same size suction cups Post-acetabular genital pore, 2 testicles, branched ovary, uterus, eggs 85x50 µm	1-2 cm 0,7-1,2 cm Operculate eggs with a small spicule	97 x 55 µm, 5 to 16 eggs in the uterus They attach to the intestines (suction cups) → inflammation	1,4 mm with "hairs" They attach to the small intestines causing inflammation. Affects other animals as well
			
Consumption of freshwater crustaceans. Asia, Africa Respiratory symptoms, brown sputum (eggs), granulomas Coprolology and sputums Praziquantel Cooking >60°C, Freezing -20°C,	South-East Asia, freshwater fishes. Prevalence: 17x10 ⁶ Asymptomatic, nausea, general Coprolology → eggs in faeces Praziquantel and Albendazol Cooking >60°C, Freezing -20°C,	North America in animals that eat infected fish Neorickettsia: gastroenteritis with bleeding Coprolology → eggs in faeces Praziquantel and doxycycline Cooking >60°C, Freezing -20°C,	Middle East, Nile Delta Region Diarrhoea, pain, eosinophilia. Epilepsies and myocarditis Coprolology and serology Praziquantel, Niclosamide Cooking >60°C, Freezing -20°C,



Meat-associated parasites

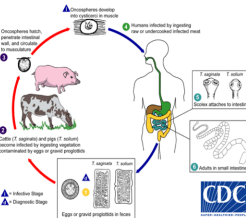
Plathelminthes > Cestodes

Nematodes

Taenia solium

5 m, scolex with 4 suction cups and rostellum armed with hooks

Immature/mature/pregnant rings. Pregnant with less than 12 uterus ramifications



Everywhere, transmission by eating infected pork uncooked
Asymptomatic. Gas, diarrhoea, Mobility: obstruction-perforation
Copology, Serology ELISA or Molecular PCR

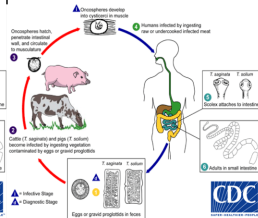
Praziquantel and Niclosamide

Cooking >60°C, Freezing -20°C, Hygiene, inspection and control

Taenia saginata

10 m, 2K rings, scolex with 4 suction cups

Immature/mature/pregnant rings. Pregnant with a lot of uterus ramifications



Everywhere, transmission by eating infected beef uncooked

Same as previous

Same as previous

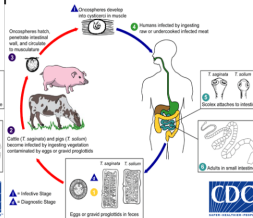
Same as previous

Same as previous

Taenia asiatica

same as *T. solium*

same as *T. solium*



same as *T. solium*

78%: pain, anal itching, diarrhoea, nausea, hunger

same as *T. solium*

same as *T. solium*

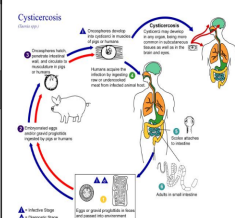
same as *T. solium*

Cysticercosis

Cysticercus is the infectious larva

Cysticercus cellulosae: 3-6 years, -24°C for 24 hours.

Cysticercus bovis: 1 year, -24°C for 3 days



Ingestion of the eggs/proglottids

Neurocysticercosis: attack the CNS → epilepsy

Same as *Taenia* spp.

Albendazole + corticosteroids. Even surgery

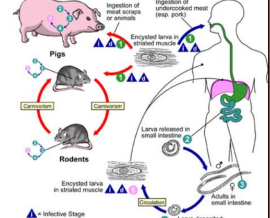
Cooking >60°C, Freezing -20°C, Faeces control and Hygiene

Trichinella spp.

females 2,2 mm, males 1,2 mm larvae 100 µm

Male has an extension to attach to the female.

Autoheteroxenous life cycle



Everywhere in the world

Invasion: gastrointestinal
Larvae: muscles, myocarditis
Encystation: muscle calcification
Eosinophilia, biopsy, ELISA

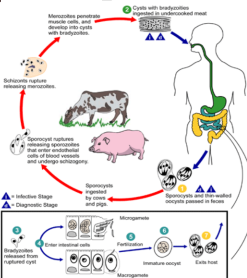
Corticosteroids. Mebendazole

Cooking >60°C, Freezing -20°C,

Protozoa

Sarcocystis

Intracellular obligated, definitive host or intermediate depending on the species. similar to



Everywhere, infected meat of every kind (high variety)

Asymptomatic. Diarrhoea, pain, nausea. Muscle-joints pain, fever.

Eosinophilia, coprology, biopsy

No treatment. Corticosteroids, Cotrimoxazole.

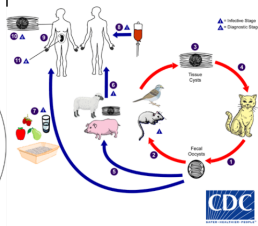
Cooking <60°C, freezing -20°C
Faeces control, pills for animals

Toxoplasma gondii

intracellular obligated parasite. Asexual and sexual phases.

Oocysts: contain sporozoites
Trophozoites

Cysts: contain bradyzoites



Oral (contaminated water), Vertical, Transfusional
Fever. Abortion, blindness, epilepsy. AIDS: eye-brain cysts
Visualisation, Serology, PCR

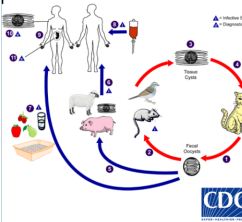
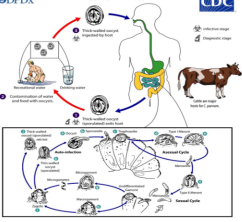
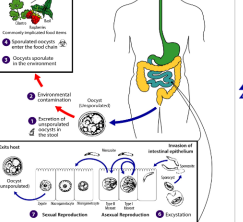
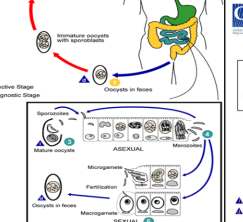
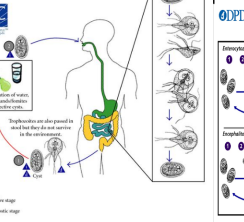
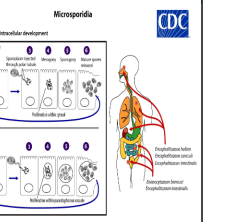
No specific treatment

Gloves, hygiene, raw meat and milk, cat litter boxes

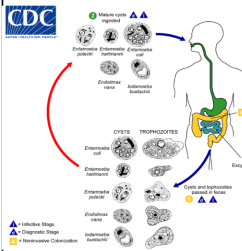
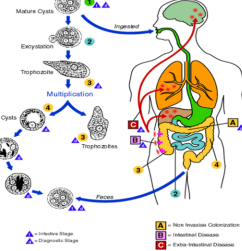
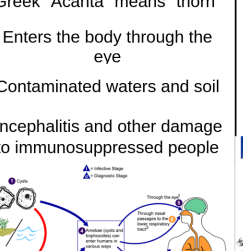
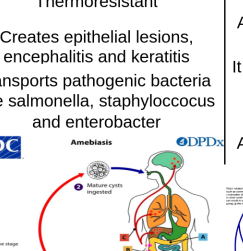


Water-associated parasites

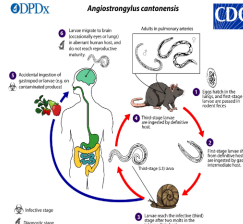
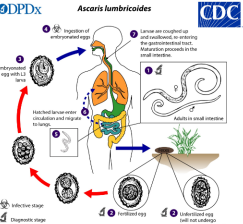
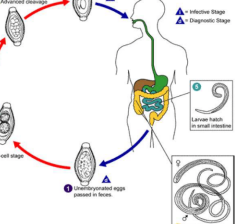
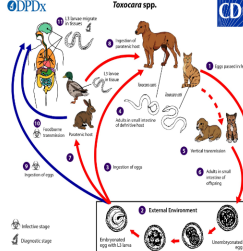
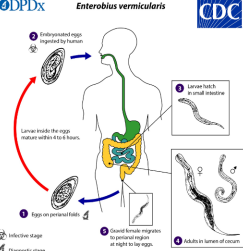
Protozoa

Toxoplasma gondii	Cryptosporidium spp.	Cyclospora cayentanensis	Cystoisospora belli	Giardia spp.	Microsporidium
intracellular obligated parasite. Asexual and sexual phases. Oocysts: contain sporozoites Trophozoites Cysts: contain bradyzoites	Oocysts, Cysts and Spores oocysts can resist Cl ⁻ Asexual and sexual phases. Digestive and respiratory tract → parasite vacuole	zoonosis. 10µm Oocysts with 2 sporozoites and 2 sporozoites	zoonosis. 30µm Oocysts with 2 sporozoites and 4 sporozoites	very frequent, flagellated and clonal parasite Oocysts (infection) and Trophozoites (attach intestines)	intracellular obligated parasite. ↑resistant spore with 2 layers: endospore and exospore. Extrusion apparatus (attach)
					
Oral (contaminated water), Vertical, Transfusional Fever. Abortion, blindness, epilepsy. AIDS: eye-brain cysts Visualisation, Serology, PCR No specific treatment Gloves, hygiene, raw meat and milk, cat litter boxes	Water quality of the country Diarrhoea, nausea, fever. AIDS: persistent infection Serology, choprology Nothing. Antiretroviral therapy Water treatment, faeces control	Cosmopolitan, Haiti mainly Diarrhoea, malabsorption, lung infection. Guillen-Barré. Coprology Sulfamethoxazole not infective at exit, hands wash and water control, veggies wash	same as C. cayentanensis same as C. cayentanensis Eosinophilia, Choprology, PCR Sulfamethoxazole and medical same as C. cayentanensis	Everywhere, zoonotic Asymptomatic. Diarrhoea, nausea, fever, malabsorption Water concentration-clarification, immunofluorescence. PCR Antibiotics: Nitroimidazoles Hygiene in schools and water control and treatment	Everywhere, especially in tropical areas. Diahorrea Water concentration-clarification, immunofluorescence. PCR Albendazol and antifungi Water treatment and control

Free-Living Amoebas

Acanthamoeba	Vermamoeba vermiformis	Naegleria fowleri	Balamuthia mandrillaris
Greek "Acantha" means "thorn" Enters the body through the eye Contaminated waters and soil Encephalitis and other damage to immunosuppressed people	Thermoresistant Creates epithelial lesions, encephalitis and keratitis Transports pathogenic bacteria like salmonella, staphylococcus and enterobacter	Contaminated water 28°C Affects immunocompetent too. 8 genotypes It has a 3rd stage with flagellum Causes Primary Amebic Meningoencephalitis Australia & Mexico legislations	On soil and suspended dust Produces encephalitis and cutaneous lesions. Keratitis They become cysts if there is no "food" Microbiologic diagnosis with PCR
			
Worldwide distribution, tropical Asymptomatic - - They're indicators of water quality	"Traveller's diarrhoea" contaminated water Asymptomatic. Diarrhoea with bleeding and ulcers Biopsy, Choprology, Serology ELISA and PCR Metronidazol Water and faeces control, hygiene, avoid oral-fecal		

Nematodes

Angiostrongylus cantonensis parasite in rats' lungs Affects paratenic and accidental hosts. Sam's case... OPDx Angiostrongylus cantonensis CDC  CHI, IND, AUS, USA, BRA... Meningitis eosinophilic: fever, headaches, stiffness, seizures... Serology, eosinophilia Not very effective. Corticosteroids ↓ Anthelmintics ↓ ↓ Rats and snail control, hygiene Hands, food and water washing	Ascaris lumbricoides White worm, the typical intestine worm. Autoinfection Males smaller than females, 30M stored - 200K eggs a day OPDx Ascaris lumbricoides CDC  Everywhere, soil transmission Lungs bleeding, obstruction and low nutrient absorption Coprology and PCR Albendazole and mebendazole Hands washing, teach children, soil & water control	Trichuris trichura male 4cm, female 5cm. 5K eggs 2 regions: thin-long and thick-short (organs). Syncytium OPDx Trichuris trichura CDC  Global top 3 parasite. Tropical Asymptomatic. Diahorrea. Intestinal bleeding. Find the egg No specific treatment Faeces control
Toxocara canis/cati typical worm of dogs/cats female 15cm, male 5cm similar to Ascaris, cephalic wings. we as accidental hosts, larvae. OPDx Toxocara spp. CDC  Common between children playing with cats and dogs Liver pain, blindness, fever, inflammation, lungs... systemic Serology ELISA, liver biopsy (ecruated cysts) No specific treatment (humans). Hygiene, cat and dog faeces control, animal treatment pills	Enterobius vermicularis 12mm white female. 15K eggs around the anus. autoinfection the most infective parasite (air transmission) causes anal itching OPDx Enterobius vermicularis CDC  500M people urban zones Anal itching mainly Graham tape in the anus Mebendazol Hygiene, children control	

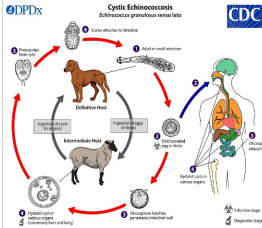


Fruit & veggies-associated parasites

Plathelminthes > Cestodes

Echinococcus granulosus

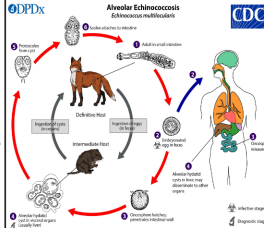
1cm, scolex similar to T.solium
It only has 3 rings: 1 immature, 1 mature and 1 pregnant.
Similar eggs to Taenia, 1.5K on each segment



Asia. Africa. S. America & Aus.
Asymptomatic. Hydatidosis: hydatid cyst in liver and lungs → various adults inflammation, anaphylactic shock (break), pressure in the organs.
Clinic, Radiology and Serology
Surgery, Albendazol ± Praziquantel
Dogs control and treatment, not feed them wild animals organs

Echinococcus multilocularis

Same as previous
Same as previous

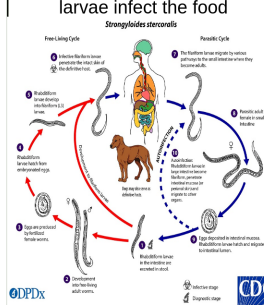


Mainly in North Europe, places with wild fruits
Same as previous
Same as previous
Same as previous
Same as previous

Nematodes

Strongyloides stercoralis

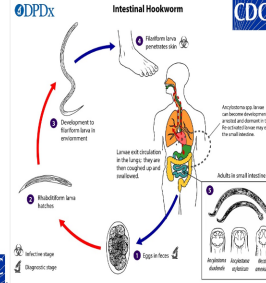
It's a Geohelminth and can enter through skin
Only females as parasites, the larvae infect the food



Everywhere... Soil & veggies
Dermatitis, pneumonia (bronchitis), gastritis and diarrhoea
Eosinophilia, coprology, serology (ELISA)
Ivermectin or Albendazole
Affected people treatment, faeces & soil control

Ancylostoma duodenale

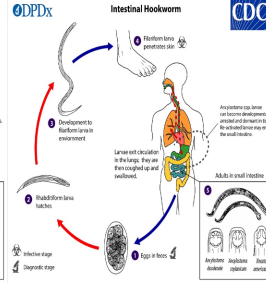
Big mouth female 9-15mm, males 7-10mm
Eggs look the same to others, but adults & larvae do differ



Very common 1/8 have it
Skin damage, pulmonary haemorrhage and bleeding faeces
Anaemia, coprology, eosinophilia
Albendazole
Affected people treatment, faeces & soil control

Necator americanus

Big mouth, female 9-11mm, males 5-9mm
same as previous



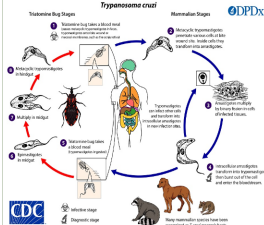
same as previous
same as previous
same as previous
same as previous
same as previous

Protozoa

Trypanosoma cruzi

Vertebrates: Trypomastigote in bloodstream and Amastigote in tissues.

Invertebrates: Epimastigote Bedbugs

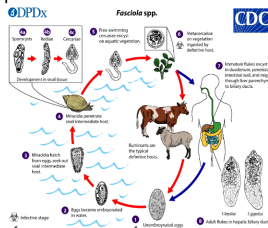


Everywhere mainly America.
Vector-blood transmission
Cell destruction, neurotoxin and autoimmune. Acute: chagoma (fatal), unspecified phase, Chronic: mega-
Clinic, Serology, blood test and PCR for Acai
Benznidazole and Nifurtimox
Bedbugs control, transfusion control and Acai control

Trematodes

Fasciola Hepatica

It has a conic form at the top
2-3 cm 2 suction cups.
Operculated eggs



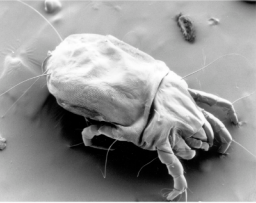
Everywhere especially in cultivated areas (leafy greens)
Hepatic problems, obstruction and malabsorption of fats
Coprology and Serology ELISA
Triclabendazole
Snail, faeces and water control.
Not eat raw aquatic plants



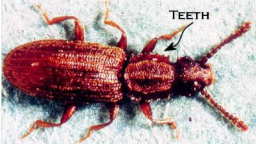
Arthropods

Dyctyoptera	
Blatella germanica	Periplaneta americana
8 oothecae with 30-48 embryos	10-15 oothecae with 16 embryos
	
By Lmbuga - Own work, CC BY-SA 3.0,	By Gary ripert - http://www.us.hawaii.edu/ahp/ahp_american_cockroach.shtml , CC BY 3.0,

Lepidoptera	
Sitotroga cerealella	Plodia interpunctella
Lives in grains, it has a V between the wings Put eggs inside grains → larva L1, L2, L3 → nvmp → adult 1 pair = 60M larvae → 2k kg of grain infected grain treatment with pyrethrins, pheromone trap, temperatures	attacks dried fruit Same as previous Similar to previous same as previous
	
By Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org, CC BY 3.0 us	

Astigmata	
Tyrophagus casei	Dermatophagoides
Mimolette cheese	Mites that attack flour
	
By Dundak - Own work, CC BY 2.5	By CSIRO, CC BY 3.0,

Prostigmata	
Eriophyidae	Tarsonemidae
live as plant parasites, commonly causing galls or other damage to the plant tissues and hence known as gall mites.	most species in this family feed on the thin-walled mycelia of fungi or possibly algal bodies
	

Coleoptera		
Dermestes spp	Oryzaephilus surinamensis	Sitophilus spp
Lives in fish flour, dried skin, meats & sausages, grains, meat flour and bones	lives in cornfield and in grains, flours, pasta, bread, nuts Same as previous	they live and they have a species for every grain: corn, cornfield and rice
		
By André Karwath aka Aka - Own work, CC BY-SA 2.5,		By Sarefo - Own work, CC BY-SA 3.0,

Diptera
Cyclorgraphic dipters
Flies. Musca domestica & Fannia canicularis. Lucilla sericata & Calliphora vomitoria. Sarcophaga carnaria (meat eaters). Eristalis tenax (faeces) Piophilha casei (cheese) eggs → L1, L2, L3 → pupae → adult Accidental myiasis producers, mechanical vectors, food seizures

By Martin Cooper from Ipswich, UK - Anthomyiidae (female), CC BY 2.0,

