Development of a rapid and reliable non-invasive technique to identify sarcoptic mange in wombats in the field

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Cover photo: Wombat being treated with moxidectin using the pole and scoop method. Photograph: Marie Wynan

February 2025: Western Sydney University and Charles Sturt University

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1. Summary

Whilst treatable, sarcoptic mange is a highly infectious disease that affects mammals. In wombats, sarcoptic mange is fatal and deaths in over 90% of some wombat populations have been recorded (Martin et al., 2018). Treating wombats in the field for sarcoptic mange is time consuming and has varied levels of success, due to wombat ecology and behaviour (Old et al., 2018). It is therefore essential that wombat treaters can readily assess the efficacy of their treatment regimens and determine the presence/absence of sarcoptic mange in the wider area. This project aimed to develop a rapid and reliable non-invasive assessment technique to identify sarcoptic mange incidence in wildlife, including wombats, based on scat analysis. The method was based on identification of mite DNA in wombat scats and would inform treaters regarding their treatment success, or otherwise, in the field, through identification of specific areas they should or should not target for treatments. Furthermore, the method, once developed, aimed to identify new areas requiring treatment and ensure wombats from care were not released into areas where they would become infected with sarcoptic mange. This novel rapid assessment method aimed to reduce time and effort for carers and treaters and provide better outcomes for released wombats.

2. Acknowledgements

We would like to thank Marie Wynan, Roz Holme and Melinda Kerr for collection of field samples for this project.

Funding acknowledgement

This project has been supported by the NSW Government under the NSW Curb Wombat Mange Program and Foundation for National Parks.

3. Project overview

Project lead (including name of lead researcher)

A/Prof Julie Old, Western Sydney University.

Project partners

Dr Hayley Stannard, Charles Sturt University.

Project timeframe

2023-2024

Grant amount

$103,453

Partner in-kind contribution amount

$29,755

4. Background

Treating wombats for sarcoptic mange infections in the field is challenging, with wombats frequently moving burrows and making it difficult to complete their treatment (Old et al., 2021). Nevertheless, mites can be killed with moxidectin or fluralaner, which are approved by the Australian Pesticides and Veterinary Medicine Authority for use in the field (Old et al., 2021; Wilkinson et al., 2021). However, despite approved protocols in place, the best treatment methods remain elusive. Furthermore, not knowing if mange is present or absent in specific areas, puts wombats released from care at risk of mange infection or re-infection. Hence, there is a need to develop a more definitive non-invasive method to identify mange in the field.

The main outcome of this research is to develop a reliable, non-invasive technique to determine the presence of sarcoptic mange in free-ranging wombat populations and is transferable to other species e.g. koalas. Our study will improve health and longevity of wombat populations and aid wombat carers/treaters to diagnose and treat sarcoptic mange. Standard non-invasive methods for determining sarcoptic mange are usually visual, either via direct observation or camera traps e.g. (Driessen et al., 2022; Stannard et al., 2021), however these techniques are constrained by low diagnostic specificity and only determines the presence of skin lesions on animals, when the disease is quite advanced, thus developing an early and definitive detection method is a significant advancement in this field.

The publicly available citizen science-based database (WomSAT - Wombat Survey and Analysis Tool) currently allows for the collection of real-time data on sarcoptic mange, and acts as a national repository for all wombat observations, including mange (observations and treatment), roadkill incidences, etc. Data stored in the database (WomSAT.org.au) has already been used to locate roadkill hotspots (Mayadunnage et al., 2023), and record treatment programs.

Initial samples to develop the rapid and reliable non-invasive monitoring assessment technique to identify mange in the field will require fresh scats to be collected from wildlife carers. Scats of known origin from wombats with mange, and others confirmed to be mange free will be collected. The technique will involve using developed DNA extraction techniques (Old et al., 2020) and optimisation of a real-time PCR assay (Angelone-Alasaad et al., 2015), shown to be successful in detecting mange mite DNA in wolf (*Canis lupus*) scats (Rousseau et al., 2021a), on the wombat scats. Once optimised the technique will then be used to assess mange status in the field. Four sites will be chosen in consultation with experienced wombat treaters, and scat samples assessed for mange status. The status and location data will be entered into WomSAT, allowing mange incidence maps to be created, and provided to treaters to inform their ongoing treatment efforts in the field.

The technique developed will provide a rapid non-invasive assessment to identify areas with and without mange in the field. Specifically identifying areas with mange presence will inform treaters regarding specific locations to target their treatment efforts, and areas identified as mange free, suitable as wombat release sites. Ultimately, the novel technique will benefit treaters and carers, in terms, of costs, time and effort, and the improve wombat outcomes.

5. Project aims

This project aimed to develop a tool to monitor success and support efforts in the field, through the development of a rapid and reliable non-invasive monitoring assessment technique used in combination with the WomSAT application. This project will also allow an upgrade to the WomSAT app (and website) that will allow in-field entries where no internet is available, further enhancing the app's capability to support treaters in the field to track treatment programs and progress.

The developed technique will provide treaters with information on sarcoptic mange status within specific areas, allowing identification of areas where treatments should be targeted, and those that do not require treatment. Our method will therefore provide treaters with rapid information to monitor recovery in areas they are treating. Specifically, this technique will save the time and money of treaters, through identification of specific areas to target, and ensuring the best outcomes for wombats.

Identification of sarcoptic mange-free areas will also benefit the wider wombat carer community, as this technique can be used to assess the sarcoptic mange status of new areas. Our developed technique will allow both identification of new areas requiring treatment and confirm areas are free of sarcoptic mange, and hence suitable release sites for wombats returning from care. Confirmation that potential release-sites are sarcoptic mange free will ultimately reduce time and costs of carers, and treaters, and have improved outcomes for individual wombats and the wider wombat population, by ensuring wombats are not released into areas where sarcoptic mange is present.

The development of the technique and its subsequent use to assess treatment trials in the field will be disseminated in the scientific literature, via WomSAT social media channels, presented at conferences, via a webinar and through the media, as outlined in the Methods section. Disseminating the results from this study across several platforms will ensure all wildlife care groups, researchers, the wider community, and other stakeholders, are well informed about the advancements in the field of sarcoptic mange treatment.

In the longer term our project will aid the conservation of this important keystone species and ecological engineer. In the ecosystem wombats turnover soils, enhancing plant growth (Guy & Kirkpatrick, 2021), and create habitat for other animals, thus they are an essential species to conserve, and support overall biodiversity in the Australian ecosystem.

6. Methods

6.1 WomSAT website and application upgrade

WomSAT is a national citizen science-based project with an associated application and website (WomSAT.org.au) used to map wombat sightings, including wombats with and without sarcoptic mange, roadkill, and other observations (Skelton et al., 2019). Established in 2015, the database has collected over 23,000 sightings to date, providing much needed real-time data on wombats. WomSAT collects data in real-time allowing sarcoptic mange hotspots to be identified, and support studies investigating long-term trends in sarcoptic mange incidence and occurrence (Mayadunnage et al., 2024). Local councils, and others, have also been using the real-time publicly available information on WomSAT to track roadkill incidence, identify hotspots (Mayadunnage et al., 2023), and put mitigation strategies in place, reducing roadkill incidence.

Currently WomSAT cannot be used in areas where there is no internet coverage, and hence, the upgrade allowing wombat sightings to be added in an offline mode will enable treaters to track their work in areas where there is no internet available, saving valuable time and effort in the field recording treatment sites. A training course has also been added to the website (not funded through this project), and assists in training and ensuring accreditation is met by treaters. Funding from this project has been used to disseminate this training course information more widely through social media. The additional data will also be beneficial to wombat researchers in identifying longer term trends in sarcoptic mange incidence, and additional wombat-related research that will assist in reducing sarcoptic mange.

6.2 Initial sample collection and method optimisation

Initial scat samples to develop the protocol were collected from wildlife carers/treaters we already collaborate with: Jarake Wildlife Sanctuary (Marie and Ray Wynan), Cedar Creek Wombat Rescue (Roz and Kevin Holme), Melinda Kerr (Kanimbla Wombats). Two other carers were unable to continue in the project. As part of the treatment process, wombat carers/treaters tracked each wombat's progress during treatment using camera traps funded through this project.

Freshly deposited scats, as defined by Banks et al. (2002) and Hermsen et al. (2016), were collected specifically from known wombats with and without sarcoptic mange via carers/treaters. We have previously extracted DNA from scats and amplified DNA using PCR for immunological studies on MHC (Hermsen et al., 2016). Based on this method we washed fresh scats, and using the wash, extract DNA using the modified protocol for the Qiagen QIAmp® DNA Power faecal Kit (Qiagen).

Using an optimised real-time PCR method based on Angelone-Alasaad et al. (2015) we aimed to amplify a 132 bp fragment of the 16S rDNA mitochondrial gene of the sarcoptic mite. We chose to use this method as it has worked successfully in other species, including

wolves (Rousseau et al., 2021b). Furthermore, real-time PCR is more sensitive than traditional PCR techniques, does not require gel electrophoresis to visualise the results, hence decreases laboratory time, and enables rapid dissemination of results to treaters.

6.3 Trial of method to monitor success of treatment in the field

Once the real-time PCR method is optimised, the technique will then be used to assess the efficacy of treatment in the field at sites chosen in collaboration with the wombat treaters named above. Collaborating with these experienced wombat treaters will ensure the study has at least three field trial sites to test the efficacy of our method at a population scale. The sites will be chosen in collaboration with wildlife carers to provide as much assistance to them in their treatment goals as possible.

Fresh scat samples (240) will be collected from each of the sites, before and two months after, wombats have been treated, to determine if sarcoptic mange remains in the population after treatment, using the developed technique. The location of each scat collected will be recorded using a hand-held GPS and added into WomSAT to allow for later mapping. Infra-red cameras (10 per site) will also be utilised by treaters to observe and confirm treatment application on wombats in the field at burrow entrances/exits.

6.4 Feedback to treaters/carers

This is pending further development of the field technique.

GPS location of scats collected, before and after the treatments, and their sarcoptic mange status, will be added into WomSAT. The maps or sarcoptic mange occurrence, developed using WomSAT, will provide clear and concise locations of where wombats still require treatment or are sarcoptic mange free. The developed maps will therefore inform treaters of the sarcoptic mange status in treatment areas, enabling ongoing informed treatment management.

6.5 Dissemination and ongoing directions

The development of the technique and its subsequent use to assess treatment trials in the field will be disseminated in the scientific literature (*Australian Mammalogy*, *Wildlife Research* or *Parasitology Research*) and in an Honours thesis. We have shared the findings of this research to date via WomSAT social media channels, presented at conferences (e.g. Australian Mammal Society and Australasian Wildlife Management Society), and through the media (radio and print using connections in WSU and CSU Media Team). Disseminating the results from this study across several platforms have ensured all wildlife care groups, researchers, the wider community, and other stakeholders, are well informed about the advancements in the field of sarcoptic mange treatment.

As the data entered into the WomSAT database is publicly available, and at the national level, it will assist with current and future research on sarcoptic mange. For example, it allows identification of areas where efforts to treat sarcoptic mange are required and

should be targeted in future treatment efforts, as well as identification of areas that are sarcoptic mange free, hence potential release-sites. In addition, it will support a range of ongoing and future research projects on wombats including sarcoptic mange status in real-time, to help identify trends in sarcoptic mange incidence, and increase our understanding of the disease in the wombat population. An upgrade to the WomSAT website and app will allow treaters to enter location data on wombats treated in the field, where there is no internet access. Previously, internet connectivity was required to locate the phone location, however the update can now access and utilise the data embedded within .jpg images to incorporate the GPS location the image was taken.

7. Key Findings

- The WomSAT database has been upgraded to allow photographs to be uploaded in bulk and no longer requires internet access.
- Research we have conducted has been shared widely at scientific conferences, and on traditional and social media platforms.
- A training course has been developed in collaboration with WSPA (through other funds) to increase education among wombat carers on the safety, efficacy and treatment of wombats with sarcoptic mange. This additional WomSAT accredited course has been added to the WomSAT website, further enhancing the benefits to carers and members of the public. The availability of the course has been shared on social media using funding from this project, and to date has been completed by over 125 individuals. The certificate can be shared with WPSA to provide evidence of course competition. WPSA may then approve carers and members of the public to treat wombats under their approval permit.
- As part of this project, a minimum of five wombats were treated successfully using cydectin, and four treated using fluralaner, in the field by carers (observed through camera trapping).
- Research is continuing into the development of a technique to assess sarcoptic mange in the field. An additional qPCR is required. Unfortunately, the qPCR machine broke down last year, and due to the age of the machine has been deemed beyond repair and will require replacement. The final qPCR is therefore pending the purchase of a new qPCR machine.
- An Honours thesis has been submitted for examination partly based on the findings of this study.

8. Discussion

It is crucial that data collected on sarcoptic mange is accurate, and ensures treatments continue to be effective for free-ranging wombats. Until now, there has not been any large-scale verified data collection of sarcoptic mange treatments by carers in the field. Understanding the importance of accuracy and consistency of data collection is pivotal when designing and recording sarcoptic mange treatment.

While efforts are continuing to develop techniques to identify sarcoptic mange areas, and to better assist carers, several issues remain, namely the difficultly of non-invasively treating wombats with sarcoptic mange in free-range settings. Nevertheless, efforts are continuing and treatments supplied to carers saved the lives of many wombats.

The update to the WomSAT website has been successful. In combination with the new training course available on WomSAT, carers now have access to scientific resources and knowledge to help support efforts to curb sarcoptic mange in wombat populations. Educating carers is pivotal to enhancing informed treatment efforts in the field. Scientifically supported education efforts help to reduce misunderstandings about current treatment regimes, often shared on social media platforms, and among group networks, and ultimately benefits wombats by encouraging best practice.

The WomSAT update allows users to enter data more quickly and easily and to better track sarcoptic mange treatment in the field, including tracking mange treatment and uploading data collected in areas that lack internet connectivity. These updates and additions to the WomSAT website will provide for a more accurate picture of how carers are treating wombats in the field, and collection of this data can, in the longer term, be analysed, something that does not currently happen. Furthermore, it will provide a more accurate understanding of treating wombats in the field and how best to support carers in their efforts to curb mange.

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