

Angelika Proskurnicka, Patryk Mazur, Tomasz Jagielski*

Department of Medical Microbiology, Institute of Microbiology, Faculty of Biology, University of Warsaw, Poland

* Correspondence to: t.jagielski@uw.edu.pl

Prototheca spp. are unicellular, non-photosynthetic, yeast-like microalgae that can inhabit a variety of natural environments. These microorganisms are the only known plants involved in a number of clinically relevant opportunistic infections in vertebrates, collectively known as protothecosis. Very little is known about the pathogenesis of *Prototheca* spp., including pathogen-host interactions. Thus, the aim of this work was to investigate the virulence potential of the *Prototheca* algae by assessing their ability to induce local or systemic infections in an experimental murine model.

Methods

Type strains of three pathogenic (*P. wickerhamii*, *P. bovis*, and *P. ciferrii*) and one saprophytic (*P. stagnora*) species were used to experimentally inoculate mice of both immunocompetent and immunodeficient phenotype. The study was carried out on 54 groups of 10-week-old, female mice (6 individuals per each) depending on the inoculum (algae or PBS as a control), the challenging dose (i.e. 5×10^6 or 5×10^7 CFU/mL), and inoculation route (subcutaneous (S.C.), intramammary (I.M.)), and intraperitoneal (I.P.)). Six weeks post-infection, the animals were euthanized, and their organs were explanted, weighted, and sent for microbiological and histopathological examination.

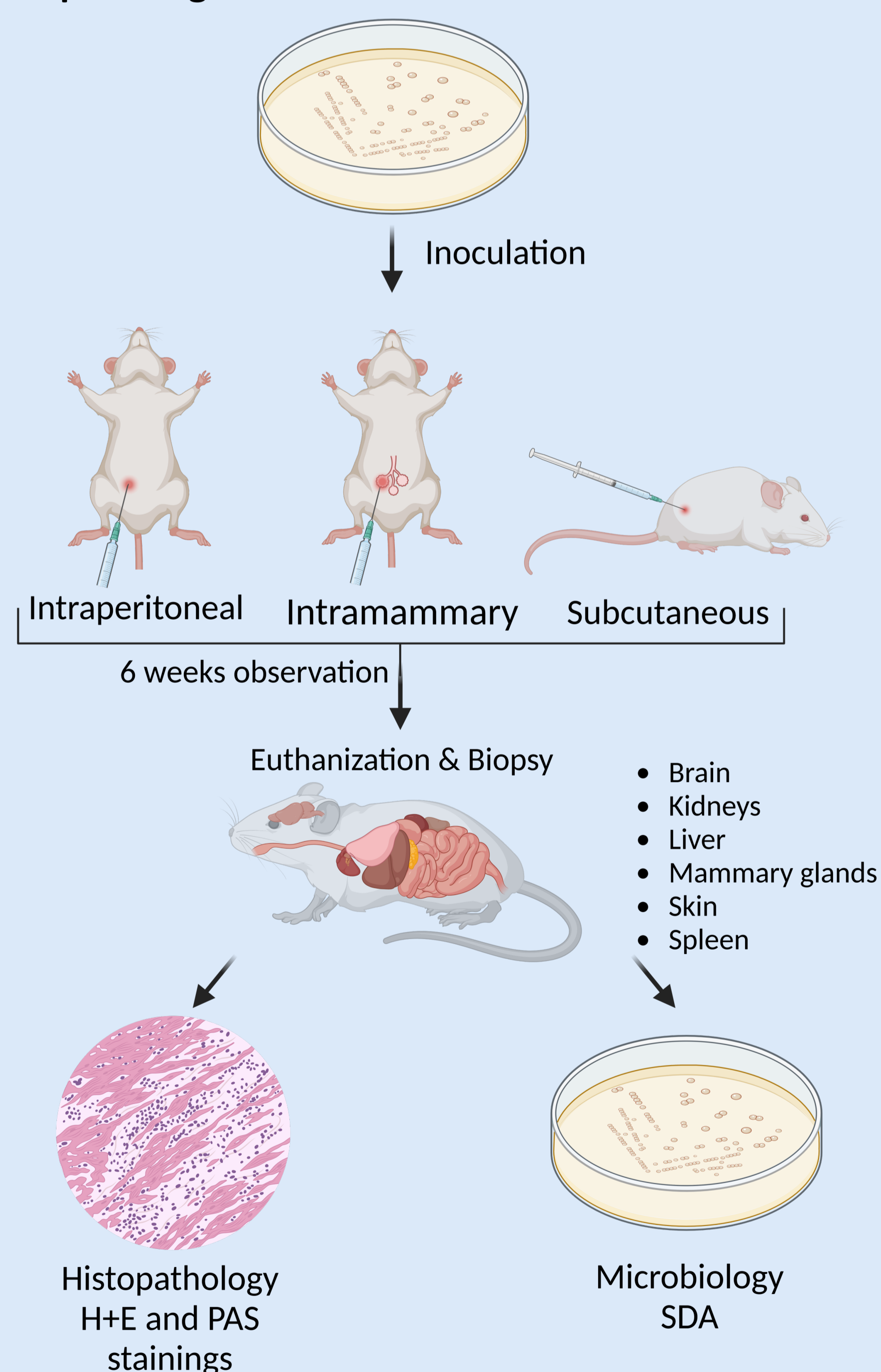


Fig. 1. *Prototheca* spp. infection model.

Acknowledgement

This research was funded by the National Science Centre within the "OPUS" funding program (contract number: 2019/33/B/NZ6/01283).

Results

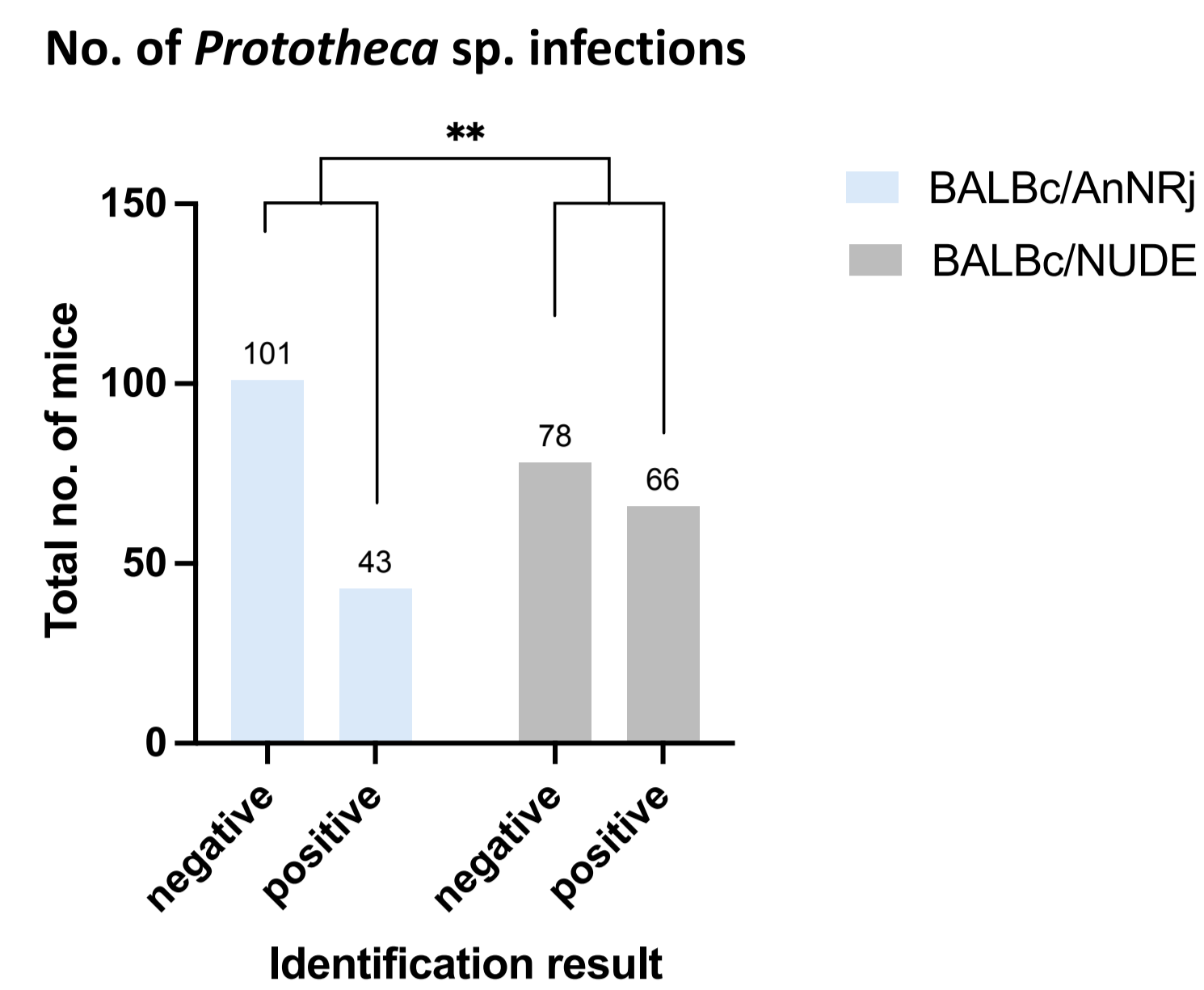


Fig. 2. Number of *Prototheca* spp. infections, assessed by culture and/or histopathology.

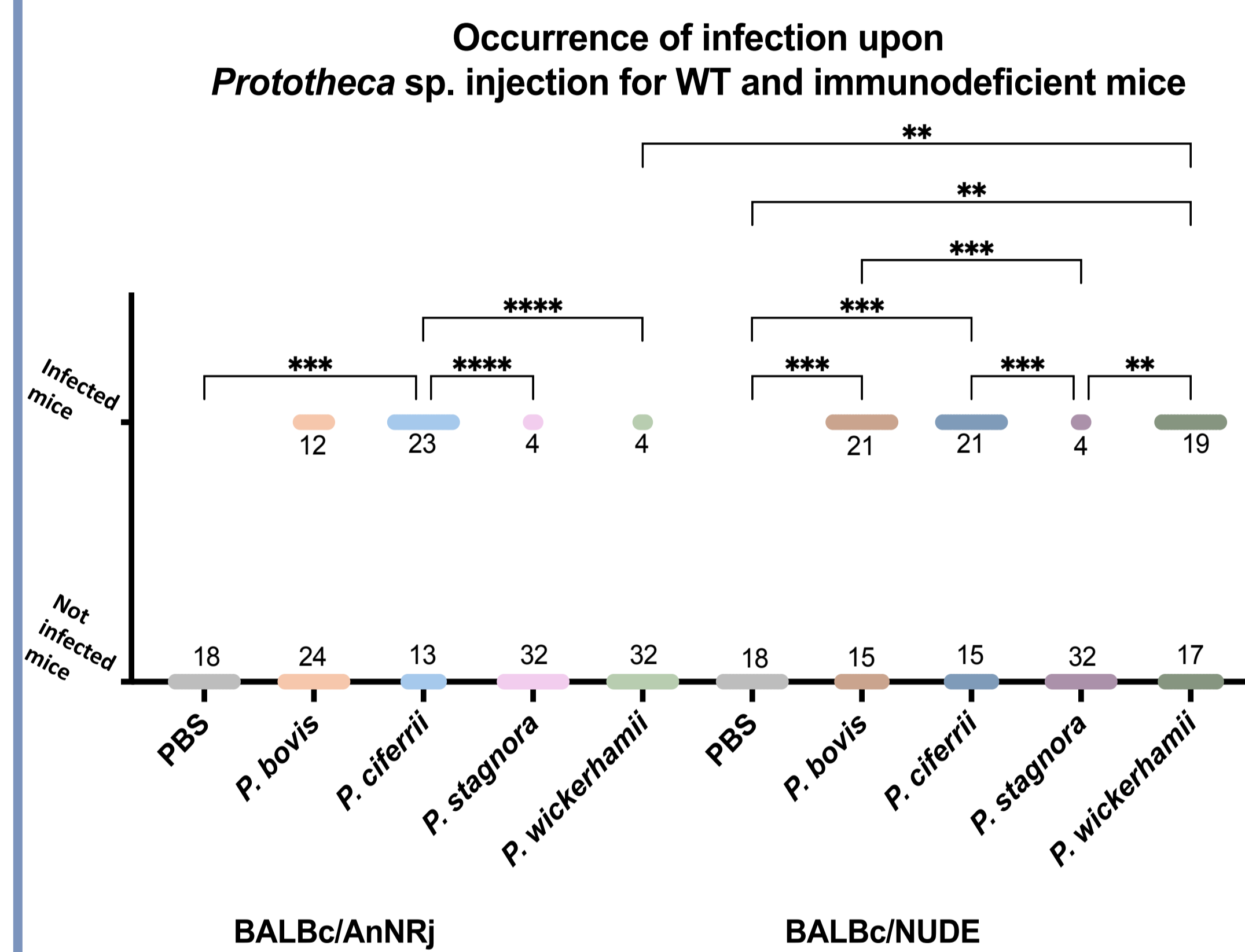


Fig. 3. Occurrence of infection upon *Prototheca* sp. inoculation – comparison of BALB/cAnNRJ (WT) and BALB/cNUDE mice.

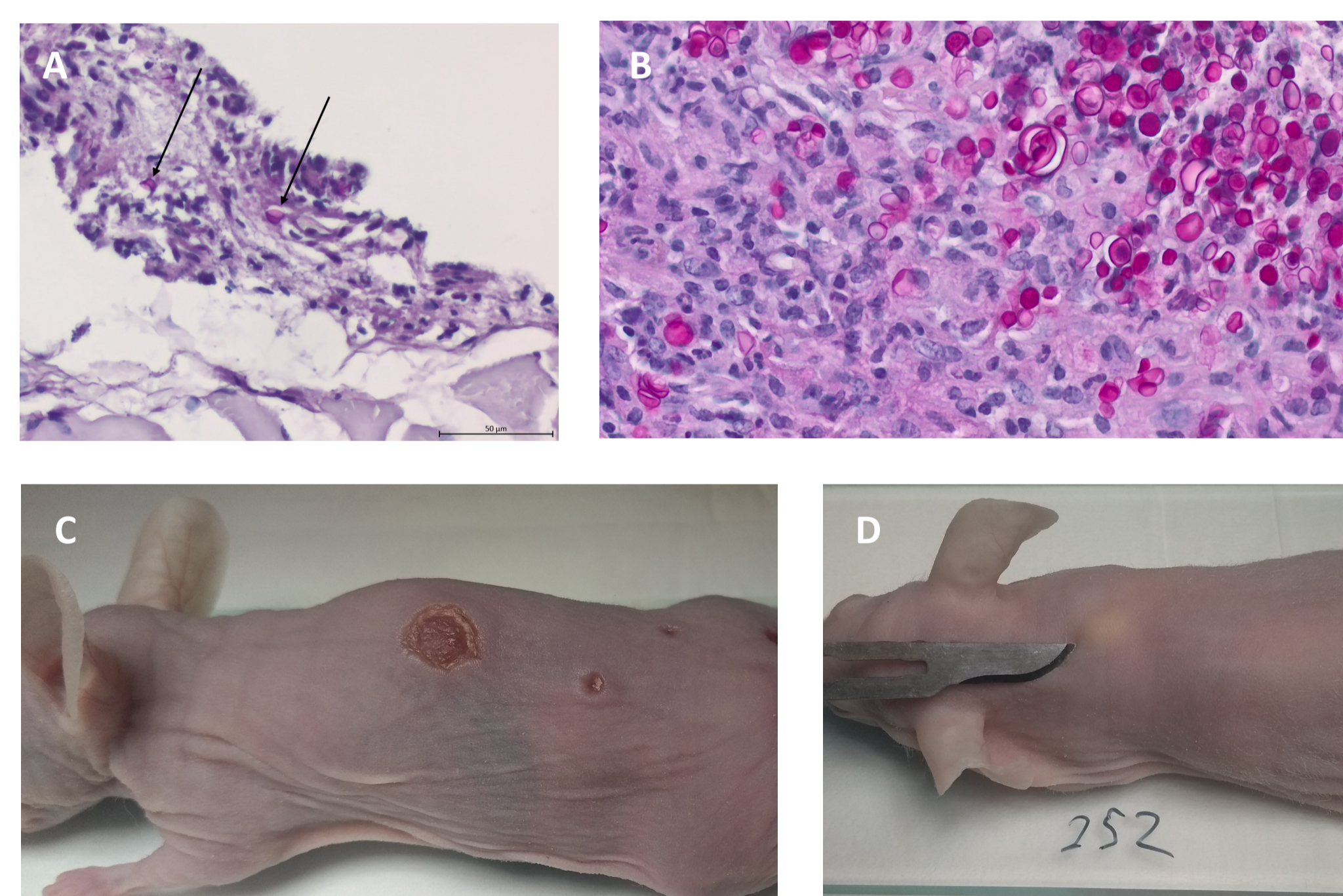


Fig. 4. Mice which developed protothecosis, biopsy 6 weeks post infection: (A) infected skin BALB/c WT mice, BALB/c WT mice (S.C. administration, *P. ciferrii*, 10^7 , PAS staining); (B) infected mammary gland in (I.P. administration, *P. ciferrii*, 10^7 , PAS staining); (C) skin lesions in BALB/c NUDE mice after I.P. administration (*P. wickerhamii*, 10^7); (D) subcutaneous abscess at the injection site in BALB/c NUDE mice (S.C. administration, *P. bovis*, 10^7).

A third (29.9%) of wild-type mice and nearly half (45.8%) of immunodeficient animals showed signs of infection. *P. ciferrii* accounted for the majority of infections (40.4%), followed by *P. bovis* (30.3%), and *P. wickerhamii* (22%). Only 7.3% of infections were due to *P. stagnora*. All routes of inoculation resulted in a similar number of infected individuals, with the infection efficiency ranging from 31.2% to 35.8%. Mammary glands were the most frequently affected organs, with a prevalence of 53.2% in both healthy and immunodeficient animals. Microbiological culture had a higher detection rate of infection (75.2%) compared to histopathological analysis (66.1%). The most notable inflammatory changes were observed in the spleen and kidneys, while the brain and liver were the least affected.

Conclusions

- The highest virulence potential was observed for *P. ciferrii*.
- Immunodeficient mice were more prone to develop *Prototheca* infection.
- Microbiological culture was more sensitive than histopathology in detection of *Prototheca* sp. infections.

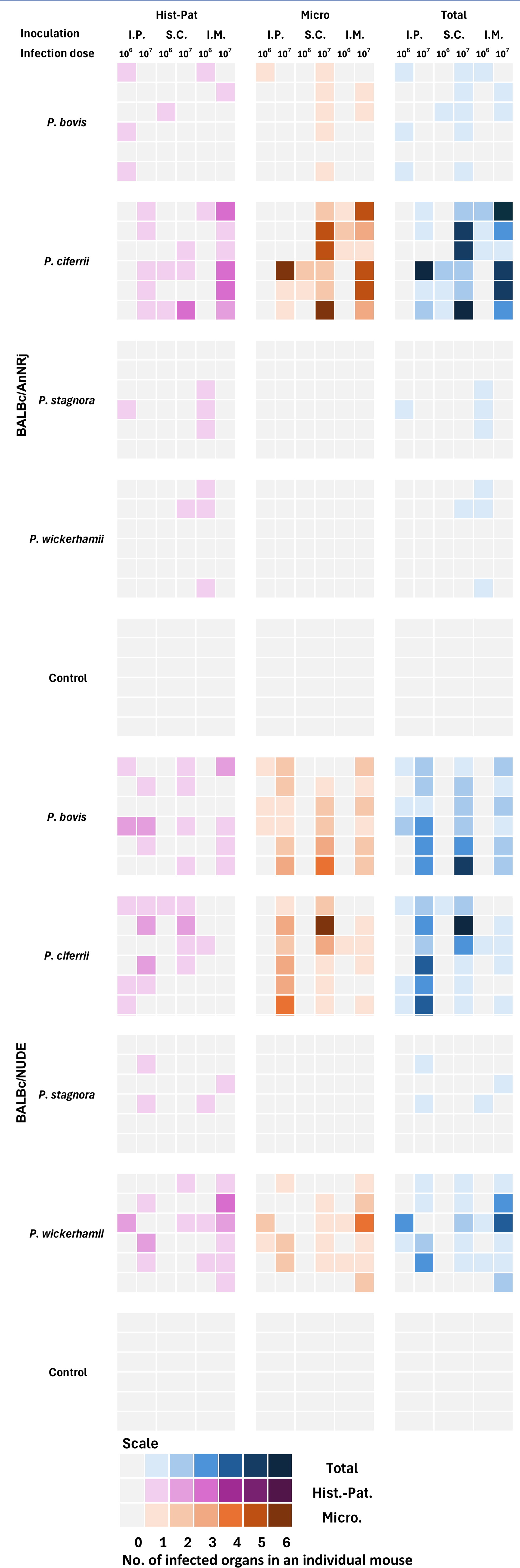


Fig. 5. Comparison of histopathology and microbiology for the detection of *Prototheca* sp. infection.

Contact us!

