



Appendix IV

**REPORT OF THE SECOND MEETING OF THE OIE AD HOC GROUP
ON DISEASES OF CAMELIDS
Paris, 3–5 May 2010**

INFECTIOUS DISEASES OF INTEREST FOR CAMELIDS

As updated at the second meeting of the OIE *ad hoc* Group on Diseases of Camelids (May 2010)

A) Viral diseases in camelids

Group I = Known to produce significant diseases

Group II = Diseases for which camelids are potential pathogen carriers

Group III = Minor diseases

Dromedary camels

Diseases	Identification of the agent	Serological tests	Recommendations for diagnostic	Recommendations for prevention
Group I				
Camelpox	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.2, TEM, virus isolation, IHC and PCR	ELISA VNT*	An ELISA kit has been developed but still needs to be validated	Vaccination
Contagious ecthyma	TEM, IHC and PCR	None	Virus isolation is necessary	Investigation on vaccine development
Papillomatosis	TEM, PCR and IHC	None		Autogenous Vaccination
Rabies	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.13, FAT and IHC	VNT* Investigation on serological tests		Vaccination with cattle dose. However the vaccination protocol needs to be investigated
RVF	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.14, Culture, AGID, PCR and Histopathology	c-ELISA VNT*	1. Validation of an ELISA on more samples would be necessary 2. Investigation on susceptibility and duration of viraemia	Investigation on vaccination
Group II				
AHS	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.5.1., Virus isolation, PCR, ELISA and VN	None	1. Investigation of susceptibility for virulent strains and serotypes 2. Investigation of duration of viraemia 3. Development of an ELISA	

BT	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.3, Virus isolation, immunological methods and PCR	c-ELISA	Investigation of susceptibility for virulent strains and serotypes, and carrier states	1. Investigation for vaccination. 2. Application of the trade measures used for bovines
BVD	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.8, Virus isolation, PCR, IHC and ELISA	c-ELISA VNT*	1. Validation of serological tests in milk 2. Virus isolation needed 3. Investigation on susceptibility	
PPR	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.7.11, Virus isolation, AGID and PCR	None	1. c-ELISA should be validated 2. Investigation on susceptibility for virulent strains	
Group III				
CCHF	Virus isolation** and PCR	None	1. Validation of ruminant c-ELISA 2. Serological survey	
Herpesvirus Infections	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.5.9 (EHV), Chapter 2.4.13 (IBR), PCR, virus isolation and Immunofluorescence	VNT*	1. Validation of serological tests 2. Investigation on susceptibility for EHV 4 and BHV 1	Investigation on vaccination using horse protocol
West Nile Fever	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.20, PCR and virus isolation	c-ELISA	Investigation on susceptibility for the two strains	

*need to work in BSL3 level lab security; **need to work in BSL4 level lab security

Bactrian camels

Diseases	Identification of the agent	Serological tests	Recommendations for diagnostic	Recommendations for prevention
Group I				
Camelpox	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.2, TEM, virus isolation, IHC and PCR	ELISA VNT*	An ELISA method has been developed but still needs to be validated	Vaccination. A protocol need to be investigated
Contagious ecthyma	TEM and IHC	None	Virus isolation	Investigation on vaccine development
FMD	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.5., PCR and virus isolation	NSP c-ELISA	1. Double check with NSP ELISA 2. More investigations needed	Vaccination. A protocol need to be investigated
Influenza A infections	Virus isolation, PCR and ELISA	HI	Investigations on the susceptibility for the different serotypes need to be done	Investigation on vaccination using horse protocol

Rabies	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.13, FAT and IHC	VNT* Investigation on serological tests		Vaccination with cattle dose. However the vaccination protocol need to be investigated
Group II				
BVD	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.8, Virus isolation, PCR, IHC and ELISA	VNT*	1. Validation of serological tests 2. Investigation on susceptibility	
Group III				
BT	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.3, Virus isolation, immunological methods and PCR	c-ELISA	Investigation of susceptibility for virulent strains and serotypes, and carrier states	1. Investigation for vaccination 2. Application of the trade measures used for bovines
CCHF	Virus isolation** PCR	None	1. Validation of ruminant c-ELISA 2. Serological survey	
Herpesvirus Infections	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.5.9 (EHV), Chapter 2.4.13 (IBR), PCR, virus isolation and Immunofluorescence	VNT*	1. Validation of serological tests 2. Investigation on susceptibility for EHV 1, EHV 4 and BHV 1	Investigation on vaccination using horse protocol

New World camelids

Diseases	Identification of the agent	Serological tests	Recommendations for diagnostic	Recommendations for prevention
Group I				
BVD	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.8, Virus isolation, PCR, IHC and ELISA	c-ELISA VNT*	Validation of serological tests	Investigation on vaccination using bovine protocol
BT	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.3, Virus isolation, immunological methods and PCR	c-ELISA	Investigation of susceptibility for virulent strains and serotypes	1. Vaccination using sheep protocol 2. Application of the trade measures used for bovines
Herpesvirus Infections	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.5.9 (EHV), Chapter 2.4.13 (IBR), PCR, virus isolation and Immunofluorescence	VNT*	1. Validation of serological tests necessary 2. Investigation on susceptibility for EHV 1 and BHV 1	Investigation on vaccination

Group II				
Contagious ecthyma	TEM and IHC	None	Virus isolation	Investigation on vaccine development
Group III				
Camelpox	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.2, TEM, virus isolation, IHC and PCR	ELISA VNT*	An ELISA kit has been developed but still needs to be validated	
Equine encephalomyelitis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.5.5. and Chapter 2.5.14., PCR and virus isolation	None	1. Investigation on susceptibility 2. Validation of available serological tests	
Rabies	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.13, FAT and IHC	VNT*		Vaccination protocol need to be investigated
West Nile fever & other Flaviviruses	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.20, PCR and virus isolation	c-ELISA VNT*	Investigation on susceptibility	

b) Bacterial diseases in camelids

Group I = Known to produce significant diseases

Group II = Diseases for which camelids are potential pathogen carriers

Group III = Minor diseases

Dromedary camels

Diseases	Identification of the agent	Serological tests	Recommendations for diagnostic	Recommendations for prevention
Group I				
Anthrax	OIE <i>Terrestrial Manual</i> 2008 Chapter 2.1.1., Immunofluorescence, PCR, culture and identification of <i>Bacillus anthracis</i>	None	None	1. Vaccination in endemic area 2. Need for vaccine field trial
Brucellosis (<i>B. melitensis</i>)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.3., Staining methods, culture and PCR	CF, RBT, SAT, c-ELISA	CF, RBT, SAT and c-ELISA need to be validated	1. Vaccination 2. Vaccination protocols need to be investigated
Clostridia infections	Isolation and typing of bacteria and detection of toxins	ELISA and PCR tests available for toxinotyping (perfringens).	Investigation on multiplex PCR	Investigation on vaccination

Colibacillosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.11., Culture, immunological method and PCR	None	1. Identification of the most pathogenic biovars 2. Development of serological tests necessary	Development of vaccines
Dermatophilosis (<i>Dermatophilus congolensis</i>)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.10., Culture, immunological methods and PCR	None	Identification of the most pathogenic strains	Development of vaccines
Haemorrhagic septicaemia (<i>Pasteurella multocida</i> or <i>Mannheimia hemolytica</i>)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.12., Culture and PCR	None	Controversial data on susceptibility and aetiology which need therefore also to be investigated	Protocol for vaccination needs to be investigated
Johne's disease	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.11., Culture and PCR	None	Validation of serological tests	Eradication of seropositive animals after validation of the tests
Pyogenic diseases (<i>Caseous lymphadenitis</i>)	Isolation and typing of bacteria	None	Development of serological test for <i>Corynebacterium pseudotuberculosis</i> and <i>Staphylococcus aureus</i>	Development of vaccines
Salmonellosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.9., Culture and PCR	None	1. Identification of the most prevalent biovars and investigation on susceptibility 2. Development of serological tests	Development of vaccines
Group II				
Leptospirosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.9., PCR	MAT	1. Identification of the most prevalent biovars 2. Investigation on susceptibility	Development of vaccines
Q fever	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.12., Staining, isolation of the agent and PCR	CF	1. Investigation on susceptibility 2. Validation of serological tests	Development of vaccines
Tuberculosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.7., Direct identification, culture and PCR	RT test	Investigation should be conducted with serological test. Need of further investigation on skin test	Eradication of positive animals after validation of the tests
Group III				
Chlamydiosis	Isolation and identification of the agent	c-ELISA	Validation of serological tests	
Glanders (<i>Melioidosis</i>)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.5.11., Culture and PCR	CF	Validation of serological tests	Eradication of seropositive animals
Plague (<i>Yersiniosis</i>)	Isolation of bacteria	None	Development of serological test	Eradication of infected animals

Bactrian camels

Diseases	Identification of the agent	Serological tests	Recommendations for diagnostic	Recommendations for prevention
Group I				
Anthrax	OIE <i>Terrestrial Manual</i> 2008 Chapter 2.1.1., Immunofluorescence, PCR, culture and identification of <i>Bacillus anthracis</i>	None	None	1. Vaccination in endemic area 2. Need for vaccine field trial
Brucellosis (<i>B. abortus</i> and <i>B. melitensis</i>)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.3., Staining methods, culture and PCR	CF, RBT, SAT, c-ELISA	CF, RBT, SAT and c-ELISA need to be validated for <i>B. abortus</i> and <i>B. melitensis</i> . Tests also need to be validated.	1. Vaccination according to the species (<i>B. abortus</i> or <i>B. melitensis</i>) 2 Vaccination protocols need to be investigated
Clostridia infections	Isolation and typing of bacteria and detection of toxins	ELISA and PCR tests available for toxinotyping (<i>perfringens</i>).	Investigation on multiplex PCR	Investigation on vaccination
Colibacillosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.11., Culture and PCR	None	1. Identification of the most pathogenic biovars 2. Development of serological tests necessary	Development of vaccines
Johne's disease	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.11., Culture and PCR	None	Validation of serological tests	Eradication of seropositive animals after validation of the tests
Plague (<i>Yersiniosis</i>)	Isolation of bacteria	None	Development of serological test	1. Eradication of infected animals 2 Control of vectors
Pyogenic diseases (<i>Caseous lymphadenitis</i>)	Isolation and typing of bacteria	None	Development of serological test for <i>Corynebacterium pseudotuberculosis</i> and <i>Staphylococcus aureus</i>	Development of vaccines
Salmonellosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.9., Culture and PCR	None	1. Identification of the most prevalent biovars and investigation on susceptibility 2. Development of serological tests	Development of vaccines
Tuberculosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.7., Direct identification, culture and PCR	RT test	1. Investigation should be conducted with serological test 2. Investigation on skin test	Eradication of positive animals after validation of the tests

Group II				
Leptospirosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.9., PCR	MAT	1. Identification of the most prevalent biovars 2. Investigation on susceptibility	Development of vaccines
Q fever	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.12., Staining, isolation of the agent and PCR	CF	1. Investigation on susceptibility 2. Validation of serological tests	Development of vaccines
Group III				
Glanders (Meliodosis)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.5.11,	CF	Validation of serological tests	Eradication of seropositive animals
Chlamydiosis	Isolation and identification of the agent	c-ELISA	Validation of serological tests	
Haemorrhagic septicaemia (<i>Pasteurella multocida</i> or <i>Mannheimia hemolytica</i>)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.12., Culture and PCR	None	Investigation on susceptibility	

New World camelids

Diseases	Identification of the agent	Serological tests	Recommendations for diagnostic	Recommendations for prevention
Group I				
Anthrax	OIE <i>Terrestrial Manual</i> 2008 Chapter 2.1.1., Immunofluorescence, PCR, culture and identification of <i>Bacillus anthracis</i>	None	None	1. Vaccination in endemic area 2. Need for vaccine field trial
Brucellosis (<i>B. melitensis</i>)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.3., Staining methods, culture and PCR	CF, RBT, SAT, c-ELISA	CF, RBT, SAT and c-ELISA need to be validated	1. Vaccination 2. Vaccination protocols need to be investigated
Colibacillosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.11., Culture and PCR	None	1. Identification of the most pathogenic biovars 2. Development of serological tests necessary	Development of vaccines
Enterotoxaemia	Isolation and typing of bacteria	ELISA and PCR tests available for toxins identification	Investigation on multiplex PCR	Protocol for vaccination needs to be investigated with available toxoid bacteria vaccines
Leptospirosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.9., PCR	MAT	Identification of the most prevalent biovars and investigation on susceptibility	Development of vaccines
Salmonellosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.9., Culture, immunological methods and PCR	None	1. Development of serological tests 2. Identification of the most prevalent biovars	Development of vaccines

Tuberculosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.7., Direct identification, culture and PCR	RT test	Tuberculin testing does not work. Serological tests should be developed	Eradication of positive animals after validation of the tests
Group II				
Johne's disease	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.11., Culture and PCR	None	Validation of serological tests	Eradication of seropositive animals after validation of the tests
Pyogenic diseases (internal abscesses)	Isolation and typing of bacteria	None	Development of serological test for <i>Corynebacterium</i> and <i>Staphylococcus</i>	Development of vaccines
Q fever	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.12., Staining, isolation of the agent and PCR	CF	1. Investigation on susceptibility 2. Validation of serological tests	Development of vaccines
Group III				
Actinobacillosis	Isolation and identification of the agent	None	Validation of serological tests	
Pasteurellosis (Haemorrhagic septicaemia)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.12., Culture and PCR	None	Investigation on susceptibility	

c) Parasitic and Fungal diseases in camelids

Group I = Known to produce significant diseases

Group III = Minor diseases

Dromedary camels

Diseases	Identification of the agent	Serological tests	Recommendations for diagnostic	Recommendations for prevention
Group I				
Cephalopina infestation	Direct agent identification	None	Identification of the parasite	Research for new treatment
Coccidiosis	Direct agent identification: <i>Eimeria</i> , <i>Isospora</i> and <i>Cryptosporidium</i> in young camels	None	1. Identification of the parasite 2. Development of PCR would be useful	Research for new treatment and development of vaccines
Gastro intestinal parasitosis	Direct agent identification: <i>Trichostrongylosis</i> , <i>Haemonchus</i> , <i>Taenia</i> , etc	None	Identification of the parasite	Investigation on treatment protocol and drugs resistance
Hydatidosis Echinococcosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.4, Direct agent identification, Coproantigen tests and PCR	ELISA	ELISA can be used with anti-camel conjugates	1. Treatment of the dogs 2. Development of vaccine

Mange (<i>Sarcoptes scabiei</i>)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.8, Direct agent identification	c-ELISA	Identification of the parasite for differential diagnosis from other skin diseases (Psoroptes, Ring Worm, etc.)	1. Quarantine and efficient drug for treatment 2. Development of vaccine
Ring Worm (Dermatophytosis)	Direct agent identification	None	Agent identification	Vaccines available (initially for bovines) but protocol for the vaccination need to be validated
Tick infestations	Direct agent identification	None	Identification of the parasite	Development of treatment protocols and vaccine
Trypanosomosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.8, PCR	CATT and Indirect ELISA (Neither ELISA is commercially available)	1. Indirect ELISA can be used with anti-camel conjugates 2. PCR	1. Systematic control for trade 2. Treatment of positive animal 3. Need of investigation on the resistance to drugs
Group III				
Myiasis other than Cephalopina	Direct agent identification	None	Identification of the parasite	Avermectines
Neosporosis	Direct agent identification	ELISA	1. Investigation on susceptibility 2. Serological assay by ELISA. Development of PCR would be useful	Development of vaccine
Toxoplasmosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.10, Isolation, tissue sections, PCR, Oocyst detection	SAT ELISA	Investigation on susceptibility	

Bactrian camels

Diseases	Identification of the agent	Serological tests	Recommendations for diagnostic	Recommendations for prevention
Group I				
Cephalopina infestation	Direct agent identification	None	Identification of the parasite	Research for new treatment
Coccidiosis	Direct agent identification: <i>Eimeria</i> , <i>Isospora</i> and <i>Cryptosporidium</i> in young camels	None	1. Identification of the parasite 2. Development of PCR would be useful	Research for new treatment and development of vaccines
Gastro intestinal parasitosis	Direct agent identification: <i>Trichostrongylosis</i> , <i>Haemonchus</i> , <i>Taenia</i> , etc	None	Identification of the parasite	Investigation on treatment protocol and drugs resistance

Hydatidosis Echinococcosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.4, Direct agent identification, Coproantigen tests and PCR	ELISA	ELISA can be used with anti-camel conjugates	1. Treatment of the dogs 2. Development of vaccine
Mange (<i>Sarcoptes scabiei</i>)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.8, Direct agent identification	c-ELISA	Identification of the parasite for differential diagnosis from other skin diseases (Psoroptes, Ring Worm, etc.)	1. Quarantine and efficient drug for treatment 2. Development of vaccine
Ring Worm (Dermatophytosis)	Direct agent identification	None	Agent identification	Vaccines available (initially for bovines) but protocol for the vaccination need to be validated
Ticks infestation	Direct agent identification	None	Identification of the parasite	Development of treatment protocols and vaccine
Trypanosomosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.4.8, PCR	CATT and Indirect ELISA (Neither ELISA is commercially available)	1. Indirect ELISA can be used with anti-camel conjugates 2. PCR	1. Systematic control for trade 2. Treatment of positive animal 3. Need of investigation on the resistance to drugs
Group III				
Myiasis other than Cephalopina	Direct agent identification	None	Identification of the parasite	Avermectines
Neosporosis		ELISA	Serological assay by ELISA. Development of PCR would be useful	Investigation on susceptibility
Toxoplasmosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.10, Isolation, tissue sections, PCR, Oocyst detection	SAT ELISA	Investigation on susceptibility	

New World camelids

Diseases	Identification of the agent	Serological tests	Recommendations for diagnostic	Recommendations for prevention
Group I				
Coccidiosis	Direct agent identification: <i>Eimeria</i> , <i>Isospora</i> and <i>Cryptosporidium</i> in young animals	None	1. Identification of the parasite 2. Development of PCR would be useful	Research for new treatment and development of vaccines
Hydatidosis Echinococcosis	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.1.4, Direct agent identification, Coproantigen tests and PCR	ELISA	ELISA can be used with specific conjugates	Treatment of the dogs. Development of vaccine

Mange (<i>Sarcoptes scabiei</i>)	OIE <i>Terrestrial Manual</i> 2008, Chapter 2.9.8, Direct agent identification	c-ELISA	Identification of the parasite for differential diagnosis from other skin diseases (psoroptes, Ring Worm, etc.)	Quarantine and good drug for treatment Development of vaccine
Neosporosis	PCR IF	ELISA	Investigation on susceptibility	Evaluation of available vaccine
Sarcocystosis	Agent identification	ELISA	An ELISA needs to be validated	Development of vaccine
Trematodosis	Indirect agent identification	ELISA only for <i>Fasciola hepatica</i>	Identification of the large and small trematodes in post mortem	Treatments. Protocol needs to be validated
Group III				
Coccidioidomycosis	Direct agent identification (post mortem)	CF and AGID		Treatments available
Ring Worm (Dermatophytosis)	Direct agent identification	None	Agent identification	Vaccines available (initially for bovines) but protocol for the vaccination need to be validated

List of Abbreviations:

Ab-ELISA:	Antibody enzyme-linked immunosorbent assay
AHS:	African horse sickness
BHV:	Bovine herpesvirus
BT:	Bluetongue
BVD:	Bovine viral diarrhoea
CATT:	Card-agglutination trypanosoma test
CCHF:	Crimean–Congo haemorrhagic fever
c-ELISA:	Competitive enzyme-linked immunosorbent assay
CF:	Complement fixation
CIRAD:	Centre de Coopération Internationale pour la Recherche Agronomique en Développement
CVRL:	Central Veterinary Research Laboratory (Dubai, UAE)
EHV:	Equine herpesvirus
FAT	Fluorescent antibody test
FMD:	Foot and mouth disease
HI:	Heamagglutination inhibition
IBR/IPR:	Infectious bovine rhinotrachitis/Infectious pustular vulvovaginitis
IHC:	Immunohistochemistry
MAT:	Microscopic agglutination test
NSP ELISA:	Nonstructural protein enzyme-linked immunosorbent assay
OIE:	World Organisation for Animal Health
OIE <i>Terrestrial Manual</i> :	OIE <i>Manual of Diagnostic Tests and Vaccines for Terrestrial Animals</i>
PCR:	Polymerase chain reaction
PPR:	Peste des petits ruminants
RBT:	Rose-Bengal test
RVF:	Rift Valley fever
SAT:	Sero-agglutination test
TEM:	Transmission electron microscopy
VNT:	Virus neutralisation test