Ann. Parasitol. Hum. Comp.,
1990, *65 :* n° 5-6, 214-217.

Mémoire.

Mots-clés : Fallisia copemani. Haemosporidie. Ultrastructure. Gamétocyte. Australie.

Key-words: Fallisia copemani. Haemosporidia. Ultrastructure. Gametocyte. Australia.

FINE STRUCTURE OF A MACROGAMETOCYTE OF *FALLISIA COPEMANI* PAPERNA AND LANDAU 1990 (HAEMOSPORIDIA: GARNIIDAE)

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SUMMARY

The fine structure of a macrogametocyte of *Fallisia copemani,* a parasite found in the circulatory blood lymphocytes of the Australian skink *Carlia rhomboidalis,* is described. The macrogametocyte is bounded by two membranes, a thick outer one and a fine inner one. Beneath these membranes, ribosomes aggregate into two concentric layers, a character unique among Haemosporidia. The cytoplasm contains a nucleus, numerous ribosomes, tubular mitochondria, osmiophilic bodies, spherical bodies and a cluster of vesicles.

RÉSUMÉ : **Ultrastructure d'un macrogamétocyte de *Fallisia copemani* Paperna et Landau, 1990 (Haemosporidia : Garniidae).**

L'ultrastructure d'un macrogamétocyte de *Fallisia copemani,* parasite du scinque australien *Carlia rhomboidalis* est décrit dans un lymphocyte circulant. Le macrogamétocyte est limité par deux membranes, une membrane externe épaisse et une membrane interne fine. Sous ces membranes, la disposition de ribosomes en deux couches concentriques est un caractère nouveau et unique parmi les Hémosporidies. Le cytoplasme renferme un noyau, de nombreux ribosomes, des mitochondries tubulaires, des corps osmiophiles, des corps sphériques et des amas de vésicules.

INTRODUCTION

Fallisia copemani Paperna and Landau, 1990 is a circulatory blood lymphocyte and thrombocyte parasite of *Carlia rhomboidalis,* a skind found in the rain forests of northern Australia. The present communication describes the fine structural details of the macrogametocyte.

MATERIALS AND METHODS

At necropsy, the level of infection in the lung and heart blood was low: 10 infected leucocytes per 10,000 counted erythrocytes, six of which contained macrogametocytes, the other four meronts (Paperna & Landau, 1990). Blood collected during necropsy from the lungs and heart of the infected skink was allowed to coagulate in a capillary tube. This was immediately followed by fixation for 1 1/2 h at room temperature in 2,5 % glutaraldehyde in 0.1 M cacodylate buffer, *p*H 7.2. After repeated washes in the same buffer, the material was post-fixed in 1 % osmium tetroxide in buffer for 1 hour, washed as above, then dehydrated in ethanol and embedded in Spurr's medium. Thin sections cut with a diamond knife on a Reichert ultramicrotome were stained on a grid with uranyl acetate and lead citrate, and examined and photographed with a Philips EM 201 in the Service d'Accueil de Microscopie Electronique CNRS, Université Paris VI, 105, Bd Raspail, Paris 75006 and a Jeol 100CX TEM, of the Faculty of Agriculture, Rehovot.

RESULTS

On the prepared grids it was only possible to detect two sections of apparently the same macrogametocyte infecting a lymphocyte.

The macrogametocyte was 6.4 × 3.0 μm and the lymphocyte was 7.2 × 6.4 μm in size *(fig. 1, 2).* The macrogametocyte is bound by a thick unit membrane closely apposed to the host cell cytoplasm. Narrow gaps occur in some sectors between the outer membrane and the gametocyte cytoplasm. A second, internal, fine unit membrane is separated from the outer wall by a 75 nm cytoplasmic

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Accepté le : 13 septembre 1990.

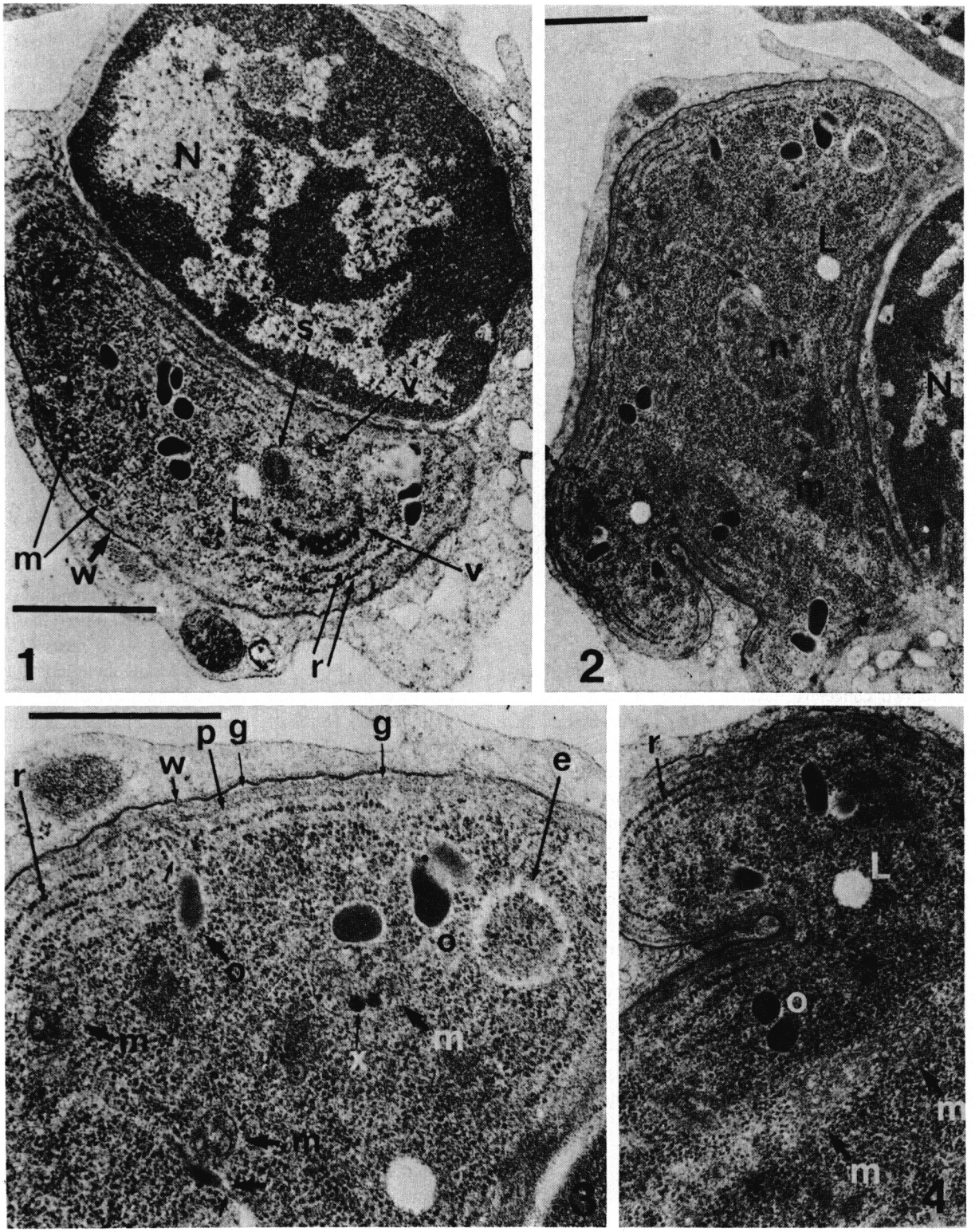

PLANCHE I. — *Fig. 1.* — Macrogametocyte within lymphocyte. *Fig. 2 :* Same in a different ultrathin section. *Figs 3, 4 :* Enlarged view of the macrogametocyte shown in *Fig. 2.*

Abbreviations: e enclave of ribosome-containing cytoplasm; g gap between the outer membrane and the gametocyte cytoplasm; L lipid vacuoles; m mitochondria; N lymphocyte nucleus; n macrogametocyte nucleus; o osmiophilic bodies; p interior membrane; r ribosome layers; s spherical body; v clouster of vesicles; w outer membrane; x electron dense particles in the mitochondron.

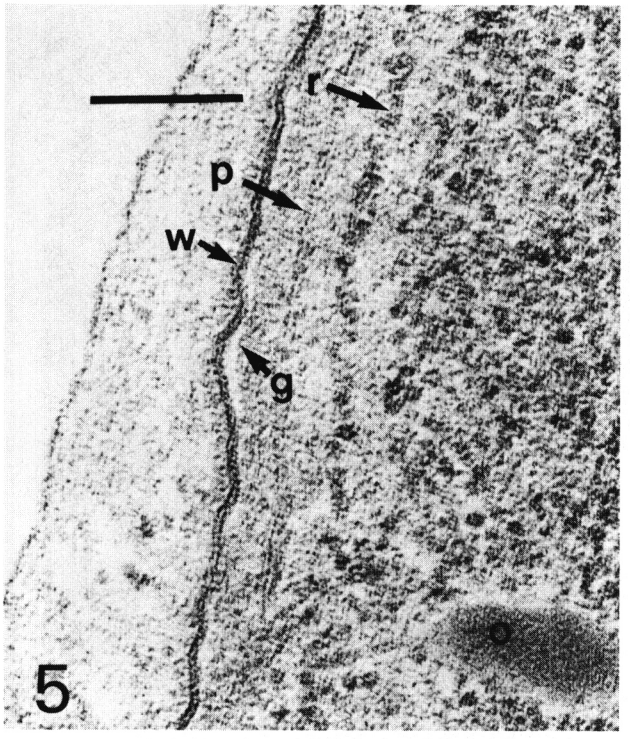

FIG. 5. — Enlarged view to show the binding membranes.

layer. Beneath the inner membrane ribosomes are stratified into two concentric layers, 75-100 nm apart *(fig. 3, 4)*. Ribosomes are also numerous in the internal cytoplasm. The nucleus consists of a nucleoplasm of variable density separated from the cytoplasm by a narrow band of lower density homogenous substance. The nucleolemma was apparently lost in processing. The cytoplasm contains several elongated mitochondria with tubular cristae, each containing a small granule in the center. Some mitochondria also contain one or two electron-dense particles. The cytoplasm also contains a cluster of vesicles or tubules embedded in an electron-dense granular substance; membrane-bound dense, granular, spherical bodies and enclaves of ribosome-containing cytoplasm delimitated by a wide halo; a few round empty spaces, possibly extracted lipid vacuoles; vague outlines of endoplasmic reticulum and a few osmiophilic bodies (« dense bodies »). A narrow ductule is seen extending from some of the osmiophilic bodies to the outer periphery of the cell.

DISCUSSION

All avian and reptilian plasmodia and hemoproteids studied to date (Aikawa *et al.,* 1969; Scorza, 1971; Sterling and Aikawa, 1972; Gallucci, 1974; Moore and Sinden, 1974) are bounded by three membranes. Of the three, the innermost, and sometimes the outermost as well, are thick and pronounced, whereas the middle layer is less distinct and cannot be seen as a unit membrane (Aikawa *et al.,* 1969). In contrast, of the two membranes observed in *F. copemani,* the outer membrane is thick while the inner one is fine. The absence of the middle membrane in *F. copemani* may be the result of processing damage. If the outermost membrane is derived from the host cell (the limiting membrane of the parasitophorous vacuole) as it has been suggested by several workers (Aikawa and Jordan, 1968; Aikawa *et al.,* 1969), then the middle fine membrane is the plasmalemma which may have lined the edge of the parasite cytoplasm along the gap seen beneath the outer membrane. The middle layer is absent or not detectable in several mammalian host plasmodia (Rudzinska and Trager, 1968; Aikawa *et al.,* 1969). The stratified arrangement of ribosomes into concentric layers at the periphery of the parasite is a peculiar feature of *F. copemani* and has been not seen in any other hemosporidian. Another member of the genus *Fallisia — F. effusa —* whose ultrastructure studied by Boulard Landau Baccam Petit and Lainson (1987), and *Plasmodium tropiduri,* which parasitizes thrombocytes of saurian hosts (Scorza, 1971), are bound by triple membrane pellicle and do not show a stratified arrangement of the ribosomes.

The macrogametocyte of *F. copemani* contained large tubular mitochondria and osmiophilic bodies, like those found in plasmodia of saurian and avian hosts (Aikawa and Jordan, 1968; Aikawa *et al.,* Moore and Sinden, 1974). *F. effusa* macrogametocytes have fewer and smaller osmiophilic bodies *(Boulard et al.,* 1987). Spherical membrane-bound bodies like the one seen in *fig. 1* were described by Desser (1972) in the macrogametocytes of *Parahaemoproteus velans.* The absence of membranes around the ribosome-containing enclave seen in *fig. 2, 3,* may have resulted from damage incurred during processing. In this case, the enclave could be the same as the membrane-bound, dense granular body seen *fig. 1.* The clusters of vesicles or tubules embedded in an electron-dense substance may be either a peripheral section of a Golgi complex or a structure peculiar to *F. copemani.* Clusters of vesicles in a background substance were reported in macrogametocytes of *P. gallinaceum* by Aikawa *et al.* (1969), were suggested to be derived from the endoplasmic reticulum, and could in fact be the Golgi apparatus.

Acknowledgments. — We wish to thank Prof. Bruce COPEMAN of the Graduate School of Tropical Veterinary Sciences, James Cook University, Townsville, Queensland, Australia for his hospitality and support in carrying out this study.

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