



# IDENTIFICATION OF CYST NEMATODES

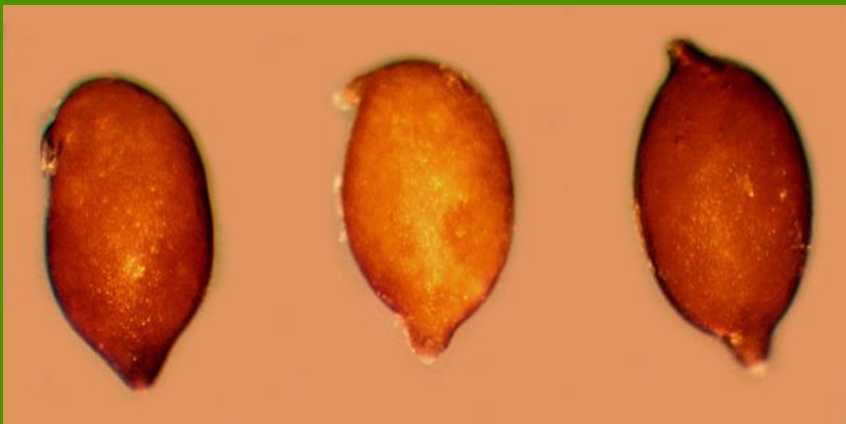
# Sedentary - cysts

*Heterodera schachtii* (Beet cyst nematode)

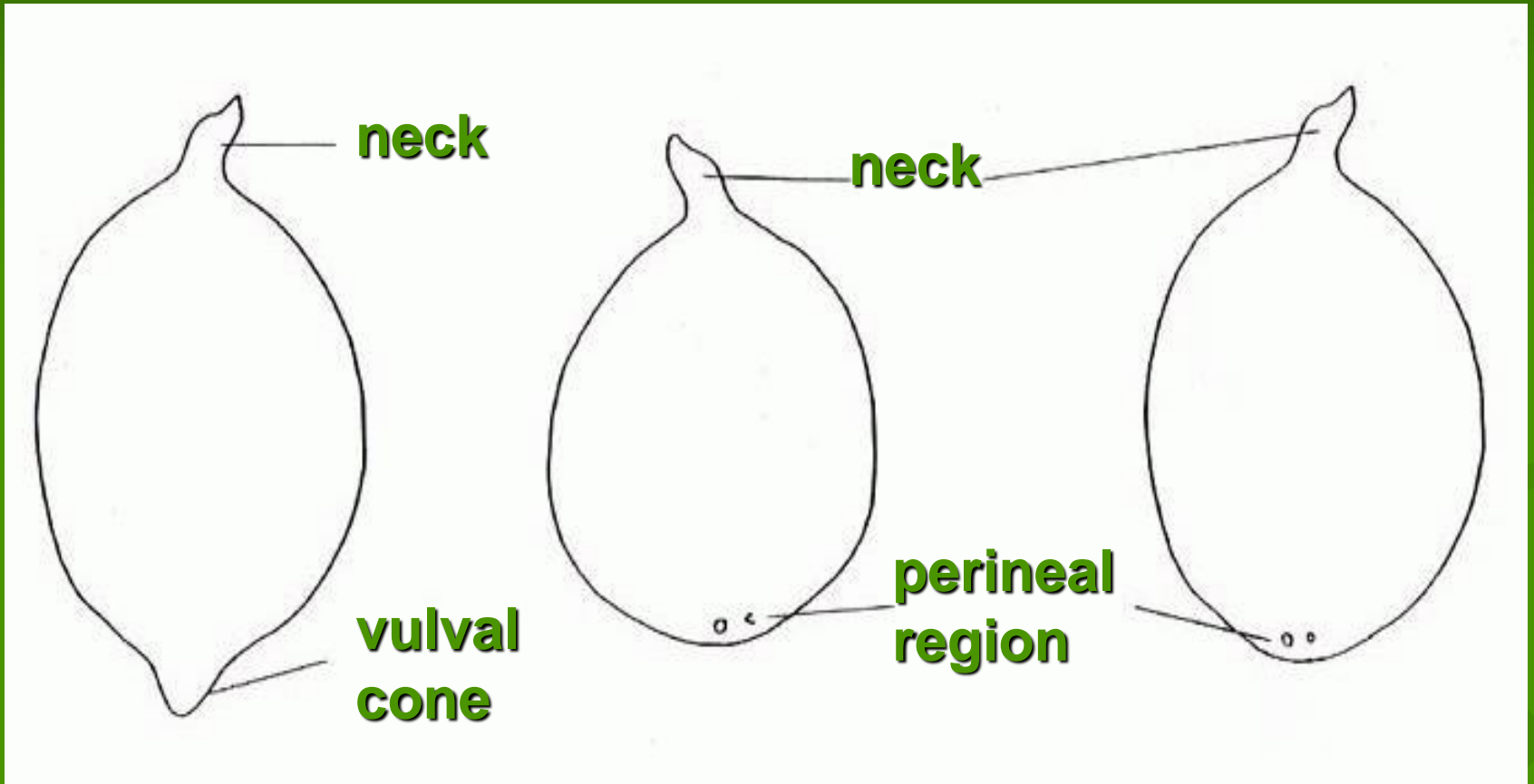
*Heterodera avenae* (Cereal cyst nematode)

*Globodera rostochiensis* & *pallida* (PCN)

*Globodera* spp. (non-PCN)



# CYST SHAPE

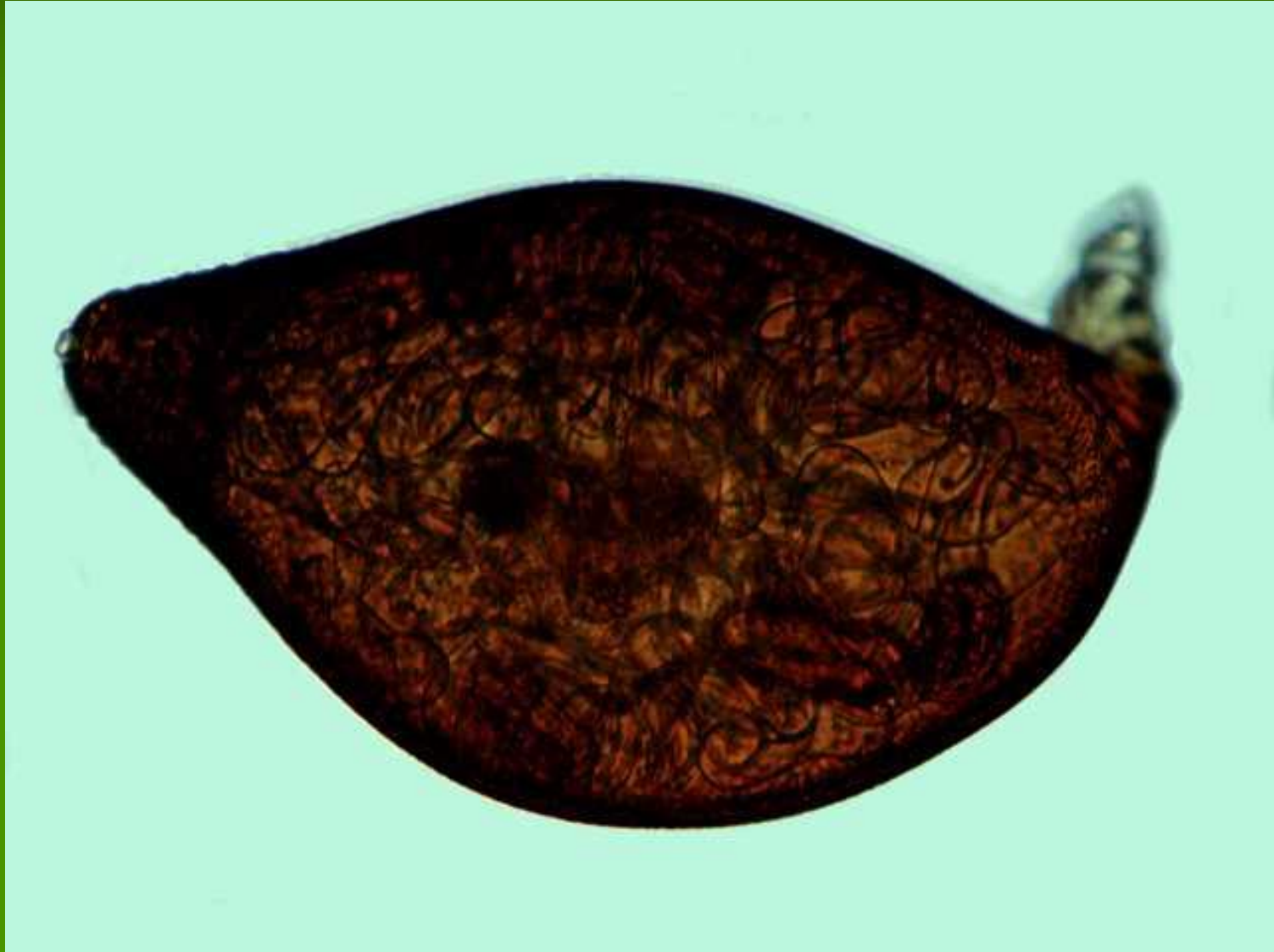


*Heterodera sp.*

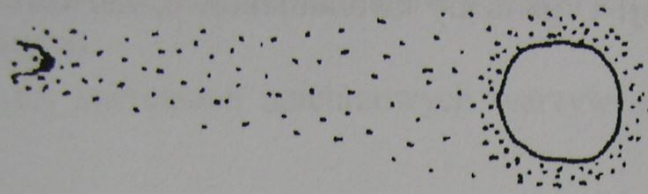
*Globodera sp.*

*Punctodera sp.*  
or immature  
*Globodera sp.*

# Lemon shaped cyst (*Heterodera glycines*)



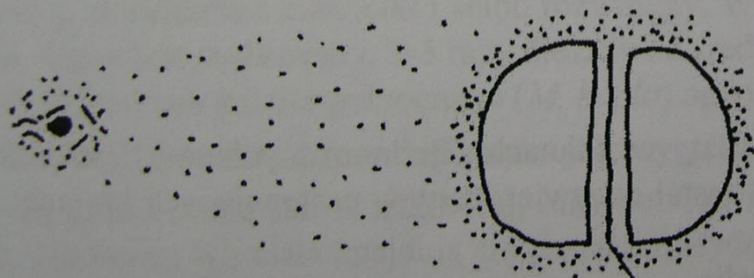
# Fenestra types



Typ circumfenestralny  
(rodzaje *Globodera* i  
*Cactodera*)



Typ circumfenestralny  
(rodzaj *Punctodera*)

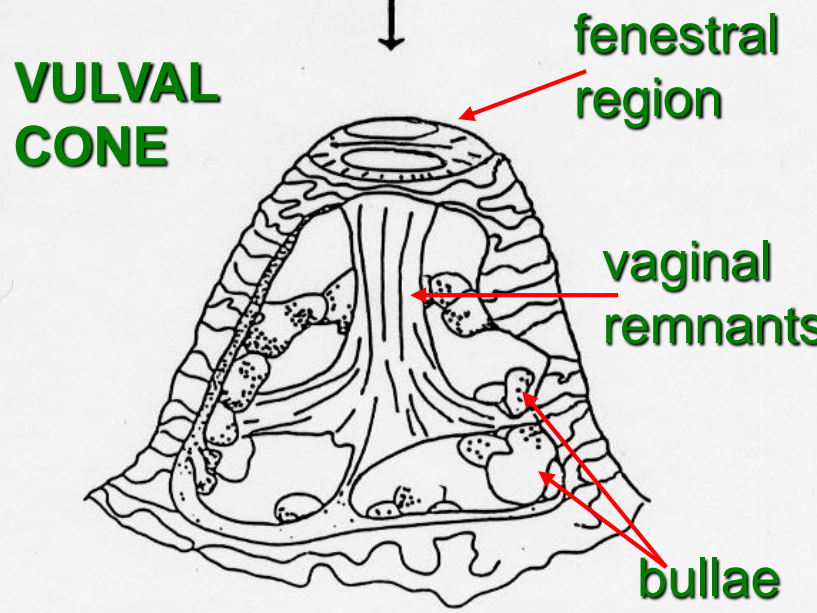
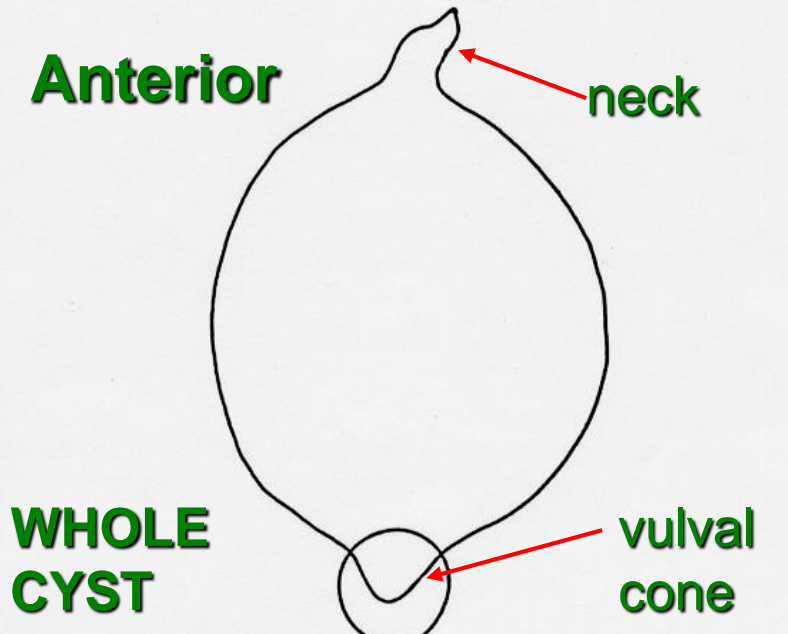


Typ bifenestralny  
(rodzaj *Heterodera*)

Most wulwalny



# Heterodera sp. cyst



# Sugarbeet field infested with *H. schachtii*





**Sugar beet root  
infested with  
*Heterodera schachtii***

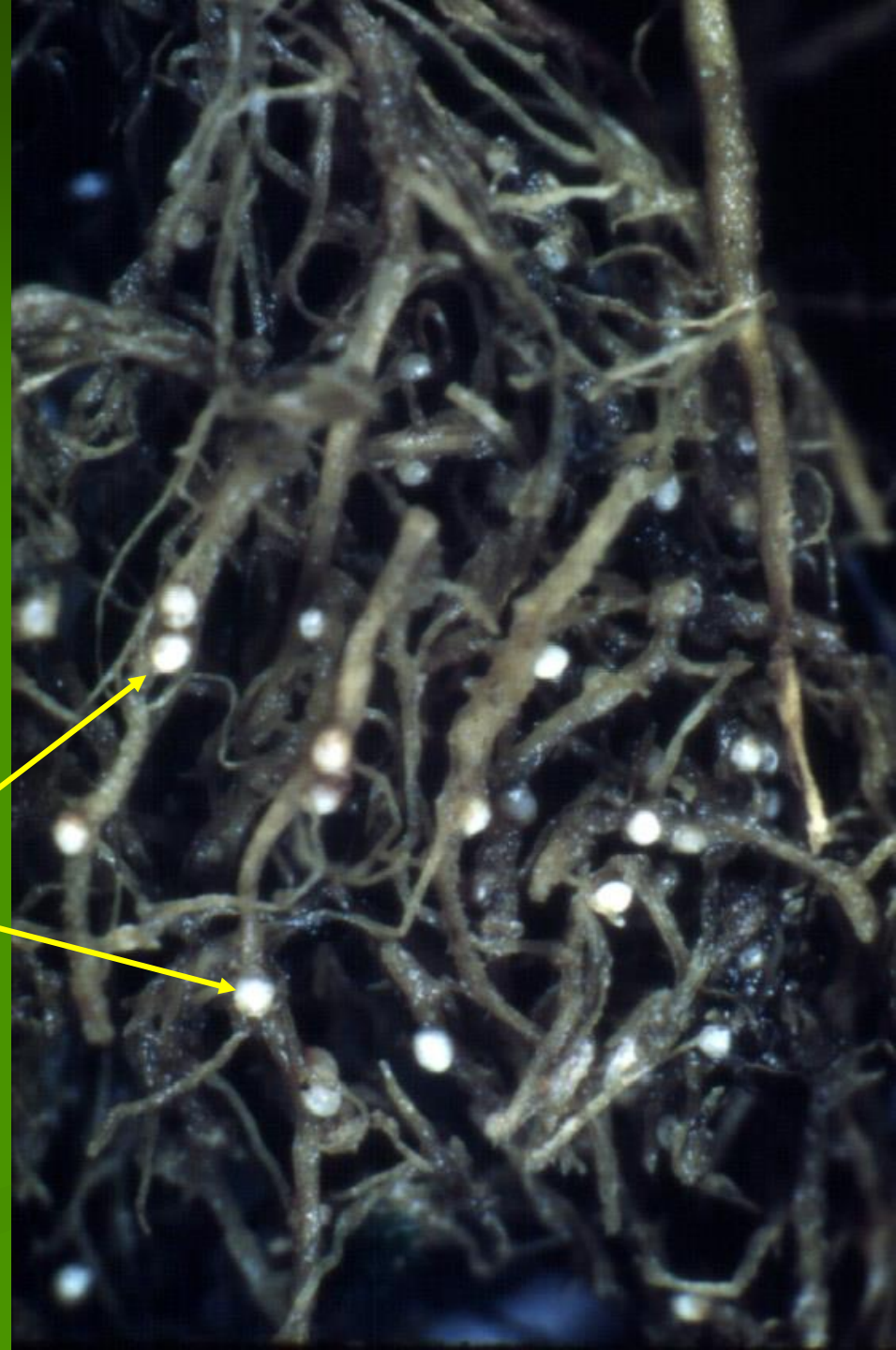
White females protruding  
from roots





**Oat roots  
infested with  
*Heterodera avenae***

White females protruding  
through roots



# PCN resistant potatoes (Irga in Poland)



**Susceptible  
variety**



# Potato field infested with *G. pallida*





# PCN damage to potato plants

Early  
senescence &  
death of plant



Healthy  
plant

Yellowing  
of leaves

Patchy  
growth



# *Globodera rostochiensis* on roots





# *Globodera pallida* on roots





# *Globodera* sp. cyst

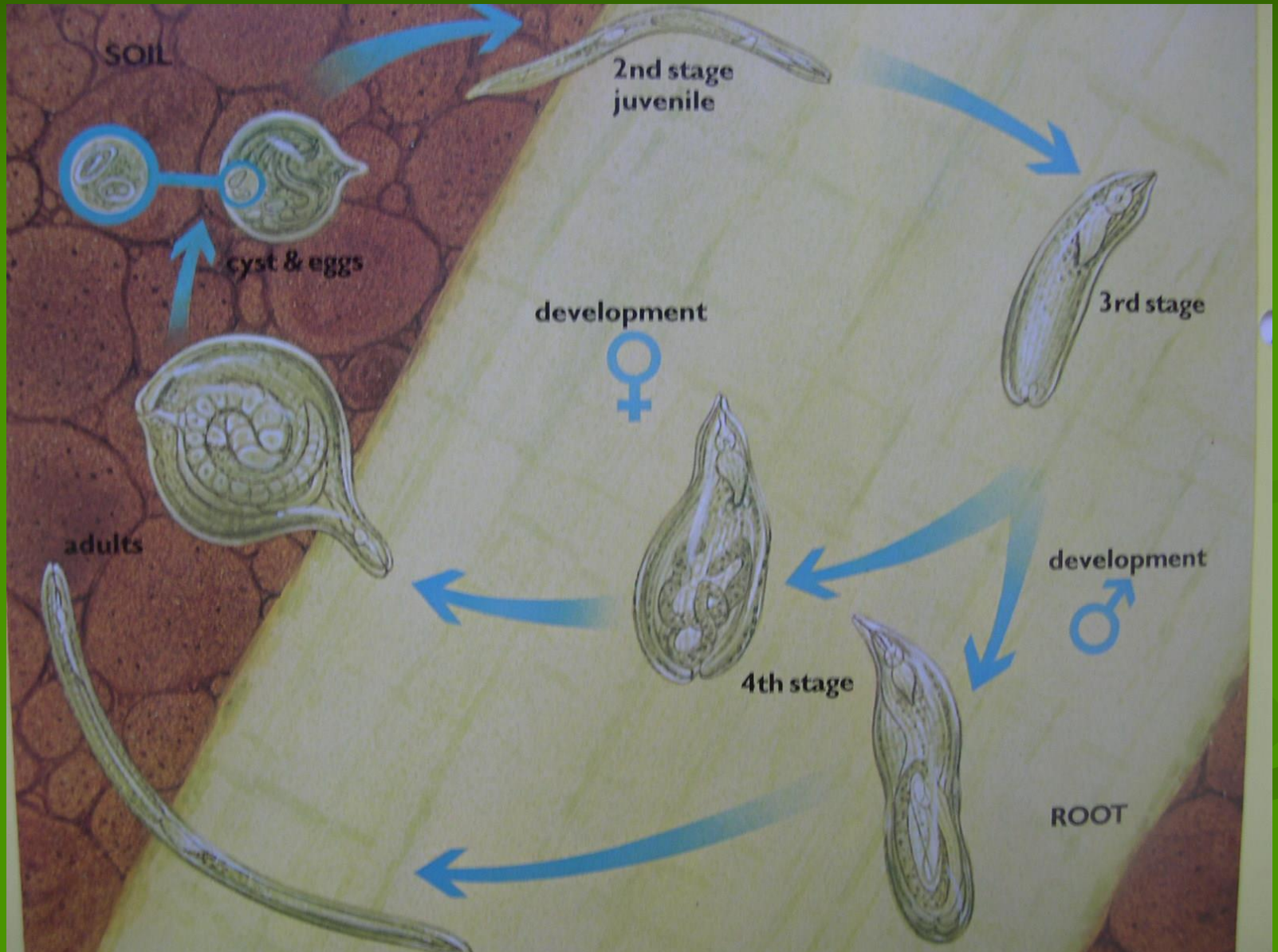


# ***Globodera* sp. cyst on root**





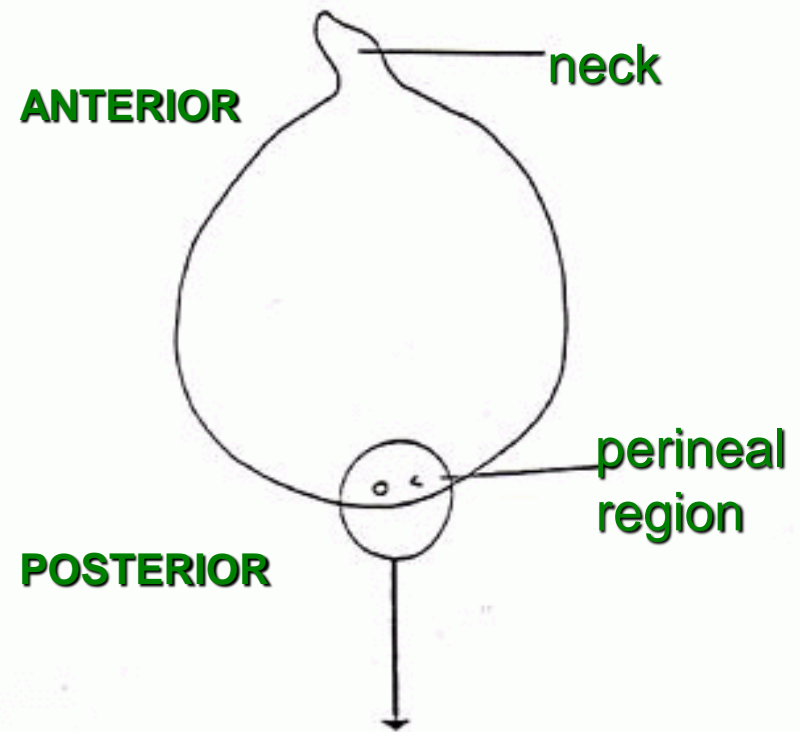
# Life cycle of Potato Cyst Nematodes



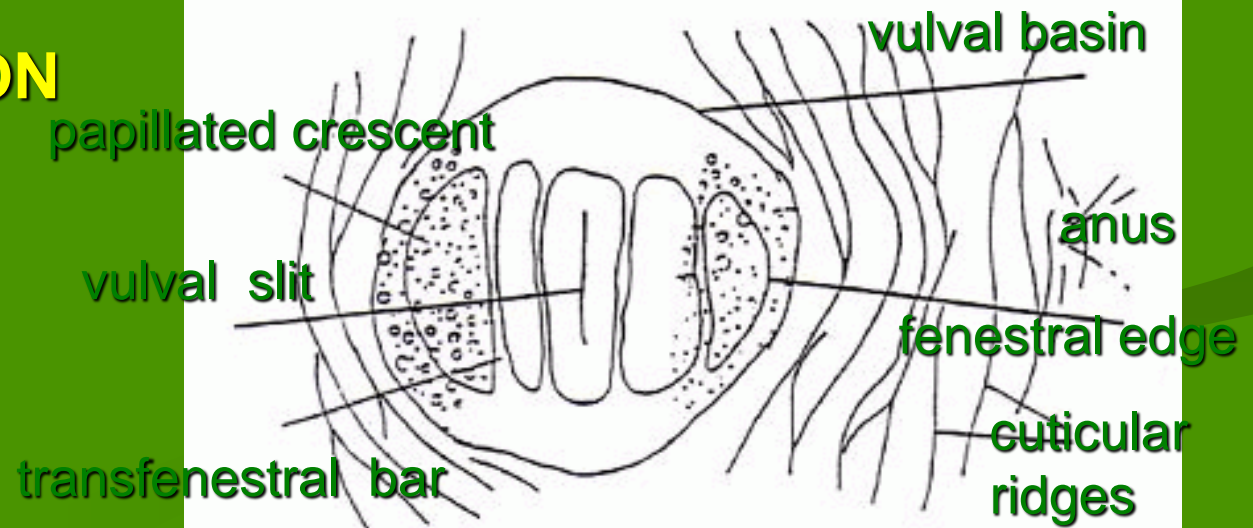


# *Globodera* sp. cyst

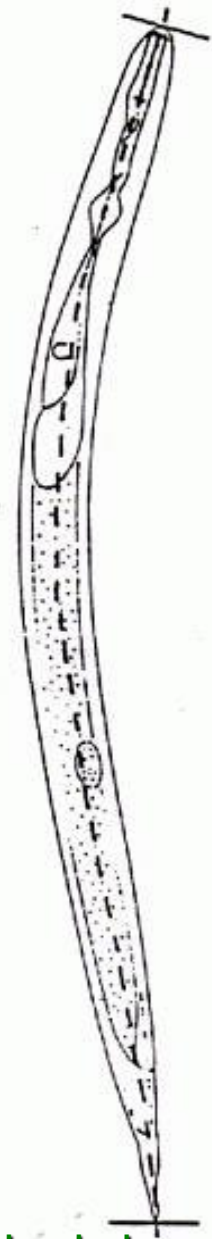
## WHOLE CYST



## PERINEAL REGION



# Second stage juvenile measurements



body length

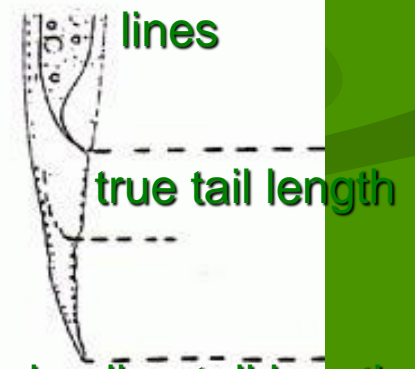
(measure through mid body)



stylet length

stylet knob width & shape

number of lateral field lines

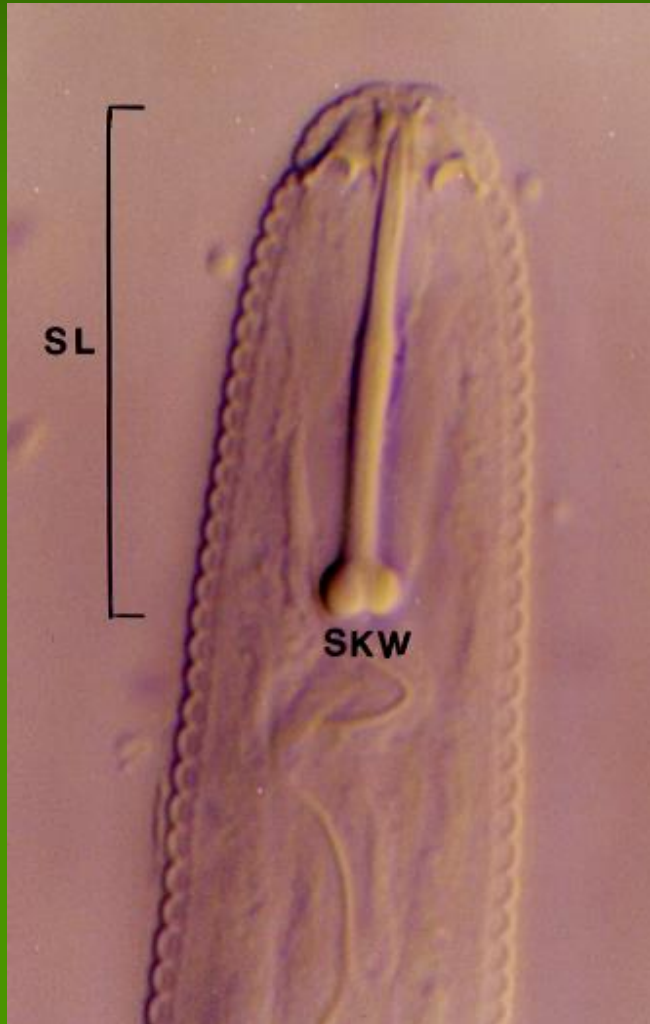


true tail length

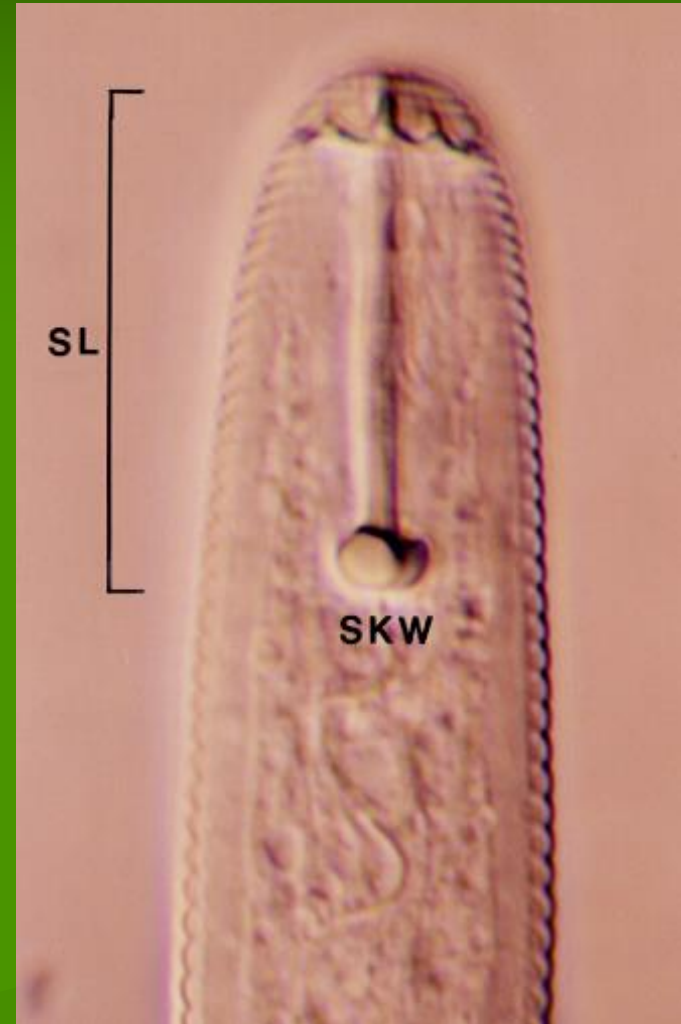
hyaline tail length

# PCN 2nd stage juveniles

(SL = stylet length, SKW = stylet knob width)



*G. rostochiensis*

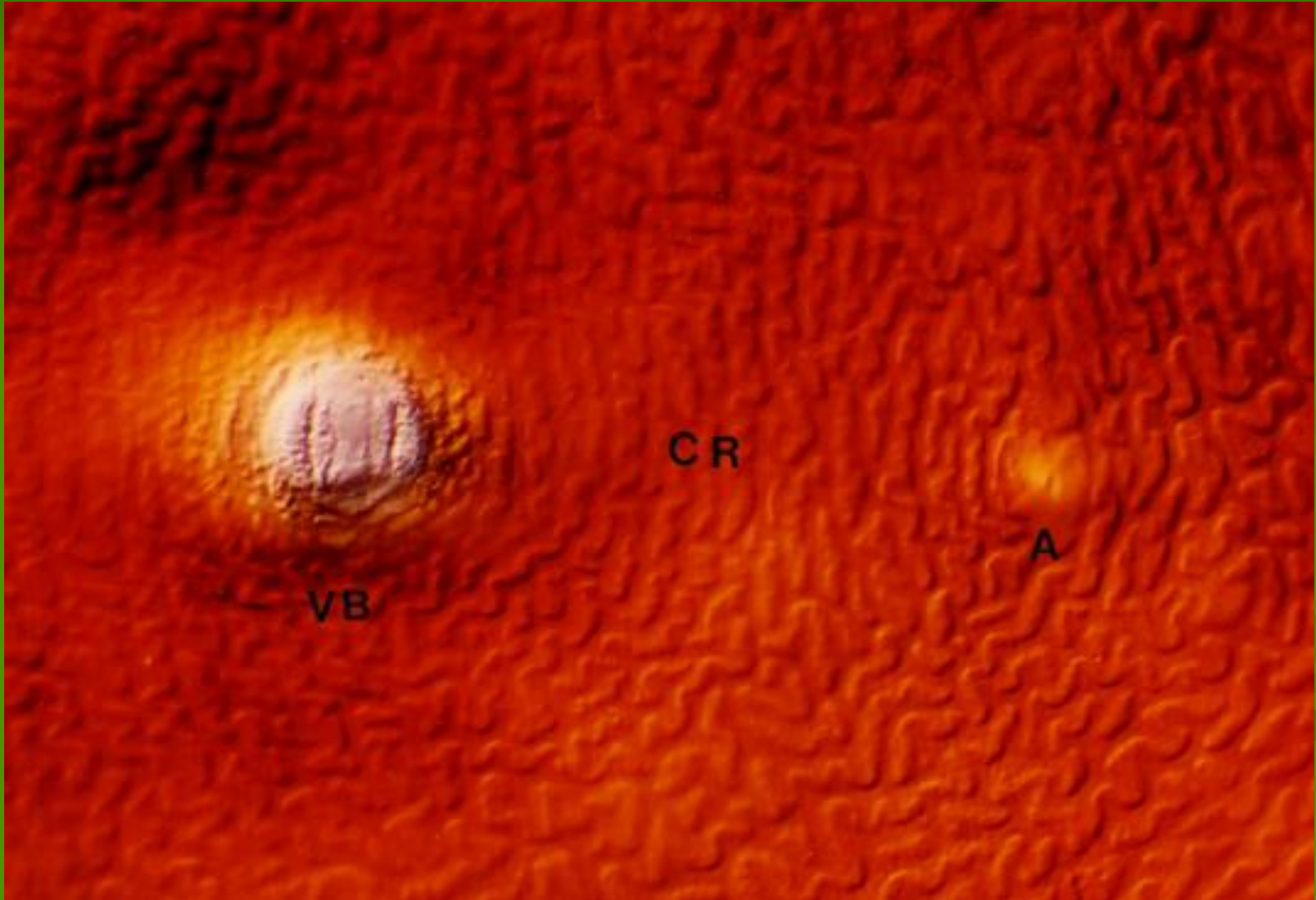


*G. pallida*



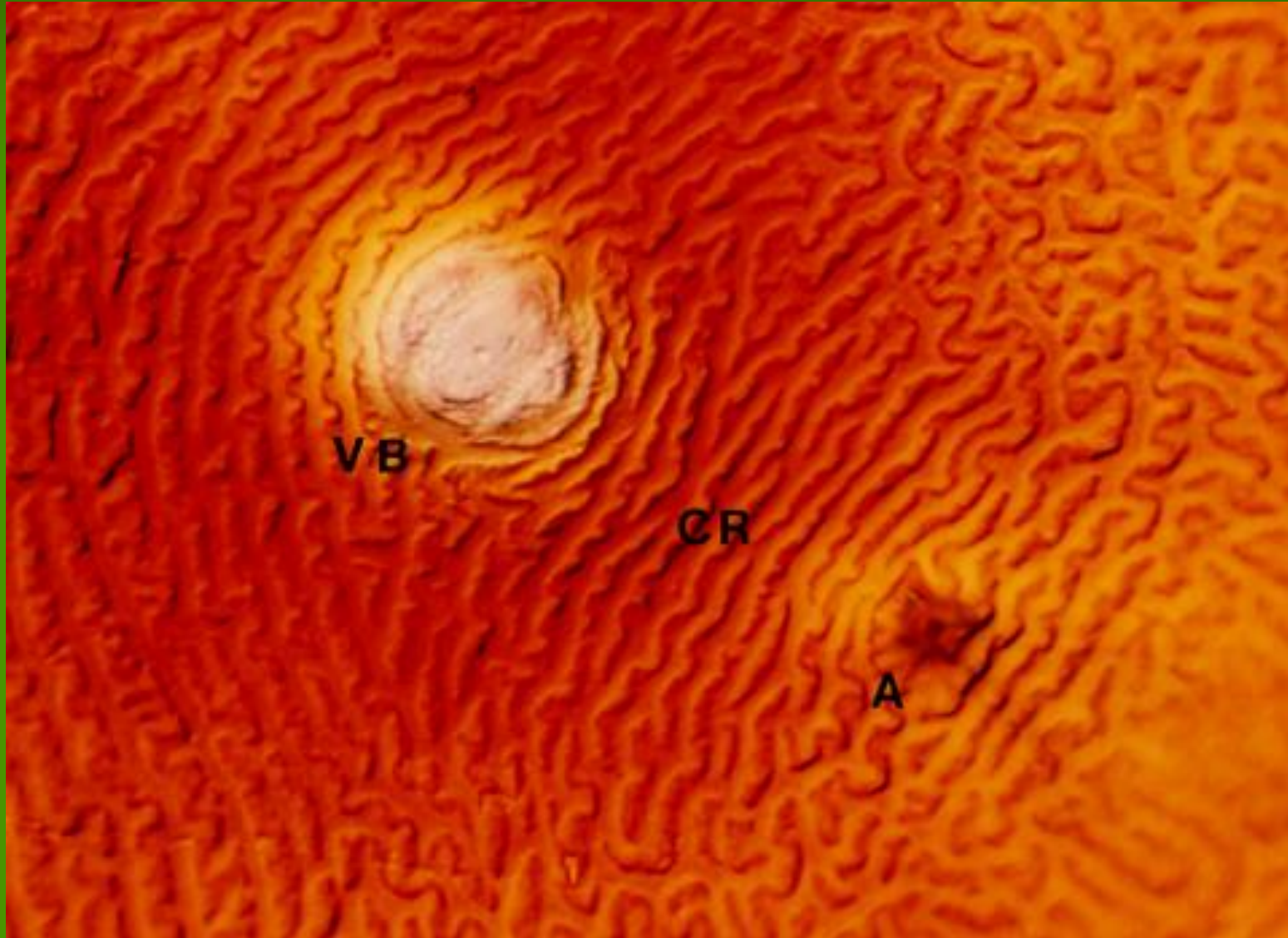
# ***G. rostochiensis* (perineal region)**

(VB=vulval basin, CR=cuticular ridges, A=anus)



# ***G. pallida* (perineal region)**

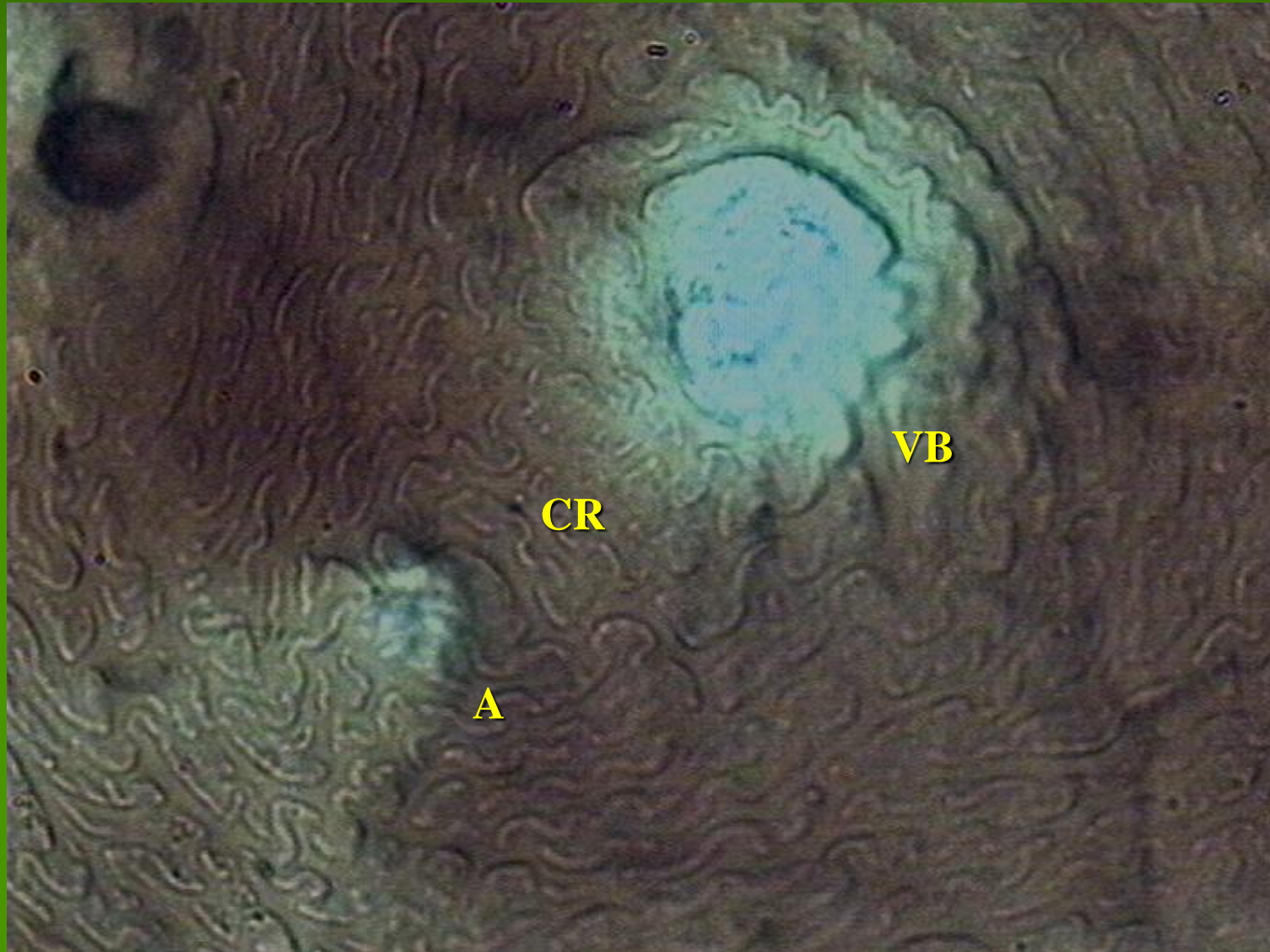
(VB=vulval basin, CR=cuticular ridges, A=anus)



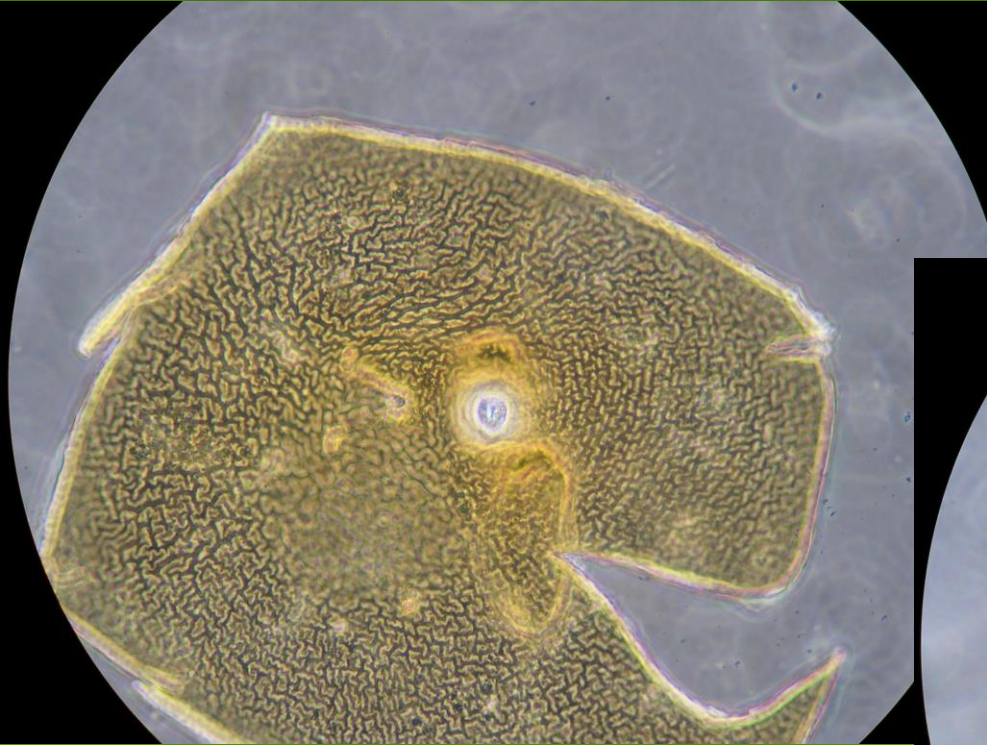


# ***G. achilleae* (perineal region)**

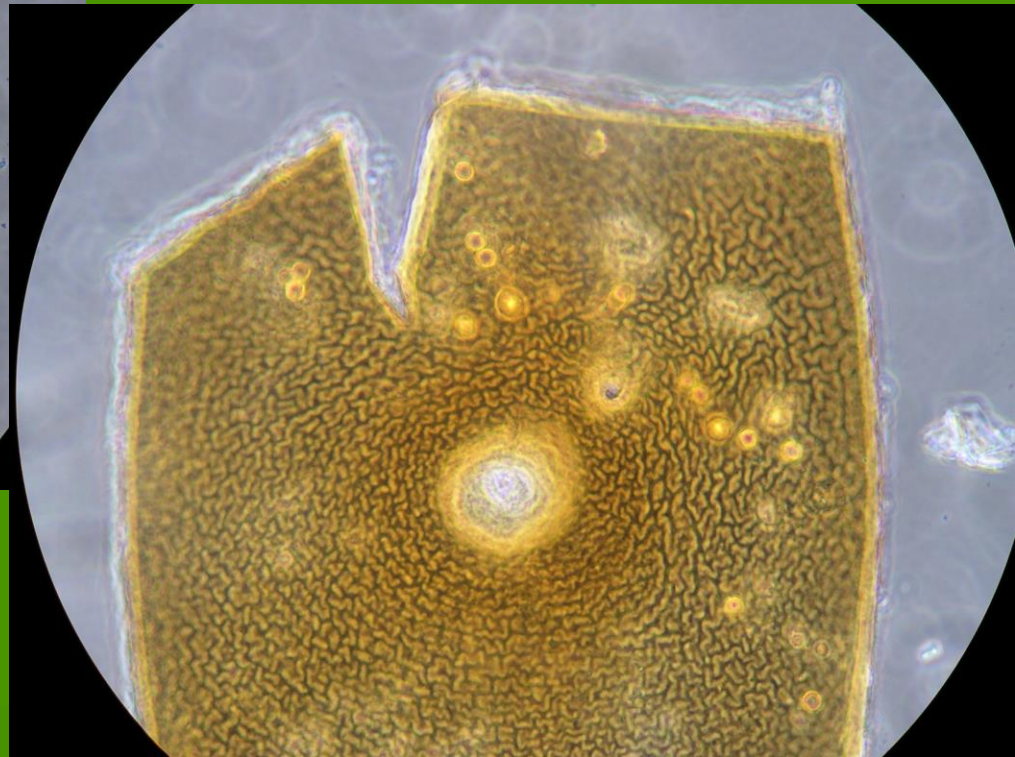
(VB=vulval basin, CR=cuticular ridges, A=anus)



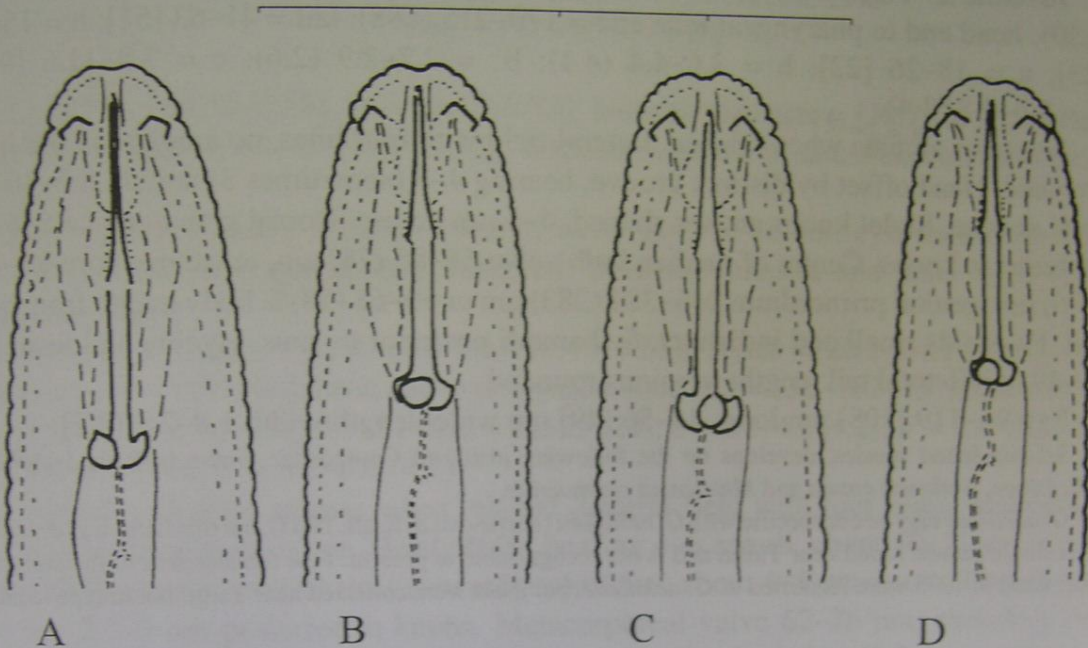
***G. pallida***



***G. rostockiensis***





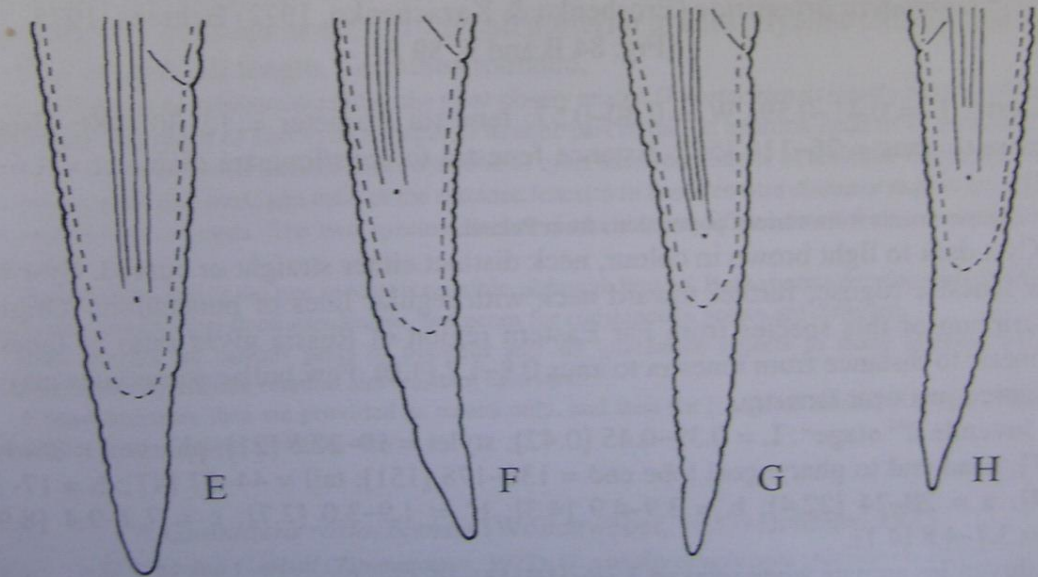


A

B

C

D



E

F

G

H

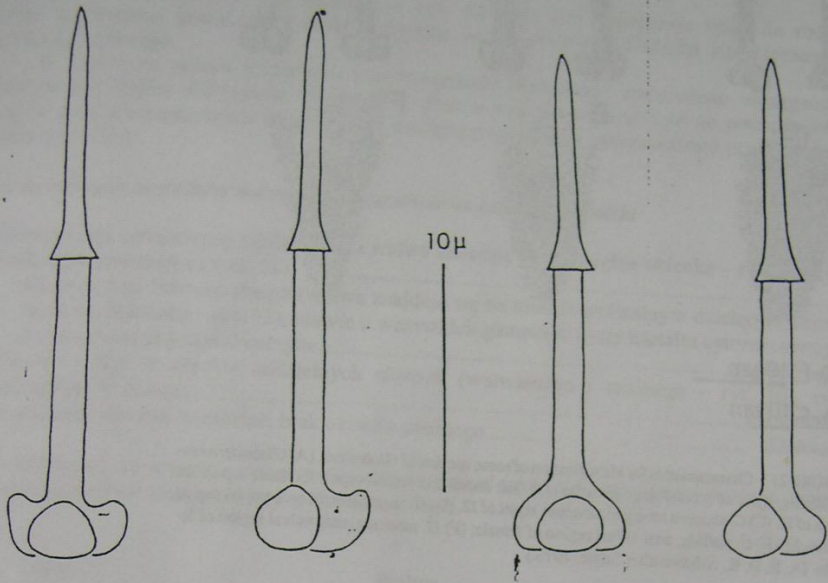
# Juveniles of *Globodera* sp.

AE *G. achilleae*

BF *G. artemisiae*

CH *G. pallida*

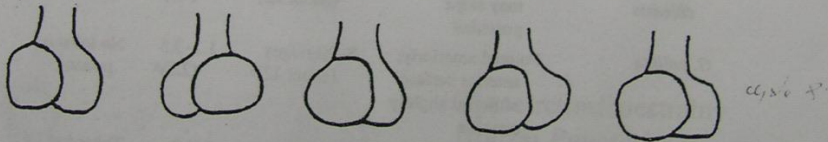
# Stylet/knob shape characteristics



G. pallida  
(23.8 µm)

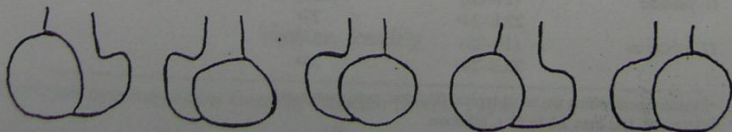
G. rostochiensis  
(21.8 µm)

## VARIATION IN STYLET KNOB SHAPE



G. rostochiensis, SMALL AND ROUNDED.

G. pallida, ROBUST AND HOOKED

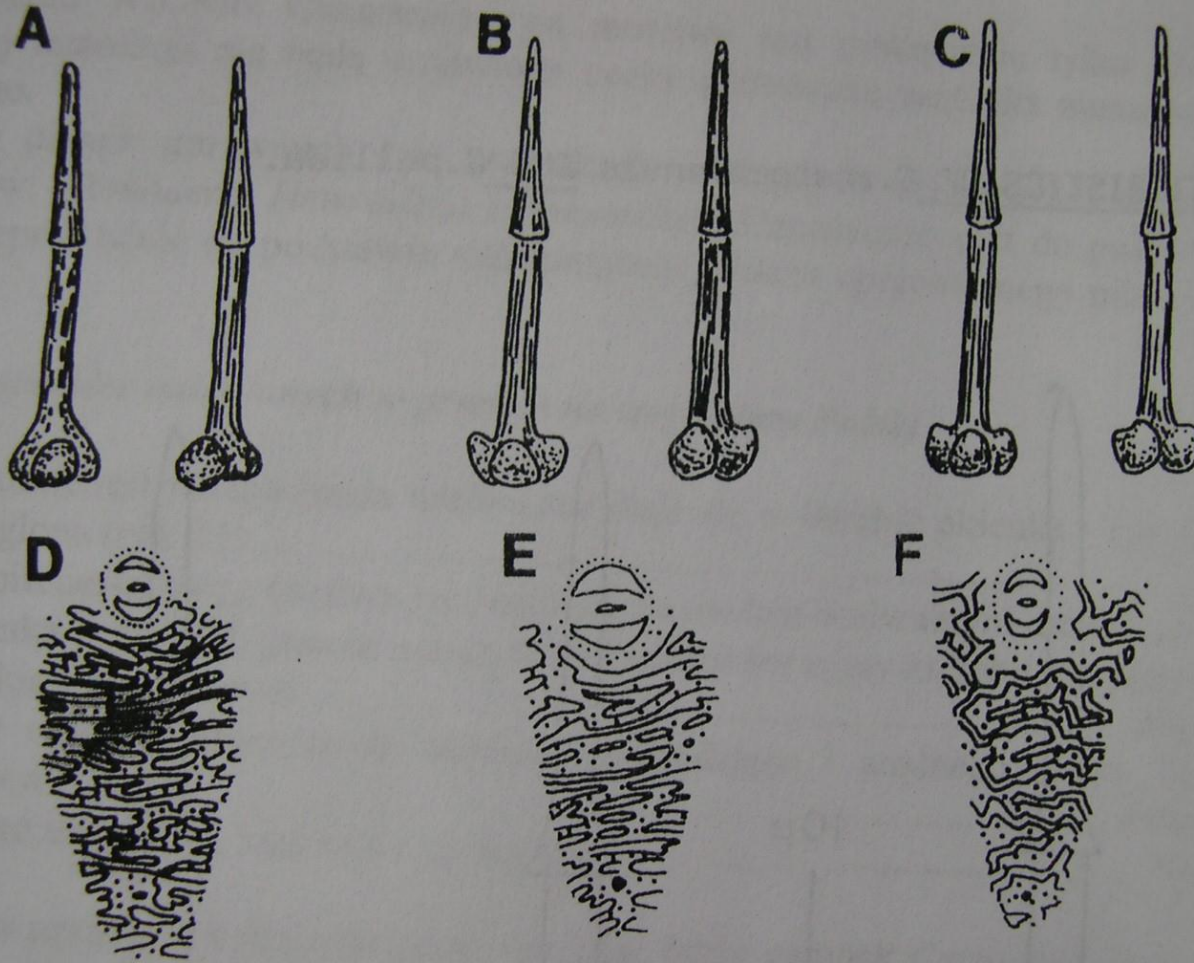


# Stylet of 2nd stage juvenile/anal & vulval region

*G. rostochiensis*

*G. pallida*

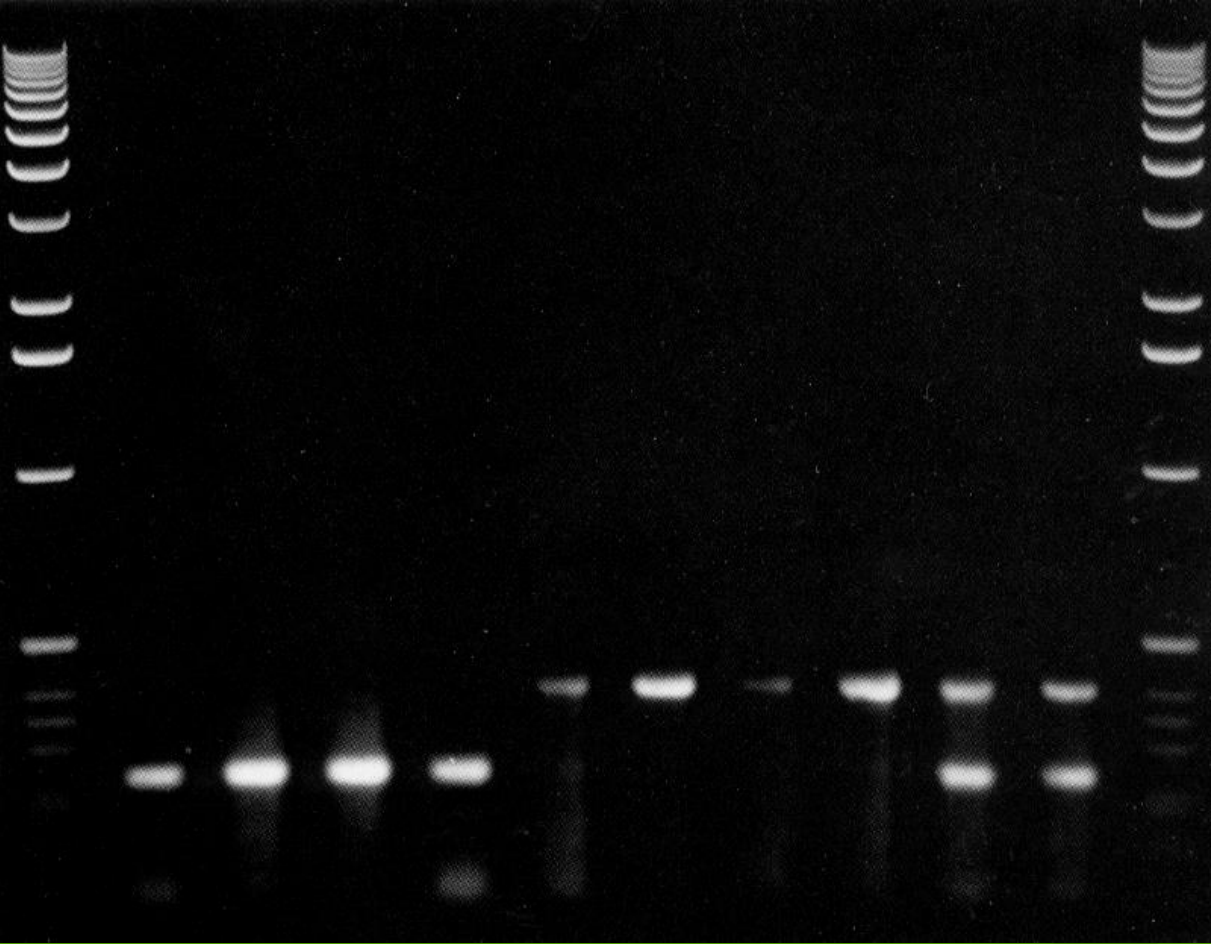
*G. tabacum*



A-C 10  $\mu$ m



# Agarose gel showing results of multiplex PCR



D = DNA markers

\* amplification product sizes indicated in base pairs

← 391 b.p.\*  
← 238 b.p.

D   *G. rostochiensis*   *G. pallida*   Species mixtures   D