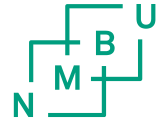


Foodborne Zoonotic Parasites

Lucy J. Robertson,
Norwegian University of Life Sciences, Oslo, Norway

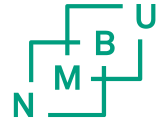
Foodborne pathogens – increasing importance ??



Increasing awareness of foodborne pathogens:

- Outbreaks
- Broad national and international food distribution
- Trends towards organic, fresh, natural, minimally-processed foods
- Increasingly susceptible populations
- Climate change
- Globalisation

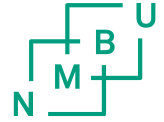
Foodborne parasites – increasing importance ??



Parasites – less focus than other pathogens:

- Often associated with vulnerable populations (impoverished, immunosuppressed....)
- Symptoms may be acute (can be fatal)
- But also may be chronic → insidious problems
- Diagnostic expertise lacking
- Long period between infection and symptoms (days → years) – food association may be missed.
- Methods for detection in food often inadequate / non-existent

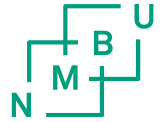
Foodborne parasites – increasing importance ??



BUT: same points apply as for other pathogens

- Outbreaks
- Broad national and international food distribution
- Trends towards organic, fresh, natural, minimally-processed foods
- Increasingly susceptible populations
- Climate change
- Globalisation

Foodborne parasites – increasing importance ??



11 personnes hospitalisées après avoir consommé de la viande de sanglier

BELGA Publié le vendredi 05 décembre 2014 à 13h33 - Mis à jour le vendredi 05 décembre 2014 à 13h34



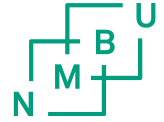
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- > [L'obésité peut abrégé la vie de huit ans](#)
- > [Découvrez le secret des "géants"](#)

SANTÉ Le dernier cas de Trichinella a été détecté en Belgique dans les années 70.

L'agence flamande Soins et Santé (VAZG) a indiqué vendredi que 11 personnes ont été hospitalisées dans les provinces d'Anvers et du Limbourg après avoir consommé de la viande de sanglier en provenance d'Espagne. Le gibier aurait été contaminé par des larves de Trichinella. Les patients présentent des symptômes grippaux. Leurs jours ne sont pas en danger.

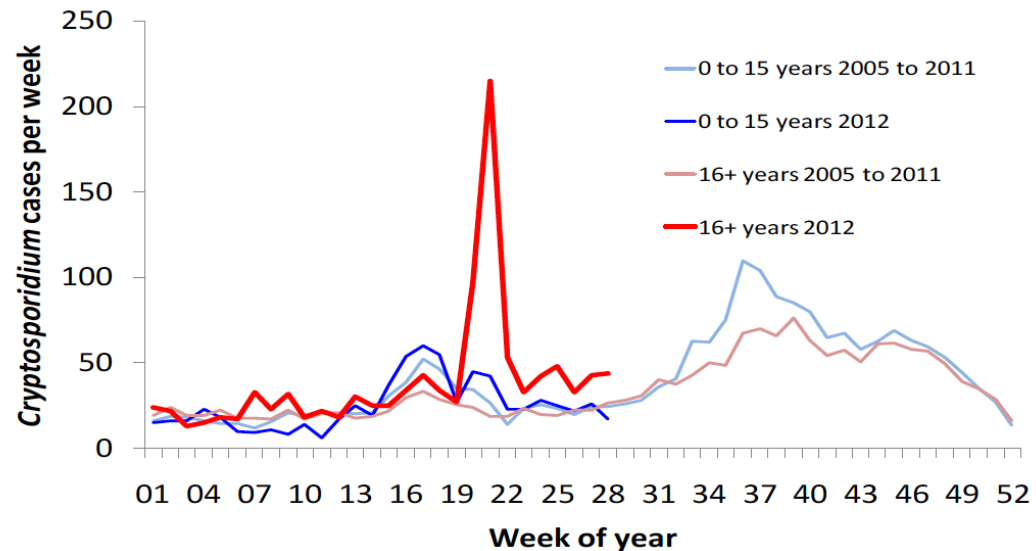
Foodborne parasites – increasing importance ??



- Spring 2012 – 300 cases of cryptosporidiosis across UK (Scotland & England) – epidemiologically associated with ready-to-eat salads

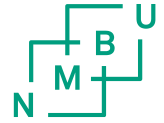


Figure 1. Epidemic curve of *Cryptosporidium* cases in people of 16 years old and above and those of <16 years by onset date in England and Wales compared to average cases for the years 2005 to 2011



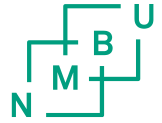
Health Protection Report Vol 7 No. 12 - 22 March 2013

Cyclospora cayetanensis: Three years of outbreaks associated with cilantro from Mexico



Year of outbreak	2013	2014	2015
Reference	CDC (2013)	CDC (2015a)	CDC (2015a)
No. infected	631	304	546
No. hospitalized	49	7	21
No. states reporting infection	Most Texas - also from 24 other states & NYC	Most Texas - also 19 other states & NYC	Most Texas - also 30 other states & NYC
Most cases	Mid-June to August	June-August	May-August
Implicated vehicles of infection	Cilantro and salad mixes	Cilantro (for cases in Texas)	Cilantro (for some cases)
Country of origin	Mexico	Mexico	Mexico
Effects on trade	<ul style="list-style-type: none"> • Implicated farm named by FDA • Export to USA from farm suspended for 2 weeks • Border surveillance for cilantro increased 	<ul style="list-style-type: none"> • Implicated farm named by FDA • Increased sampling of cilantro at the U.S./Mexico border by FDA 	<ul style="list-style-type: none"> • FDA import alert on cilantro from Puebla, Mexico April 1 - August 31 annually, unless from firm on the Green List

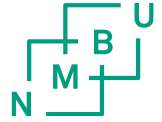
Importance of knowledge of parasites in food safety



- Which parasites may occur in which food matrices?
- How likely are they to occur and how severe are the diseases they may cause?
- Morbidity, mortality, DALYs (YLL + YLD)
- What are the risks associated with these parasites?
 - and what are the risk factors?
- Can these parasites be detected in food products
 - and if so, how?
- How can the parasites be inactivated?
- How can the lifecycles be interrupted?

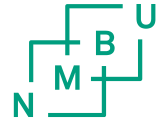
- Considerable focus on bacteria/virus in foods – parasites are important too!

Challenges when considering foodborne parasites



- Huge number of different parasites can be foodborne
- Different parasite groups
 - worms: nematodes, cestodes, trematodes
 - protozoa: very diverse
- Very differing lifecycles and transmission routes
 - Some zoonotic, some not – some possibly zoonotic...
 - In meat or fish, or as contaminants of fresh produce
 - Multiple transmission routes
- Very differing symptoms/pathology
 - Can be severe (possibly fatal)
 - Often chronic, long-term sequelae - burden hidden
- Very differing diagnostic methods
- How to focus resources???

Which foodborne parasites should have most attention and resources?

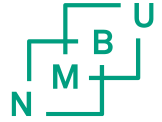


Codex Committee on Food Hygiene (CCFH) requested WHO/FAO:

“to provide the CCFH with advice and guidance on the parasite-commodity combinations of particular concern”

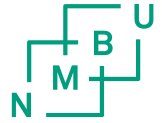
- 21 experts from 20 countries covering all global regions
- **95** potential foodborne parasites initially identified for consideration
- 24 parasites for ranking

Global risk-ranking of foodborne parasites



- Multicriteria-based ranking for risk management of foodborne parasites
- Joint FAO/WHO expert meeting, 3-7 September, 2012
- 24 potentially foodborne parasites ranked
- 7 criteria used for ranking
- Each criterion with a different weight

Global risk-ranking of foodborne parasites

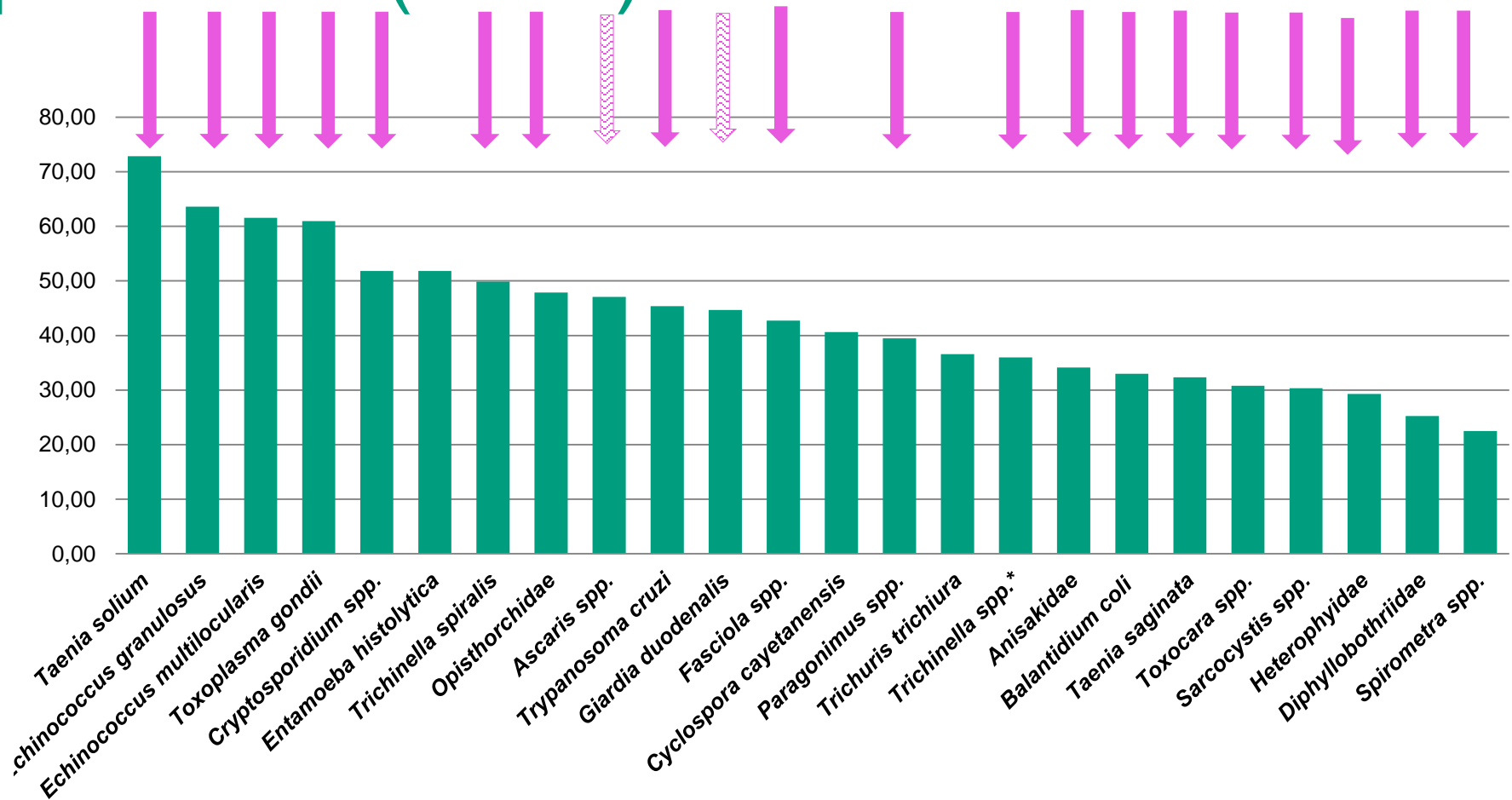
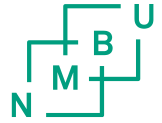


Criteria weight		Average weighting from experts
W1.	Number of global foodborne illnesses	0.24
W2.	Global distribution	0.15
W345.	Morbidity severity	0.23
W6.	Case-fatality ratio	0.16
W7.	Increasing illness potential	0.06
W8.	Trade relevance	0.06
W9.	Impacts to economically vulnerable communities	0.09

The overall score for each parasite is given by the following equation:

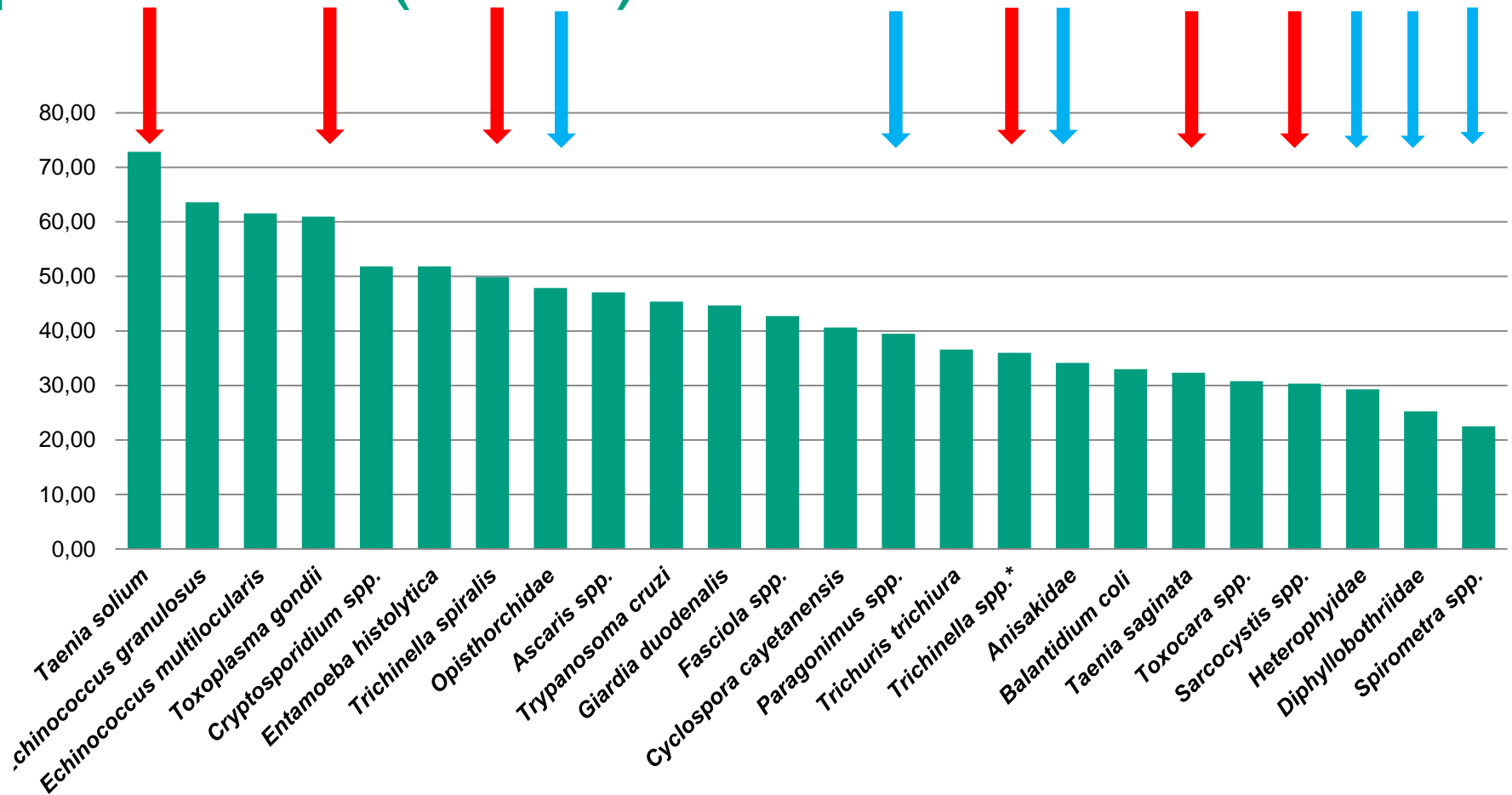
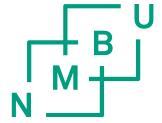
$$C1*W1+C2*W2+\{C3*(1C5)+C4*C5\}*W345+C6*W6+C7*W7+C8*W8+C9*W9$$

Global risk-ranking of foodborne parasites (2012)



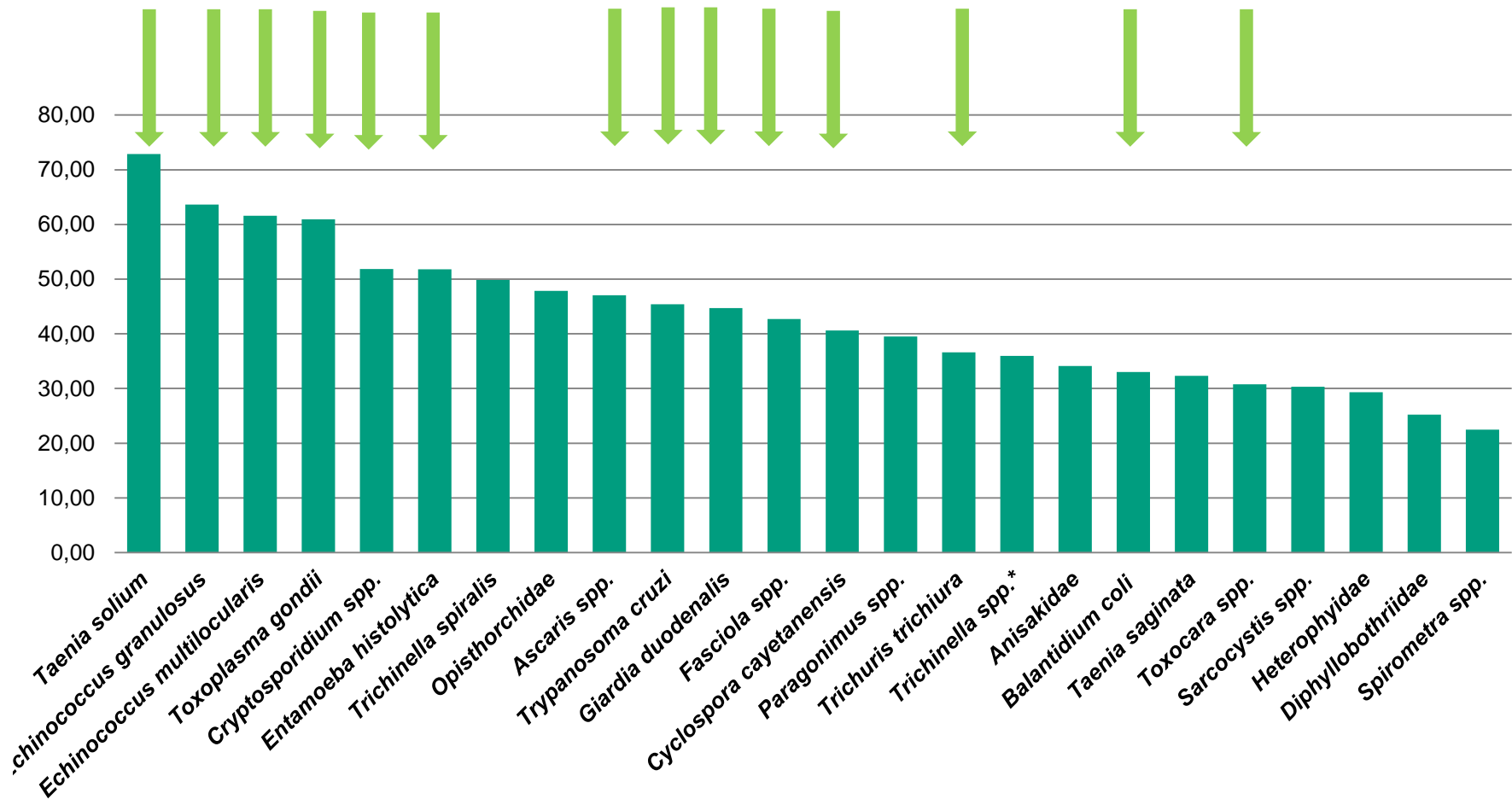
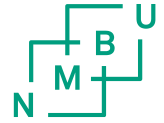
Zoonoses highlighted

Global risk-ranking of foodborne parasites (2012)



Meatborne + fishborne highlighted

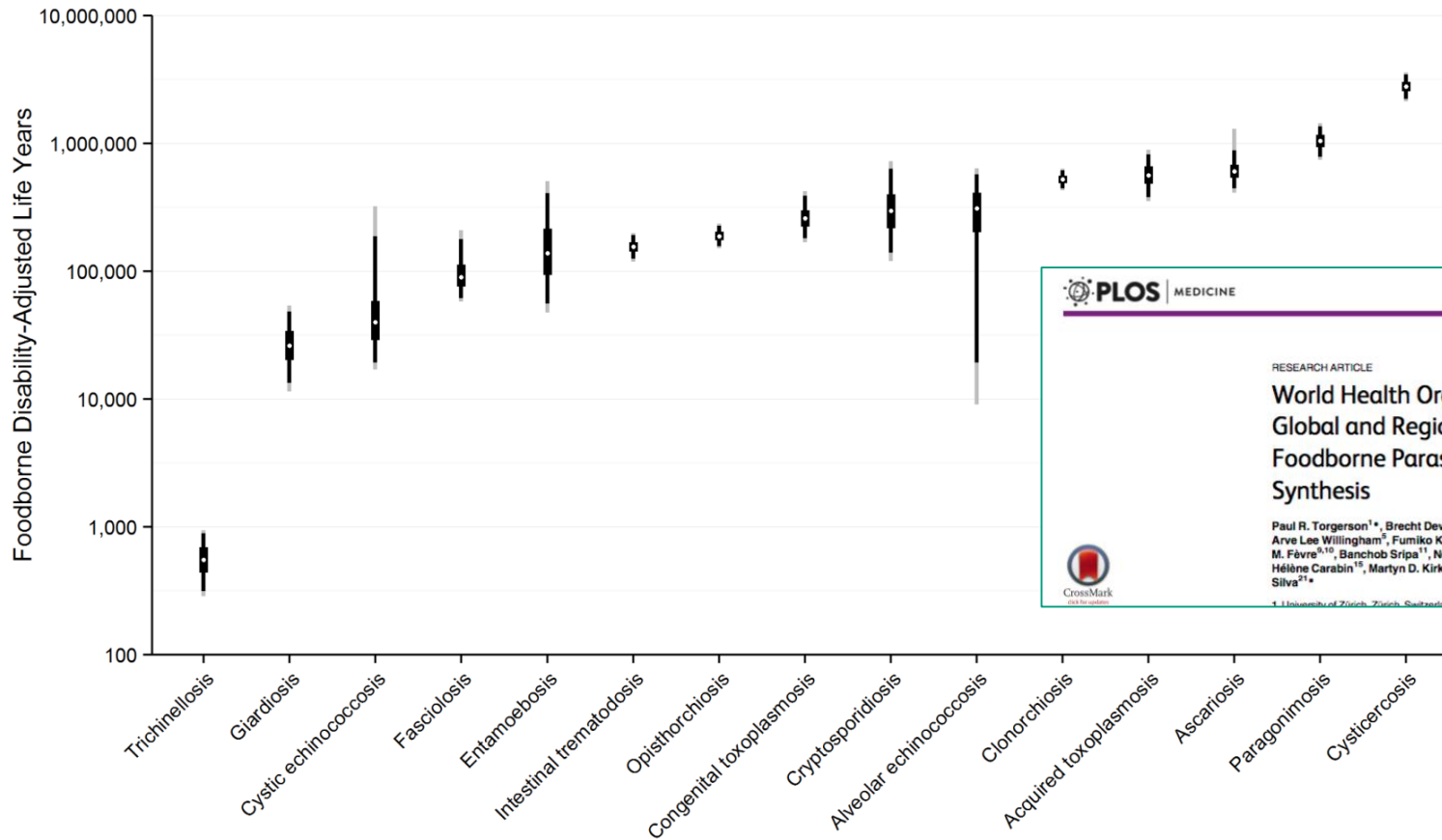
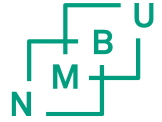
Global risk-ranking of foodborne parasites (2012)



Produce-borne highlighted

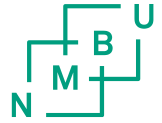
<http://www.fao.org/3/a-i3649e.pdf>

FERG analysis



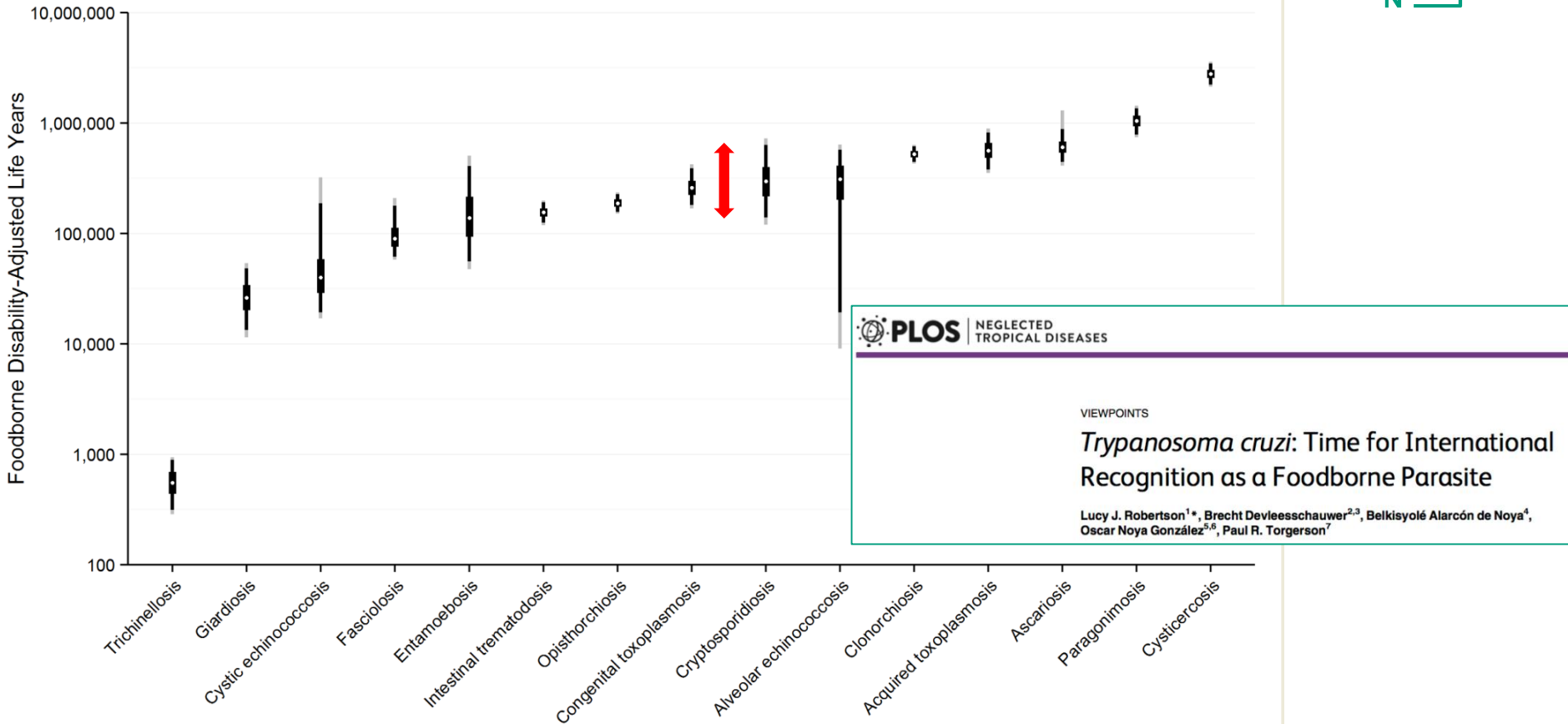
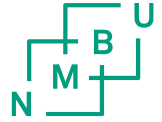
- Cf with FAO/WHO risk ranking.
- Only public health significance considered and diseases rather than parasites - fewer parasites (14 of 24) – concentrated on DALYs.
- NB: BUT - same parasite at the top!

Global analyses vs regional analyses

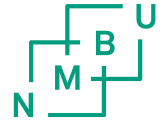


- Global analyses – give snapshot for attention, but may underestimate importance of regionally important parasites
- *T. cruzi*
 - Position 10 out of 24 in global FAO/WHO ranking
 - Not included in FERG analyses
 - However:
 - estimated global prevalence: 15 million
 - estimated global incidence: 200,000
 - estimated deaths annually: 15,000
 - 67 % estimated as foodborne
 - Use conservative estimate of 50 % foodborne
 - 273,000 DALYs per year (8th place in FERG)

FERG analysis + *T. cruzi*



- Illustration of importance of regional significance
- Resources often focused at the regional / national level
- *T. solium* / cysticercosis important globally - but of less importance where pigs are not reared or are only reared inside



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www.zoopa.org

WELCOME TO ZOOPA!

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A platform for sharing tools and knowledge on veterinary and human medical research on zoonotic infections, with specific focus on foodborne and waterborne parasites.

Collaborative research-based educational project funded by the Norwegian Centre for International Cooperation in Education (SIU), Norway through the Utforsk programme.

Sponsored By - UTFORSK PROGRAMME, Norwegian Centre for International Cooperation in Education (SIU), Norway

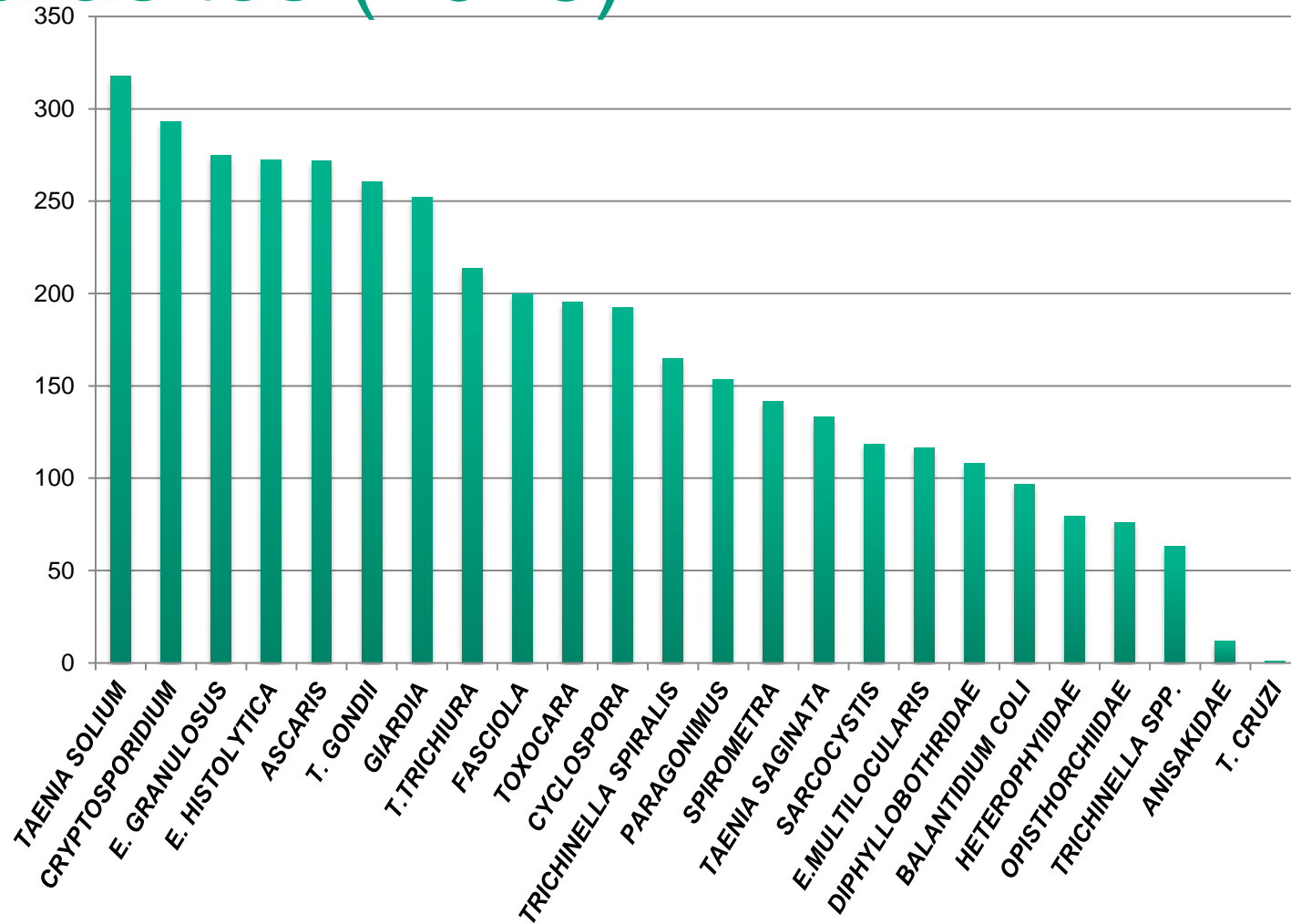
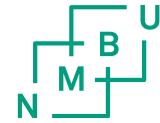
One Health and Parasitology, Turkish Congress of Microbiology. Nov 2016

Norwegian University of Life Sciences

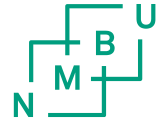
ZooPa activities

- Workshops in India and Norway
 - Risk ranking of foodborne parasites
 - Same approach as FAO ranking from
 - Scenarios and problem solving for zoonotic parasites
- Hands-on training courses
 - Detection of parasites as contaminants of food
 - Parasitology diagnostics
- Student exchanges and small-scale One Health research projects

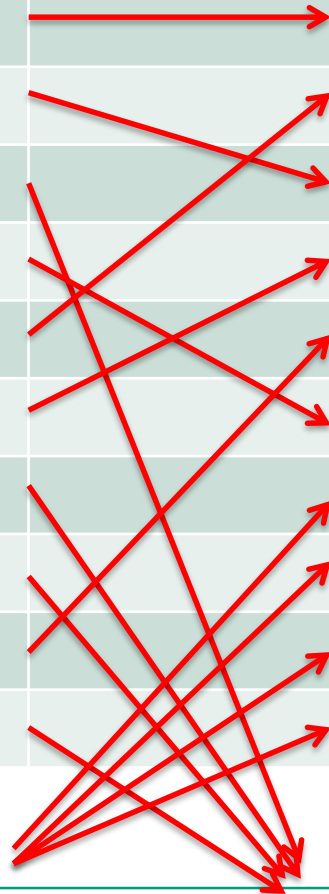
Indian risk-ranking of foodborne parasites (2015)



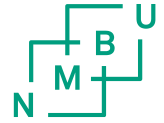
Comparison of Indian and Global ranking of top 10 parasites



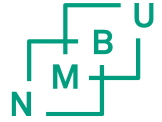
Rank	GLOBAL RANKING		INDIAN RANKING
1	<i>Taenia solium</i>	→	<i>Taenia solium</i>
2	<i>Echinococcus granulosus</i>	→	<i>Cryptosporidium</i> spp.
3	<i>Echinococcus multilocularis</i>	→	<i>Echinococcus granulosus</i>
4	<i>Toxoplasma gondii</i>	→	<i>Entamoeba histolytica</i>
5	<i>Cryptosporidium</i> spp.	→	<i>Ascaris</i>
6	<i>Entamoeba histolytica</i>	→	<i>Toxoplasma gondii</i>
7	<i>Trichinella spiralis</i>	→	<i>Giardia duodenalis</i>
8	Opisthorchiidae	→	<i>Trichuris trichiuria</i>
9	<i>Ascaris</i>	→	<i>Fasciola</i>
10	<i>Trypanosoma cruzi</i>	→	<i>Toxocara</i>



European risk-ranking of foodborne parasites (2016)



Regional or national ranking

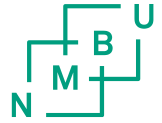


Reflection of:

- Local prevalences
- Local concerns
- Local dietary or culinary customs
- Provides better indication of where resources should be focused at the regional or national scale
- Even within a region, there may well be differences according to factors affecting transmission of specific parasites

- What about Europe (incl. Turkey) ??

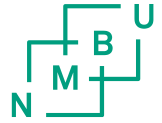
European Network for Foodborne Parasites (Euro-FBP)



- COST Action FA1408
- Funded by EU – from 2015-2019
- No research funding, but funding for meetings, workshops, short-term scientific missions.....
- 4 WorkGroups
 - WG1 - Region-specific ranking and current surveillance systems
 - WG2 - Analytical and diagnostic methods for FBP
 - WG3 - Interventions
 - WG4 - Global trends, risk assessment and research agenda prioritisation and consolidation



European Network for Foodborne Parasites (Euro-FBP)



- HOMEPAGE: <http://www.euro-fbp.org>

COST
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EURO-FBP

THE ACTION THE NETWORK ACTIVITIES RESOURCES JOIN THE ACTION! LOG IN

EURO-FBP

A European Network for Foodborne Parasites

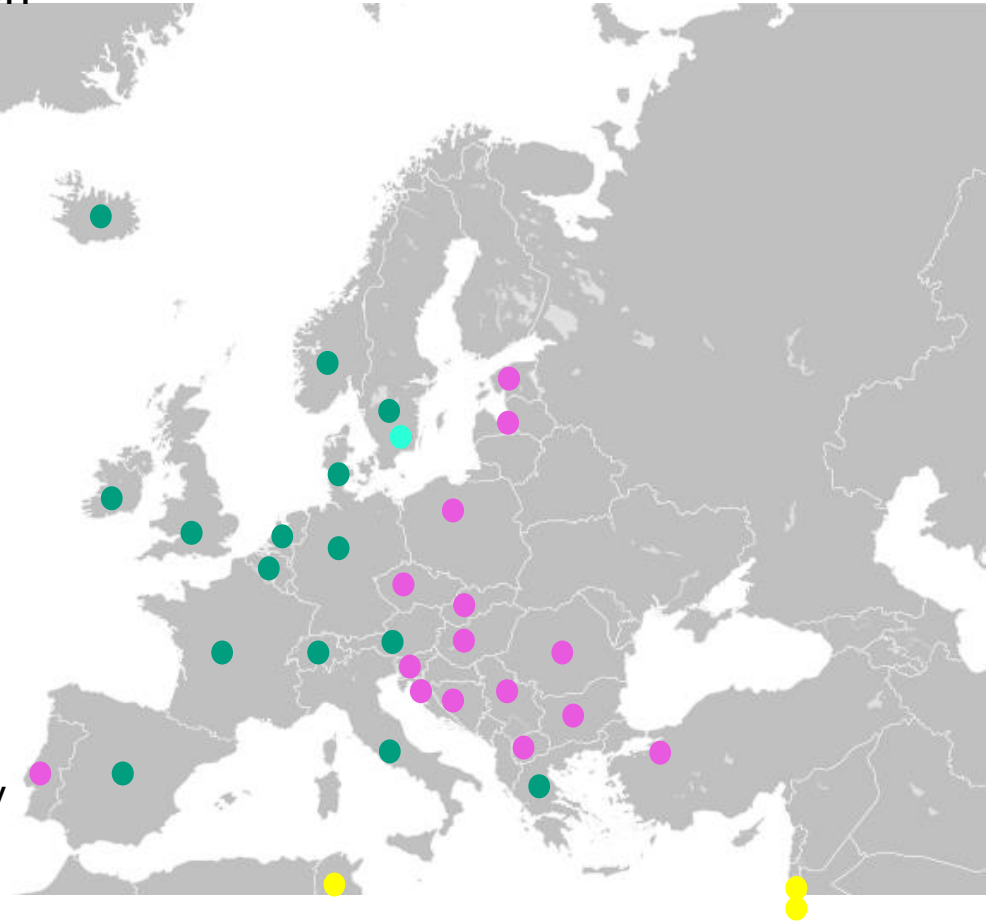
Recent News

COST Action EURO-FBP (FA1408) promotes collaboration between scientists working on foodborne parasites in Europe.

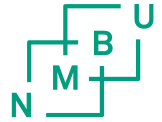
The goal of **COST Action EURO-FBP** (FA1408) is to decrease the impact on human health from foodborne parasites (FBP), through establishing a risk-based control programme for FBP containing robust and appropriate protective strategies.

30 COST countries (14 inclusiveness countries), 3NNC, 1 IPC, 1 organization

- Austria
- Belgium
- Bosnia + Herzegovina
- Bulgaria
- Croatia
- Czech Republic
- Denmark
- Estonia
- France
- FYR Macedonia
- Germany
- Greece
- Hungary
- Iceland
- Ireland
- Italy
- Latvia
- Netherlands
- Norway
- Poland
- Portugal
- Romania
- Serbia
- Slovakia
- Slovenia
- Spain
- Sweden
- Switzerland
- Turkey
- UK
- Palestinian Authority
- Tunisia
- Israel
- ECDC
- USA (IPC)



European Network for Foodborne Parasites (Euro-FBP)



Euro-FBP Meeting **Ljubljana, Slovenia 26-28th September 2016**

Meeting title: Analytical Methods on Foodborne Parasites: analysis of food matrices and diagnostics in human medical and veterinary samples

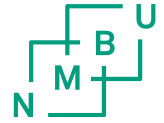
This EURO-FBP meeting was a co-located meeting with COST Action TD1302 Cystinet on Day 3.

Organisation of Meeting: WG2 (WG leader – Christian Klotz)

Local organisers: Miha Skvarč and Barbara Šoba

[For more info click here.](#)

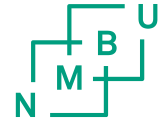
European risk-ranking of foodborne parasites (2016)



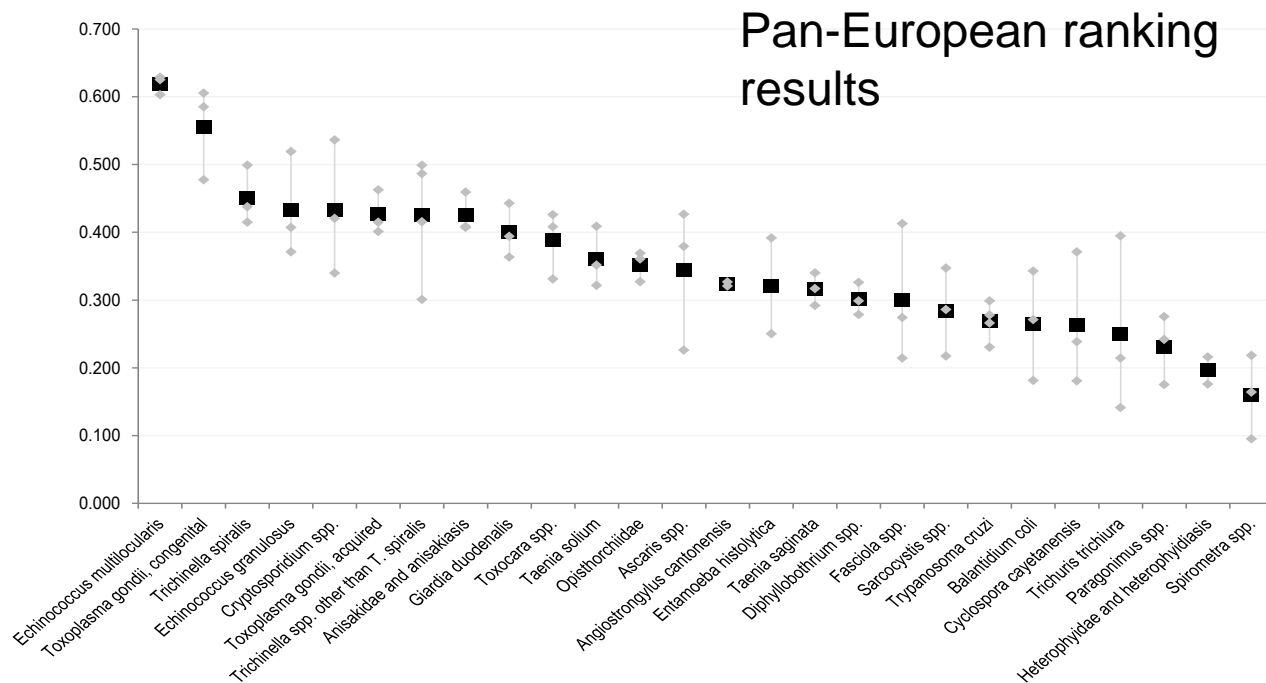
- Meeting in Bilthoven in Jan 2016 organised by WG1 leader to rank parasites from a Europe-wide and at the European regional level.

Region (ESCMID)	Countries
Northern Europe (5)	Denmark (3), Finland, Iceland, Norway (1), Sweden (1)
Western Europe (7)	Austria, Belgium (1), France (1), Germany (1), Ireland (1), Lichenstein, Luxembourg, Netherlands (1), Switzerland (1), UK (1)
Eastern Europe (10)	Czech Republic (1), Estonia (1), Latvia (1), Lithuania, Poland (2), Moldova, Hungary (1), Romania (3), Slovakia (1)
SW Europe (2)	Andorra, Italy (1), Malta, Monaco, Portugal, San Marino, Spain (1)
SE Europe (11)	Albania, Bosnia & Herzegovina, Bulgaria (1), Croatia (1), Cyprus, Greece (2), Kosovo, Macedonia (2) Montenegro, Slovenia, Serbia (4), Turkey (1)

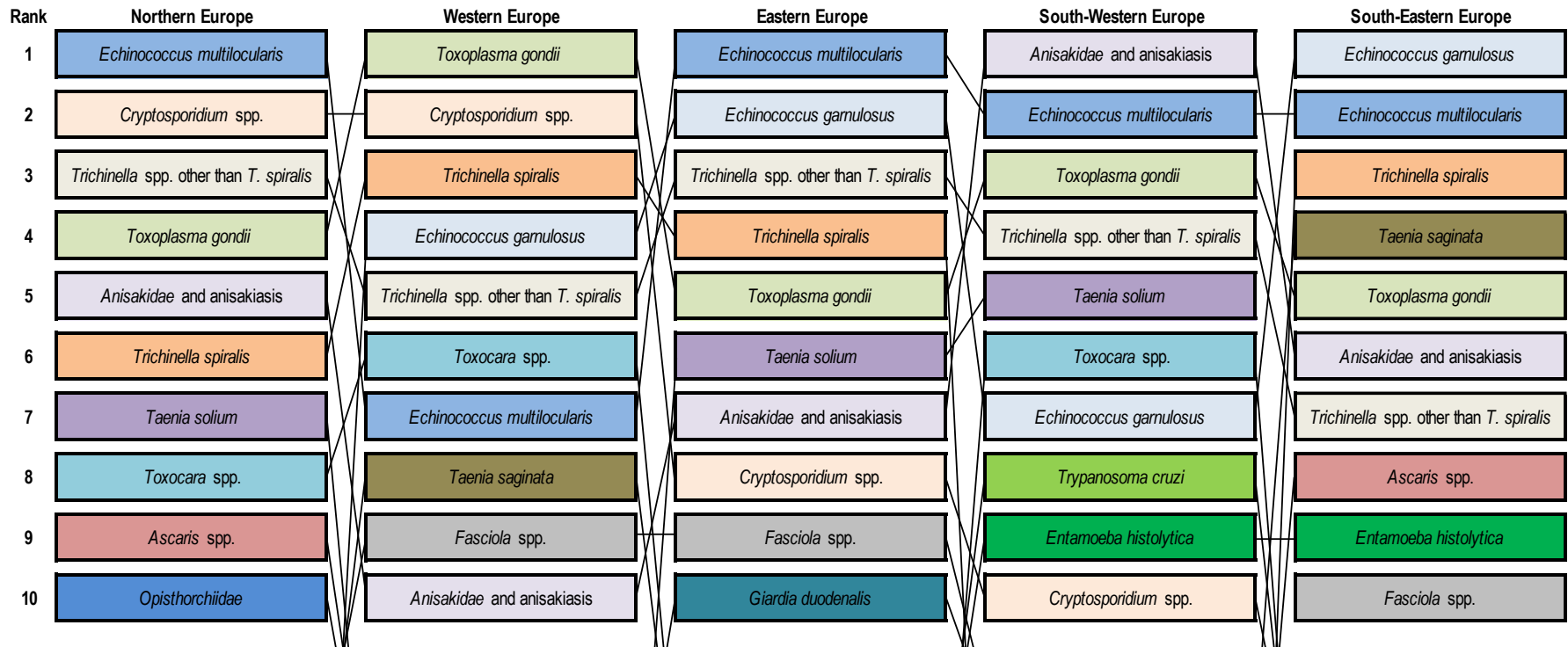
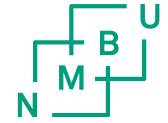
European risk-ranking of foodborne parasites (2016)



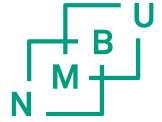
- Similar methodology to FAO/WHO ranking (and Indian ranking) – that is not just DALYs (FERG)
- Both pan-European and regional



European risk-ranking of foodborne parasites (2016)



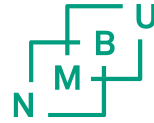
European risk-ranking of foodborne parasites (2016)



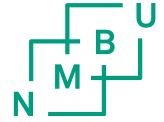
- Conclusions

- *Echinococcus multilocularis*, *Toxoplasma gondii*, *Trichinella spiralis*, *Echinococcus granulosus* and *Cryptosporidium* spp. ranked highest at the Pan-European level
- The top-priority foodborne parasites in almost all regions (ranked 1st or 2nd) was *E. multilocularis*.
- But only 7th in Western Europe
- *T. gondii* was considered top priority in Western Europe, but 3rd-5th in all other regions.
- Parasites in top 10 in ALL regions: *Echinococcus multilocularis*, *Toxoplasma gondii*, *Trichinella* other than *T. spiralis*, Anisakidae; ALL ZOONOSES

European risk-ranking of foodborne parasites (2016)



Foodborne zoonotic parasites – concluding comments



- Most foodborne parasites are zoonotic
- One Health approach important in control
- Identifying outbreaks may be difficult for some parasites due to non-specific symptoms and multiple possible transmission routes
- Prevalence and importance affected by regional factors
- Robust transmission stages indicate that control options may be limited, especially for food that is not cooked
- Join Euro-FBP to make a difference



Thank you for your attention!

