PLATE 16

Figs.1.-4. Ultrastructural features of a young sporangium.

Fig.1. A transverse section through the sporangium reveals the presence of a large central nucleus (N), with nucleolus (Nu), a well developed Golgi system (G), vacuoles (V), chloroplasts (C) on the periphery, mitochondria (M) and other inclusions (arrows).

Fig.2. Detail of the nucleus (N) surrounded by dictyosomes (D) which has produced a large number of vesicles (arrows). Note the small, spherical vesicles just adjacent to the nuclear envelope.

Fig.3. Large inclusion (I), composed of a number of membrane profiles.

Fig.4. Longitudinal section revealing a fewer number of cells than in more mature sporangia. A large central nucleus (N) dominates the cell cytoplasm.

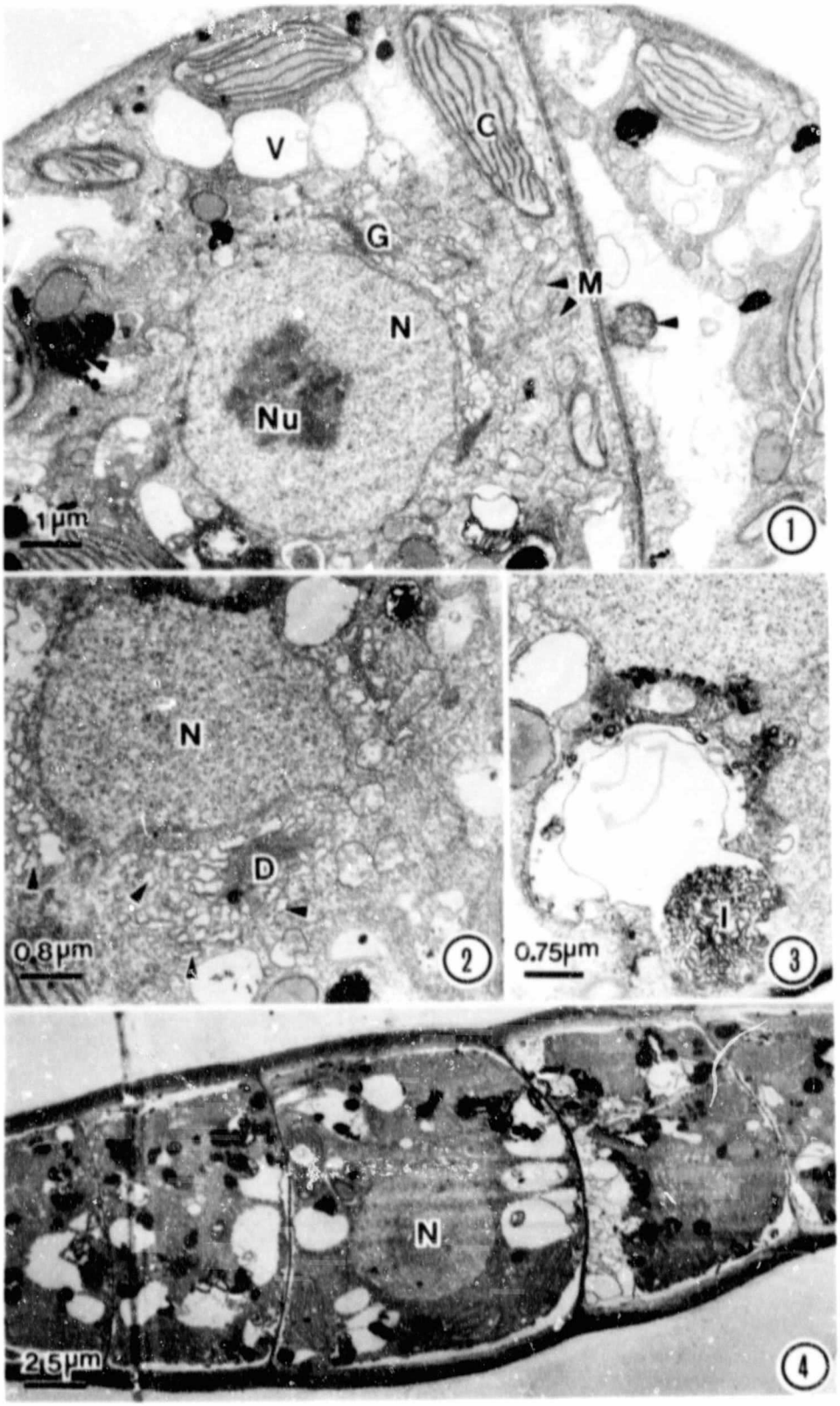
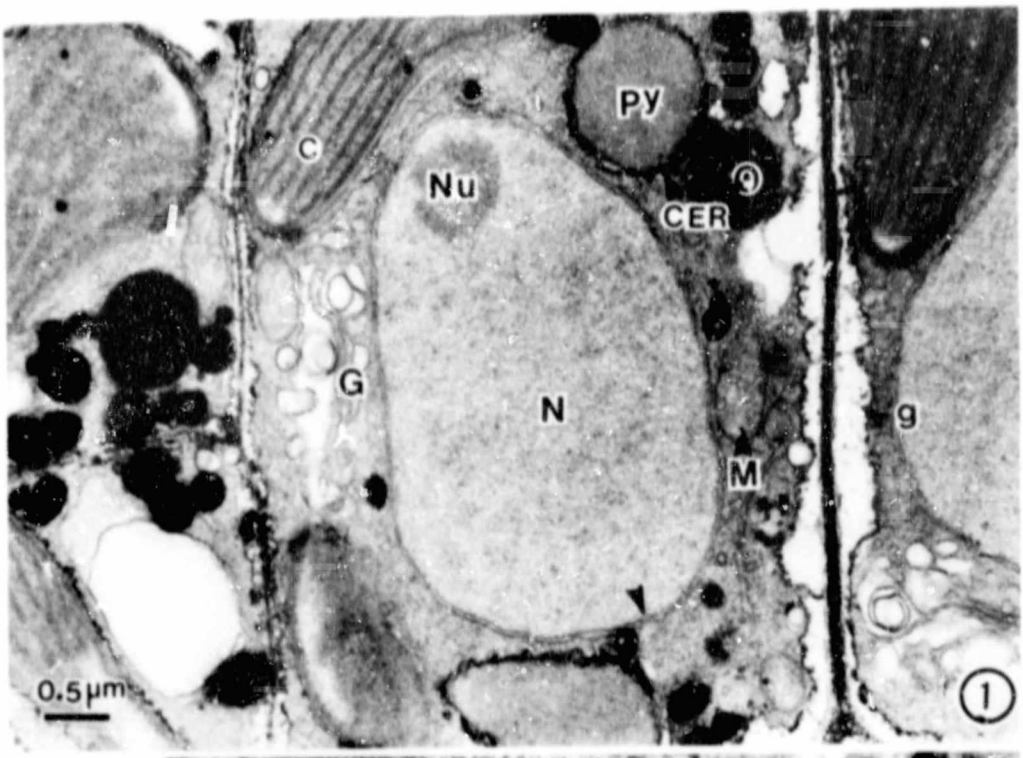

V
C
G
M
N
Nu
1μm
1
N
D
0.8μm
2
I
0.75μm
3
N
2.5μm
4

PLATE 17

Figs.1.& 2. The ultrastructure of an intermediate stage of zoospore development.

Fig.1. A large volume of the cell consists of the nucleus (N) with nucleolus (Nu). The double nuclear envelope is interspersed with nuclear pores (arrow). Other organelles evident are the Golgi system (G), pyrenoid (Py), with chloroplast endoplasmic reticulum (CER) surrounding it, mitochondria (M), osmophilic bodies (O) and chloroplasts (C). Globular-like bodies (g) are evident outside of the cytoplasm, adjacent to the cell wall.

Fig.2. The arrangement of a number of cells within the sporangium is indicated. Note that there are no flagella or flagellar bases visible.


Py
C
Nu
CER
G
N
M
g
0.5μm
1

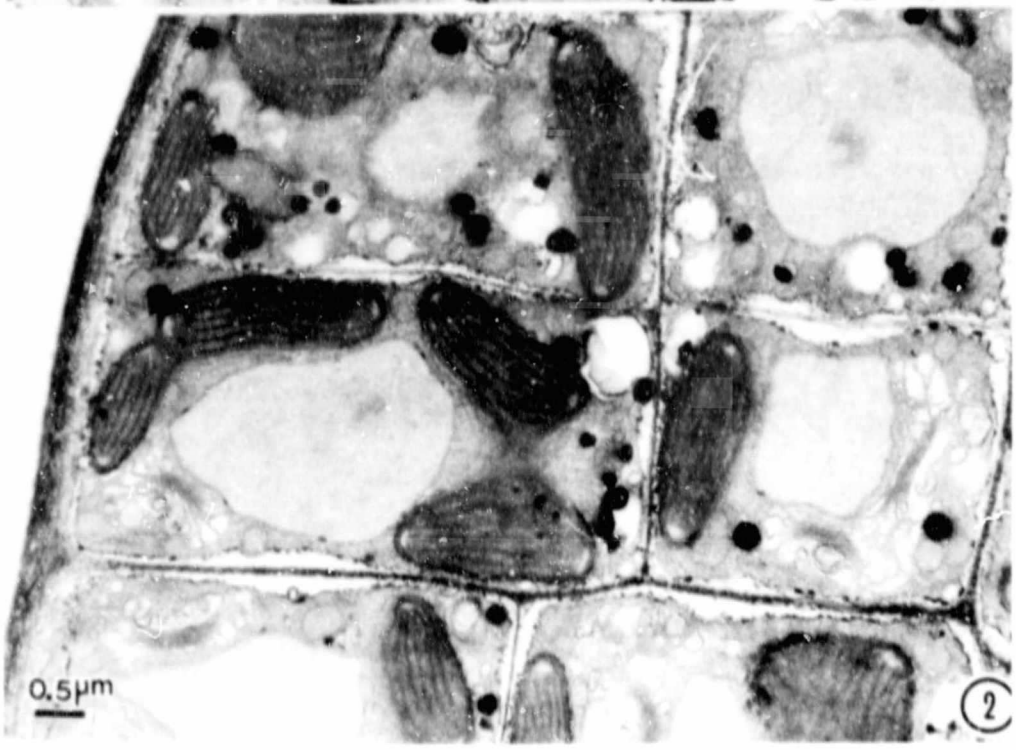

0.5μm
2

PLATE 18

Fig.1. Longitudinal section through a sporangium in an intermediate stage of zoospore development. At the base, a large vacuolate vegetative cell (V) is evident. No flagella or eyespots are apparent yet. The nuclei (N) occupy a large portion of the cytoplasm in most cells.


N
V
1μm
1

PLATE 19

Figs.1.& 2. Ultrastructure of mature sporangia.

Fig.1. A later stage of zoospore development, when flagellar formation is occurring. Many sections through flagella are visible (arrows) and each flagellum pair is in its own flagellar vesicle. Note that the cytoplasm of the developing motile is no longer adjacent to the cell wall.

Fig.2. Just prior to release, the motiles appear to have rounded up. The separating cell walls (arrows) are very thin.

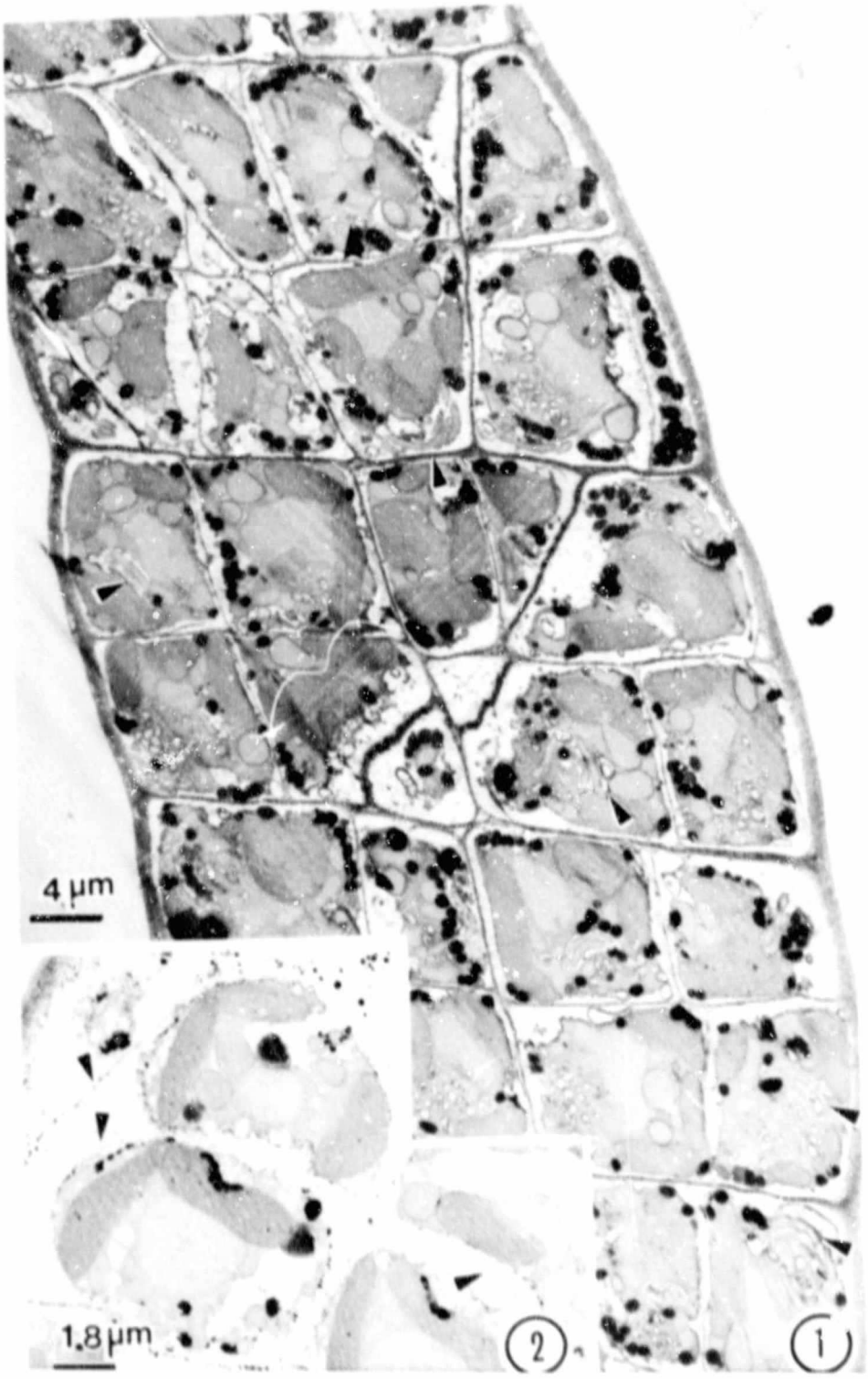

4 µm
1.8 µm
2
1

PLATE 20

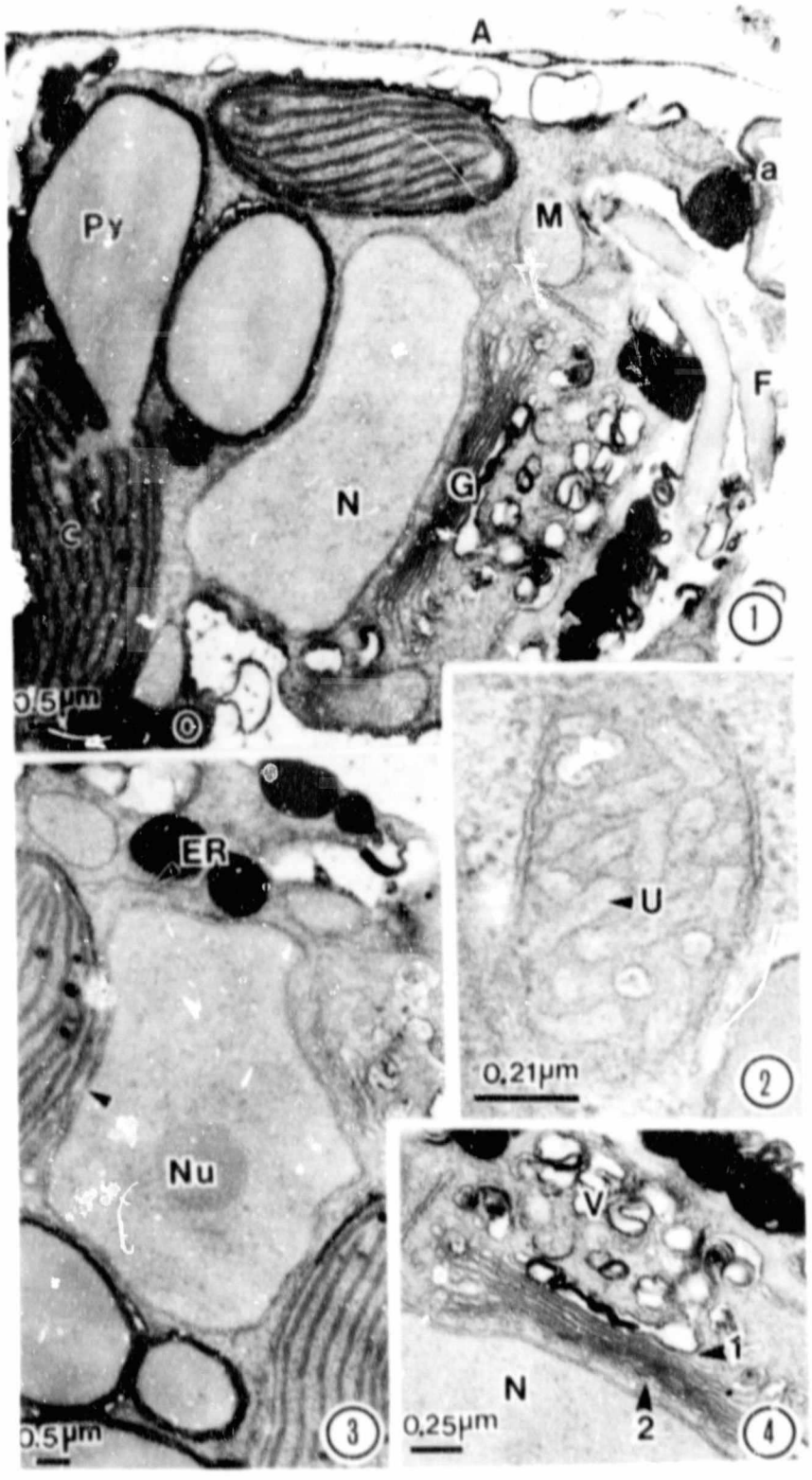
Figs.1.-4. Ultrastructural features of the mature plurilocular sporangium cell.

Fig.1. An entire cell showing a large central nucleus (N), a well developed Golgi system (G), flagella (F), a paramural body in the cytoplasm (a), mitochondria (M), osmiophilic bodies (O) and a large stalked pyrenoid (Py) associated with the chloroplast (C). The cell cytoplasm (A) has pulled away from the cell walls and the remaining space is probably filled with mucous.

Fig.2. A mitochondrion showing a double unit membrane, boundary and tubular cristae (U).

Fig.3. Detail of a nucleus with a nucleolus (Nu) in the centre. The double membrane surrounding the nucleus has a number of nuclear pores (arrow), and endoplasmic reticulum (ER) is often associated with the nucleus.

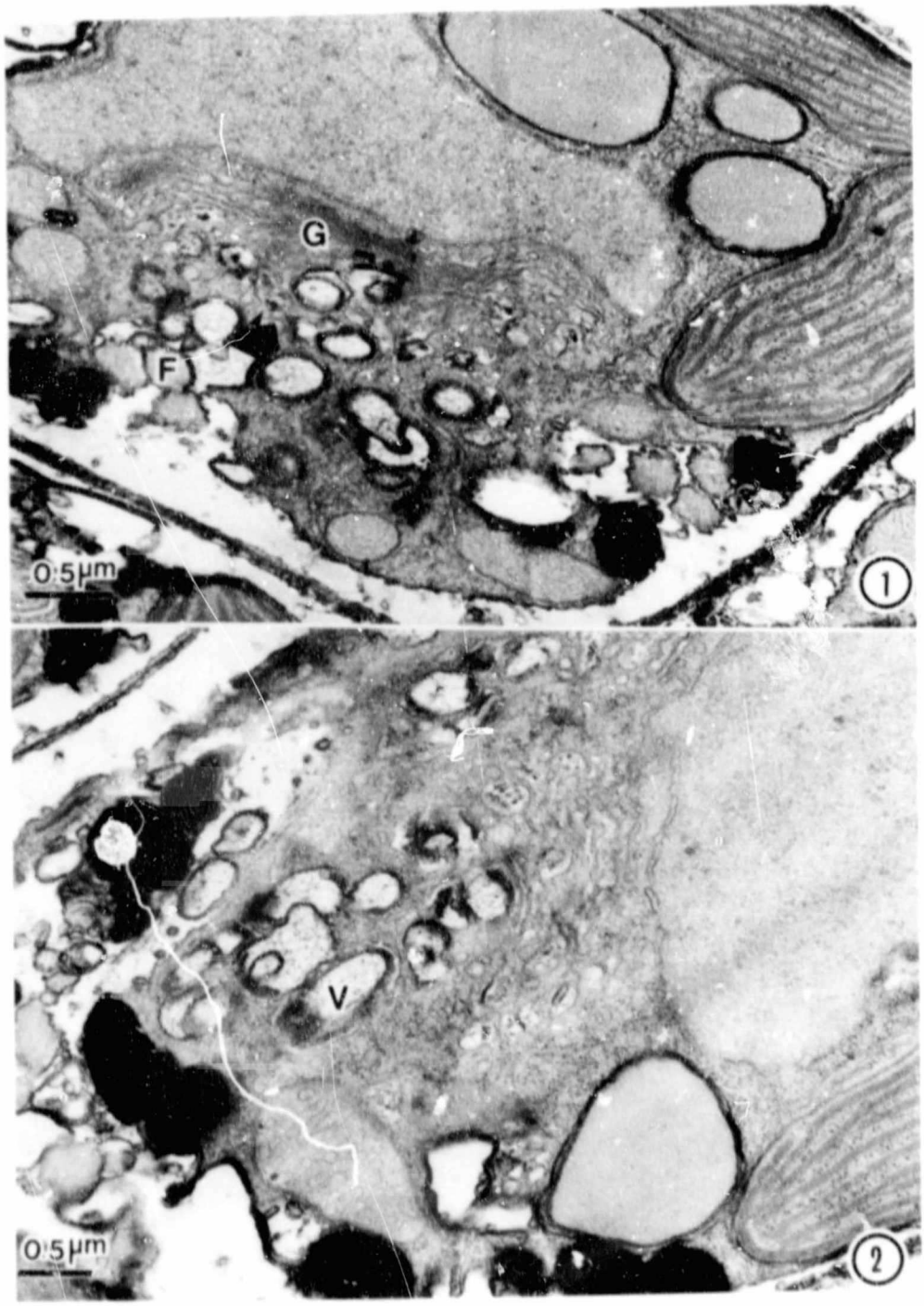
Fig.4. The Golgi system is commonly located adjacent to the nucleus (N) and has a forming face (2) and a mature face (1). A number of vacuoles (V) are associated with the Golgi.


A
Py
M
a
F
N
G
C
0,5µm
1
ER
Nu
0,5µm
3
U
0,21µm
2
V
1
N
2
0,25µm
4

Figs. 1.& 2. Ultrastructure of mature sporangial cells, focussing on the activity of the Golgi system.

Fig.1. Numerous vesicles appear to be associated with the mature face of the Golgi (G). These vesicles appear to coalesce (arrow) and become confluent with the surrounding matrix in the region of the flagella (F).

Fig.2. Another view of vesicles (v) blebbing off a dictosome. Note the abundance of mitochondria in this region.


G
F
0·5μm
1
V
0·5μm
2

Figs.1.-5. Chloroplast ultrastructure

Fig.1. A plate-like chloroplast from an early stage of zoospore development, revealing a genophore (H) or DNA zone at each pole and an unusual sheath-like structure (K) on one side of the chloroplast. Thylakoids (t) are arranged in groups of threes within the chloroplast stroma.

Fig.2. A stalked pyrenoid (Py) is evident extending from a chloroplast of 'intermediate' age. A girdle lamella (gi) encircles the chloroplast edge and occasionally inter-connections run between lamellae (arrow).

Fig.3. Osmiophilic bodies (O) are evident within the chloroplast of a vegetative cell.

Fig.4. A tangential section of a mature sporangial cell, through an eyespot reveals that it is made up of a number of lipid globules. The flagella (F) are often found near chloroplasts.

Fig.5. The chloroplast of a mature plurilocular sporangium cell possessing an eyespot (E), within a chloroplast. The girdle lamella (gi) is clearly apparent as is the genophore (H). Both the chloroplast envelope (CE) and the chloroplast endoplasmic reticulum (CER) are in evidence.

Fig.6. A stalked pyrenoid is continuous with the chloroplast stroma. The pyrenoid occurs in two separate portions as it probably loops back on itself. It is surrounded by chloroplast endoplasmic reticulum (CER) and its own membrane. Groups of lamellae are interconnected (arrow) by single lamellae.

Fig.7. Membrane profiles (mf) between the chloroplast envelope and the chloroplast endoplasmic reticulum are evident. Ribosomes (D) in the chloroplast stroma are also evident.

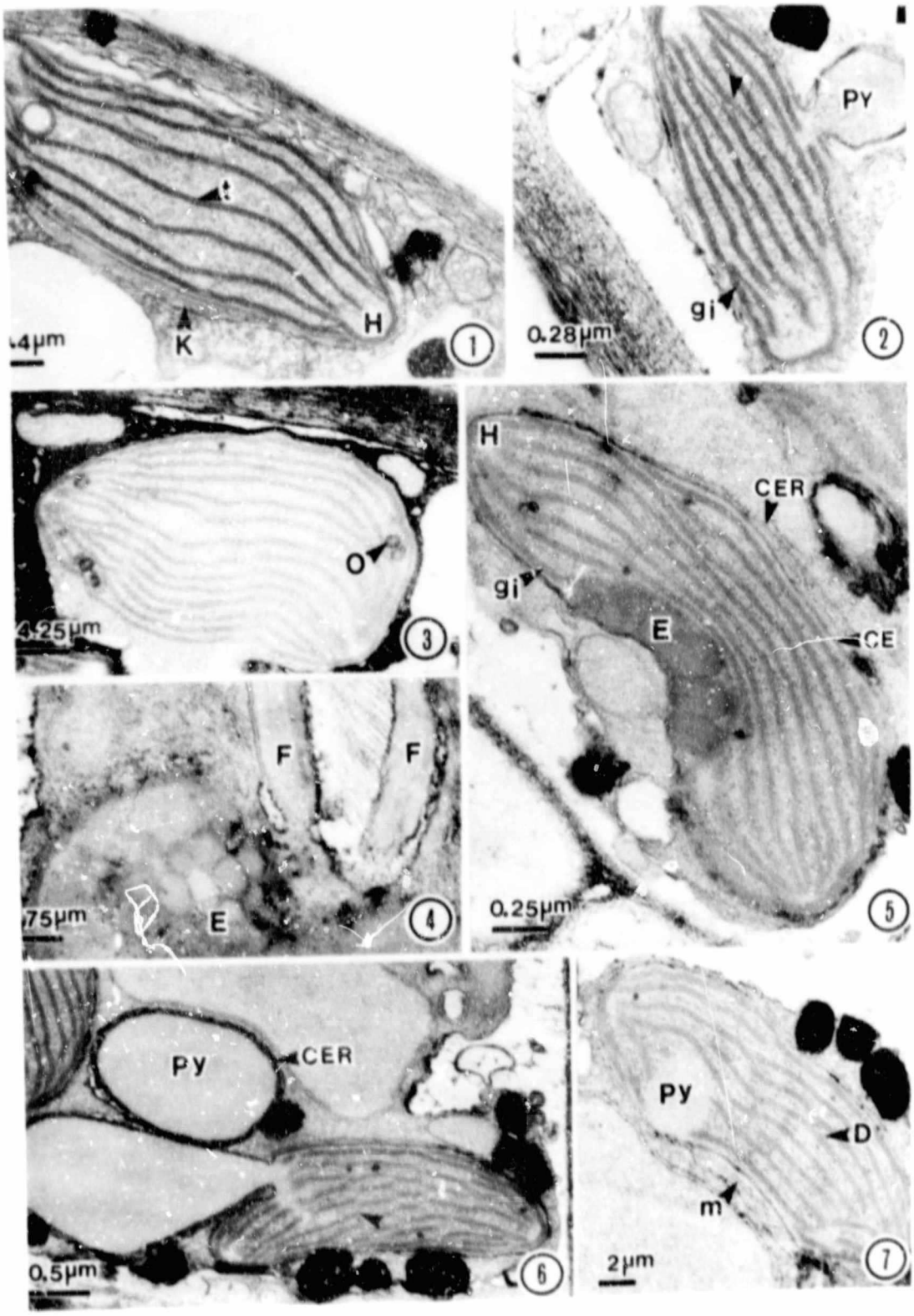

K
H
1
0.28µm
Py
gi
2
O
0.25µm
3
H
CER
gi
E
CE
0.25µm
5
F
F
E
4
Py
CER
0.5µm
6
Py
D
m
2µm
7

PLATE 23

Figs. 1.-4. Ultrastructural features of an advanced stage of zoospore development.

Fig.1. A lysosome (L) containing a number of smaller vacuoles is closely appressed to the cell wall.

Fig.2. A number of lysosomes (L) within the cell cytoplasm. Note also the endoplasmic reticulum (ER) and Golgi (G).

Fig.3. Paramural bodies (a) are evident outside of the plasmalemma (arrow) and near to the cell wall. These bodies apparently consist of concentric layers of membranes.

Fig.4. Here the granular nature of the cytoplasm in the form of ribosomes is illustrated. The endoplasmic reticulum (ER), nuclear membrane (Nm), and mitochondria (M) are also apparent.

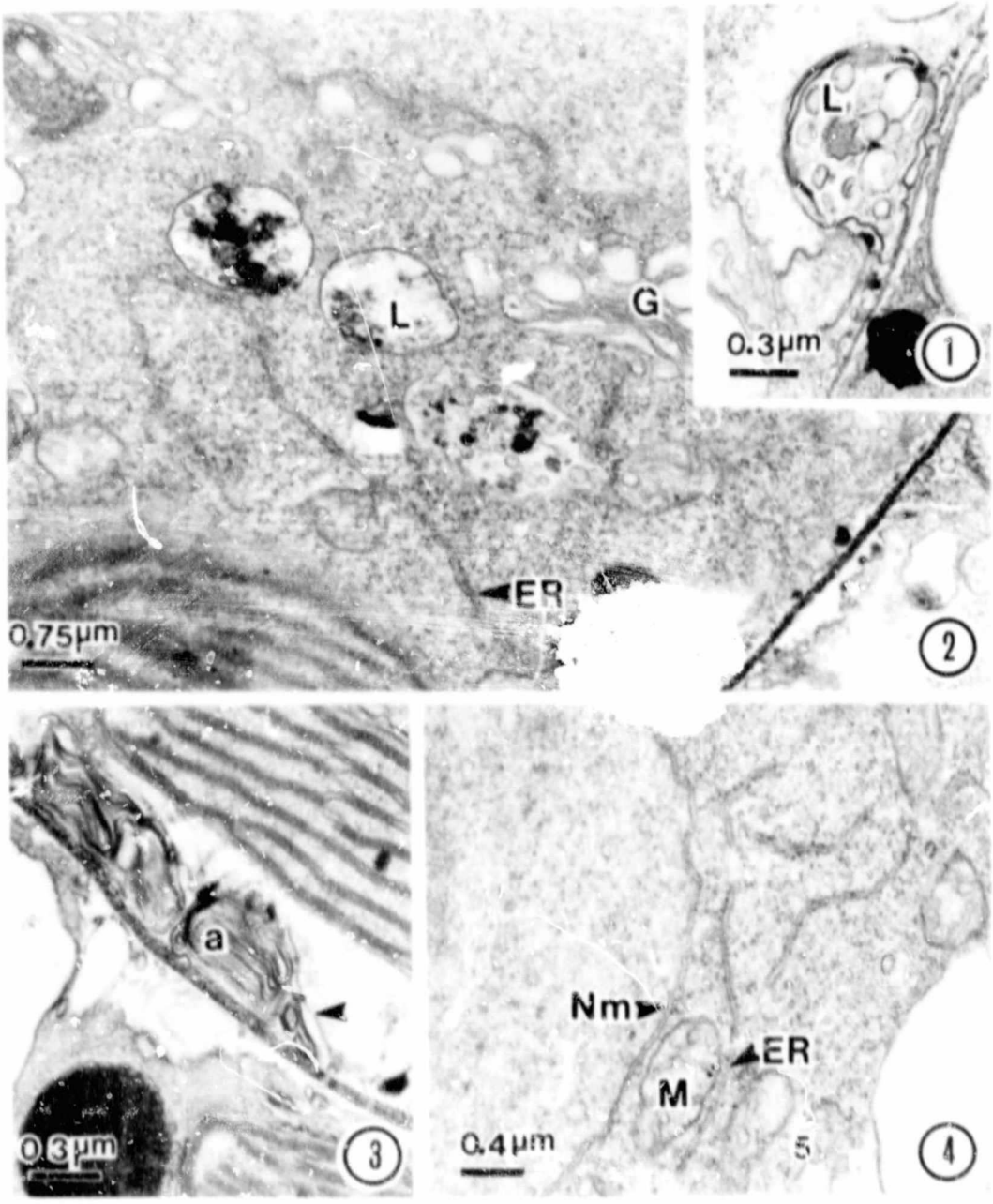

L
G
ER
0.75μm
2
L
0.3μm
1
a
0.3μm
3
Nm
ER
M
0.4μm
5
4

PLATE 24

Figs.1.-4. Stages in the development of the locule wall in the sporangium.

Fig.1. A thin layer of cell wall material (arrow) has been deposited between the chloroplasts (C) of two adjoining cells.

Fig.2. A large number of vacuoles (V) are associated with the thin layer of cell wall material (arrow). Note that the Golgi appear to be producing similar large vacuoles.

Fig.3. Portions of this thin cell wall layer appear to be fragmented.

Fig.4. The vacuoles associated with this later stage of cell wall formation are smaller. The cell wall material appears to be of a globular nature. A number of mitochondrion (M) can be seen in the region of cell wall formation. Plasmodesmata (pm) are evident in the mature cell walls but not in the more recently formed cell wall to the right of the micrograph.

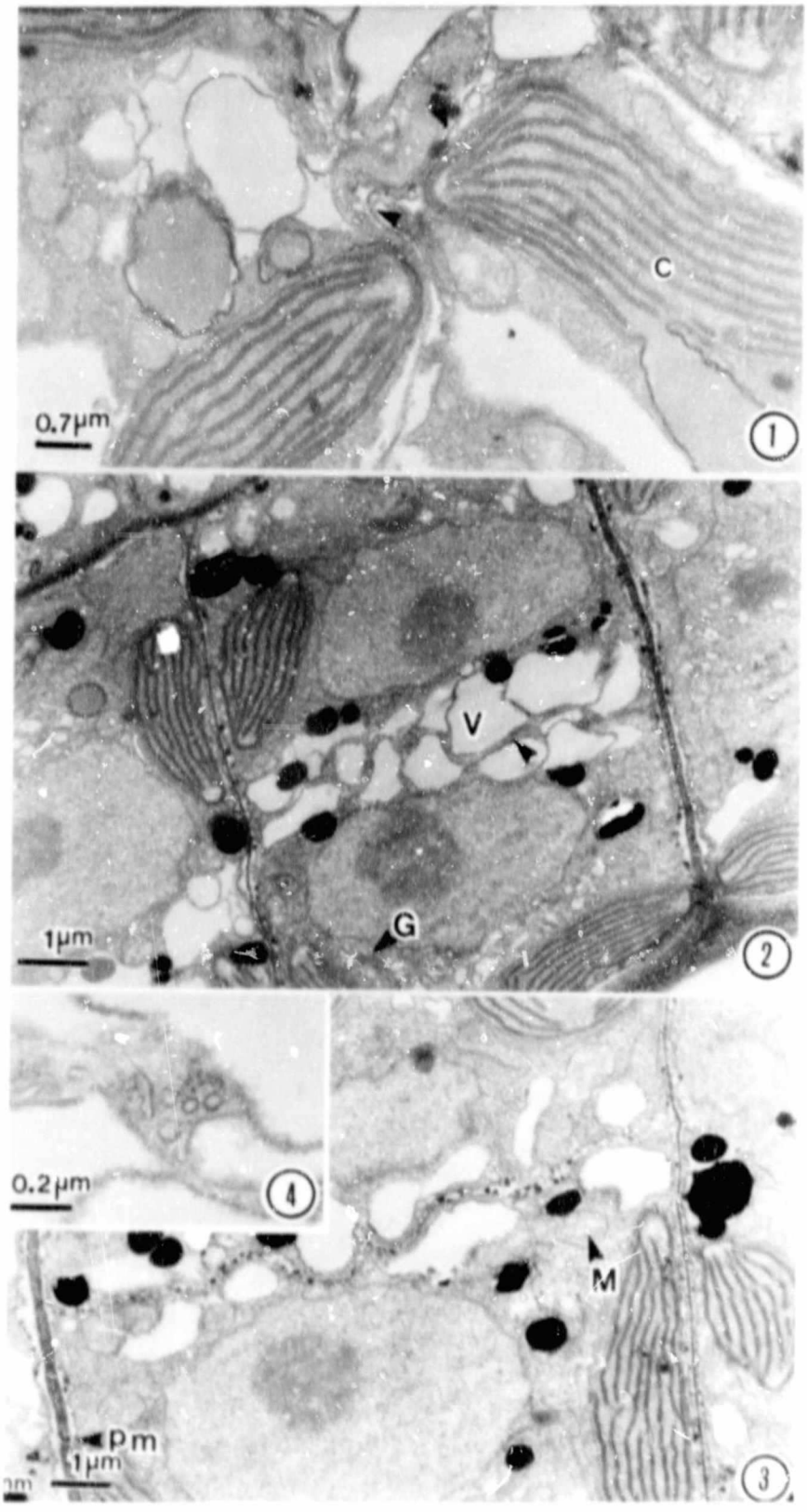
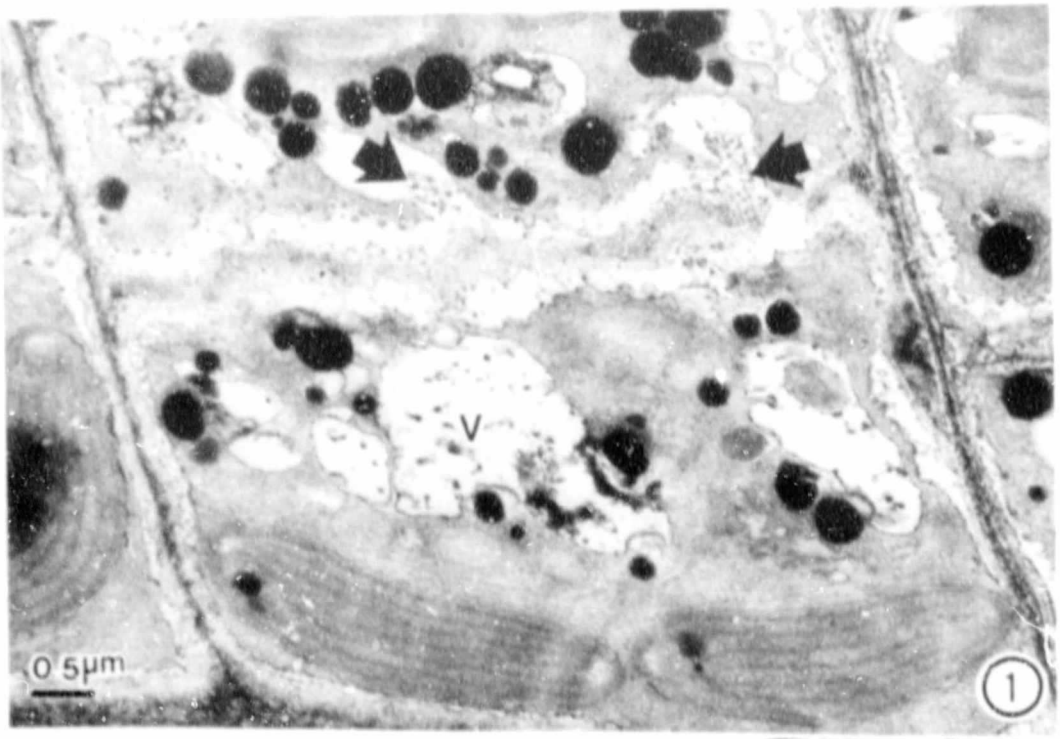

C
0.7μm
1
V
G
1μm
2
0.2μm
4
M
pm
1μm
3

PLATE 25

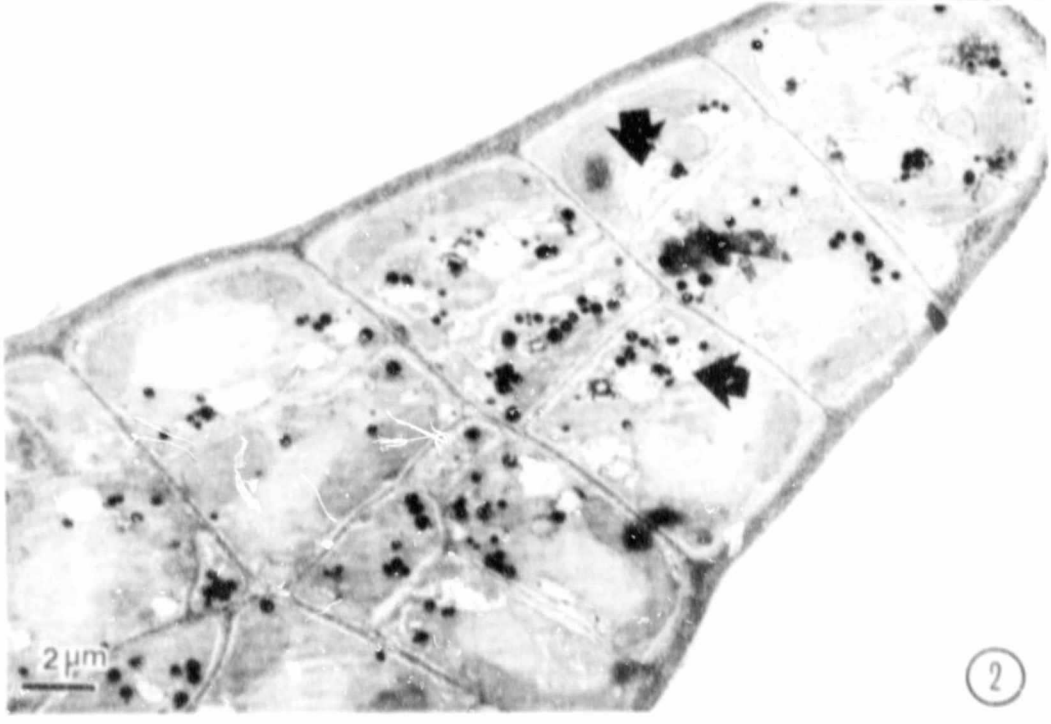
Figs.1.& 2. Stages in the development of the cell wall.

Fig.1. Detail of fibrous-like material (arrow) being released from vacuoles (v) in the region of the cell wall, between two adjacent cells.

Fig.2. Lower magnification of the above cells in a longitudinal section of a sporangium. Numerous vacuoles (arrows) contain fibrous-like material.



①



②

PLATE 26

Figs.1.-6. Stages in the development of locule cell walls and the ultrastructure of mature cell walls.

Fig.1. Detail of the lattice work of fibres (f) in a later stage of cell wall development. The orientation of fibres appears to be disorganised. The globules (g) may contain the fibres required for cell wall formation.

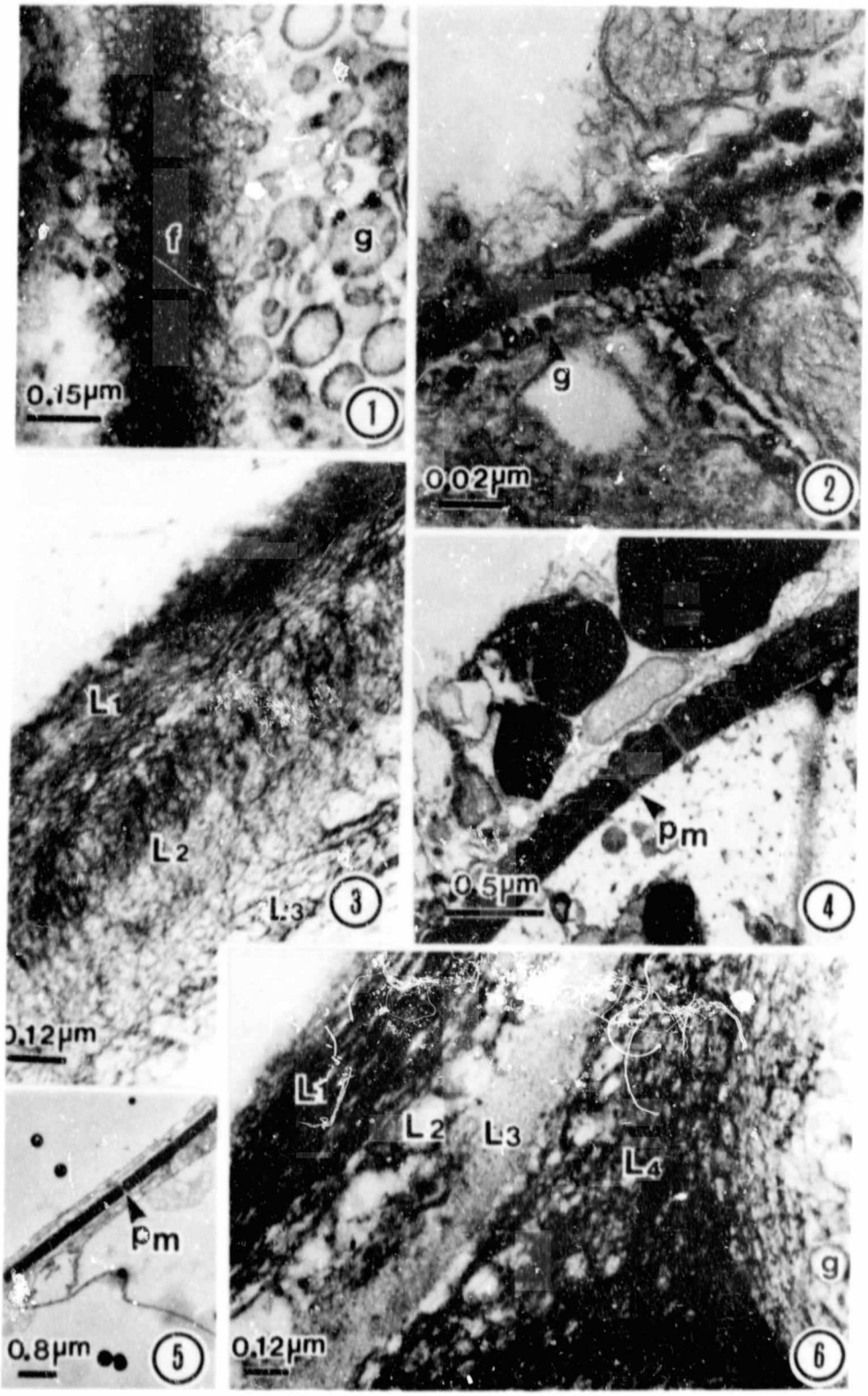
Fig.2. Globules (g) are evident at the cytoplasm edges adjacent to the cell wall.

Fig.3. The arrangement of fibres in a mature cell wall of a sporangium consists of an outer, tightly-woven, horizontal fibre layer (L_1), a middle, more loosely -woven, vertical fibre layer (L_2), and a lower, very loosely-woven, horizontal fibre layer (L_3).

Fig.4. The presence of plasmodesmata (pm) between cells of a mature sporangium.

Fig.5. Cell wall detail revealing plasmodesmata (pm) between two vegetative cells.

Fig.6. Multiple-layered mature cell wall consisting of an outer, tightly-woven, horizontal layer (L_1), a loosely-woven layer below this (L_2), a granular layer (L_3),and a loosely and tightly-woven layer (L_4). Some globules (g) are still in evidence.


f
g
0.15μm
1
g
0.02μm
2
L1
L2
L3
3
pm
0.5μm
4
0.12μm
pm
0.8μm
5
L1
L2
L3
L4
g
0.12μm
6

Figs.1.-4. Details of the flagella of developing motiles cells within the sporangium.

Fig.1. A flagellar base (FB) and associated microtubular root system (m) and Golgi system (').

Fig.2. A mature sporangium cell revealing the insertion region of flagella (F) and the flagellar vesicle in which mastigonemes (ma) can be found.

Fig.3. The tinsel (T) flagellum is evident, located in a flagellar vesicle. The mastigonemes emerge from one side of the flagellum only.

Fig.4. The smooth flagellum (S) appears to be more closely appressed to the cytoplasm than the tinsel flagellum (T). Microtubules (m) are evident in the flagella and a tangential section through the eyespot (E) of a chloroplast is also visible.


G
FB
m
1
0.2 µm
Ma
F
2
0.5 µm
m
S
T
3
0.75 µm
E
T
4
0.25 µm

PLATES 28

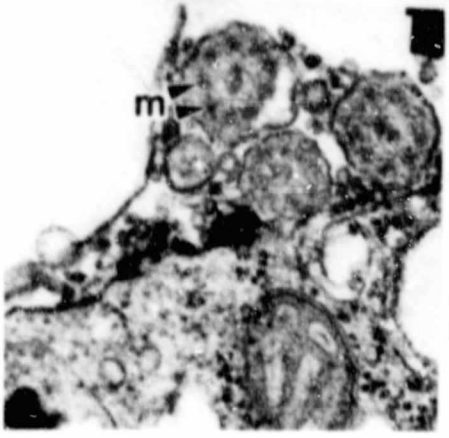
Figs.1.-3. Ultrastructural detail of flagella of mature sporangial cells.

Fig.1. The flagella (F) are found in groups of threes, in flagellar vesicles (arrow), outside of the cytoplasm.

Fig.2. This section through the flagellar shaft shows the 9+2 arrangement of the microtubules (m).

Fig.3. The mastigonemes (Ms) of the tinsel flagellum (T) occur on one side of the flagellum only.


F
0.4μm
1


m

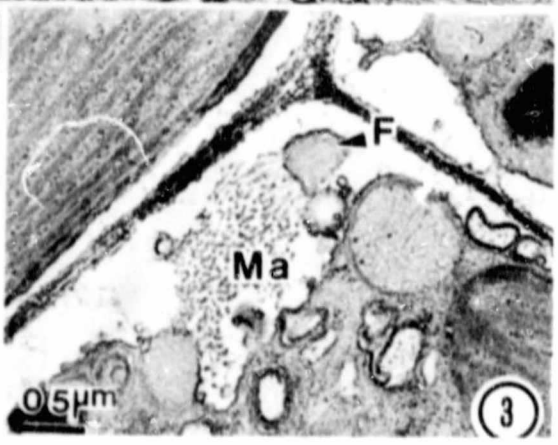

F
Ma
0.5μm
3

PLATE 29

Figs.1.-4. Details of the motiles.

Fig.1. A negatively stained motile (Mo) with two flagella (F), both lacking mastigonemes, due to preparation technique. There is possibly an acronema (an) at the tip of one of the flagella.

Fig.2. Scanning electron micrograph of a number of motiles (Mo) associated with a mucilage like substance (X), in which bacteria (B) are evident. The 'spines' on the motiles are probably an epiphyte (arrow).

Fig.3. Ultrastructural details of a motile revealing a large nucleus (N), two chloroplasts (C), Golgi (G), mitochondrion (M), a vacuole (V) and a large number of smaller vacuoles (Va). Sections through the flagellar shaft (F), showing microtubules are evident.

Fig.4. Light microscope detail of motile cells. Each motile has two flagella (F) and a nucleus.

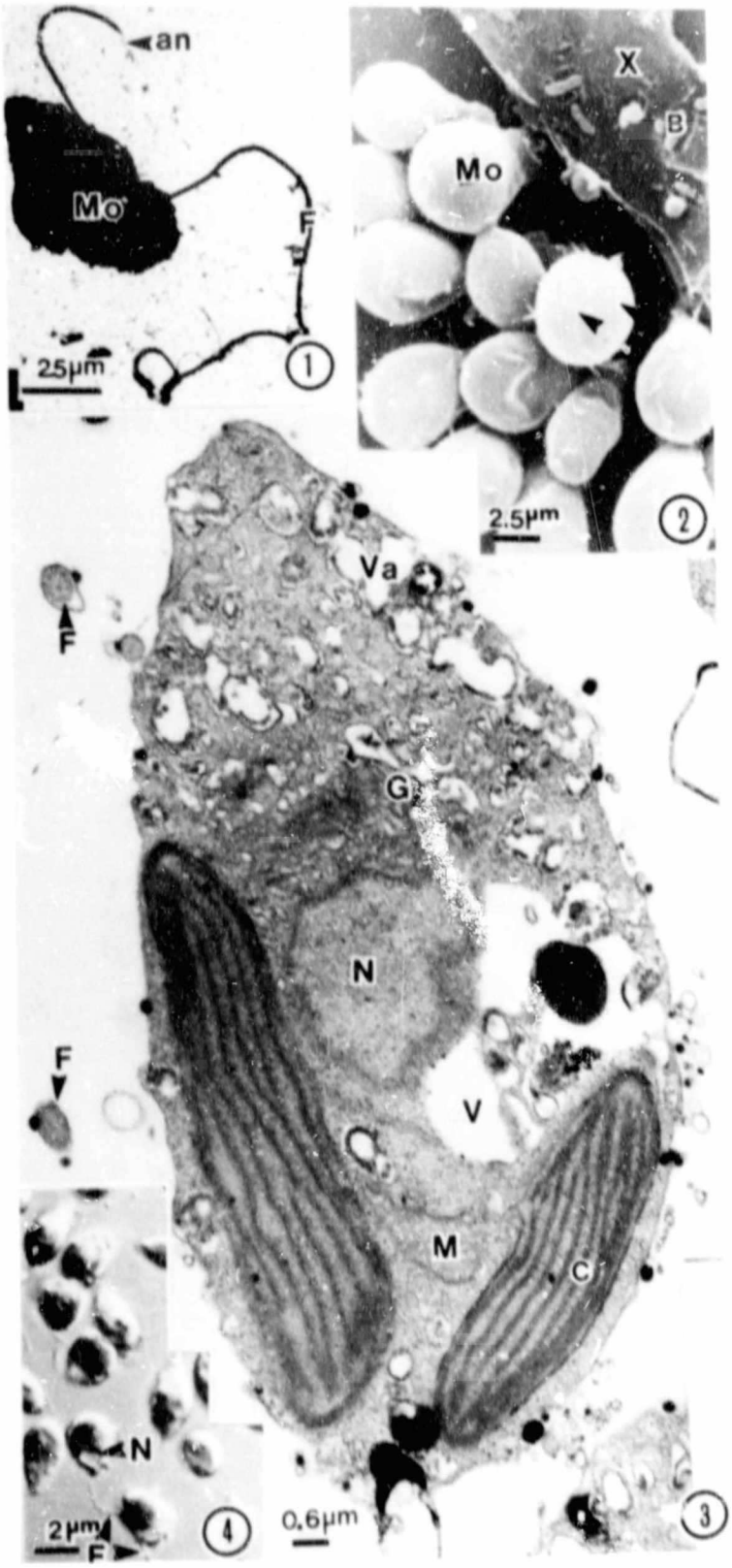

an
Mo
F
25μm
1
X
B
Mo
2.5μm
2
Va
F
G
N
F
V
M
C
N
2μm
F
4
0.6μm
3

PLATE 30

Figs.1.-3. Ultrastructural detail of motiles of Feldmannia sp.

Fig.1. A section through a motile revealing: nucleus (N), mitochondria (M), osmiophilic bodies (O), chloroplasts (C), endoplasmic reticulum (ER), Pyrenoid (Py), a vacuole (V) and flagella (F).

Fig.2. A tangential section through the anterior region of the motile revealing the presence of a large number of mitochondria (M) and vacuoles (V).

Fig.3. The smooth flagellum (S) is apparently associated with the chloroplast (C) and eyespot (E), while the tinsel flagellum (T) baring mastigonemes (ma) can be found in a depression (d).

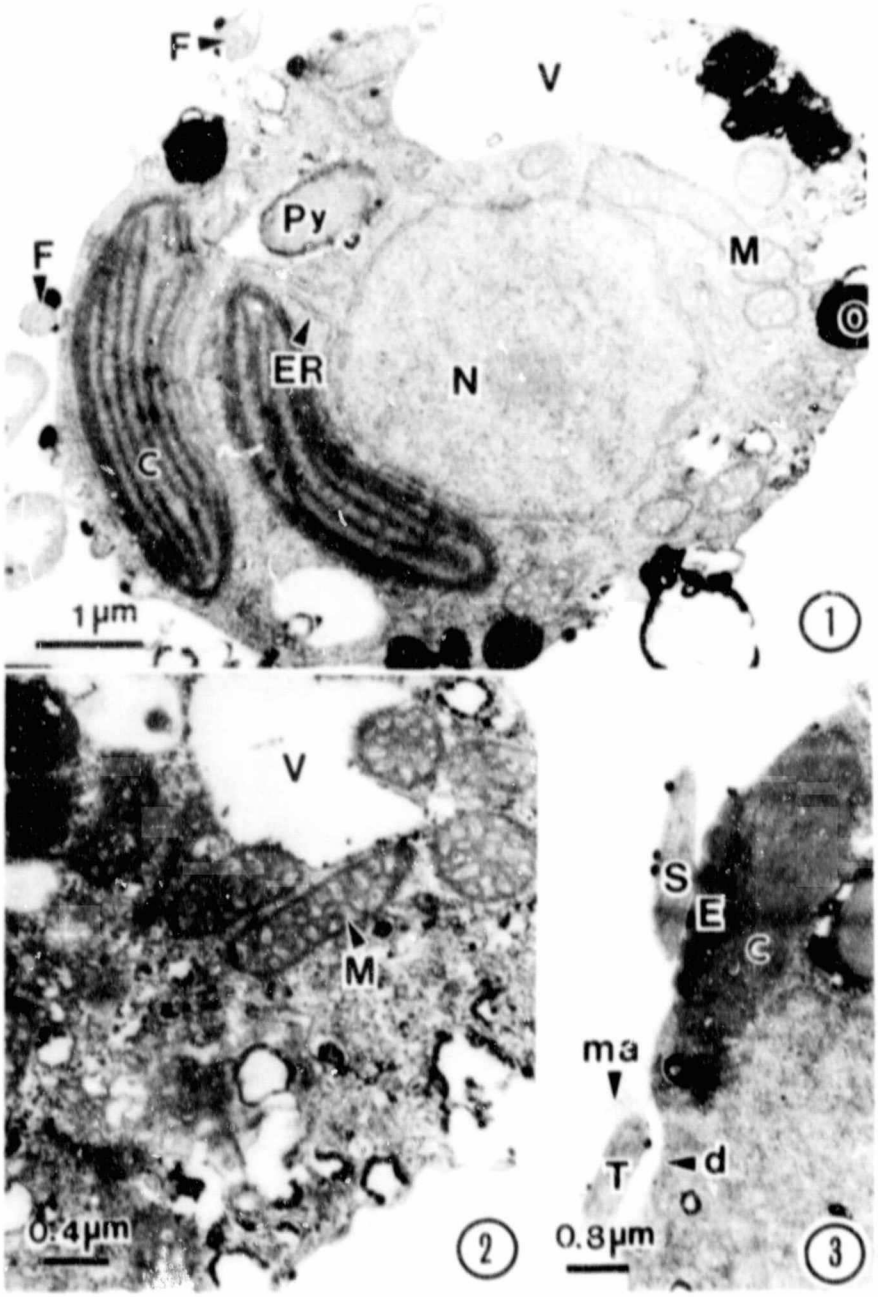

F
V
Py
F
M
ER
N
C
1μm
1
V
M
0.4μm
2
S
E
C
ma
T
d
0.8μm
3

PLATE 31

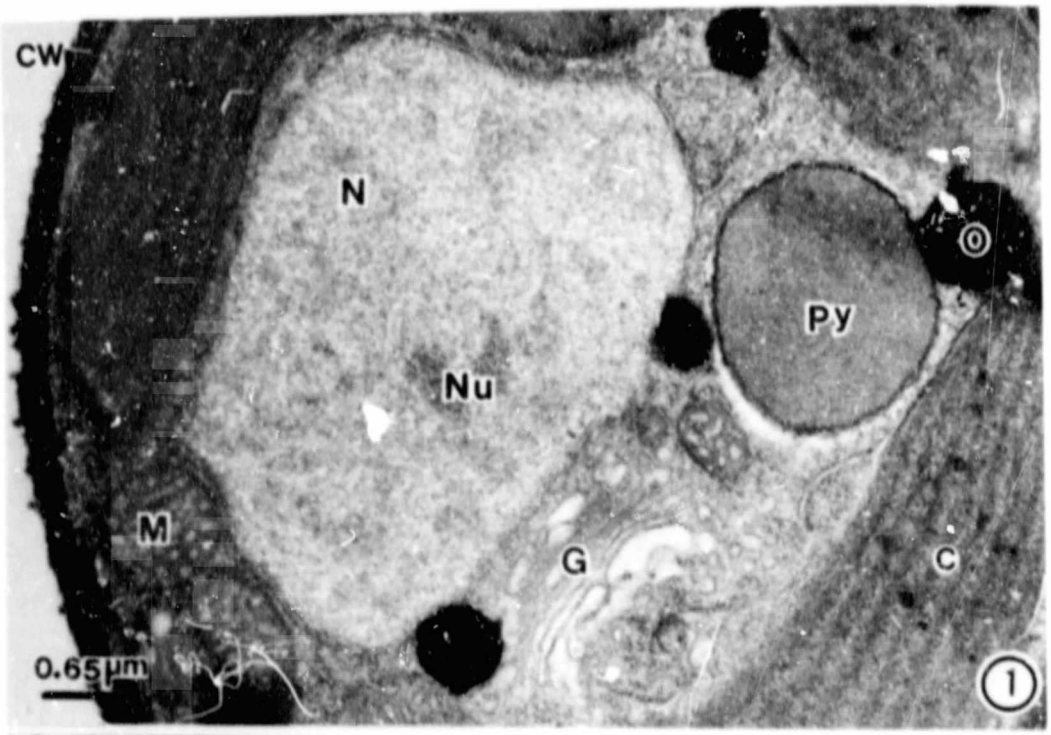
Figs.1.-4. Ultrastructural detail of settled motiles.

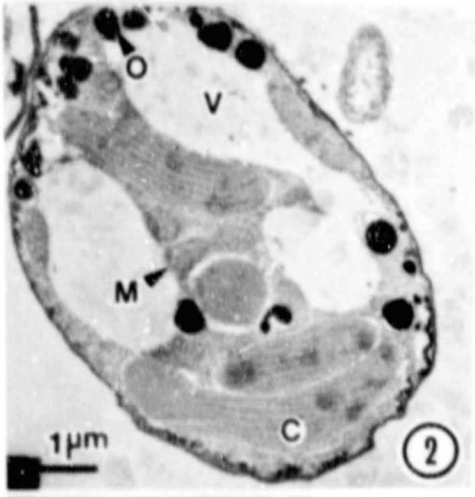
Fig.1. The settled motile has a large nucleus (N) with nucleolus (Nu), chloroplast (C) and pyrenoid (Py), mitochondria (M) with tubular cristae, Golgi (G) and osmiophilic bodies (O). The cell wall (CW) is relatively thick.

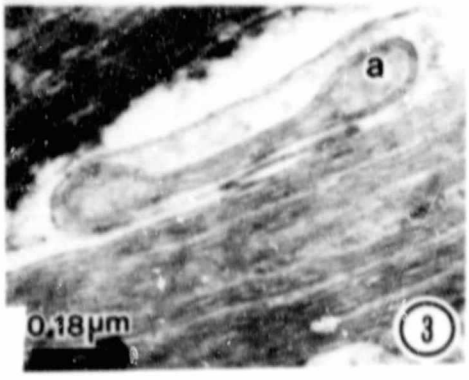
Fig.2. This newly settled motile appears to have an abundance of mitochondria (M), large vacuoles (V) and chloroplasts (C). The osmiophilic bodies (O) are concentrated to some extent at one end.

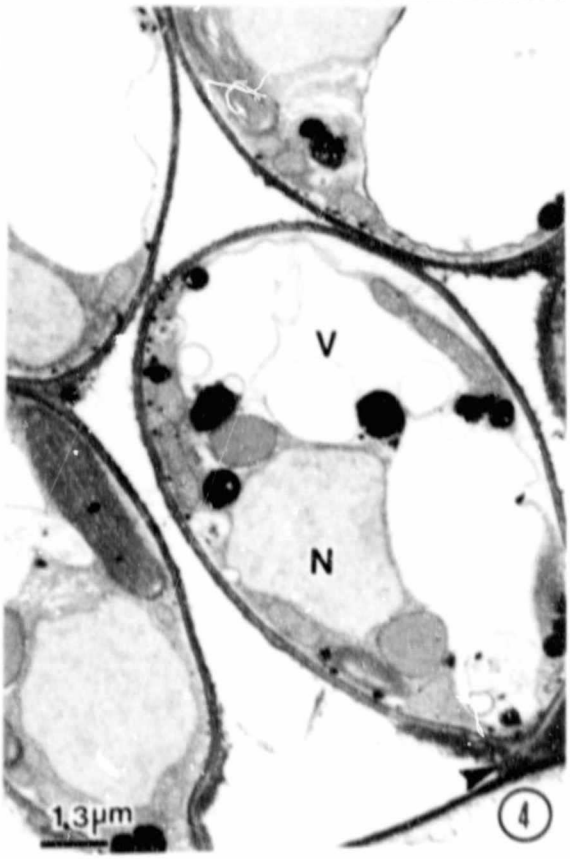
Fig.3. A bone-shaped paramural body (a) is evident in the cytoplasm alongside the cell wall.

Fig.4. These motile cells are dominated by a large vacuole (V) and have a large nucleus (N). Note the point of attachment (arrow).


CW
N
Py
Nu
M
G
C
0.65µm
1


O
V
M
C
1µm
2


a
0.18µm
3


V
N
1.3µm
4

Author Duff Sandra
Name of thesis Ultrastructural And Experimental Studies On The Development Of Feldmannia Sp. (ectocarpales, Phaeophyceae). 1989

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