

## RESEARCH NOTE

# A PRELIMINARY ULTRASTRUCTURAL STUDY OF THE UREDIAL STAGE OF *Puccinia arachidis*

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### ABSTRACT

Keywords: Rust; ultrastructure; *Puccinia*; *Arachis*; groundnut

The ultrastructure of the uredial stage of *Puccinia arachidis* Speg. is similar to that described for other susceptible rust/host interactions. Intercellular hyphae are bonded to host cell walls and have pulleywheel septa. Haustoria are surrounded by a double layered sheath and uredospore germ pores differ from those described in other rust fungi.

### Uittreksel

#### 'N VOORLOPIGE STUDIE VAN DIE ULTRASTRUKTUUR VAN DIE UREDIALE STADIUM VAN PUCCINIA ARACHIDIS

Die ultrastruktuur van die urediale stadium van *Puccinia arachidis* stem ooreen met dié beskryf vir ander vatbare roes/gasheerinteraksies. Intersellulêre hifes is gebind aan gasheerselwande en het katrolvormige septums. Haustoriums is omring deur 'n dubbellaagse skede en uredospor-kiempore verskil van dié beskryf vir ander roesswamme.

### Résumé

#### UNE ÉTUDE ULTRASTRUCTURALE PRÉLIMINAIRE DU STADE UREDIAL DU PUCCINIA ARACHIDIS

L'ultrastructure du stade uredial du *Puccinia arachidis* Speg. est similaire à celle décrite pour les inter-actions susceptibles rouille/hôte. Les hyphas intercellulaires sont fixés aux parois cellulaires de l'hôte et ont des septa en roue de poulie. Les haustoria sont entourées par un fourreau à double couche et les pores germe uredosporos diffèrent de ceux décrits dans d'autres mycètes de rouille.

Rust caused by *Puccinia arachidis* Speg. was first reported on groundnuts (*Arachis hypogaea* L.) in Africa in 1971 (Bromfield, 1971). The ultrastructure of many rust fungi has been studied but, to our knowledge, *P. arachidis* has not been examined with the electron microscope. The present study was therefore made of the host/rust interaction in a peanut variety susceptible to the rust.

Material from mature leaves bearing young uredosori of *P. arachidis* was collected from field grown peanut plants and fixed for 12 hours in 2% glutaraldehyde. Material was post-fixed in 1% osmium tetroxide in cacodylate buffer for three hours, dehydrated in a graded ethanol and propylene oxide series and embedded in Araldite. Embedded material was sectioned with a diamond knife on a Reichert OMU3 ultramicrotome, stained with a 2% solution of uranyl acetate for 20 min and post-stained in Reynolds (1963) lead citrate for 15 min. Sections mounted on copper grids were examined in a Hitachi HU-11E electron microscope.

Intercellular hyphae, composed of binucleate cells, appeared bonded to the host cell walls by fusion of the outer wall layer of the parasite with the host cell wall (Fig. 1). Previous authors (Hardwick, Greenwood & Wood, 1971; Rijkenberg & Truter, 1973) have also reported that bonding appears to occur between fungal and plant cells. Pulleywheel septa, occasionally occluded (Fig. 2), were surrounded by cytoplasmic vesicles. The lack of host cell reaction to adjacent fungal cells appears to indicate that the

groundnut/rust interaction examined in this study is fully susceptible. Heath & Heath (1971) and Heath (1974), examining resistant reactions and Rijkenberg (unpublished) in a study of partial resistance to *Puccinia striiformis* West. have observed marked cytological evidence of resistance.

Haustorial mother cells, with localized wall apposition at the point of penetration, penetration tubes with neckbands, and poorly developed collars were similar to those described by other authors. The haustorial body was binucleate and enveloped, often irregularly, by a sheath (Fig. 3). The irregular deposition of sheath material cannot be explained. The two-layered nature of the sheath, an electron-dense inner and electron-transparent outer layer, has also been noted in other rust/host interactions (Rijkenberg & Truter, 1973; Rijo & Sargent, 1974; Harder, Roringer, Samborski, Kim & Chong, 1978). Uredosporogenesis did not differ markedly from descriptions given by other authors. Germ pores were observed in uredosporos (Fig. 4) and differed in structure from those in *Uromyces appendiculatus* (Pers.) Unger (Müller, Rijkenberg & Truter, 1974; Hardwick, Greenwood & Wood, 1975), *Melampsora lini* (Pers.) Lev. (Manocha & Shaw, 1967) and *Puccinia graminis tritici* Eriks & Henn. (Sussman, Lowry, Durkee & Maheshwari, 1969).

### ACKNOWLEDGEMENT

The authors are indebted to Mrs M. G. Gilliland, Mr V. H. Bandu and Mr M. Kundalram of the Electron Microscope Unit, University of Natal, for their assistance during this study.

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Received 29 July 1980; approved 25 November 1980

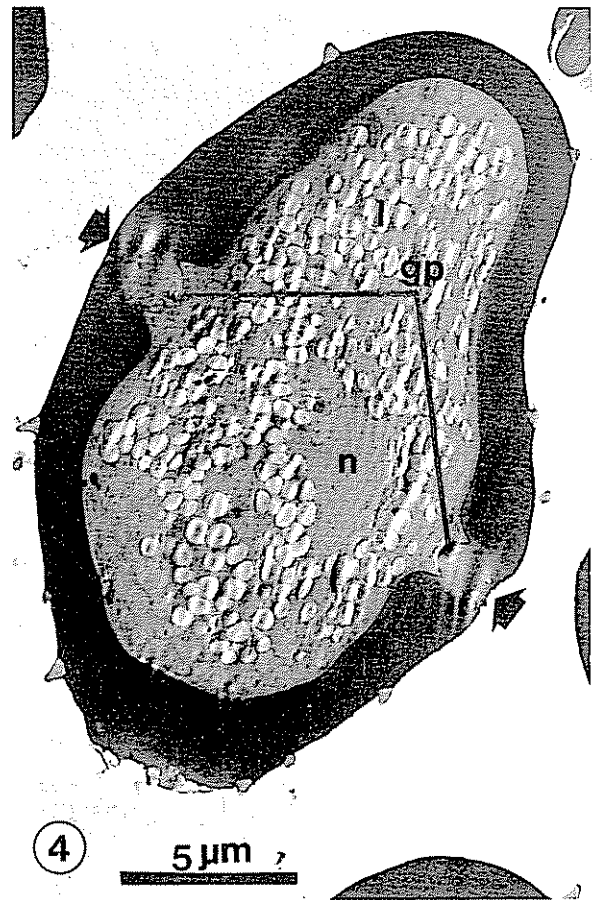
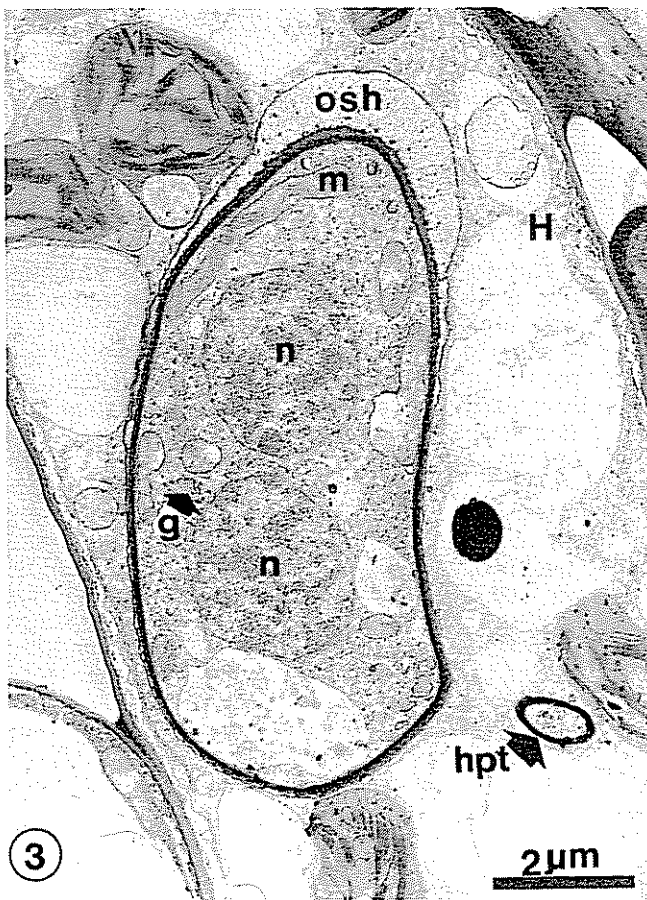
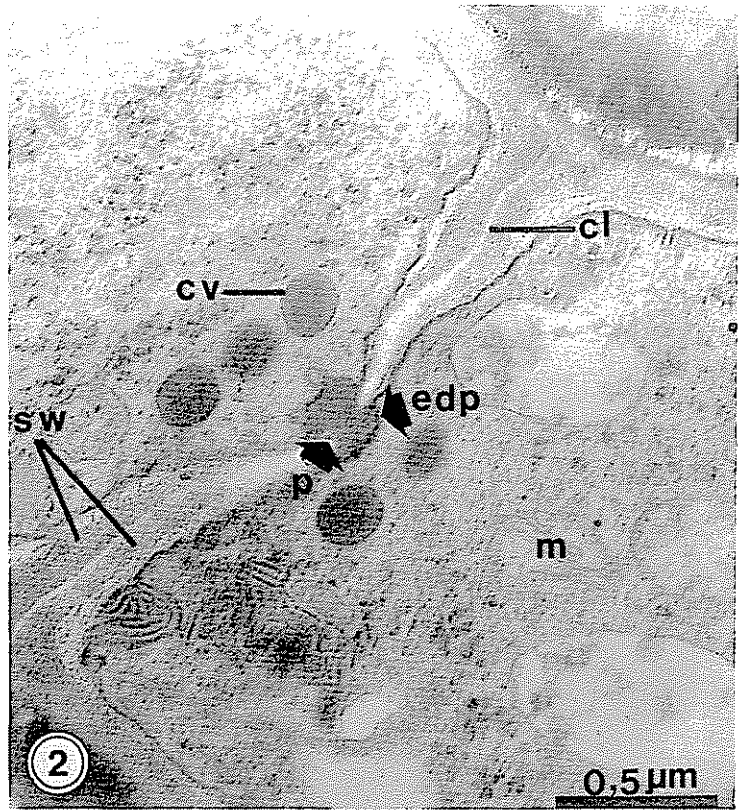
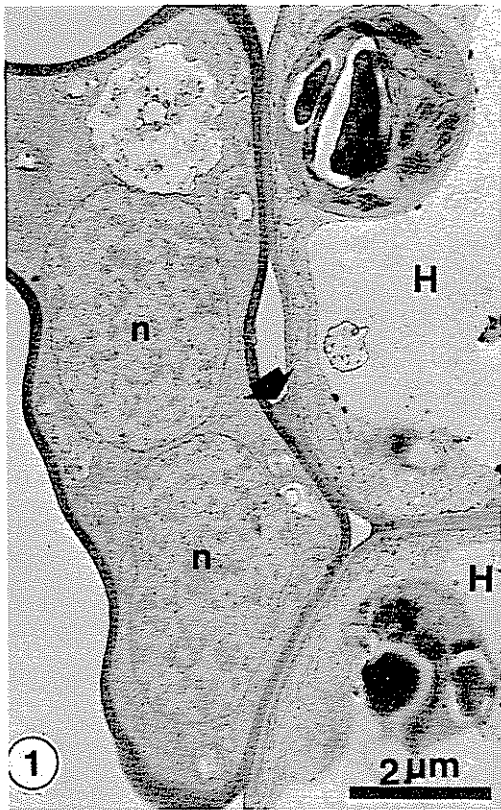


FIG. 1-4 Ultrastructure of *Puccinia arachidis*/Ultrastruktuur van *Puccinia arachidis*. 1. Binucleate intercellular hypha bonded (arrow) to host cell wall/Tweekernige intersellulêre hife (pyl) gebind aan gasheerselwand. 2. Septum of intercellular hypha/Septum van intersellulêre hife. 3. Binucleate haustorial body within the host cell/Tweekernige haustoriale liggaam binne die gasheersel. 4. Germ pores opposite each other (arrows) in a uredospore/Kiempore oorkant mekaar in 'n uredospoor

## ABBREVIATIONS/AFKORTINGS

## FUNGUS/SWAM

- cl central lamella/sentrale lamella  
 cv cytoplasmic vesicles/sitoplasmiese vesikels  
 edp plates of septal pore apparatus/plate van septumpoorapparaat  
 g glycogen granules/glikogeenkorrels  
 gp germ pores/kiempore  
 hpt haustorial penetration tube/haustoriale indringbuis  
 l lipid bodies/vetliggaampies  
 m mitochondrion/mitochondria  
 n nucleus/nukleus  
 osh outer sheath layer of haustorium/buiteskedelaag van haustorium  
 sw septal walls/septumwande

## HOST/GASHEER

- H host cell/gasheersel

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