FERAL PIG ECOLOGY IN CAPE TRIBULATION NATIONAL PARK, NORTH QUEENSLAND, AUSTRALIA

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Abstract: Results of an initial feral pig trapping and sampling program in the Cape Tribulation National Park and results from a survey of pig activity are presented. Pigs from the central and northern areas of the Park have a different origin from feral pigs from other regions of Australia. This is based on coat colour, the presence of a Melanesian tick, and a stomach nematode not previously recorded in Australia. Feral pigs pose a risk to human health. From this sample of 61 pigs, 11 different serovars of Leptospirosis were isolated. 66% of the sample was positive for Meliodosis, while Brucellosis occurred in 1% of the sample. The pig helminths Stomach Worm, Lungworm and Kidney Worm were found at high infection rates. A peculiarity of the area was the close association of human habitation with feral pigs around subdivisions adjacent to the Park. Pigs from these areas were on average 2x heavier, weight for age, than their purely forest dwelling associates. Pig activity in the central and southern areas of the Park was recorded as an adjunct to a survey of cassowaries in the area. With data on elevation and habitat, it was possible to investigate the association of pig activity with these variables in selected catchments over the 7 months of the survey. Information presented includes: measured impacts on the environment, management implications of these initial research data and guidelines for future work on trapping, investigation of seasonal habitat usage and applied ecology of feral pigs in the Wet Tropics World Heritage Area of North Queensland.

Keywords: Feral pig, *Sus scrofa,* Suidae, Diseases, Parasites, Health, Pathology.

IBEX J.M.E. 3:148-151

1. Introduction

The origin of pigs in North Queensland is uncertain. They may have been traded with Timor, New Guinea and/or Melanesia before the arrival of Europeans.

There has been limited feral pig research in North Queensland. This includes a 4 year ecology study in the tropical savannah environment (Pavlov, 1991) and the examination of a sample of 6 animals from the Tully area (Pavlov & Graham, 1985). The pig situation prior to January 1992 was presented in Pavlov, Crome and Moore (1992). A small project on the ecology and control of pigs on the tropical coastal lowlands (Pavlov, 1992; Pavlov & Edwards, 1992) was carried out between April and July 1992. A cassowary survey, which included pig activity observations, by Crome and Moore was undertaken between September 1992 and April 1993.

Pigs are distributed throughout the area and they are perceived as having an adverse but as yet unquantified impact on many aspects of the environment. There is a heightened public awareness that feral pigs are a negative feature of rainforests of the wet tropics. Results of community consultation during 1992 (community attitude survey, public introductory questions, a workshop summary and public submission summary) demonstrated to the Wet Tropics Management Agency, that control of feral animals and weeds were the highest priority issues in the public's mind (W.T.M.A., 1992).

Feral pigs cause further problems as reservoirs for diseases and parasites that can infect humans and/or domestic livestock (Pavlov, 1987; Pavlov, 1988) and are a potential physical threat to visitors of forested areas.

2. Methods

Ecological information was obtained from trapped and field shot animals. After basic morphometrics were recorded and the pig aged according to Matschke (1967), each animal was autopsied and parasite infections determined, pathology samples collected and reproductive information recorded from the females. Blood samples were left to clot at ambient temperature for 12 hours. Sera were sent to the Department of Primary Industries, Oonoonba Research Laboratory, for Leptospirosis, Brucellosis and Meliodosis screening, and also to the Department of Health, Brisbane, for detailed Leptospirosis screening. Stomach contents were weighed at the time of dissection and stored frozen for later particle and nutritio-

nal analysis. Contents were sorted by hand and the relative components weighed. Nutritional analysis of pig stomach contents was carried out by the Department of Primary Industries, Animal Research Institute, Yerongpilly, Qld.
Control: Weldmesh traps of panel, circular and box design were used. The panel and the circular traps incorporated a one-way swinging gate at the entrance, while the box trap used a drop door at the entrance. A range of food sources for the traps was trialled subjectively. The most suitable, as judged by cost, availability, safety for non-target species and effectiveness, was found to be cracked corn (soaked in water overnight).
Because of the short duration of the study, it was not possible to assess the long-term response of the pig population to the continuous presence of traps baited with particular foods, or the seasonal acceptability of the most suitable bait used during the trial period.
Transects: Activity transects were defined by flagging a one kilometer line from sea level directly west, with a marker (plastic flagging tape) every l0 metres. Pig activity was recorded each week, in a strip 5 metres wide, either side of this line. The two sites recorded for the duration of the project were in an area of high visitor use (including the Oliver Creek Marrdja Boardwalk) and an area partially developed which passed an open rubbish dump and then continued through rainforest (Myall valley). With regular monitoring, it was possible to define pig activity in three categories: fresh (< 24 hours old), recent (< one week old), and old (> than 1 week old).

3. Results

3.1. Ecology

Pigs in the rainforest of Cape Tribulation National Park are mostly agouti patterned adults. The range of species of rainforest fruits eaten by pigs is potentially great, but awaits detailed analysis over all seasons at representative sites. Earthworms were present in most of the stomachs, reaching 20.4% of the contents in one instance. The percentage reduction of worms due to pig predation varied from 62% to 93%. Unidentified fibrous plant material was the most common item in forest-dwelling pigs. Of interest was the occurrence of garbage in one animal (No. 51). The stomach contents of a further three pigs from the vicinity of the rubbish dump consisted almost entirely of garbage, indicating their role as scavengers around human habitation.

3.2. Parasites and diseases

Parasites and diseases (the latter recorded by positive antibody titres) found in feral pigs are listed in table 1. They include the pathogens that cause disease in humans (Brucellosis, Leptospirosis and Meliodosis). Ross River Virus and Murray Valley Encephalitis Virus have been isolated from feral pigs on Cape York Peninsular (Pavlov, 1988), but have not been surveyed for in the Wet Tropics Management Area to date.
Of note is the high external parasite load. Ticks averaged 1.6 per animal and the groin was the preferred site of attachment. There was a high incidence of Kidney Worm and Red Stomach Worm. These helminths have a direct infective larval stage so that an intermediate host is not required for the successful completion of the life cycle. Lungworm was also common, and with earthworms as the intermediate host, the importance of this dietary item to feral pigs is further supported.

Table 2 illustrates the development of parasite infection in young pigs. By 6 months of age, Kidney Worm has infected 75% of the sample, and Stomach Worm and Lungworm have infected approximately 50% of the sample. Because Kidney Worm and Lungworm are capable of direct infection, the penning of pigs of this age would ensure an escalation of helminth infection. By 12 months of age, infection rates have reached adult levels.

Table 3 illustrates the sex of trapped pigs, showing a 2:1 ratio of females to males trapped in this trial.

4. Discussion

The presence of a high proportion of agouti patterned adults, body stripes on many of the pigs under 6 months of age, a high incidence of Melanesian ticks and confirmation of the identity of the Stomach Nodule Worm (a new parasite record for Australia) all support the contention that pigs from this area do not have a common origin with the European domestic pig.
There is no documentation of pig introduction to this area, so the origin of these animals remains unknown.
Particle analysis of stomach contents from Cape Tribulation indicated that pigs were a regular predator of earthworms. Because the protein content of worms (58-71% on a dry weight basis) is high in essential amino acids

Table 1: Parasites and diseases found in feral pigs from Cape Tribulation National Park (number in sample = 52)

Parasite/Disease	% infected
External Parasites	
Ornate Tick *Ambylomma cyprium cyprium*	40
Pig Louse *Haematopinus suis*	91
Internal Parasites	
Red stomach Worm *Hyostrongylus rubidus*	75
Stomach Worm *Physocephalus sexalatus*[1]	1
Stomach Nodule Worm *Simmondsia paradoxa*	8
Thorny-headed Worm *Macracanthorhynchus hirudinaceus*	6
Lungworm *Metastrongylus* spp.	79
Plerocercoids of *Spirometra erinacei* [1]	1
Cysts of Bladder Worm *Taenia hydatigena*	1
Kidney Worm *Stephanurus dentatus*	90
Diseases	
Brucellosis *Brucella suis* [1]	2
Meliodosis *Pseudomonas pseudomallei* [1]	66
Leptospirosis *Leptospira interrogans* serovar *australis* [1]	2
" " " *bulgarica*[1]	6
" " " *celledoni* [1]	4
" " " *gippotyphosa* [1]	2
" " " *hardjo* [1]	2
" " " *kremastos* [1]	2
" " " *pomona*[1]	6
" " " *robinsoni* [1]	4
" " " *swajizak* [1]	2
" " " *tarrasovi* [1]	4
" " " *zanoni* [1]	2

[1] = Human pathogen

Table 2: Percentage infection rate of Cape Tribulation pigs < 12 months old (N = 34).

Age Class (months)	Percentage Infection Rate				
	Stomach Worm	Kidney Worm	Lung Worm	Thorny-headed Worm	Stomach Nodule Worm
< 6	52.6	75	43.8	0	0
7-12	83	100	88.9	5.6	11.1

Table 3: Sex of trapped pigs

Age (months)	Males	Females
60	0	1
43-48	0	1
31-36	0	1
25-30	0	3
18-24	1	0
6-12	6	10
0-6	5	9
Total	12	25

(Sabine, 1983), and the overall protein content of the pig diet is low, it indicates that pigs will choose high protein sources when available. Earthworm predation by feral pigs should be further examined, since the finding that they can remove up to 93% of the worms from a feeding site.

With a worm population density of up to 188 per m^2, and the finding of 263 earthworms in one pig stomach, it is estimated that pigs can dig up significant areas (1.4 m^2 to 150 m^2) during one period of feeding activity. The introduced earthworm *Pontoscolex corethrurus* and the native earthworm *Diporochaeta nashi* were identified as the species present in the pig stomachs and feeding areas sampled. Further sampling would elaborate on the range of species involved. Dr. G. Dyne (pers. comm.) suggested that the transport of egg capsules of introduced earthworms on the hair or feet of feral pigs could assist in their distribution into the rainforest. Seasonal dietary sampling would determine impacts on other species of earthworms and soil-dwelling fauna, *i.e.* land snails, insects and their larvae. With the lack of information about pigs in tropical rainforest the following needs to be addressed: (a) determine the distribution and abundance of feral pigs, based on indirect assessment; (b) estimate the seasonal ecological impact of pigs on rainforest environments, particularly in relation to the long-term processes of forest dynamics; (c) estimate basic population parameters of pigs in those target areas in order to assess the likely efficacy of control methods.

5. Acknowledgements

The Cape Tribulation feral pig ecology/trapping study was funded by the Wet Tropics Management Agency through the Department of Environment and Heritage, National Parks and Wildlife Service For Northern Region. Serology, pathology, tick identification and nutritional analysis of stomach contents was undertaken by the Department of Primary Industries. The Queensland Department of Health identified the strains of Leptospirosis. The identification of *Simmondsia paradoxa* and *Physocephalus sexalatus* was confirmed by Dr. D. Spratt, CSIRO Division of Wildlife and Ecology, Canberra.

The generous assistance of F.H.J. Crome and L. A. Moore, CSIRO Tropical Forests Research Station, in providing data on pig activity in rainforest catchments is greatly appreciated. Dr. Geoff Dyne, N.T. Conservation Commission, identified the earthworm species. Assistance of local people in the Cape Tribulation/Cow Bay area is acknowledged.

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