

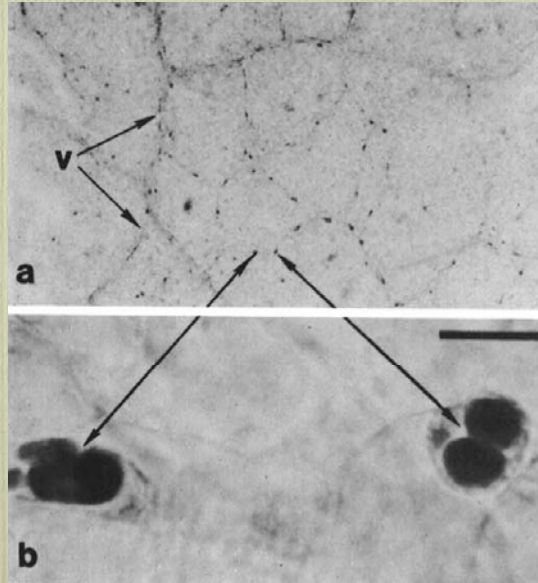
## Light Microscopy



## Microscopy

- Light vs. electron microscopy

## Light vs. electron microscopy



- Nuclear inclusions of a geminivirus

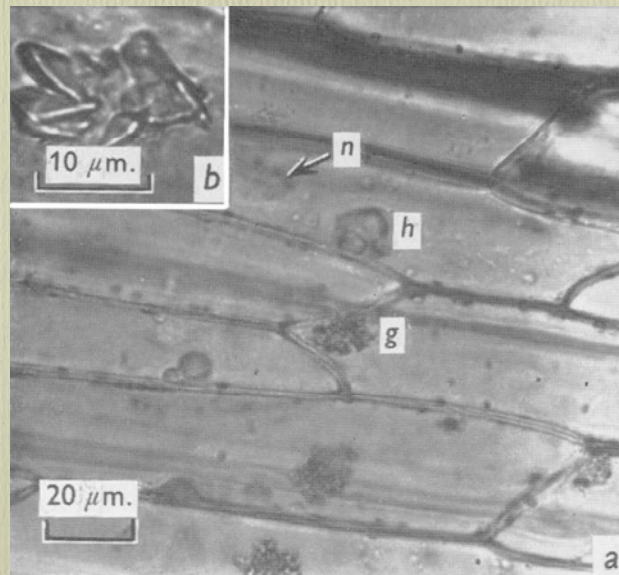
## *Virus inclusions*

- Intracellular evidence of virus infection
  - Altered host constituents
  - Aggregated viruses or CP shells
  - Virus coded proteins ( $\neq$  CP)
  - Mixture of the above

## Cell abnormalities

- Histological or Morphological changes
- Hypoplasia or Hyperplasia

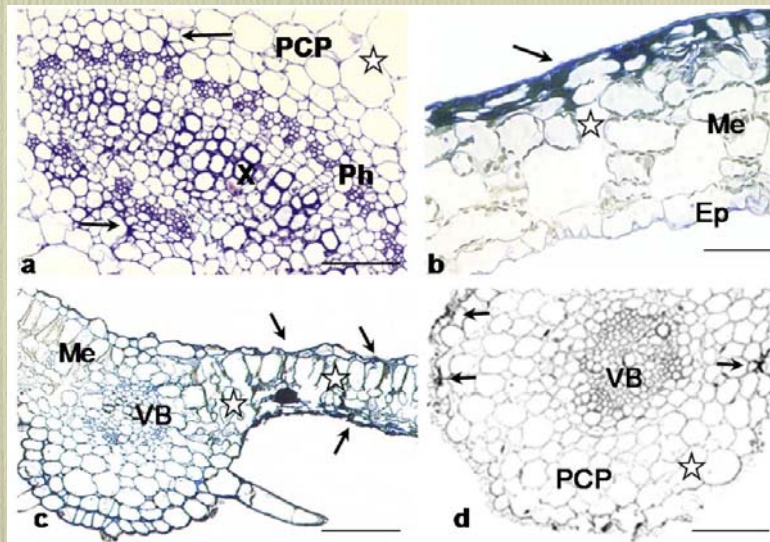
### Tobacco epidermal cells Infected by Tobacco necrosis virus



Kasanis et al 1970



## PVY in tobacco



Otulak et al, 2014

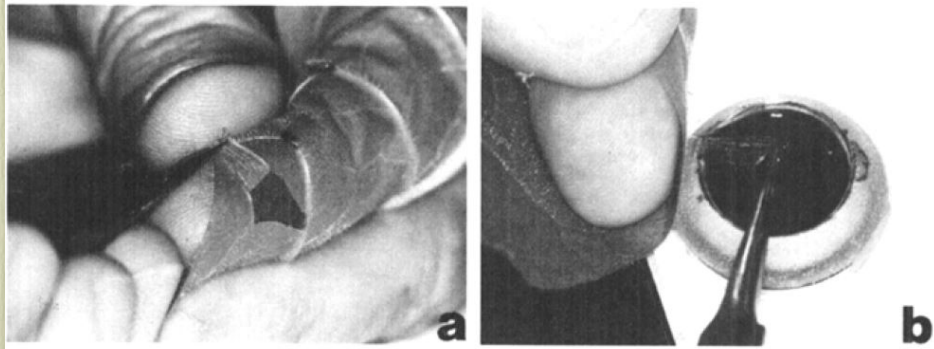
## Stains

### Staining reactions of cellular constituents

	Nucleus	Nucleolus	Plastids	Microcrystals	Protein	Cytoplasm
O-G (calcomine orange)	Blue	Red-violet	Faint pink to colorless	Colorless	Colorless	Colorless
Azure A	Orange	Green	Yellow	Green	Olive green	Pale yellow

Toluidine blue, Crystal violet, Methylene blue, and Azure B are useful for the detection of pathogenic alterations in virus infected plant tissues

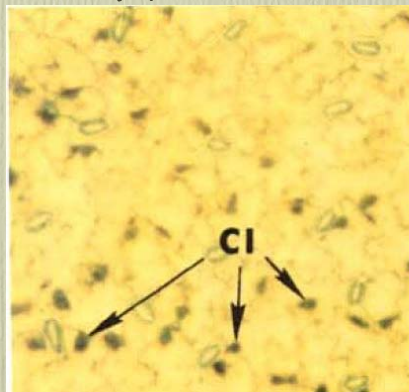
## Tissue preparation



- Christie and Edwardson, 1986

## Christie and Richardson, 1986

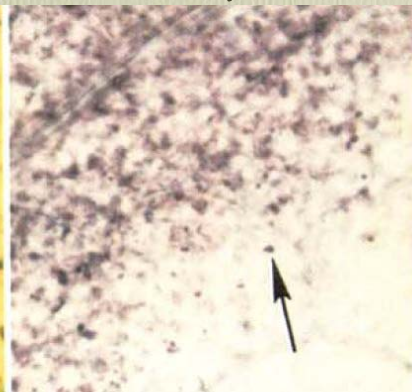
Cytoplasmic inclusions



PRSV, stained w/ O-G

Chenopodium

Virus crystal



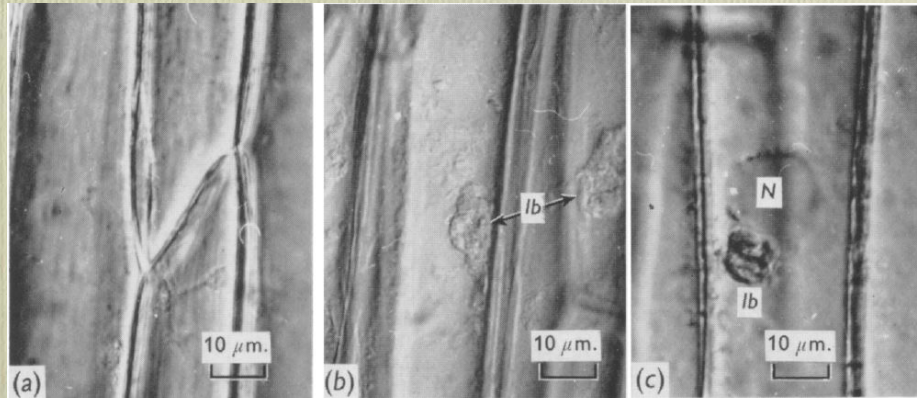
CMV, stained with Azure A

Tobacco

### *Brassica napa* unstained cells

Healthy

Inclusions in infected cells

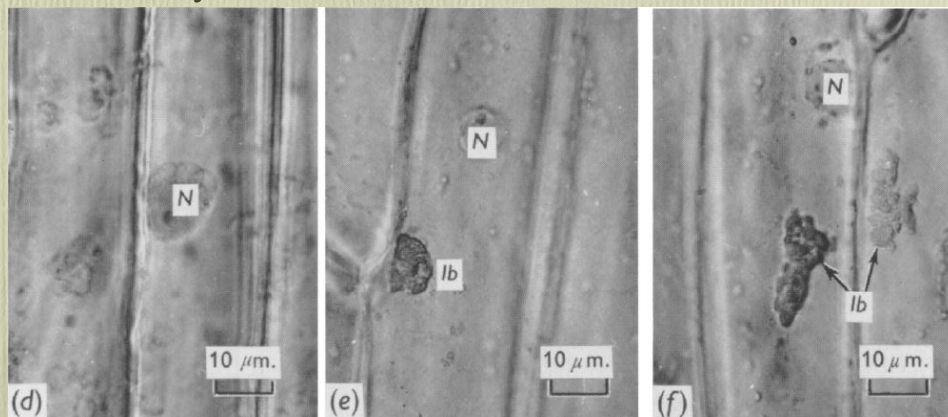


Martelli et al, 1971

### Mercuric bromophenol blue stain

Healthy

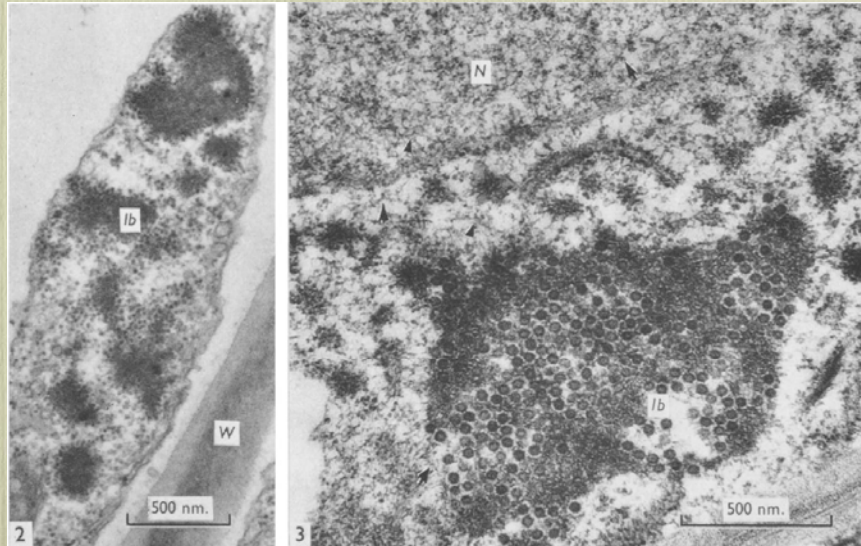
Inclusions in infected cells



Martelli et al, 1971



## Inclusion bodies viewed by TEM Cauliflower Mosaic Virus



Martelli et al, 1971

## Florida Department of Agriculture Viral inclusions gallery

<http://www.freshfromflorida.com/Divisions-Offices/Plant-Industry/Science/Florida-Plant-Viruses-and-Their-Inclusions>