BESNOITIOSIS IN RODENTS FROM COLORADO

G. E. Dagle, T. F. Winsor, and R. R. Adee

Abstract:

Parasitic cysts of Besnoitia jellisoni were found in three Peromyscus maniculatus and one Spermophilus tridecemlineatus trapped in Eastern Colorado. The parasite was associated with a granulomatous inflammatory reaction in the lungs of each rodent and was disseminated in several organs from one Peromyscus. The ultrastructural appearance of the merozoites and the cyst wall formed by the host cell were studied.

Introduction:

Besnoitia are a group of coccidia similar to Toxoplasma that infest a variety of animals (Levine, 1973). B. besnoitia infect several species of cloven-hooved animals in Africa and Europe, B. bennetti are found in Equidae from Europe and North America, B. tarandi infect reindeer and caribou in Alaska, B. paramensis has been found in 2 species of Panamanian lizards, and B. jellisoni was first described in the white-footed deer mouse, Peromyscus maniculatus, in Idaho. Besnoitia jellisoni have also been described in the rodent Microxus torques in Peru, an opossum in Texas, and rats, Dipodomys sp., in Utah and California (Ernst et al., 1968).

The pathogenicity and life cycle of the parasite is unclear (Smith et al., 1970). This report notes the parasite in Peromyscus maniculatus from Colorado where they had not previously been reported, describes the natural infection in an additional species, Spermophilus tridecemlineatus, and describes the ultrastructural appearance of the parasite and the pathogenic response of the host in natural infections.

Materials and Methods:

The rodents were live trapped near the foothills on the Eastern slope of the Rocky Mountains at Rocky Flats, Colorado. The parasites were found among the following number of rodents examined: 93 Peromyscus maniculatus,

MASTER

NOTICE
This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Energy Research and Development Administration, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

OT
CONTRACT NO. E(11-1)-1156
DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

feg

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

9 Spermophilus tridecemlineatus, and 19 Microtus pennsylvanicus. Gross necropsy examination was made of each rodent and specimens of lung saved in 10% buffered formalin. Specimens were also saved from other organs if lesions were observed. Histopathologic examination was made of hematoxylin and eosin stained paraffin sections; special stains included the Periodic Acid Schiff reaction (PAS), Gormori methenamine silver (GMS) Giemsa, and Gram stains. Electron microscopic examination was made of a lung specimen from one Peromyscus that was post-fixed in osmium tetroxide, embedded in epoxy resin, ultramicrotomed, and stained with uranyl acetate and lead.

Results:

Gross examination showed small grey foci less than 1 mm in diameter on the lung surfaces of 2 Peromyscus maniculatus and, in addition, the skin, intestine, and skeletal muscle of one of these 2 rodents that later showed cysts of *Besnoitia*. Histopathologic examination showed cysts up to 1 mm in diameter in the lungs of three Peromyscus maniculatus and one Spermophilus tridecemlineatus, and with the grossly observed foci in the skin, intestine, and skeletal muscle of one Peromyscus. The cyst wall was about 1.0 microns thick and eosinophilic with hematoxylin and eosin staining (Fig. 1). Within the cyst were densely packed crescent shaped microorganisms measuring 1 to 2 μ m long. The cyst wall and organism were positive with the PAS reaction and argyrophilic with GMS stain, and did not stain with either the Giemsa or Gram stains. Ultrastructural studies showed the outer portion of the cyst wall to be surrounded by lamellar fibrillar material apparently formed by host cells, a middle portion composed of the cytoplasm of the host cell presumably a macrophage, and an inner limiting membrane (Fig. 2). The merozoites had nuclei, mitochondria, conoids, toxonemes, and other organelles (Fig. 3). A granulomatous inflammatory reaction was present in the lung of each rodent containing a cyst, but was not associated with the cysts in the heart, intestine, or skeletal muscle.

Discussion:

The parasite in these wild rodents is identified as B. jellisoni from the morphologic appearance and host specificity. The finding of the parasite in a relatively small sampling from 3 species of rodents suggest that the parasite may be quite common in that population. The presence of a granulomatous reaction in the lungs suggest an inflammatory response of the host although the inflammation could have been coincidental from some other unknown cause. Pathogenicity of Besnoitia jellisoni was described in the kangaroo rat from Utah (Chobatar, et al., 1970).

The ultrastructural appearance of the cyst and merozoites were similar to those described in experimentally infected mice (Scholytyseck et al., 1974; Senaud et al., 1974; and Sheffield, 1966). Although the designation of pseudocyst was historically preferred when the cyst was formed from host structures, that nomenclature no longer has diagnostic significance. Further application of electron microscopy is needed to elucidate the biology of this parasite within host tissues.

REFERENCES:

1. Chobota, B., L. C. Anderson, J. V. Ernst, and D. M. Hammond. 1970. Pathogenicity of Besnoitia jellisoni in naturally infected Kangaroo Rats (Dipodomys order) in Northwestern Utah. J. Parasit. 56: 192-193.
2. Ernst, J. V., B. Chobota, E. C. Oaks, and D. M. Hammond. 1968. Besnoitia jellisoni (Sporozoa: toxoplasma) in rodents from Utah and California. J. Parasit. 54: 545-549.
3. Levine, N. D. 1973. Protozoan parasites of domestic animals and of man. 2nd Edition. Burgess Publishing, Minneapolis. Pp. 307-316.
4. Scholtyseck, E., H. Mehlhorn, and B. E. G. Muller. 1974. Feinstruktur der Cyste und Cystenwand von Sarcocystis tenella, Besnoitia jellisoni, Franklin sp., und Toxoplasma gondii. J. Protozool. 21: 284-294.
5. Senaud, J., H. Mehlhorn, and E. Scholtyseck. 1974. Besnoitia jellisoni in macrophages and cysts from experimentally infected laboratory mice. J. Protozool. 21(5): 715-720.