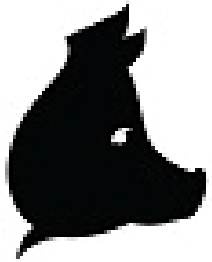
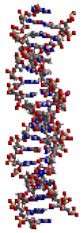


Molecular epidemiology of the neglected meat-borne pathogen *Sarcocystis* spp. in pigs and cattle: an update



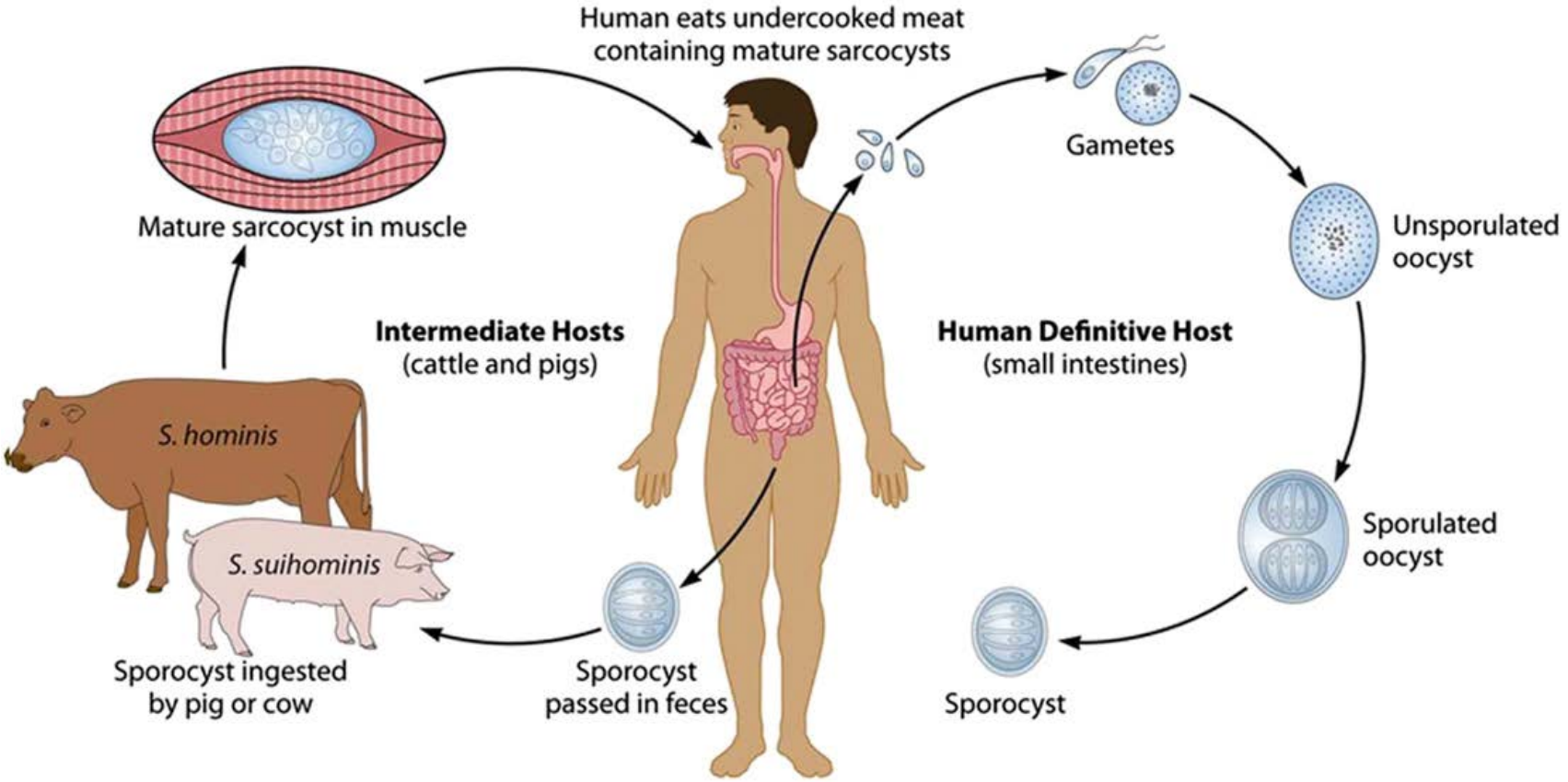
CASEE
Central and South Eastern Europe

Kálmán IMRE, Adriana MORAR, Mirela IMRE, Claudia SALA

Department of Animal Production and Veterinary Public Health,
Faculty of Veterinary Medicine,
Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timişoara, Romania

General considerations

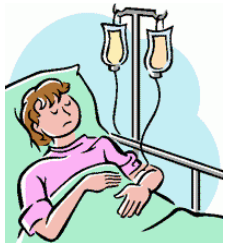
- *Sarcocystis* spp. are considered cyst-forming intracellular coccidian (Apicomplexa: Sporozoa) parasites



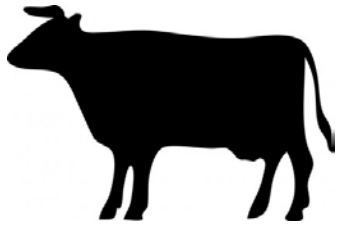
Dubey, J. (2015) – *Food and Waterborne Parasitology*, 1, 2-11

General considerations

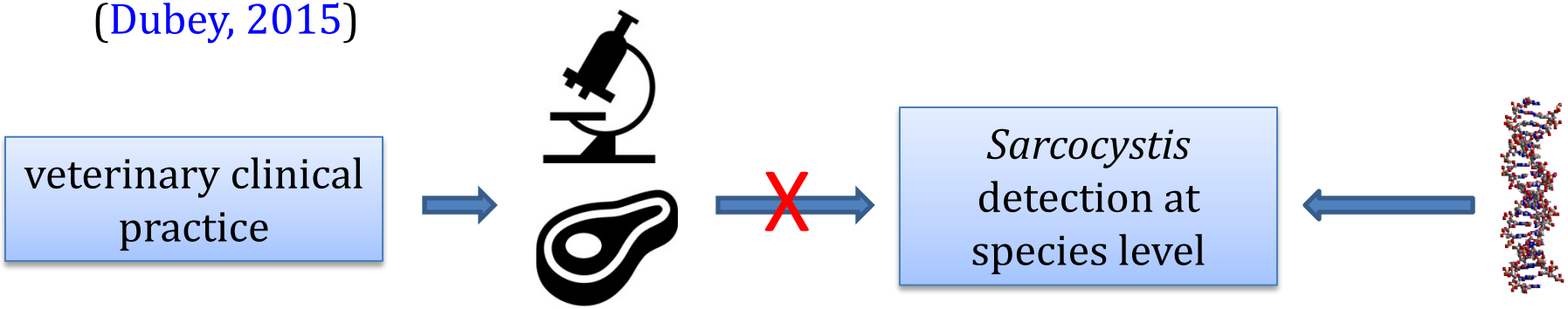
Consequences of the illness in humans (sarcocystosis):
appetite loss, vomiting, nausea, diarrhea, abdominal pain, respiratory disorders or tachycardia



• *Sarcocystis* spp. in **cattle** (*Bos taurus*):
S. cruzi, *S. hirsute*, *S. hominis*, *S. rommeli*, *S. heydorni* and *S. sinensis* – nomen nudum (Dubey, 2015)
S. bovifelis, *S. bovini* (Gjerde, 2016)

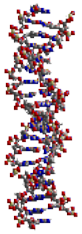


• *Sarcocystis* spp. in domestic (*Sus scrofa domesticus*) and feral **pigs** (*Sus scrofa*):
S. miescheriana, *S. suihominis*, and *S. porcifelis* (Dubey, 2015)



Aim

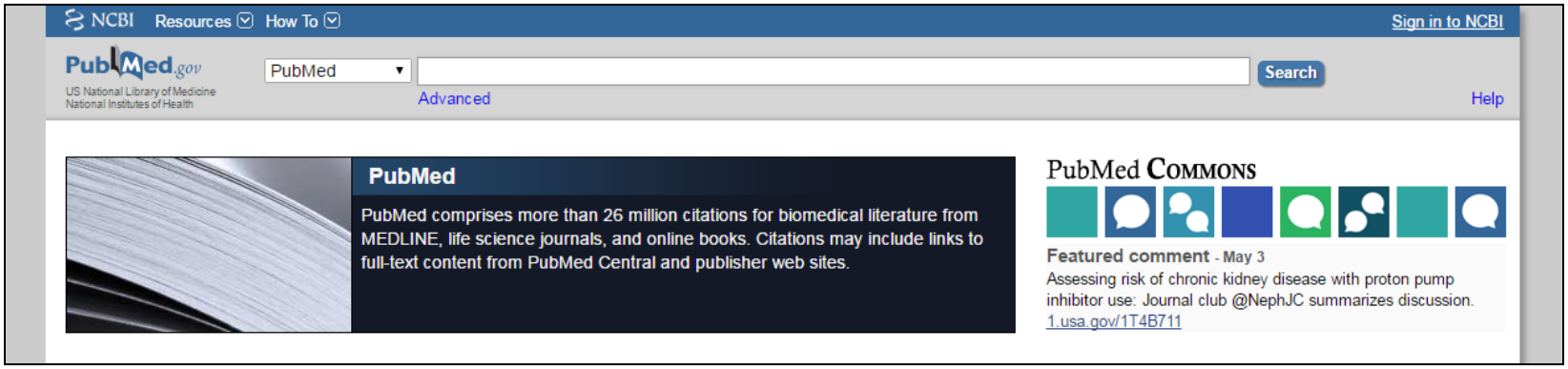
- review the worldwide distribution and molecular epidemiology of *Sarcocystis* spp. in cattle and pigs, processing PubMed retrieved relevant scientific papers, published in the new century and based on molecular tools
- prevalence values of the infections according to countries and geographical regions
- incriminated *Sarcocystis* spp. and their isolation sources together with the targeted genes and used primers
- public health significance of the isolates



Study design

The data for the current update covers the period from 2009 to nowadays.

Pub Med searching using "*Sarcocystis*" and "sarcocystosis" terms combined with "pig" "wild boar" and "pork" or "cattle" "bovine" "beef"



a total of 18 representative papers were selected

more than 80% out from the available published information from the scientific literature in the last 6 years.

Domestic pigs – epidemiological aspects

Host	County (geographical region)	No. of *Sarcocystis* positive samples / examined (%prevalence)	Isolation source (tissue)	Targeted gene region/primer set	Identified species (%)/no. of sequenced isolates	References
Sus scrofa domesticus	Switzerland	1* – case study	myocardium	18S rRNA / COC1 and COC2	*S. miescheriana*	Caspari et al. 2011
	China (Henan Province-Central region)	4/4 (100%) – isolates for slaughtered pigs	diaphragm	18S rRNA / S18SF and S18SR	*S. miescheriana*/4	Yan et al. 2013
	India (Punjab)	182/250 (72.8%)	myocardium	18S rRNA /	*S. miescheriana* (n=1), *S. suihominis* (n=6)/7	Kaur et al. 2016

http://www.producer.com/2015/06/program-touts-domestic-pork/

Feral pigs (wild boar) – epidemiological aspects

Host	County (geographical region)	No. of *Sarcocystis* positive samples / examined (%prevalence)	Isolation source (tissue)	Targeted gene region/primer set	Identified species (%)/no. of sequenced isolates	References
Sus scrofa	Portugal (North-Eastern)	76/103 (73.8)	diaphragm	18S rRNA / Sar-F, Sar-R, SmiesF and SsuihR	*S. miescheriana*/19	Coelho et al. 2015
	United States of America	44/147 (29.9)	myocardium	18S rRNA / 2L and 3H	*S. miescheriana*/31	Calero - Bernal et al. 2015
	Spain	8/25 (32)	myocardium	18S rRNA / 2L , 2H and 3H	*S. miescheriana* (n=7) *S. suihominis* (n=1)/8	Calero - Bernal et al. 2015
	Iran	1*	thigh muscle	18S rRNA / SarcoF and SarcoR	*S. miescheriana*	Kia et al. 2011

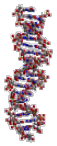
Cattle– epidemiological aspects

Host	County (geographical region)	No. of *Sarcocystis* positive samples / examined (%prevalence)	Isolation source (tissue)	Targeted gene region/primer set	Identified species (%)/no. of sequenced isolates	References
Bos taurus	Hungary	100/151 (66)	oesophagus myocardium	18S rRNA / COC1 and COC2; BJ1 and BN2	*S. cruzi* (64), *S. hominis* (19), *S. sinensis* (17)/36	Hornok et al. 2015
	Germany	174/257 (67.7)	minced (muscle) beef	18S ribosomal DNA/ SarcoFext and SarcoRext	*S. sinensis* (n=22), *S. hominis* (n=5) and S. *hirsuta* (n=1)/28	Moré et al. 2014
	Argentina	135/380 (35.5)	loin	18S rRNA / SarcoF and SarcoR	*S. cruzi* (n=16), *S. hominis* (n=13)	Moré et al. 2011
	Italy (North-Western)	279/384 (72.7) 228/384 (59.4) 225/384 (58.6)	oesophagus diaphragm myocardium	18S rRNA / -	*S. cruzi* (285), *S. hominis* (164), *S. hominis*-like (71), *S. hirsuta* (7)	Domenis et al. 2011
	Iran	90/101 (89.1)	diaphragm	18S rRNA / designed primers	*S. cruzi* (89), *S. hominis* (48)	Akhlaghi et al. 2016
		40/123 (32.5)	oesophagus diaphragm myocardium intercostals muscle	18S rRNA / 18S1H and 18S9L	*S. cruzi*	Hamidinejat et al. 2015
		1*	hamburger	18S rRNA / SarF and SarR	*S. hominis*	Ahmadi et al. 2015
			diaphragm	18S rRNA	*S. hominis*	Hajimohammadi et al. 2014
	Malaysia	49/77 (63.6)	myocardium	18S rRNA	*S. cruzi* (49)	Latif et al. 2015
	Vietnam	63/101 (62.4)	oesophagus, diaphragm, tongue and cervical muscle	18S rRNA / 18S9L and 18S1H	*S. cruzi* (55), *S. hominis* (54), *S. hirsuta* (28)	Jehle et al. 2009

Cattle– epidemiological aspects

Host	County (geographical region)	No. of *Sarcocystis* positive samples / examined (%prevalence)	Isolation source (tissue)	Targeted gene region/primer set	Identified species (%)/no. of sequenced isolates	References
Bos taurus	Argentina	147 excised individuals sarcocysts from 12 samples of cattle meat	beef muscle tissue	Partial *Cox*1/SF1 and SR9 and for 7 isolates of *S. bovifelis* SR8D and and SR9; and Ss1R, Ss2R for *S. bovifelis*, Sb1R and Sb2R for *S. bovini*	*S. bovifelis* (n=67) *S. bovini* (5), *S. hirsuta* (1) *S. cruzi* (n=21)	Gjerde, 2016
	New Zeeland				*S. bovifelis* (n=38), *S. bovini* (19) *S. hirsuta* (19)	
	Brazil				*S. bovifelis* (n=15), *S. hirsuta* (15)	
	Uruguay				*S. bovifelis* (n=1) *S. cruzi* (1)	
	Germany				*S. bovifelis* (n=26) *S. hirsuta* (n=21)	

Conclusions



- Scanty background of molecular studies, especially in European countries, even if the food safety regulations require the surveillance of protozoa in meat and derivate products by each member state.

- In domestic pigs and wild boar: widespread occurrence of *S. miescheriana*, a narrower appearance of *S. suihominis* (only 2 studies) and the lack of *S. porcifelis* with uncertain taxonomic status

- In cattle: *S. cruzi* and the zoonotic *S. hominis* seems to be the most prevalent species, followed by *S. sinensis* (currently recognized as *nomen nudum*) and *S. hirsuta*. In addition, the presence of a considerable number of *S. bovifelis* and *S. bovini* has been reported in a single study, and currently they can be considered genetically distinct species.

- The relatively reduced number of publications presenting *Sarcocystis* molecular epidemiologic background in livestock meat intended for human consumption, pointed out the necessity of the increasing the number of surveys dedicated to this topic at worldwide level and special emphasis on European countries.

Thank you for your attention!