An Overview of Canine Parasitic Diseases, Their Treatment and Prevention

By Rick Speare

I’m going to talk about canine parasitic diseases, particularly as they relate to Aboriginal communities. Kathryn [Wilks] touched on these earlier today. The data I have is from a program we ran in conjunction with the Yarrabah community from 1993 to 1997.

Yarrabah is a community on the Queensland coast about 40 km south of Cairns, a beautiful location. The primary language is English. It’s not really a traditional community to any great extent at the moment; in fact, it’s becoming urbanised. So they have a different approach to dogs from what has been described for Arnhem Land and Central Australia.

Essentially the program came from the community council, which called the shots to a large extent and told us what they wanted us to do. Prior to commencing the project, we assisted them to circulate a community questionnaire. It explained that the council was interested in conducting a dog program and asked people what they wanted done. First, a large proportion of community members said there were too many dogs and they caused too much trouble (chasing horses at night, knocking into rubbish bins and so on). They wanted dog numbers reduced quite dramatically and almost listed that as their first priority. Second, they were concerned about potential diseases. They said their dogs weren’t healthy, and they were worried about diseases getting across to themselves and their children. They wanted healthier dogs but under control.

The first phase of the resulting program was getting rid of the unwanted dogs; the next phase was bringing in a control program using ivermectin and Covinan. Two principal vets were involved (myself and Jack Shields), along with a number of other people. In fact, the whole program was run through the Environmental Health Workers (Rangers) with us as vets assisting. Since the community was in favour of getting rid of sickness and unwanted dogs, we had the opportunity to conduct post mortems and examine the parasites from those dogs. This was also a great opportunity to show the Rangers what parasites looked like. I think that’s one of the big benefits of running a program like this in communities—people can understand what these things are.

I’ll talk about the dogs that were killed and then examined. In the first year of the program (1993) over 100 dogs were euthanased out of a population of around 400–450. In that year we examined 70 dogs in post mortems. In the second year (1994) we examined over 40 dogs and in 1995 about 45 dogs. Estimating the population of dogs in the community and then calculating the percentage of dogs that were culled, in 1993 over 14% of the population was euthanased, in 1994 about 10% and in 1995 about 12%. After that the numbers dropped off dramatically because people perceived they had got rid of the dogs they didn’t want and were quite happy keeping the remaining dogs. In 1996 fewer than 2% of dogs were euthanased.

We found parasites at three sites—the skin, the heart arteries and the intestine.

Mites

In the skin were fleas, lice and [NAME UNCLEAR IN TRANSCRIPT .......spinia?], a louse that occurs in wallabies and has got across into dogs in these northern east coast communities. There were also ticks and mites. I’ll concentrate on mites.

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4 This paper is an edited transcript of the author’s presentation.
We found the two types of mites we already knew occurred, but we were surprised how common they were. *Sarcoptes scabiei*, the mite that causes scabies, lives in the very top layer of the skin. *Demodex canis*, the other mite, lives in the hair follicles and the sebaceous glands of the skin. It’s much deeper down. They can exist together in the same dog and this was particularly obvious at Yarrabah.

*Video of female scabies mite.*

Here you see a female crawling on to the skin. Scabies mites are only about 0.5 mm long. The females can be seen with the naked eye though it’s difficult. The males and females mate, lay eggs and live their lives in burrows in the superficial layer of skin. The eggs hatch after three days, and from the egg being laid to the adult stage is somewhere around 10 days. The flakes of skin in the affected animal fall off containing eggs and larvae, and these can then hatch on the surface where they’ve fallen and the larvae can walk around and move to another host. (So if an animal has a heavy load of skin falling off all the time, you would expect there to be mites on the bedding and so on.)

The mite here on the video is very enlarged. These mites have four legs on the front, and each leg has a stick on it with a suck at the end. They walk on these suckers and can move quite rapidly. They can also climb walls and walk upside down. They have another four legs at the back. These are jointed and have stiff hair, which the mite uses to push itself forward. It makes a burrow in the surface layer of the skin and eats its way along, pushing itself with its back legs so it can move forward.

*Video of skin scraping.*

This is a skin scraping. You can see a row of eggs there—a female mite has made a burrow along the skin and, as it has progressed, has laid eggs and they are developing. When the burrows change direction, the larvae mites have hatched. If this was a piece of skin fallen off onto the floor, you’d have a mixture of eggs and larvae coming out of the skin.

*Video of larval mite waiting to hatch.*

This shows an egg with a larval mite waiting to hatch. Here’s the head—it’s moving its jaws backwards and forwards and pushing with its front legs. Then the egg starts to split. If the mite came off at this stage onto a surface, within a day or so it would be out of the egg. The larval mite is too small to see with the unaided eye, about 0.2 mm long. It’s hard to pick up even under a dissecting microscope. At this stage it can survive perhaps three days off a host, given the right conditions. The wrong conditions are when it’s very dry; then the mite dies from dehydration. But if it’s nice and moist, the mite can survive for two to three days.

*Video of larvae walking around.*

This is a larval mite walking around on its four front legs, trailing its back legs behind it. They wander around looking for a suitable host, and when they find one they burrow into the surface of the skin.

There haven’t been many studies done with mites from dogs, but studies done with mites from humans show how intense the contamination can be. One study done in a hospital room showed about 400 mites per gram off the curtains and 1000 mites per gram in the dust on the floor. So many of the dogs with thickened skin have a lot of mites sitting in those scales of skin. This means there is quite a lot of potential for transmission from dog to dog and the possibility of transmission from dog to human.
What has been found in European mainstream communities where there is no scabies in the humans is that about 25% of people in contact with infected dogs complain of itch. They may not have classical scabies, but they certainly get itchy from the dog mites. Kathryn mentioned getting itchy from working with dogs, and I have become infected working with dogs with scabies. But when you try to isolate the mite from people who have been infected with scabies from dogs, you can’t actually find it—there are so few mites that it is hard to locate them.

[Slides of electron micrographs of Sarcopes scabiei.]

You can put the scabies mite under the electron microscope and look at it in greater detail. If you look closely at the head you can understand how it feeds. In the past people have said it has jaws and chomps its way through the skin, but this is impossible because of the rigid structure of the head. What appears to happen is that the mite secretes saliva which digests the skin and makes it into liquid slurry. It then sucks this slurry in and grinds it up.

[Slides of electron micrographs of Demodex canis.]

The other mite is Demodex canis. With this you get a severe inflammatory action. Demodex, as I said earlier, lives at the bottom of the hair follicles, the bottom of the hair surface. It’s more secretive than the scabies mite, smaller and narrower and a completely different shape. It has eight short, stumpy legs and a very long body.

This mite doesn’t move very much. It’s got to live in a tunnel way down in the hair follicle, like a cylinder. It seems that most infections go from the mother dog to the pup, and probably a lot of dogs get infected with it as pups and the disease only comes out later if they have trouble with poor nutrition or immunosuppression or something like that. It doesn’t cause symptoms in people.

Both Demodex canis and Sarcopes scabiei cause skin disease, hair loss, itching, scratching, thickened skin and inflammation with secondary bacterial infection. They can both end up causing leather dogs, although scabies is a much more common cause of leather dogs.

When we looked at the dogs we post mortem in Yarrabah, we were surprised to find scabies present in 80% and Demodex in 79%. So they were almost equal. At least 60% of dogs had the two mites living together. In the subsequent program, the Rangers at Yarrabah gave ivermectin on biscuits once a month for 12 months. After 12 months we couldn’t find scabies at all on the dogs that came in, but we did still find Demodex, including some quite severe cases. It’s well known that ivermectin is quite effective against Sarcopes but not very effective against Demodex.

Heartworm

[Slide of clump of heartworms.]

Heartworm is quite common in tropical areas. This is a clump of heartworms taken out of the heart of a dog. They are quite long, up to about 15 cm.

The main problem is they live in the right side of the heart but can move into the pulmonary arteries that supply the lungs and cause changes in the arterial lining. Infected dogs end up with severe cardio-pulmonary disease, so the heart has to pump much harder to get blood through the lungs (pulmonary hypertension). Clinically you see reduced exercise tolerance, coughing; dogs can’t run like they used to and then progress to heart failure. The other condition dogs can get from heartworm is the cable syndrome, where too many worms get packed into the right heart and it produces a strange reaction where the blood breaks down and comes out in the urine.

The heartworm’s life cycle is that it lives in the right side of the heart where it produces babies that
circulate around the blood; these are sucked up by a mosquito, which probably remains infected between 10 and 14 days; the mosquito injects the heartworm into another dog, where it develops under the skin; then after about 90 days it moves back to the heart where it grows into an adult. It takes about six-and-a-half months before a mature adult is sitting in the heart. You don’t usually find heartworm in dogs less than eight months of age.

In dogs at Yarrabah the overall prevalence of heartworm in the total population was 83%, but in dogs older than a year it was 87%. That is a high prevalence and it was having a marked effect on people’s dogs. It meant that after about two years most dogs had heartworm and would end up either dying or being useless--no good for hunting.

When we looked at the dogs that were post mortemed after the ivermectin program had been running for 12 months, the prevalence of heartworm had fallen to just 14%. This was in the worst dogs in the community, the dogs that were unwanted or ill. So the program made a dramatic difference to the amount of heartworm present.

**Intestinal parasites**

We also found intestinal parasitic nematodes in the dogs. The hookworm was present along with another species that we have also found in Townsville. Potentially both can move across to humans but they are not the classical human hookworms. *Strongyloides*, the round worm, was not present in this particular community.  

[Video of hookworm.]

Hookworm lives in the small intestine. It attaches to the lining of the small intestine and sucks blood. You can see it hangs using its teeth. Hookworms are particularly important in community dogs because they make pups anaemic and actually kill a lot of pups by three months of age.

[TRANSCRIPT BREAKS OFF HERE.]

**Discussion from Rick Speare’s talk**

**Kevin de Witte** (*Katherine, Department of Primary Industries and Fisheries*) Is there any evidence in this work or any other work you’ve done of the hydatid tapeworm, and any comments on whether it’s likely to infest Aboriginal camp dog populations or not?

**Rick Speare** We didn’t find any *Echinococcus*, or the hydatid tapeworm, at all. It is quite common in dingo in that particular area. David Banks, working just west of Townsville, found it in about 15% of dingo. The only place I am aware of is the Forster community in northern New South Wales. I’m not aware of it having being found in any other dogs in Aboriginal communities.

**Debbie Osborne** The dogs that you were still finding *Demodex* on: had their coats actually improved? Did they still look mangy or did they look normal?

**Rick Speare** The dogs were ones presented to us for euthanasia; we weren’t looking for *Demodex*. It’s easy to find when you digest the skin; if you don’t do this it’s quite difficult to find. I think that’s why we got such a high rate.

What we found was that in general the health of the skin of dogs in the community improved quite dramatically. But there were some dogs that had persistent problems, and they were the ones that had *Demodex*. When we scraped the skin we could find it. We put them on long courses of
ivermectin every week for two months. It just didn’t seem to make any difference. It was a persistent problem. We didn’t go to daily ivermectin treatments because Yarrabah is 350 km from Townsville and we didn’t want them to give it every day in case something went wrong.

**Jo Mansson** *(vet, Gove)* Were you using oral ivermectin or injectable [ivermectin] orally, and did you lose many with heartworm when giving large amounts of ivermectin?

**Rick Speare** Good question. You are worried about giving ivermectin to dogs that have heartworm in case they get a reaction. No, we pressed ahead giving it orally. I’m not actually aware of any reactions that we could say were due to ivermectin. Jack, have you got any comment?

**Jack Shield** It's really a non-event in my experience. We used injectable ivermectin orally and saw virtually no problems with it.

What we were most afraid of was the idiosyncratic deaths in Collie-type dogs. We didn’t see that at all, even though some of the dogs in the community would have had Collie genes in them.

We saw some intoxications, and these were usually quite identifiable as the greedy little pup that would follow you around and scoff a few biscuits. They looked pretty terrible, but they recovered quite quickly and easily.

**Anne Quain** As some of the dogs retained some sort of parasite burden, have you considered using an alternative product?

**Rick Speare** I’m not involved in that community any more. I suppose Moxidectin would be the one to use. No, it was disappointment that the treatment got rid of scabies and still left us with *Demodex*. We would explain that to people and they’d accept it. Sometimes they would euthanase them if it was too severe.

**Jenny Youl** I wanted to comment on ivermectin and heartworm. I was under the impression that using ivermectin in animals with an adult burden of heartworm actually disguised the burden rather than caused any problems, so you weren’t able to detect any other stages.

**Rick Speare** Yes, that’s potentially true, but these were from post-mortems. If you give ivermectin, you might get rid of the microfilaria and not be able to make the diagnosis from the blood. But these are actually post-mortem examinations, so we could see it had made a significant difference.