EXTERNAL REFERENCES

ID SCREEN® CCHF MULTI-SPECIES

Last update: March 2022

Publications / References:

(Click on the reference name below to download the pdf)

Frías M., Cuadrado-Matías R. *et al.* (2022). **The spatial pattern of human exposure to Crimean–Congo haemorrhagic fever virus is not consistent with red deer-based risk predictions.** Transboundary and Emerging Diseases, 1–7.	• a cross-sectional study to test the exposure pattern of the **human population** to CCHFV: sera of 1384 donors from different risk gradients were analyzed using the ID Screen CCHF Double Antigen Multi-species • none of the samples reacted positively indicating a seroprevalence of 0% **This study confirms the excellent specificity of the ID Screen CCHFDA Multi-species for human samples**		**Test of particular species**	**Epidemiological study**		
Lado S., Futas J. *et al.* (2022) **Crimean–Congo Hemorrhagic Fever Virus Past Infections Are Associated with Two Innate Immune Response Candidate Genes in Dromedaries.** Cells, 11, 8	• seroprevalence study on dromaderies (n=121) using the ID Screen® CCHFDA Multi-species. • *Results:* prevalence = 70%.			**Epidemiological study**		
Altaliby M. A. S., Esmaeel S. A *et al.* (2021) **Seroprevalence Of Crimean-Congo Haemorrhagic Fever In Sheep And Goats In Iraq** Bulgarian. Journal of Veterinary Medicine, ISSN 1311-1477	• 120 sheep and 80 goat sera were tested using the ID Screen® CCHFDA Multi-species. • *Results*: Serological evidence for CCHF infection was found in 28/200 samples (14%), which included 23/120 sheep samples (19.16%) and 5/ 80 goat samples (6.25%).			**Epidemiological study**		
Balinandi S., von Brömssen C. et al. (2021) Serological and molecular study of Crimean-Congo Hemorrhagic Fever Virus in cattle from selected districts in Uganda. Journal of Virological Methods 290 114075	• 500 cattle sera samples were analyzed for CCHFV antibodies using an in-house Elisa and the ID Screen® CCHFDA Multi-species, in parallel with IFA. • *Results*: CCHFV seropositivity was 12.6 % (n = 63) and 75.0 % (n = 375) with the in-house and IDVet ELISAs, respectively. The IFA results were more comparable to IDVet (K coefficient = 0.88, p = <0.01) than to in-house (K coefficient = 0.32, p = 0.02).	**Correlation with other techniques**		**Epidemiological study**		

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	The ID Screen® CCHFDA Multi-species is useful to detect anti-CCHFV antibodies in cattle and is well correlated with IFA.					
Blanco-Penedo I., Obanda,V. *et al.* (2021) **Seroepidemiology of Crimean-Congo Hemorrhagic Fever Virus (CCHFV) in Cattle across Three Livestock Pastoral Regions in Kenya.** Dairy 2, 425–434.	• seroepidemiological study of the sera of 148 cattle, 23 sheep and 17 goats using the ID Screen® CCHFDA Multi-species. • *Results:* overall, 31.5% CCHFV seropositivity was observed.			Epidemiological study		
Camp J.V., Weidinger P. *et al*. (2021) **Association of Dromedary Camels and Camel Ticks with Reassortant Crimean-Congo Hemorrhagic Fever Virus, United Arab Emirates.** Emerging Infectious Diseases Vol. 27, No. 9,	• cross-sectional serologic survey of CCHFV in dromedary camels, cattle, goats and sheep using the ID Screen® CCHFDA Multi-species. • *Results:* antibodies to CCHFV were found in 72/90 camels, 7/51 cattle, 1/45 goats, and 4/55 sheep.		Test of particular species	Epidemiological study		
Cuadrado-Matias R., Casades-Marti L. *et al.* (2021) **The spatiotemporal dynamics of Crimean-Congo haemorrhagic fever virus in enzootic Iberian scenarios.** Poster presented at the Virtual 69th WDA /14th EWDA 2021 Joint Conference Cuenca, Spain.	• 6178 sera from red deer screened with the ID Screen® CCHFDA Multi-species in Spain. • *Results*: Seroprevalence was very high in the southern half of mainland Spain (72.0%-87.1%) whereas it was lower in central (43.6%) and northern (30.6%) areas of the country. **The ID Screen® CCHFDA Multi-species is useful to detect anti-CCHFV antibodies in red deer.**		Test of particular species	Epidemiological study		
Esmaeel S.A., Hussain K.J. *et al*. (2021) **Seroprevalence of Crimean Congo Hemorrhagic Fever in cows by ELISA in Mosul city.** Iraqi Journal of Veterinary Sciences, Vol. 35, No. 4 (803-807)	• Seroprevalence study on cows (n=184) using the ID Screen® CCHFDA Multi-species. • *Results*: 40 out of the 184 sampled animals revealed positive results indicating seroprevalence of 21.7%.			Epidemiological		
Espunyes J., Cabezón O. *et al.* (2021) **Hotspot of Crimean-Congo Hemorrhagic Fever Virus Seropositivity in Wildlife, Northeastern Spain.** Emerging Infectious Diseases Vol. 27, No. 9,	• serosurvey for Crimean-Congo hemorrhagic fever virus antibodies in various wildlife species (serum samples from 174 red deer, 84 Iberian ibexes, 79 roe deer, 35 European rabbits, 156 wild boars and 4 fallow deer) using the ID Screen® CCHFDA Multi-species. CCHFV antibodies. • *Results*: of 532 samples tested, CCHFV antibodies were detected in 72 animals, including Iberian ibexes (66/84), roe deer (1/79), and wild boar (5/156); all 72 seropositive samples came from the same area.		Test of particular species	Epidemiological study		
Hartlaub J., Daodu O.B. *et al.* (2021) **Cross-Reaction or Co-Infection? Serological Discrimination of Antibodies Directed against Dugbe and Crimean-Congo Hemorrhagic Fever Orthonairovirus in Nigerian Cattle.** Viruses 13, 1398	• 300 nigerian cattle sera (150 CCHFV seropositive and 150 CCHV seronegative samples) with CCHF status validated using serological assays including the ID Screen® CCHFDA Multi-species were screened for DUGV antibodies via N protein-based ELISAs, indirect immunofluorescence and neutralization assays.	Correlation with other				

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	• *Results*: no correlation between the ID Screen® CCHFDA Multi-species and the DUGV ELISA results (cross-tabulation and comparative ROC analyses); statistics have not shown a significant association for DUGB Elisa and the ID Screen® CCHFDA Multi-species while cross reactions were observed when using IFA. **The ID Screen® CCHFDA Multi-species does not present cross-reactions with Dugbe virus antibodies.**	Correlation with other techniques		Epidemiological study		
Hartlaub J., Keller M. *et al*. (2021) **Deciphering Antibody Responses to Orthonairoviruses in Ruminants** Microorganisms 2021, 9, 1493	• experimental infection studies involving sheep (n=13) and cattle (n=5) with Nairobi Sheep Disease Virus (NSDV); all the sera were seropositive in NSDV and were run in three different CCHFV ELISA systems including the ID Screen® CCHFDA Multi-species and one indirect immunofluorescence test. • *Results:* all sera were negative with the ID Screen® CCHFDA Multi-species with one exception, one hyperimmunized calf tested positive with all of the assays whereas significant cross reactivities were observed in IFA. **The ID Screen® CCHFDA Multi-species does not present cross-reactions with Nairobi Sheep Disease Virus.**	Correlation with other techniques		Epidemiological study		
Khbou M.K., Romdhane R. *et al.* (2021) **Presence of antibodies to Crimean Congo haemorrhagic fever virus in sheep in Tunisia, North Africa.** VetMed Sci. 1–7	• 270 sheep were screened using the ID Screen® CCHFDA Multi-species in October 2019, after a peak activity of Hyalomma ticks; sera of the same animals taken at different periods between April 2018 and July 2019 were also used to obtain comparative results; positive sera were tested using a virus neutralisation test (VNT). • *Results:* Three out of 270 tested sera were seropositive to CCHFV. The seropositive ewe no. 1 showed a high ELISA titre (115%). The seropositive ewes no. 2 and no. 3 showed ELISA titres of 33.60% and 34.15%, respectively. When testing sera collected prior to October 2019, only ewe no. 1 displayed high ELISA titres (>110%). The VNT demonstrated that the serum of ewe no. 1 had a distinct titre as ND50 (50% neutralising dose) of 1:64. In contrast, the sera of ewes no. 2 and no. 3 showed no such a neutralising effect. **Because CCHFV viremia is short and of low intensity in livestock, the ID Screen® CCHFDA Multi-species offers the best alternative to detect CCHFV antibodies in sheep and is easy to implement in laboratories with limited resources.**	Correlation with other techniques		Epidemiological study		
Negredo A., Sánchez-Ledesma M. *et al*. (2021) **Retrospective Identification of Early Autochthonous Case of Crimean-Congo**	• retrospective identification of a **human case** dating back to 2013. The case strongly suggested CCHF infection. In 2020, a new serum sample was collected and tested by the ID Screen CCHFDA Multi-species and a commercial	Correlation with	Test of particular			

Hemorrhagic Fever, Spain, 2013. Emerging Infectious Diseases Vol. 27, No. 6	indirect immunofluorescence test for CCHFV-GPC and CCHFV-N. Retrospectively, stored samples collected 10 days after symptom onset were tested by PCR and IFA. • *Results:* The serum sample collected in 2020 was tested positive for antibodies to CCHFV with the ID Screen CCHFDA Multi-species further confirmed by IFA yielding positive results to both GPC and N antigens. In sample collected in 2013, CCHV genome was detected by PCR and IFA revealed CCHFV-N–specific IgG and IgM. **The ID Screen CCHFDA Multi-species is able to detect CCHFV antibodies in human samples, in correlation with commercial IFA for detection of CCHFV antibodies human samples.**			Epidemiological study		
Obanda V., Agwanda B. *et al.* (2021) **Livestock Presence Influences the Seroprevalence of Crimean Congo Hemorrhagic Fever Virus on Sympatric Wildlife in Kenya.** Vector-Borne And Zoonotic Diseases, Volume 21, Number 10	• Seroprevalence on 191 buffalo and 139 cattle using the ID Screen® CCHFDA Multi-species. • Results: seroprevalence for buffalo:75.3%; seroprevalence for cattle: 28.1%.			Epidemiological study		
Phonera M. C., Simuunza M.C. *et al.* (2021) **Seroprevalence and Risk Factors of Crimean-Congo Hemorrhagic Fever in Cattle of Smallholder Farmers in Central Malawi.** Pathogens 10, 1613	• seroprevalence study on cattle (n=416) using the ID Screen® CCHFDA Multi-species. • *Results:* seroprevalence = 46.9%.			Epidemiological study		
Zouaghi K., Bouattour, A. *et al.* (2021) **First Serological Evidence of Crimean-Congo Hemorrhagic Fever Virus and RiftValley Fever Virus in Ruminants in Tunisia.** Pathogens, 10, 769.	• 879 serum samples from cattle, sheep and goats were tested for CCHFV antibodies with the ID Screen CCHFDA Multi-species and IFA . • Results : among 97 sera detected positive by CCHFV ELISA, 76 samples were confirmed positive by IFA. In contrast, all inconclusive ELISA samples (n = 6) were tested negative by IIFA. The overall seroprevalence of CCHFV antibodies was 8.6% . **The use of both the ID Screen CCHFDA Multi-species and IFA are suitable to confirm the presence of anti-CCHFV IgG antibodies (greatly reducing the likelihood of false positive results).**	Correlation with other techniques		Epidemiological study		
Bouaicha F., Eisenbarth A. *et al*. (2020) **Epidemiological investigation of Crimean-Congo haemorrhagic fever virus infection among the one-humped camels (Camelus dromedarius) in southern Tunisia Ticks and Tick-borne Diseases.** Ticks and Tick-borne Diseases, Vol 12, Issue 1	• 273 dromedaries were tested in parallel with the ID Screen® CCHFDA Multi-species and a camel-specific indirect in-house CCHFV ELISA developed by the FLI. When the results of the two serological tests were concordant, the result was admitted. In cases of inconsistent or inconclusive findings, an indirect immune-fluorescence assay was used as a confirmatory test.	Correlation with other techniques	Test of particular species	Epidemiological study		

	• *Results:* of 273 tested sera, 245 were positive for anti-CCHFV antibodies (seroprevalence 87%); the results for the in-house ELISA and the ID Screen® CCHFDA Multi-species showed a substantial concordance (K = 0.74). **The ID Screen® CCHFDA Multi-species is useful to detect anti-CCHFV antibodies in camels.**					
Grech-Angelini S., Lancelot. R. *et al*. (2020) **Crimean-Congo Hemorrhagic Fever Virus Antibodies among Livestock on Corsica, France, 2014–2016.** Emerging Infectious Diseases; 26(5):1041-1044	• serologic survey for CCHFV antibodies in livestock (cattle, sheep, and goats; N = 3,890) with the ID Screen® CCHFDA Multi-species. PPRNT was then applied on 35 positive and 5 negative sera to confirm serological status and detect possible immune cross-reactions with Hazara virus and Dugbe virus . • *Results:* overall estimated seroprevalence was 9.1%. Of 35 ELISA-positive serum samples tested, none showed neutralizing antibodies against Hazara and Dugbe viruses, and no ELISA-negative serum sample showed neutralizing antibodies against CCHFV, Hazara virus, or Dugbe virus. Of 35 ELISA-positive serum samples, 23 had neutralizing antibodies against CCHFV. **The ID Screen® CCHFDA Multi-species does not present cross-reactions with Hazara and Dugbe viruses.**	Correlation with other techniques		Epidemiological study		Performance evaluation
Hartlaub J., von Arnim F. *et al*. (2020) **Sheep and Cattle Are Not Susceptible to Experimental Inoculation with Hazara Orthonairovirus, a Tick-Borne Arbovirus Closely Related to CCHFV.** Microorganisms 8, 1927	• One calf and one sheep were hyper immunized with inactivated Hazara virus, antisera were tested using the ID Screen® CCHFDA Multi-species and other serological methods. • *Results:* the ID Screen® CCHFDA Multi-species was clearly able to discriminate between HAZV and CCHFV antibodies, while cross-reactivities between these viruses in iIFA and WB may occur. **The ID Screen® CCHFDA Multi-species does not present cross-reactions with Hazara virus.**	Correlation with other techniques			Experimental infection	Performance evaluation
Mangombi J.B., Roqueplo C. *et al*.(2020) **Seroprevalence of Crimean-Congo Hemorrhagic Fever in Domesticated Animals in Northwestern Senegal.** Vector-Borne And Zoonotic Diseases, DOI: 20. 10.1089/vbz.2019.2592	• serologic survey for CCHFV antibodies. The ID Screen® CCHFDA Multi-species was tested on different species (n= 283). • *Results:* The prevalence of (CCHFV) infection among horses, cattle, sheep, dogs, donkeys, and goats was 70.3%, 57.1%, 22.1% , 18.2% , 17.2% and 6.9% respectively. **The ID Screen® CCHFDA Multi-species is suitable for use in different species and highlighted high seroprevalence in horses and cattle.**		Test of particular species	Epidemiological study		

Zohaib A., Saqib M. *et al*. (2020) **Crimean-Congo Hemorrhagic Fever Virus in Humans and Livestock, Pakistan, 2015–2017.** Emerging Infectious Diseases 26 (4)	• 1,838 sera from domestic animals (311 buffaloes, 480 camels, 183 cattle, 440 goats, and 424 sheep) were tested with the ID Screen® CCHFDA Multi-species in parallel with 1872 human sera tested with a ELISA for human samples and IFA. • *Results*: Of the 1,838 animals, 666 (36.2%) were positive for CCHF. The prevalence of CCHFV antibodies was significantly higher among camels (56.7%). **Detection of the CCHF antibodies in domestic livestock species with the ID Screen® CCHFDA Multi-species indicates a potential role of these animals in human infections.**		**Test of particular species**	**Epidemiological study**		
Sas M.A., Comtet L. *et al*. (2018) **A novel double-antigen sandwich ELISA for the species-independent detection of Crimean-Congo hemorrhagic fever virus-specific antibodies.** Antiviral Research 151, 24-26	• development and validation of the ID Screen® CCHFDA Multi-species for the detection of anti-CCHFV nucleoprotein antibodies; positive sera from 95 cattle and 176 small ruminants from CCHF-endemic regions (CCHF antibody status previously confirmed by two other serological assays) and negative sera from 402 cattle and 804 small ruminants from countries considered outside of the CCHFV endemic zone; suitability of the ID Screen® CCHFDA Multi-species was tested on different species. • *Results*: specificity 100%; sensitivity 99.9%; suitability of the ID Screen® CCHFDA Multi-species for cattle (50), goats (50), sheep (50), camels (4), rats (6), ferrets (4), dogs (5), raccoons (23), raccoon dogs (21), foxes (57), hares (21), pigs (50), humans (30). **The ID Screen® CCHFDA Multi-species is a highly specific and sensitive novel assay suitable for use in different species including humans.**	**Correlation with other techniques**	Test of particular species			**Performance evaluation**

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