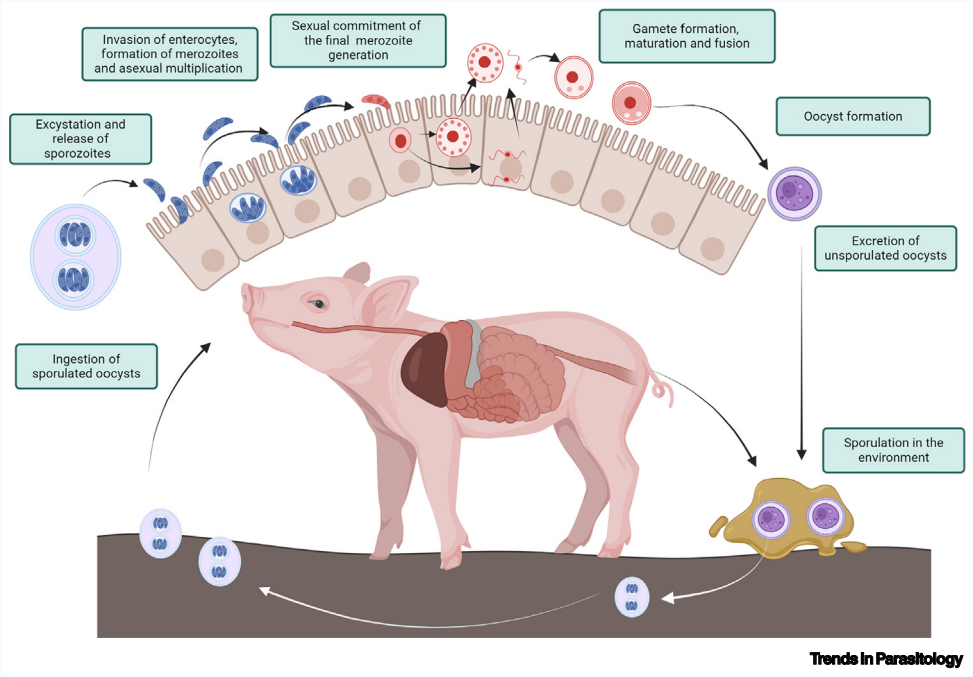
Trends in Parasitology | Parasite of the Month

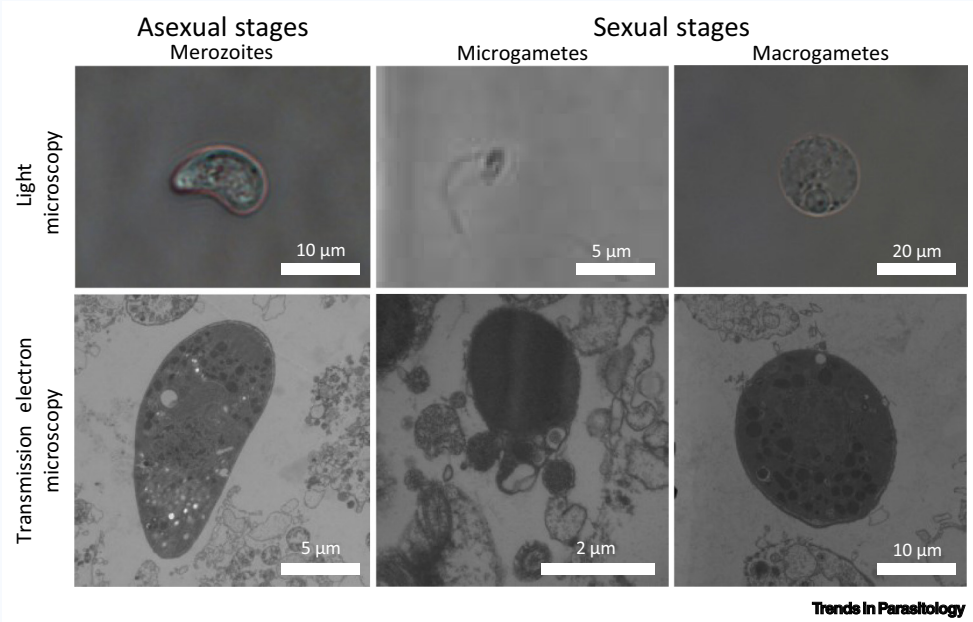
Cystoisospora suis

Anna Sophia Feix [1,*] **and Anja Joachim** [1]

[1]Institute of Parasitology, Department of Pathobiology, University of Veterinary Medicine Vienna, Veterinärplatz 1, A-1210 Vienna, Austria



Cystoisospora suis, an obligate intracellular protozoan parasite of the order Coccidia, causes porcine cystoisosporosis predominantly in suckling piglets, with significant economic losses in the pig-producing industry worldwide. It has a direct life cycle with sporulated oocysts as transmissible stages and, despite its monoxenic development, is a close relative of *Toxoplasma gondii* and *Neospora caninum*. Unlike any other member of the Coccidia, however, *C. suis* can be cultivated *in vitro* in all developmental phases, allowing for detailed studies on the morphology, development, transcriptomic, and proteomic makeup of asexual, presexual, and, specifically, sexual stages (gametes) which are frequently only poorly accessible in this order due to their short life span and low number. Over the years, *C. suis* has grown into a non-model member of the Coccidia with implications for new ways to control coccidiosis in livestock and man.



KEY FACTS:

C. suis infection results in significant economic losses in the pig-producing industry, due to its high prevalence in pig farms worldwide, which lies between 58% and 82% of infected piglets.

In contrast to other *in vitro* culture systems for Apicomplexan parasites, the advanced *C. suis in vitro* system makes the cultivation of sexual stages possible, which to date is unique in Coccidia and other important groups of apicomplexan parasites.

As soon as merozoites have undergone their development and matured to sexually committed forms, sexual stages can be cultured with or without host cells, and oocysts arise from cultures.

DISEASE FACTS:

Most common symptoms are non-haemorrhagic diarrhoea and reduced weight gain leading to increased production costs and poor performance in industrialised pig production.

Despite limited treatment options, toltrazuril, the only registered compound in the EU, remains active against *C. suis*. However, resistance to toltrazuril is on the rise.

As of now, no commercially available vaccine is available. However, vaccination targets hold promise for future control options.

TAXONOMY AND CLASSIFICATION:

PHYLUM: Apicomplexa
CLASS: Conoidasida
ORDER: Eucoccidiorida
FAMILY: Sarcocystidae
GENUS: *Cystoisospora*
SPECIES: *C. suis*

*Correspondence:
Anna.Feix@vetmeduni.ac.at (A.S. Feix).

https://doi.org/10.1016/j.pt.2024.03.009

Acknowledgments

We would like to thank Bärbel Ruttkowski for her constant improvement of *C. suis in vitro* cultivation over the past 20 years, as well as the Austrian Science Fund for financial support in research on *C. suis* gametes (project number PP33123-B). The figures were created using BioRender.

Declaration of interests

The authors declare no competing interests.

Resources

https://swinehealth.ceva.com/blog/coccidiosis-in-piglets

www.apicowplexa.net/index.php/bern-2021/

Literature

1. Cruz-Bustos, T. *et al.* (2023) Unravelling the sexual developmental biology of *Cystoisospora suis*, a model for comparative coccidian parasite studies. *Front. Cell. Infect. Microbiol.* 13, 1271731
2. Feix, A.S. *et al.* (2023) *In vitro* cultivation methods for coccidian parasite research. *Int. J. Parasitol.* 53, 477–489
3. Feix, A.S. *et al.* (2022) Inhibition of sexual stage-specific proteins results in reduced numbers of sexual stages and oocysts of *Cystoisospora suis* (Apicomplexa: Coccidia) *in vitro*. *Int. J. Parasitol.* 52, 829–841
4. Cruz-Bustos, T. *et al.* (2022) The transcriptome from asexual to sexual *in vitro* development of *Cystoisospora suis* (Apicomplexa: Coccidia). *Sci. Rep.* 12, 5972
5. Joachim, A. and Ruttkowski, B. (2021) *Cystoisospora suis* merozoite development assay for screening of drug efficacy *in vitro*. *Exp. Parasitol.* 220, 108035
6. Feix, A.S. *et al.* (2021) Progression of asexual to sexual stages of *Cystoisospora suis* in a host cell-free environment as a model for Coccidia. *Parasitology* 148, 1475–1481
7. Feix, A.S. *et al.* (2020) Characterization of *Cystoisospora* suis sexual stages *in vitro*. *Parasit. Vectors* 13, 143
8. Hinney, B. *et al.* (2020) *Cystoisospora suis* control in Europe is not always effective. *Front. Vet. Sci.* 7, 113
9. Palmieri, N. *et al.* (2017) The genome of the protozoan parasite *Cystoisospora suis* and a reverse vaccinology approach to identify vaccine candidates. *Int. J. Parasitol.* 47, 189–202
10. Shrestha, A. *et al.* (2015) *Cystoisospora suis*—a model of mammalian cystoisosporosis. *Front. Vet. Sci.* 2, 68

https://doi.org/10.1016/j.pt.2024.03.009