

“Seek, and you shall find”: Hidden species diversity of *Acanthobothrium* van Beneden, 1849 (Cestoda: Onchoproteocephalidea) discovered from the spotted skate in South Africa

Linda Van Der Spuy¹, Nico J. Smit¹ and Bjoern C. Schaeffner^{1,2,3}

¹ Water Research Group, Unit for Environmental Sciences and Management, Potchefstroom Campus, North-West University, Potchefstroom, South Africa; ² Institute for Experimental Pathology at Keldur, University of Iceland, Keldnavegur 3, 112 Reykjavík, Iceland; ³ South African Shark Conservancy, 7200 Old Harbour, Hermanus, South Africa

INTRODUCTION

- Acanthobothrium* is the most species rich genus of all elasmobranch-infecting cestode genera, with over 200 valid species recognised worldwide.¹
- It is estimated that an additional 800, if not more, species of *Acanthobothrium* are yet to be discovered worldwide.²
- It is estimated that an average of four cestode species parasitise a single elasmobranch host species.²
- As a consequence, the diversity of cestodes in the waters of South Africa is predicted to be either equal to, or, more likely, greater than the diversity of the chondrichthyan hosts present in these waters.
- However, with merely 9 % (18 of 204) of elasmobranchs off southern Africa examined for the presence of cestodes, it is expected that there is an immense hidden species diversity of cestodes infecting elasmobranchs in South African waters.^{3,7}

AIM

The aim of this study was the assessment of onchoproteocephalidean cestodes in the spotted skate, *Raja straeleni*, off the Western Cape of South Africa.

OBJECTIVES

- To extract cestodes from spiral intestine;
- To determine cestodes on species level;
 - To identify taxonomic status;
- To describe species new to science.

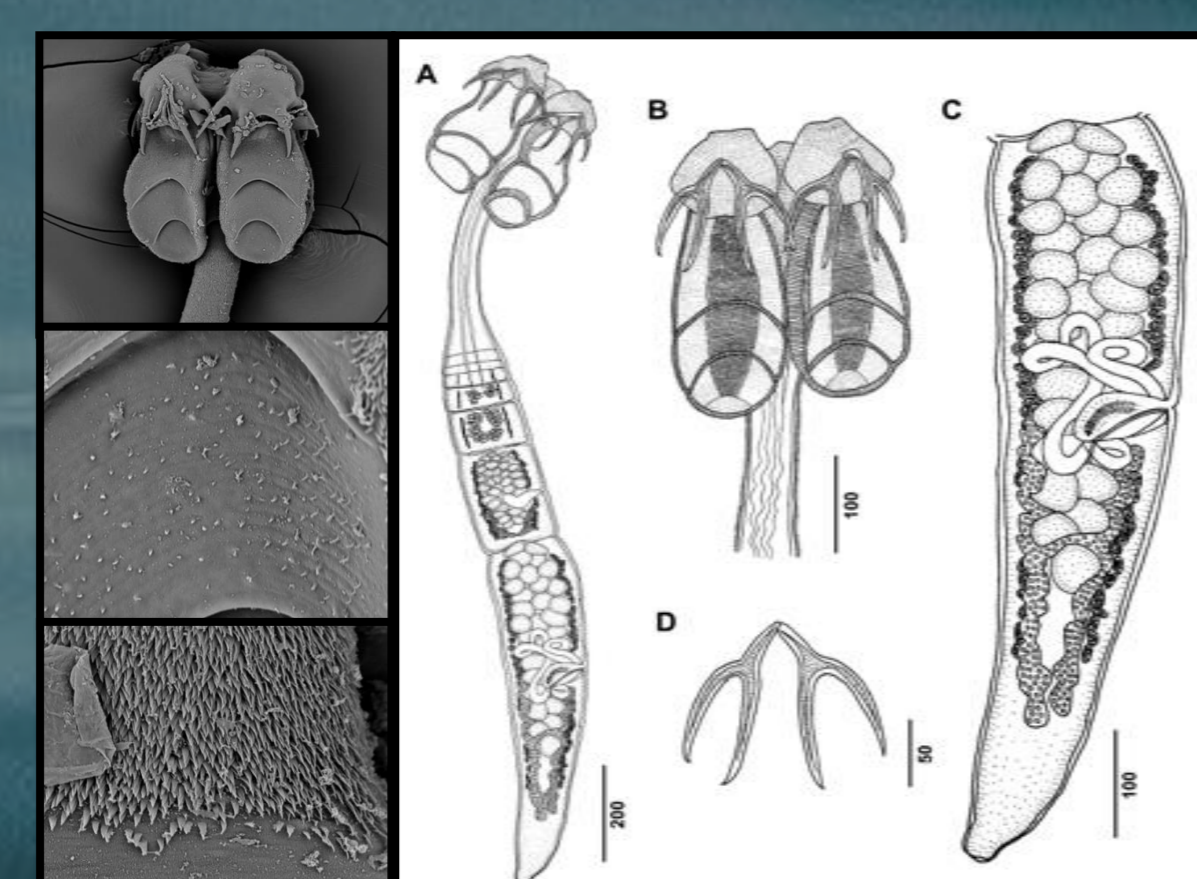
MATERIALS & METHODS

- 8 spotted skates were collected by longline off the coast of Hermanus, SA.
- The spiral intestine of each skate was removed and fixed in 4 % neutral buffered formalin, and ultimately transferred to 70 % ethanol.
- Specimens of *Acanthobothrium* were handpicked from spiral intestines, hydrated in a graded ethanol series, stained in Delafield's haematoxylin, dehydrated in a graded ethanol series, cleared in clove oil, and permanently mounted on microscope slides using Canada balsam.
- Images and measurements were taken of various internal organs and characteristic body structures.
- Drawings were made by the use of a drawing attachment tube.
- Two to three specimens of each species were used for scanning electron microscopy (SEM).

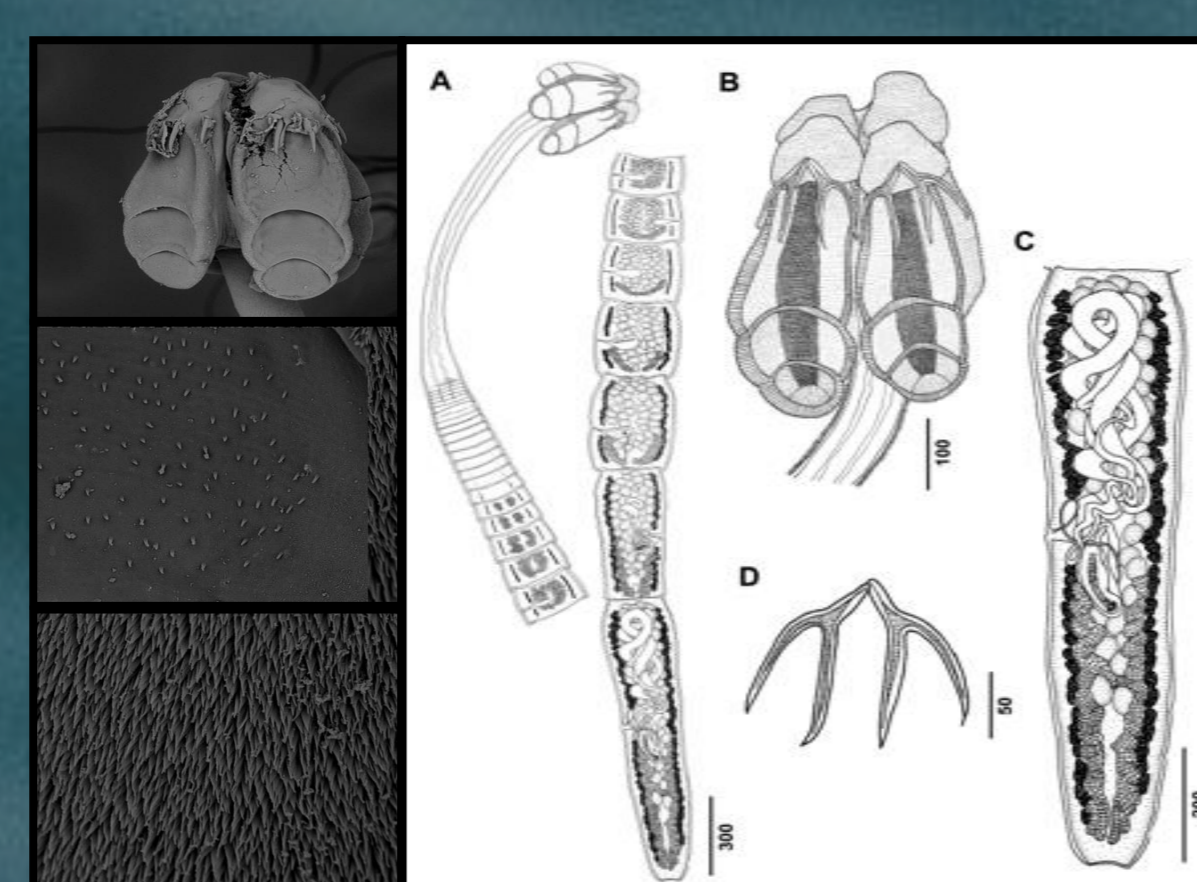
RESULTS

4 NEW species of *Acanthobothrium*

- A. microhabentes*
- A. microtenuis*
- A. crassus*
- A. dolichocollum*



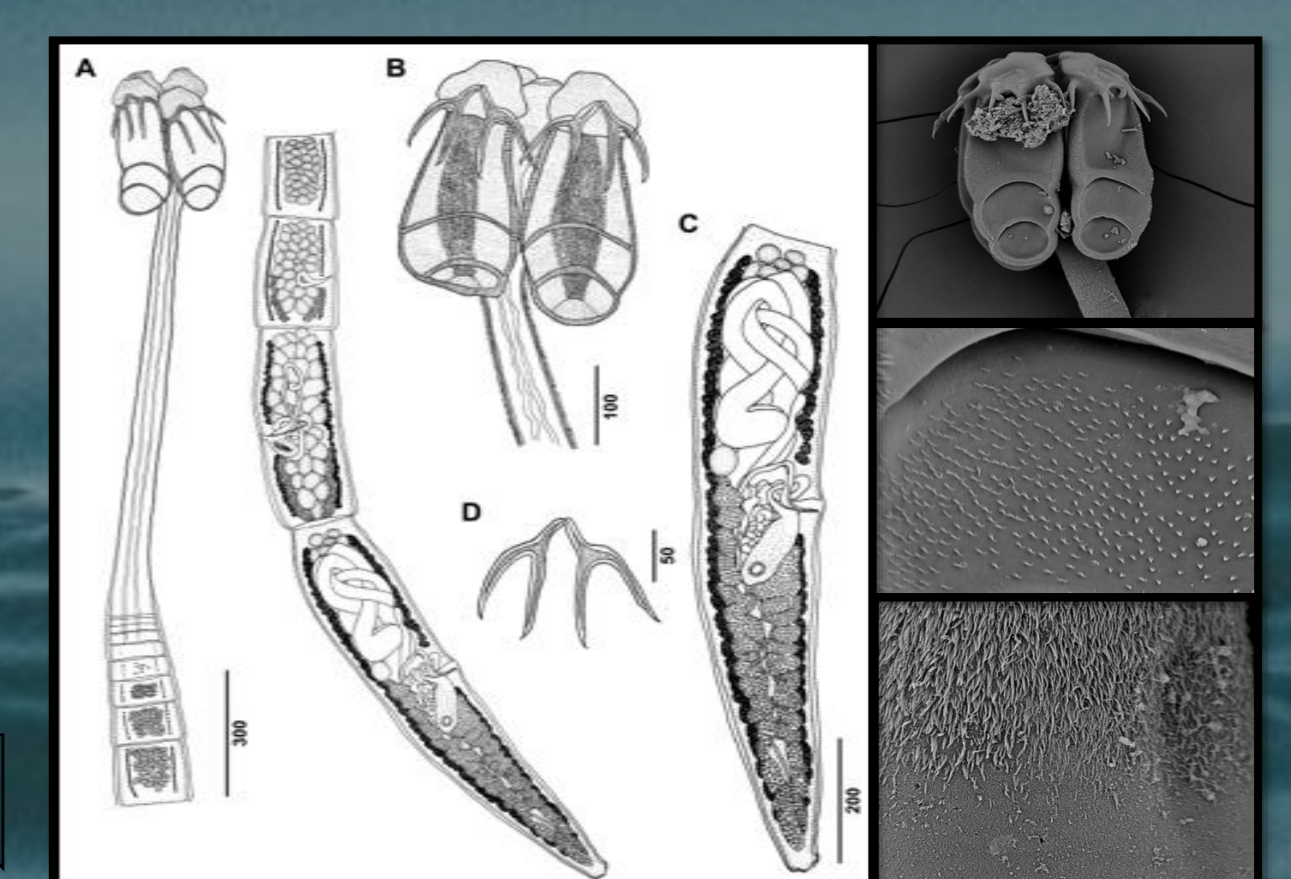
Acanthobothrium microhabentes



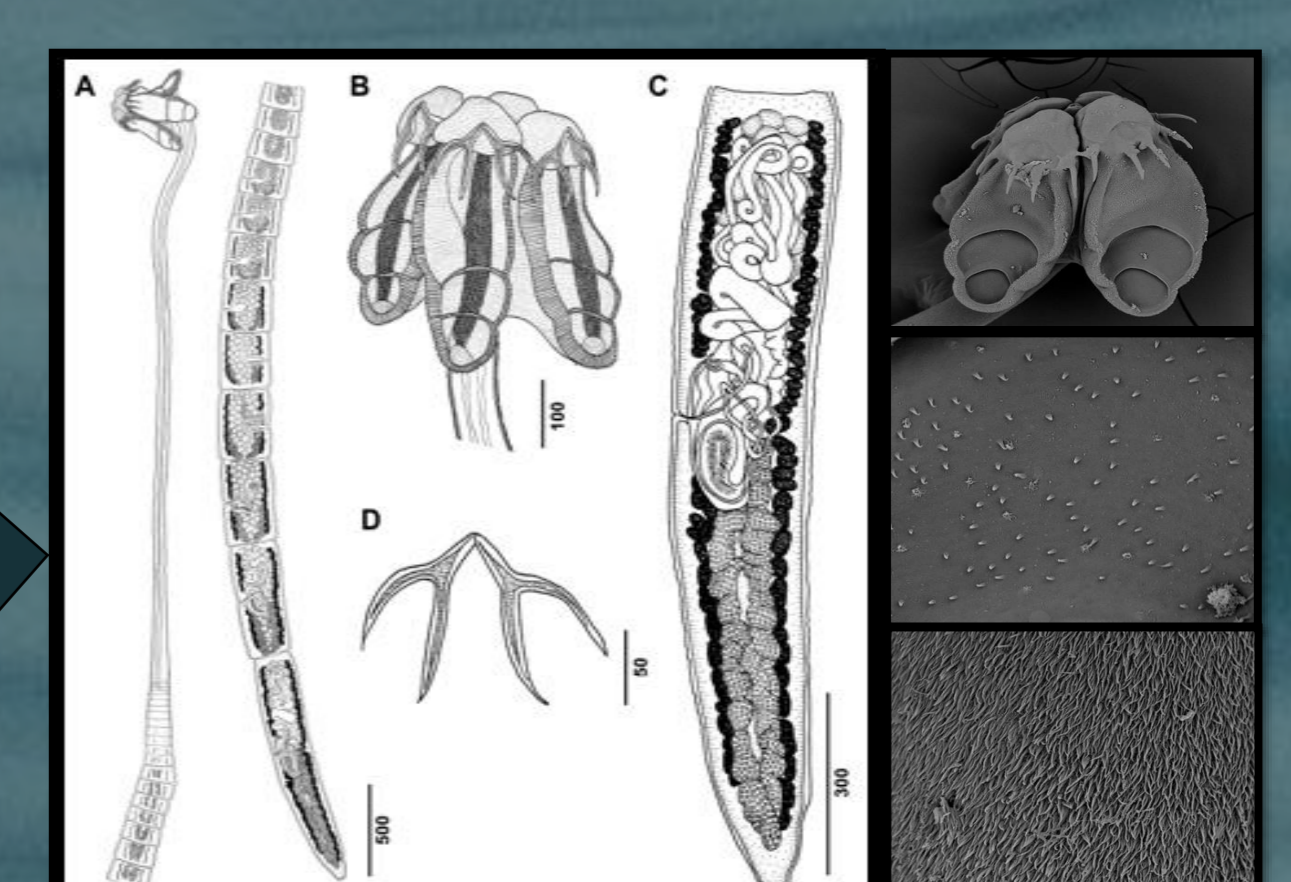
Acanthobothrium crassus



Raja straeleni



Acanthobothrium microtenuis



Acanthobothrium dolichocollum

DISCUSSION AND CONCLUSION

- The South African species are all category 2 species (< 15 mm in total length, < than 50 proglottids, < than 80 testes, and an asymmetric ovary). The total number of species of *Acanthobothrium* allocated to category 2 is increased to 51 species.⁶
- The South African congeners are very easily distinguished from all except two of these congeners by the presence of postovarian testes, being a highly unusual feature among species of *Acanthobothrium*, as it has only been documented in merely 6% (12 out of 203) of all species of *Acanthobothrium* known to infect elasmobranchs.
- The only two other category 2 species reported to exhibit postovarian testes are *A. popi* Fyler, Caira et Jensen, 2009, and *A. bobconniorum* Fyler et Caira, 2010. These differ, however, in a combination of morphological features from the four morphotypes of the present study, which, in turn, were described as species new to science.
- This study reports the first species of *Acanthobothrium* from both South Africa and *Raja straeleni*, and are also the first known to bear postovarian testes outside of the Indo-Pacific realm.
- The current extensive and rapid rate of loss in biodiversity, limits the time remaining for the discovery and description of the cestode diversity, which will likely result in the extinction of numerous cestode species before they are even discovered.
- Additional large-scale surveys on elasmobranch parasites will lead to numerous new species discoveries in the future.
- New, sustainable conservation schemes should be enforced, including a combination of multidisciplinary approaches. Hereby, information can be gained from parasites, providing us with a better understanding of the host, such as its evolutionary and demographic history and migratory patterns.
- The work presented here was published recently in *Folia Parasitologica* (doi: 10.14411/fp.2020.036).

ACKNOWLEDGEMENTS

The South African Shark Conservancy for their collaboration and assistance in the field (Megan McCord, Björn von Düring, Natalia Drobniewska and Guy Paulet). The Unit for Environmental Sciences and Management, North-West University (NWU) for the use of field equipment and laboratory facilities. Our colleagues Ruan Gerber, Chantelle Pretorius, and Rian Pienaar from the NWU-Water Research Group who assisted with the collection of samples.

REFERENCES

- Caira J.N., Jensen K., Fyler C.A. 2018: A new genus of tapeworm (Cestoda: Onchoproteocephalidea) from sawfish (Elasmobranchii: Pristidae). *J. Parasitol.* 104: 133–144.
- Caira J.N., Jensen K., Ivanov V.A. 2017: Onchoproteocephalidea II. In: J.N. Caira and K. Jensen (Eds.), *Planetary Biodiversity Inventory (2008–2017): Tapeworms from Vertebrate Bowels of the Earth*. The University of Kansas Natural History Museum. Special Publication no. 25, pp. 279–304.
- Ebert D., van Hees K.E. 2015: Beyond jaws: rediscovering the 'lost sharks' of southern Africa. *Afr. J. Mar. Sci.* 37: 141–156.
- Fyler C.A., Caira J.N. 2010: Phylogenetic status of four new species of *Acanthobothrium* (Cestoda: Tetrathyphidae) parasitic on the wedgetail *Rhynchobatus laevis* (Elasmobranchii: Rhynchobatidae); implications for interpreting host associations. *Invertebr. Syst.* 24: 419–433.
- Fyler C.A., Caira J.N., Jensen K. 2009: Five new species of *Acanthobothrium* (Cestoda: Tetrathyphidae) from an unusual species of *Himantura* (Rajiformes: Dasyatidae) from northern Australia. *Folia Parasitol.* 56: 107–128.
- Ghoshroy S., Caira J.N. 2001: Four new species of *Acanthobothrium* (Cestoda: Tetrathyphidae) from the whiptail stingray *Dasyatis brevis* in the Gulf of California. *J. Parasitol.* 87: 354–372.
- Schaeffner B.C., Smit N.J. 2019: Parasites of cartilaginous fishes (Chondrichthyes) in South Africa - a neglected field of marine science. *Folia Parasitol.* 66: 002.



[Click here to download the full article!](#)