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Globidia infection in the gut of an Australian gecko *Heteronotia binoei*

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Abstract. Globidia, at various stages of differentiation were found in histological sections prepared from the digestive tract of an Australian gecko *Heteronotia binoei* Gray, 1845. The globidia – seemingly in hypertrophic endothelial host cells – were located in the lamina propria of the small intestine, and were enclosed in a parasitophorous vacuole with various stages of differentiating meronts. When fully matured, globidia contained hundreds of merozoites within their parasitophorous vacuole.

Although the taxon *Globidium* Flesch, 1883 was and still is a taxonomic uncertainty, the term "globidium" has been applied by Pellerdy (1974) to giant meronts, localised in the lamina propria of the gut, which give rise to numerous merozoites.

Globidia have been reported from digestive tracts of ruminants and from marsupials. There is one record from reptiles, from a snake (Guyenot et al. 1922, Harant and Cazal 1934). In this communication we report the finding of globidia in the gut tissue of the gecko - *Heteronotia binoei* Gray, 1845, from north-west Queensland, Australia.

MATERIALS AND METHODS

The gecko, *Heteronotia binoei,* was collected in the Mt Isa region, north-west Queensland. Following the recovery of *Eimeria gastrosauris* Paperna, 1994 and isosporan oocysts from the faeces, the gecko was sacrificed for the study of endogenous stages. Segments from the stomach and the intestine were fixed in neutral buffered formalin for histology. Fixed tissue, after dehydration in graded ethanols, was embedded in glycol-methacrylate medium (GMA of Agar Comp., UK). Sections 3-4 μm thick were cut with a glass knife on a Sorval JB4 microtome and stained with Meyer's haemalum-eosin (MH-E). Measurements were obtained from 5-7 specimens. Data on sizes were obtained from at least five measurements.

RESULTS

Globidia at various stages of differentiation were found exclusively in the sections of the small intestine. They were absent elsewhere in the digestive tract.

In the same gecko, globidia coexisted in the small intestine with an as yet undescribed *Isospora* species which developed in the nuclei of the mucosal epithelial cells (Finkelman and Paperna, unpublished), and *Eimeria gastrosauris* was found in the stomach epithelial cells (see Paperna 1993,1994).

Globidia occurred in the lamina propria of the villi of the small intestine, where they appeared to develop in the endothelial cells. The host cells were hypertrophied and possessed a hyaline cytoplasm enclosed in a distinct wall (Figs. 1-3). The innermost layer of cytoplasm contained a fibrillar network as well as lacunae or small vacuoles (Figs. 3, 4). The host cells were multinucleate, and segments of grossly hypertrophied nuclei seen in cross-section were either portions of a large lobulated nucleus or parts of several nuclei (Figs. 1, 3, 5). The parasitophorous vacuole contained early, undivided (Figs. 1, 3) and dividing meronts (Figs. 3-6), or large numbers of merozoites (Figs. 7-9). Merozoites differentiated from the multinucleate meronts (Figs. 3, 4) and budded off from the meront body (Figs. 5, 6). Some residual cytoplasm packed with pyknotic nuclei remained following the completion of the nuclear division (Figs. 6, 7). The host cell of fully developed globidia were reduced to a thin hyaline shell (Figs. 8, 9), but retained from one to several nuclei (Fig. 8).

In cross-sections host cells containing early-stage and differentiating globidia ranged from 30 × 30 to 70 × 45 μm in size, with nuclear segments measuring 11-18 × 4-12 μm. The parasitophorous vacuole containing from 5 to 20 merogonic nuclei ranged from 20 × 6 to 40 × 32 μm. Host cells of fully differentiated globidia were 90-105 × 50-90 μm in size, with several nuclei of up to 30 × 5 μm in size, and with parasitophorous vacuole measuring 75-80 × 55-75 μm. In a single cross-section about 150-300 merozoites could be counted measuring 7-9 × 1-3 μm.

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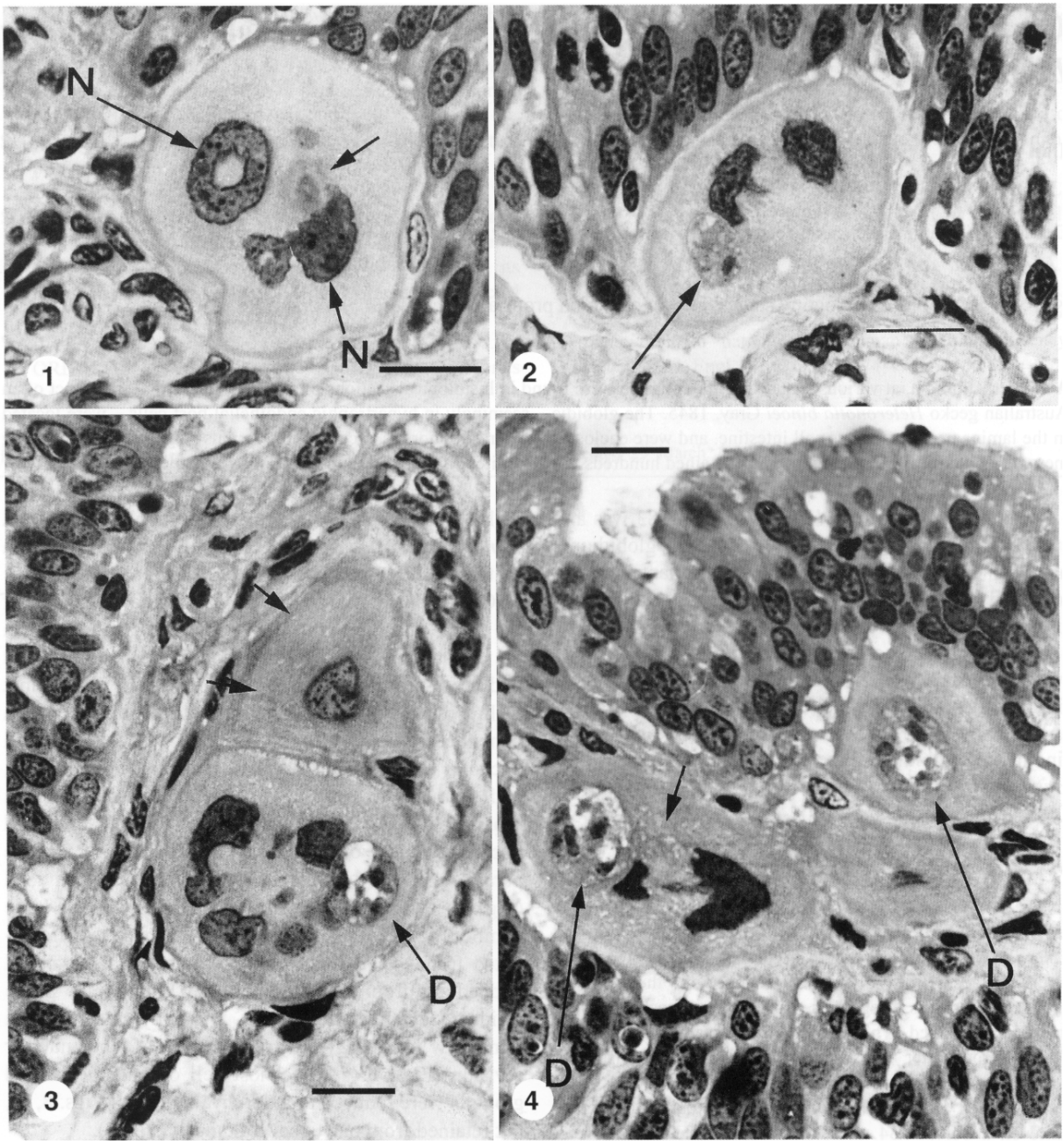
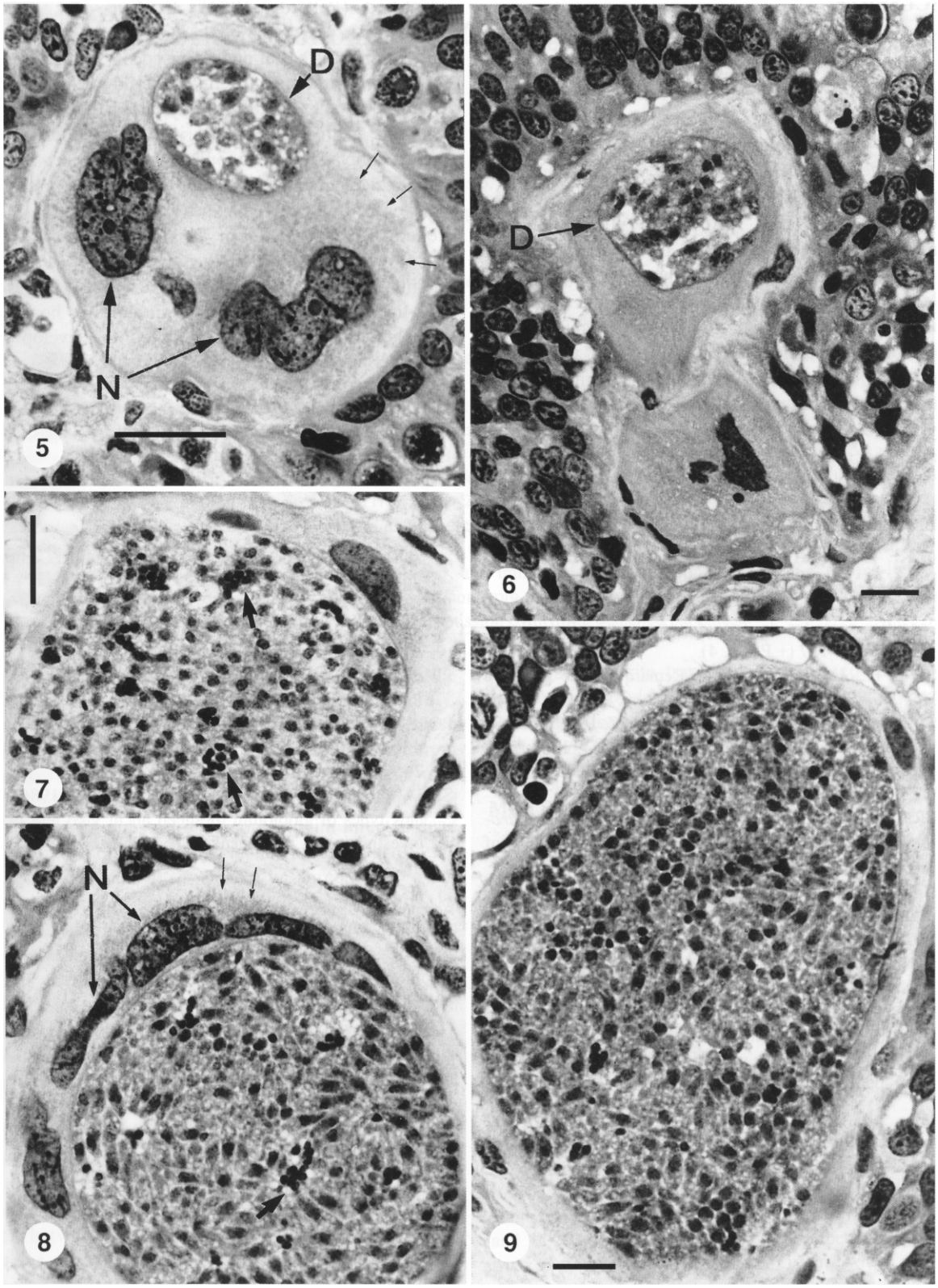


Figs. 1-4. Globidia in the lamina propria of the small intestine of the gecko *Heteronotia binoei*. **Fig. 1.** A young globidium with its hyaline cytoplasm and nuclear lobes (N) and a parasitophorous vacuole containing early stage meront (arrow). **Fig. 2.** Cross section of a globidium harbouring an undivided meront (arrow). **Fig. 3.** Fibrillar network with lacunae can be seen in the top globidium (arrows). In the globidium below cross-sections of parasitophorous vacuole a dividing meront can be seen (D). **Fig. 4.** Globidia with a parasitophorous vacuoles containing meronts differentiating into merozoites (D); note the lacunae in the globidium cytoplasm (arrow). Scale bars = 10 μm.



Figs. 5-9. Globidia in the lamina propria of the small intestine of the gecko *Heteronotia binoei*. **Figs. 5-6.** Globidium with a parasitophorous vacuole showing a meront in an advanced stage of differentiation (D). **Figs. 7-9.** Mature globidia packed with merozoites. Note aggregates of nuclei (arrows, Figs. 7, 8), differences in the consistency of the outer and inner layers of the globidial host-cell cytoplasm (arrows, Fig. 8), and the presence of several host-cell nuclei (N, Fig. 8). Scale bars = 10 μm. (Figs. 7, 8 – same magnification).

DISCUSSION

Globidia were not found in any of 16 other specimens of *Heteronotia binoei* examined histologically, or in other gecko species examined from Queensland or South Australia (Paperna, unpublished).

Despite the apparent similarities to the besnoitian tissue stages (*Globidium besnoiti* sensu Henry and Masson 1932, see Pols 1960, Bigalke 1981), including a hypertrophic host cell, with giant nuclei, and the formation of many merozoites, there is no evidence indicating multiplication by endodyogeny, characteristic of *Besnoitia* and other cyst-forming Coccidia (Mehlhorn et al. 1984). Merozoites of eimeriid coccidians are formed by differentiation (budding) from the meront cytoplasmic body. Globidia have been commonly found in abomasum and small intestine of sheep and goats. They are considered to be developmental stages of eimeriid coccidians, but their species annot usually be identified (Pellerdy 1974). Evidence for regarding globidia as extraepithelial meronts of eimeriids is largely circumstantial and is based on their presence in the host with concurrent eimeriid infections (see Guyenot et al. 1922, Pellerdy 1974, Bigalke 1981). Globidia with the characteristic hypertrophic multinucleated hyaline-like cytoplasm bear no resemblance to large-sized eimeriid meronts of *Eimeria tenella* of chicken, or *E. parva* of sheep and goats (fig. 224 in Pellerdy 1974, Mehlhorn et al. 1984, Senaud et al. 1984) which develop in the lamina propria. Globidia might well be an eimeriid-analogue to the stages of a cyst-forming coccidian in the prey host, with gamogonic-oogonic stages destined to develop in an obligatory predator host.

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