alkaloid 2-methyl tetrahydrobetacarboline.[18] Phalaris is known to produce the latter two compounds.

PE-like sudden death has not been a significant problem in traditional, set-stocked, grazing management systems.[4] However, the increasing use of restrictive grazing management strategies, such as rotational grazing, cell grazing and crash grazing, would appear to have enhanced the risk of this condition occurring. Consequently, livestock owners using these grazing systems should be particularly vigilant when grazing *P aquatica* pastures during periods of moisture stress.

Acknowledgments

We thank the owners, management and farm staff of the "Jigsaw Farms" Group, at Hamilton Victoria, for their cooperation and assistance.

References

1. Bourke CA and Carrigan MJ. Mechanisms underlying *Phalaris aquatica* "sudden death" syndrome in sheep. *Aust Vet J* 1992;69:165-167.
2. Bourke CA The clinico-toxicological differentiation of *Phalaris* spp toxicity syndromes in ruminants. In: Colegate SM, Dorling PR, editors. *Plant-associated toxins: Agricultural, phytochemical and ecological aspects.* CAB International, Wallingford, 1994:523-528.
3. Anderton N, Cockrum PA, Walker DW, Edgar JA. Identification of a toxin suspected of causing sudden death in livestock grazing phalaris pastures. In: Colegate SM, Dorling PR, editors. *Plant-associated toxins: Agricultural, phytochemical and ecological aspects.* CAB International, Wallingford, 1994:269-274.
4. Bourke CA. Factors affecting the incidence of the PE 'sudden death' form of *Phalaris aquatica* poisoning in sheep. In: Michalk DL, Pratley JE, editors. *Agronomy - Growing a Greener Future, Proceedings of the Ninth Australian Agronomy Conference*. Australian Society of Agronomy, Wagga Wagga, 1998:326-329.
5. Mayhew IG. *Large animal neurology, a handbook for veterinary clinicians.* Lea and Febiger, Philadelphia, 1989:73-146.
6. Harata N, Iwasaki Y. Evidence for early blood-brain barrier breakdown in experimental thiamine deficiency in the mouse. *Metabolic Brain Dis* 1995;10:159-174.
7. Gummow B, Bastianello SS, Labuschagne L, Erasmus GL. Experimental *Albizia versicolor* poisoning in sheep and its successful treatment with pyridoxine hydrochloride. *Onderstepoort J Vet Res* 1992;59:111-118.
8. Everist SL. *Poisonous plants of Australia.* Angus and Robertson Publishers, Sydney, 1981: 106-108.
9. Keeler RF, Crowe MW. Teratogenicity and toxicity of wild tree tobacco, *Nicotiana glauca* in sheep. *Cornell Vet* 1984;74:50-59.
10. Bourke CA. Tunicaminyluracil toxicity, an emerging problem in livestock fed grass or cereal products. In: Colegate SM, Dorling PR, editors. *Plant-associated toxins: Agricultural, phytochemical and ecological aspects.* CAB International, Wallingford, 1994:399-404.
11. Dowling RM, McKenzie RA. *Poisonous plants a field guide*. Queensland Department of Primary Industries, Brisbane, 1993:28-29.
12. Seawright AA. *Chemical and plant poisons.* Animal health in Australia Vol 2, 2nd edn. Bureau of Rural Resources, Queensland Department of Primary Industries and Energy, Australian Government Publishing Services, Canberra, 1989:305-307.
13. Keeler RF. In: Cheeke PR, editor. *Toxicants of plant origin, volume 1, alkaloids.* CRC Press, Florida, 1989:133-167.
14. Seawright AA. *Chemical and plant poisons.* Animal health in Australia Vol 2, 2nd edn, Bureau of Rural Resources, Queensland Department Primary Industries and Energy, Australian Government Publishing Services, Canberra, 1989:54-57.
15. Seawright AA. *Chemical and plant poisons.* Animal health in Australia Vol 2, 2nd edn, Bureau of Rural Resources, Queensland Department Primary Industries and Energy, Australian Government Publishing Services, Canberra, 1989:22-25.
16. Seawright AA. *Chemical and plant poisons.* Animal health in Australia Vol 2, 2nd edn, Bureau of Rural Resources, Queensland Department Primary Industries and Energy, Australian Government Publishing Services, Canberra, 1989:120-122.
17.Tokania CH, Peixoto PV, Dobereiner J. Experimental poisoning by *Palicourea marcgravii* (Rubiaceae) in sheep. *Pesqui Vet Bras*, 1986;6:121-131.
18. Kemmerling W. Toxicity of *Palicourea marcgravii*: combined effects of fluoroacetate, N-methyltyramine and 2-methyltetrahydro-beta-carboline. *Naturfors*, section C, biosciences, 1996;51:59-64.

(Accepted for publication 30 July 2003)

Zoonotic importance of parasites in wild dogs caught in the vicinity of Townsville

B BROWN
DB COPEMAN

Australian Institute of Tropical Veterinary and Animal Science, James Cook University, Townsville, Queensland 4811

Aust Vet J 2003;81:700-702

Encroachment of suburban development into previously undeveloped areas fringing Townsville has brought people and wild dogs, which use the area as part of their territory, into frequent contact. Press reports of attacks by dingoes elsewhere have contributed to heightened awareness in the Townsville community of the potential threat of wild dogs to public safety. Concerns have also been raised that such dogs may carry diseases of zoonotic importance or which may infect domestic dogs. No examination of parasites in wild dogs in the Townsville district has previously been made, and relatively little is known about their prevalence elsewhere in Australia.[1] To address these issues, several local institutions funded a program to cull wild dogs. This action presented an opportunity to examine the dogs for the presence of parasites and thus permit an assessment of the potential human and animal-health risks they pose. Results are reported in this paper.

The dogs trapped in this study are locally referred to as dingoes. Coat colour varied between dogs from light tan to dark tan. Body shape was typical of the dingo. However, DNA testing (A N Wilton, personal communication, University of New South Wales, 2002) and examination of skull morphology (P Wulf, personal communication, James Cook University, 2002) indicated that there has been hybridisation between dingoes and domestic dogs within this group but estimates of the extent of the hybridisation differed. Consequently, we have used the term wild dogs[2] to describe the animals examined.

The parasites present in 27 wild dogs trapped in areas fringing suburban Townsville during August-September, 2002 are listed in Table 1. All but one of the dogs was trapped on lowland areas surrounding Mount Stuart, which is a major geographic feature located on the southern outskirts of the city. The mountain and immediate surrounding lowland area supports open eucalypt forest and is used by the Department of Defence for training purposes. Adjacent developments include the army base, the campus of James Cook University, the new Townsville Hospital and new suburbs being constructed along the southern bank of the Ross River (Riverside Estate, Annandale, Douglas).

Of the parasites found, *Echinococcus granulosus, Ancylostoma caninum, Dirofilaria immitis, Dipylidium caninum, Spirometra erinacei, Haemaphysalis* sp and *Amblyomma* sp may also infect or infest humans. Potentially the most important from the point of view of public health is *E granulosus* because ingestion of eggs of *E granulosus* from canine faeces can cause hydatid disease in humans. Flies are thought to be the main means of spread of *Echinococcus* eggs from dog faeces to surrounding objects.[3] Thus, areas frequented by wild dogs may become contaminated with worm eggs and be a potential source of human infection. The six infected dogs (of 20 adult wild dogs exam-

ined) were all trapped within the Defence training area or close to its boundary. However, the risk of infection for Defence personnel or others is likely to be low or absent over most of the area. Factors combining to moderate the risk are the large size of the area relative to the small number of infected dogs, the low burden of worms (fewer than 1000) in infected dogs and the warm dry weather experienced for most of the year in Townsville, which could be expected to reduce the survival of the *Echinococcus* eggs in the environment.[4] The potential risk of infection with *E granulosus* may be higher in focal areas where wild dogs defecate and personnel congregate (for example at the junction of tracks and where food is consumed). There may also be a higher risk in more elevated sites of Mount Stuart than lowland sites where these wild dogs were trapped. This is because dogs on the mountain may have a higher prevalence of infection due to their increased likelihood of preying on rock wallabies, which are known to harbour viable hydatid cysts.[4,5] A concurrent dietary investigation of canine scats in the area where dogs were caught (R Palmer, personal communication, Environmental Resources Management Australia, 2002) revealed that agile wallabies were the staple prey of wild dogs, occurring in 57% of faecal scats (n = 118) and whiptail wallabies were of secondary importance (15% occurrence). Other prey included a diverse range of mostly medium to large mammalian species, including rock wallabies (4% occurrence). This observation, absence of hydatid cysts in numerous agile wallabies examined from the area in past years[6] and the low burden of *E granulosus* suggest that infected dogs hunted mainly in lowland areas and may have had only occasional access to an infected wallaby.

The hookworm, *A caninum*, was found in 18 of the 20 adult dogs examined. A similar occurrence (87%) was found in dogs from the pound in Townsville,[7] and eosinophilic enteritis and cutaneous larval migrans in humans, caused by infection with larvae of these parasites, are significant to human health concern in Townsville.[8,9] Thus, while faeces from wild dogs is a potential source of human infection with *A caninum* if it comes in contact with bare skin, especially during the wet season, it is likely to be less important in terms of public health than faeces from infected domestic pets. On the other hand, infection with hookworm may be a significant cause of disease in the wild dogs because enteric haemorrhage and dark tarry faeces, typical of a clinical infection, were present in a number of the animals.

The canine heartworm, *D immitis*, may infect people through the bite of an infected mosquito but rarely develops to the adult and clinical disease has not been reported.[10,11] Over the past decade the widespread use of prophylactic drugs for heartworm in dogs has reduced the occurrence in domestic dogs in Townsville from an estimated 77% in 1972[12] to about 15% in adult dogs in the pound in 2001 (D B Copeman, unpublished observations). The occurrence of *D immitis* in 75% of the adult wild dogs examined in this study could thus be regarded as a reservoir of infection for domestic dogs. However, if domestic dogs are receiving a preventive drug, this risk is eliminated. The risk to humans of infection from wild dogs is negligible.

The presence of *D caninum* in 59% of the wild dogs is similar to that (49%) recorded in 1999 in dogs from the Townsville pound.[7] Dogs (and occasionally people) become infected from the ingestion of infected fleas. Infection is usually subclinical but the presence of mobile proglottids in faeces of pets may cause concern to owners. There is thus a low risk of human infection with *D caninum* from accidental ingestion of an infected flea from a domestic pet, but it appears unlikely that a flea from a wild dog would be ingested by a person.

Table 1.Parasites present in 27 wild-dogs caught in areas fringing suburban Townsville during August-September, 2002

Parasite	Age of dog (years)			Total (n = 27)
	0.2 (n = 7)	1.4 – 3 (n = 6)	4 – 7 (n = 14)	
Dirofilaria immitis	NA[a]	2[b]	13[b]	15[b]
Echinococcus granulosus	0	2[b]	4[b]	6[b]
Spirometra erinacei	0	4[b]	8[b]	12[b]
Dipylidium caninum	4[b]	3[b]	9[b]	16[b]
Ancylostoma caninum	2[b]	5[b]	13[b]	20[b]
Ctenocephalides felis	5[b]	2[c]	3[b]	10[b]
			2[c]	2[c]
Amblyomma sp	2[b]	2[b]	8[b]	12[b]
	3[c]	2[c]	2[c]	7[c]
Haemaphysalis sp	1[b]	2[b]	6[b]	9[b]
	3[c]	2[c]	2[c]	7[c]

[a]Not applicable
[b]Number positive
[c]Not examined

Spirometra erinacei was found in 44% of the wild dogs, which is lower than might have been predicted because their plerocercoids (spargana) are commonly present in animals that eat frogs such as some species of snake, owls and wild pigs in the district (D B Copeman, unpublished observations). While plerocercoids may also infect humans who drink water containing copepods infected with procercoids (which become infected from larvae hatched from eggs in canine faeces deposited in water), or be acquired directly from raw infected meat,[13] the infection is usually subclinical. Nevertheless, personnel in the Defence training area should be discouraged from drinking untreated ground water to avoid infection.

Identification of the ticks was made only to genus, because many of the specimens were larvae or nymphs that could not be speciated using the available key for adults.[14] However, the few adult specimens collected were *H bancrofti* and *A triguttatum*, both of which are primarily parasites of macropodids,[14] which are numerous in the areas where the wild dogs were caught. *H bancrofti* and *A triguttatum* will also parasitise humans and other animals[14] and *A triguttatum* has been incriminated in transmission of Q fever from kangaroos to humans.[15] Thus, infestation of wild dogs with these ticks may contribute to the persistence of these ticks in the region but their role is probably minor in comparison to that of their usual and more numerous macropod hosts. Occasional attachment, especially to personnel in the Defence training area, can be expected. The ticks are easily removed and have no toxic effects but their potential to transmit Q fever in this region is unknown.

We gratefully acknowledge the assistance provided by Mr Mark Goullet who caught the wild dogs, Mr Russell Palmer who shared information on dietary analysis of dog faeces he collected in the areas where wild dogs were caught, and Dr Peter Wulf and Dr Alan Wilton who provided information on the extent to which their analyses indicated the extent to which the wild dogs caught were pure dingoes or hybrids with domestic dogs.

References

1. Jenkins DJ, Morris B. *Echinococcus granulosus* in wildlife in and around the Kosciuszko National Park, south-eastern Australia. *Aust Vet J* 2003;81:81-85.
2. Fleming P, Corbett L, Harden B, Thomson P. *Managing the Impacts of Dingoes and other Wild Dogs* Bureau of Rural Sciences, Canberra, 2001;186.
3. Lawson RJ, Gemmell MA. Hydatidosis and cysticercosis: the dynamics of transmission. *Adv in Parasitol* 1983;22:261-308.
4. Banks DJD. *The epidemiology of echinococcus in tropical Queensland.* [PhD Thesis]. James Cook University, Townsville, Australia, 1984.
5. Beveridge I, Spratt DM, Close RL, Barker SC, Sharman GB. Helminth parasites of rock wallabies, *Petrogale* spp.(Marsupialia), from Queensland. *Aust Wildl Res* 1989;16:273-287.
6 Speare R, Beveridge I, Johnson PM, Corner LA. Parasites of the agile wallaby (Marsupialia). *Aust Wildl Res* 1983;10:89-96.
7. Wallner JD. *The use of a coproantigen ELISA to determine the prevalence of* Echinococcus granulosus *in pig-hunting dogs* in Townsville/Thuringowa. [MSc. Thesis]. James Cook University, Townsville, Australia, 1999.
8. Prociv P, Croese J. Human eosinophilic enteritis caused by dog hookworm *Ancylostoma caninum. Lancet* 1990;335:1299-1302.
9. Croese J, Fairley S, Loukas A, Hack J, Stronach P. A distinctive aphthous ileitis linked to *Ancylostoma caninum. J Gastroenterol Hepatol* 1996;11:524-531.
10. Moorhouse DE, Abrahams EW, Stephens BJ. Human pulmonary dirofilariasis in Queensland. *Med J Aust* 1971;2:1230-1233.
11. Welch JS, Dobson C. The prevalence of antibodies to *Dirofilaria immitis* in Aboriginal and Caucasian Australians. *Trans Roy Soc Trop Med Hyg* 1974;68:466-471.
12. Aubrey JN, Copeman DB. Canine dirofilariasis: an evaluation of bimonthly diethylcarbamazine therapy in prophylaxis. *Aust Vet J* 1972;48:310-312.
13. Roberts LS, Janovy Jr J. *Foundations of Parasitology* 6th edn. McGraw-Hill, Singapore, 2000:670.
14. Roberts FHS. *Australian Ticks.* Commonwealth Scientific and Industrial Organization, Melbourne, 1970:267.
15. Pope JH, Scott W, Dwyer R. *Coxiella burnetti* in kangaroos and kangaroo ticks in Western Queensland. *Aust J Exp Biol Med Sci* 1960;38:17-28.

(Accepted for publication 18 August 2003)

BOOK REVIEWS

***Exotic Animal Medicine for the Veterinary Technician**. Ballard B and Cheek R. IowaState Press, Ames, 2003, 320 pages. Price USD49.99. ISBN 0 81381928 8.*

This book is aimed at the person studying to be a veterinary technician, or veterinary nurse, and also the qualified nurse. Each chapter covers anatomy, physiology, husbandry, nutrition, diseases, restraint, radiology, anaesthesia and surgery, parasitology, haematology, clinical techniques, emergencies and euthanasia of a group of species. The animals included are birds, lizards, snakes, chelonians, amphibians, ferrets, rabbits, mice, rats, gerbils and hamsters, chinchillas, guinea pigs, hedgehogs, and skunks, prairie dogs and sugar gliders. Tighter editing would have removed the numerous inconsistencies found between chapters of this multi-authored book. The avian and ferret chapters are too superficial, whereas the reptile chapters contain much more detail. Some chapters use US units, while others use international units, and there are contradicting statements between chapters.

The book focuses inadequately on those tasks that are specifically assigned to the veterinary nurse in practice. While there is good coverage of restraint techniques, venepuncture, radiology and anaesthetic monitoring, other areas such as faecal examinations and in house diagnostic tests, such as Gram stains, are covered minimally or not at all.

Although there are some photographs of faecal parasites the range presented is inadequate for the book to be useful as a reference in this area. The rabbit chapter is the only one to contain normal haematology and biochemistry values and a drug formulary. However, the book does contain much useful background information on the anatomy, physiology, husbandry and nutrition of the various species.

Oddly, some of the same photographs are presented in both colour and black and white. The lizard chapter highlights important client information in italics. Given the important role that the veterinary nurse has in liaising with clients it is unfortunate that the other chapters do not do the same. More in depth information should have been provided on common zoonoses, such as chlamydophilosis and salmonellosis.

The final two chapters provide useful information on avian and reptile haematology (the colour photographs of blood cells are particularly valuable) and the technician's role in wildlife rehabilitation, including hand rearing.

The main drawback from the Australian perspective is the book's focus on North American species. The sugar glider is the only Australian mammal covered, albeit briefly. And even then there are factual errors; sugar gliders not in fact being native to New Zealand.

Although there is considerable room for improvement, particularly in some of the chapters, the book is worth purchasing if the practice sees a significant number of birds, reptiles and other exotic pets. It provides considerable basic information and there is nothing else comparable currently on the market.

PH Holz

Dr Holz is a veterinarian at Healesville Santanctuary, Victoria.