

capillary endothelial cell degeneration and necrosis apparently causes extensive interstitial oedema and acute hepatic and pneumonic incompetence leading to clinical manifestations of anorexia, muscular weakness, and primary and secondary central nervous system depression.

Supplementary selenium is stored in the kidney and liver and is rapidly excreted. Muscle tissue accumulates selenium only slowly. The *Victorian Food and Drug Standards Regulations 1966* require that no food should contain more than 2 mg selenium/kg, on the basis of tissue selenium concentrations at day 35 (Table 1) the carcass muscle was accepted by the Victorian Meat Inspection Authority as being fit for human consumption, whereas all offal was rejected.

Many concentrated essential elements when given in excess are toxic to animals. In this case sodium selenite was added directly to the feed-stuff, a practice which may readily result in toxic overdoses when very small quantities of active ingredient are being supplemented. Such risks can be minimised by using carrier compounds, commonly used in commercial rations.

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Kangaroos and wallabies as carriers of *Basidiobolus haptosporus*

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The fungus *Basidiobolus haptosporus* is a cause of cutaneous phycomycosis of horses in northern Australia (Connole 1973; Miller and Pott 1980; Miller 1983). It is a terrestrial fungus living in decaying vegetation (Drechsler 1947), but it has also been isolated overseas from the faeces and gut of amphibians, lizards and gekkos (Coremans-Pelseneer 1973; Porto and Milanez 1979; Gugnani and Okafor 1980) and in Australia from the faeces of the bearded dragon, *Amphibolurus barbatus* (Miller 1983). Miller (1983) proposed an epidemiological schema for equine basidiobolomycosis in which terrestrial lizards acted as reservoirs for the fungus, enabling it to survive adverse environmental conditions and suggested that infected lizards may also increase contamination of areas they frequented. Mammals have not been reported to act as reservoir hosts for *B. haptosporus*. This communication reports the isolation of *Basidiobolus* from the gastrointestinal tracts and faeces of macropods in northern Queensland.

Faecal material was obtained directly from the cloaca of live macropods or in the case of autopsied macropods, from the lower colon. Samples obtained at autopsy and from the cloaca of live animals were collected using aseptic techniques. Samples of cleaned, artificial pouches in which joeys were restrained and of soil were also examined. The pouches were made of various types of cloth, were replaced when soiled and cleaned by laundering. The soil samples were taken from

the superficial layer, included detritus, and were collected from areas that had previously been frequented by joeys from which *Basidiobolus* had been isolated. All samples were plated on 10% sheep blood agar and MacConkey agar plates, incubated in air at 37°C and examined after 24 and 48 h. Fungal isolation was attempted on Sabourad dextrose agar* and Mycosel agar† with added thiamine, incubated at 28°C for up to 14 days. Isolation of *Basidiobolus* from soil samples was attempted by plating directly as well as by the inverted culture technique of Coremans-Pelseneer (1973).

Some 285 of 480 specimens from 162 macropods were cultured for fungi. Seventeen isolates of *Basidiobolus* sp were recovered from 14 macropods: 15 from faeces, one from stomach contents and one from small intestinal contents. *Basidiobolus* sp was not isolated from 10 skin or hair specimens and 262 samples from various organs and other sites.

All the *Basidiobolus* sp grew on specific fungal isolation media at 28°C and on the blood agar plates at 37°C. They produced thick walled chlamydo-spores occurring predominantly in chains. Seven of the 17 isolates produced smooth-walled zygo-spores and using the criteria of King (1979) and

TABLE 1

Prevalences of *Basidiobolus* sp. in 16 species of macropod

Species	Total number	No. of joeys	No. positive	% Joeys positive
<i>Aepyprymnus rufescens</i>				
rufus rat				
kangaroo	4	2	0	0
<i>Dendrolagus lumholtzi</i>				
Lumholtz' tree kangaroo	2	0	0	0
<i>Hypsiprymmodon moschatus</i>				
musky rat kangaroo	1	0	0	0
<i>Lagorchestes conspicillatus</i>				
spectacled hare wallaby	5	1	1	100
<i>Macropus agilis</i>				
agile wallaby	39	33	1	3.0
<i>Macropus antilopinus</i>				
antilopine kangaroo	1	0	0	0
<i>Macropus dorsalis</i>				
black stripe wallaby	10	4	0	0
<i>Macropus giganteus</i>				
eastern grey kangaroo	60	48	6	12.5
<i>Macropus parryi</i>				
whiptail wallaby	4	3	0	0
<i>Macropus robustus</i>				
eastern wallaroo	11	4	2	50
<i>Macropus rufus</i>				
red kangaroo	7	7	1	14.3
<i>Onychogalea fraenata</i>				
bridled nailtail wallaby	2	0	0	0
<i>Onychogalea unguifera</i>				
northern nailtail wallaby	3	3	2	66.7
<i>Petrogale assimilis</i>				
Palm Island rock wallaby	6	3	0	0
<i>Petrogale purpureicollis</i>				
purple neck rock wallaby	1	0	0	0
<i>Wallabia bicolor</i>				
swamp wallaby	6	4	1	25
Total	162	112	14	12.5

* Oxoid Australia Ltd, Heidelberg West, Victoria

† BBL, A.E. Stansen and Co Pty Ltd, Mt Waverley, Victoria

Gugnani and Okafor (1980) would be classed as *B. haptosporus*. The remaining isolates were also likely to be *Basidiobolus haptosporus* but lost the ability to sporulate before their identity could be confirmed.

Basidiobolus sp including *B. haptosporus* was isolated from 7 species of macropods (Table 1.) There was no apparent seasonal or geographical variation nor any associated pathology. *Basidiobolus* sp was not isolated from the adult macropods, but was found in 14/112 (12.5%) orphaned pouch young or juvenile macropods aged 115 to 360 days (mean 223) and which had been held captive for 1 to 65 days (mean 29). With the exception of one isolate from stomach and another from small intestine, the remainder were recovered from faeces, 6 from the rectum at autopsy. Thirty-six of the 162 macropods were sampled in the wild and *Basidiobolus* sp was not isolated from any; however only 4 of these were pouch young, the remainder being adult. Two joeys from which *Basidiobolus* sp was isolated within 24 h of becoming orphaned had not emerged from the pouch and were not eating solid feed. Eight of the 14 joeys from which *Basidiobolus* sp was isolated would not have yet permanently emerged from the pouch in the wild, and 6 of the 14 were feeding only on milk and not on solid feed at the time of sampling. *Basidiobolus* sp was isolated at autopsy from both stomach and rectal contents of one joey and from 2 other joeys on 2 occasions, one 3 months apart at 2 different locations in Townsville and the other 3 weeks apart at the same location.

Faecal specimens from 23 possums, 7 reptiles (including 3 lizards) and one native bird were negative for *Basidiobolus*, as were 6 samples from artificial pouches and 16 soil samples

from 3 of the 7 locations which had been frequented by joeys, from which *Basidiobolus* sp had been isolated.

B. haptosporus has not been previously reported from the faeces of mammals without phycosporosis. Immature wallabies and kangaroos in northern Queensland have significant carriage rates of *Basidiobolus* sp. Although *Basidiobolus* sp was isolated from only captive macropods, its presence in 2 joeys within 24 h of removal from the wild suggests closer examination of the wild population will yield positive results. The isolation of *Basidiobolus* sp from 2 macropods on 2 occasions suggests a true carrier state may exist. Its presence in the gastrointestinal tract may, however, merely reflect its common occurrence in the environment. Retrospective sampling of likely sources of *Basidiobolus*, that is pouches and soil, were negative. Further extensive environmental sampling carried out simultaneously with sampling of macropods is required before a true carrier state can be proved.

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