



***BOTRYCHIUM***

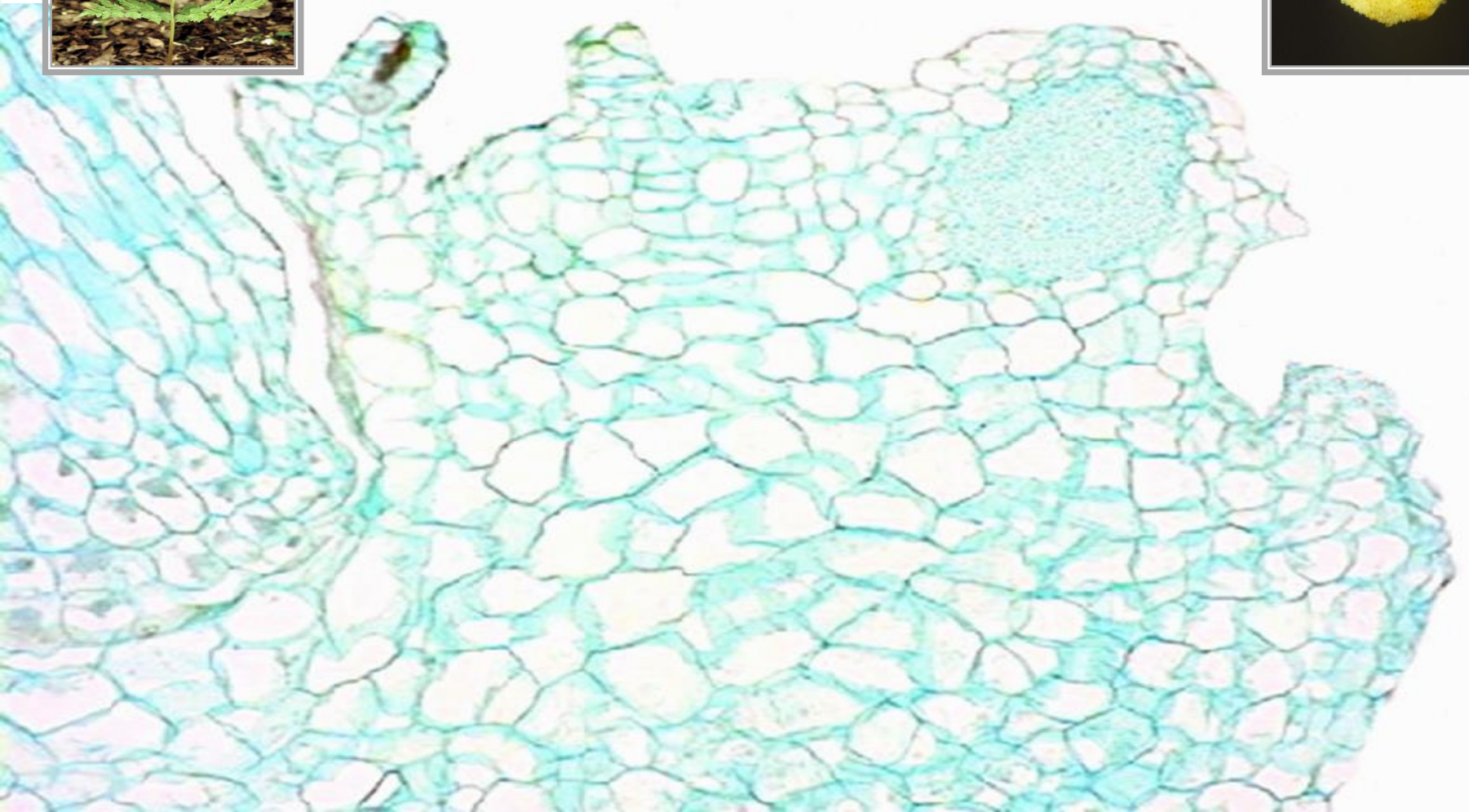
**GAMETOPHYTE**



**BISEXUAL**

# VASCULAR PLANTS LABORATORY #5

G

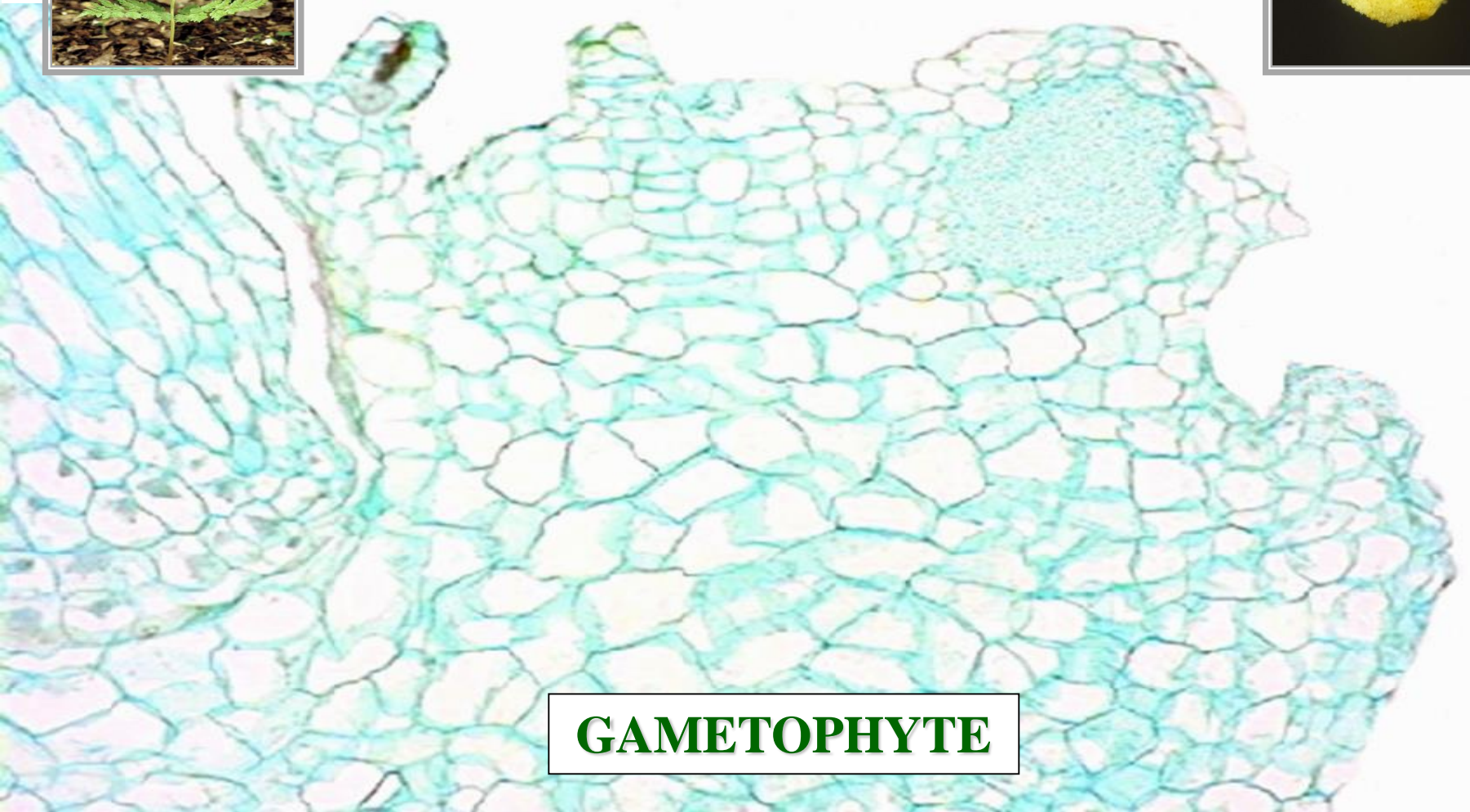


***BOTRYCHIUM / GAMETOPHYTE / L. S.***

# VASCULAR PLANTS

## LABORATORY #5

?

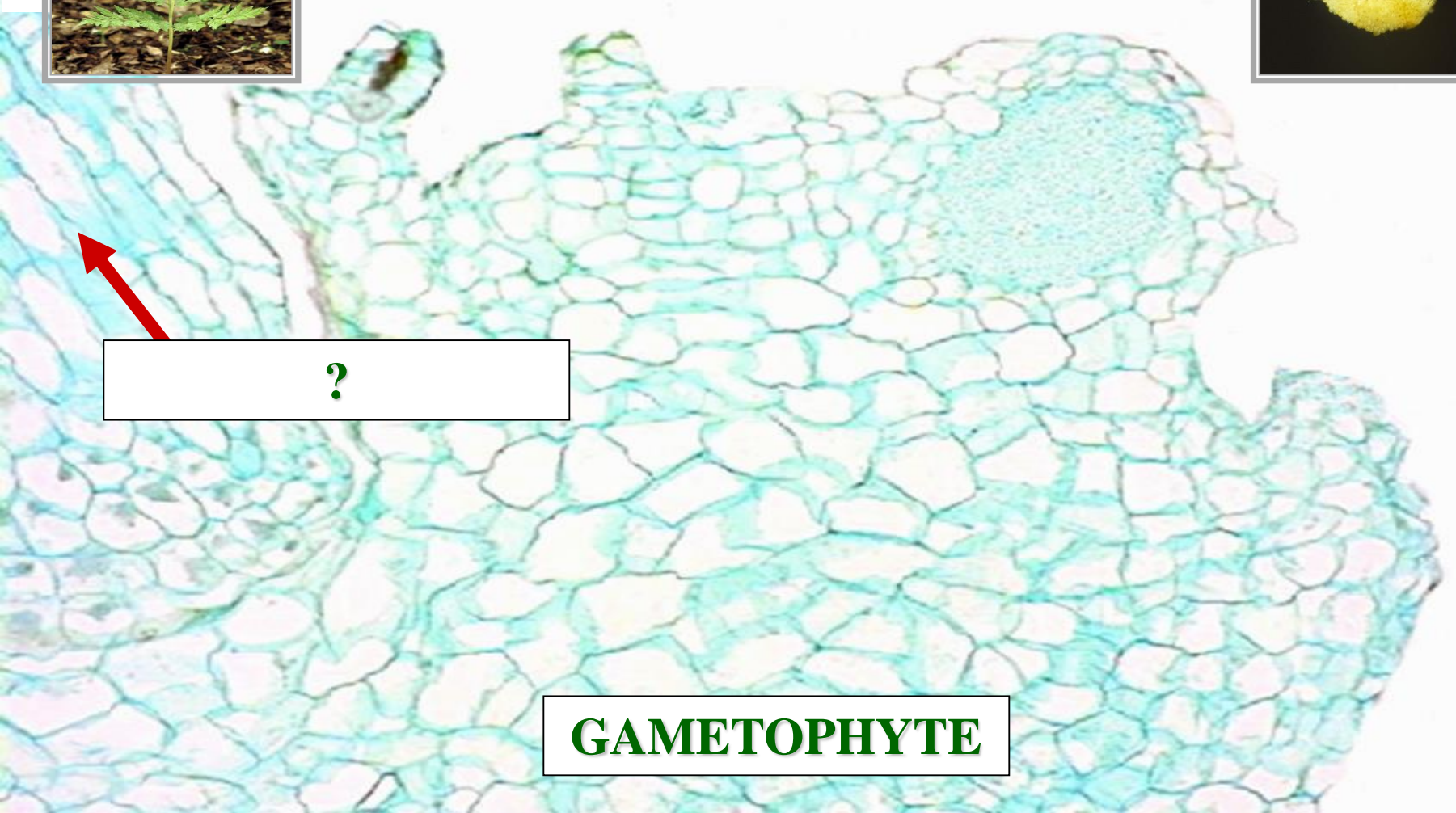


**GAMETOPHYTE**

***BOTRYCHIUM / GAMETOPHYTE / L. S.***

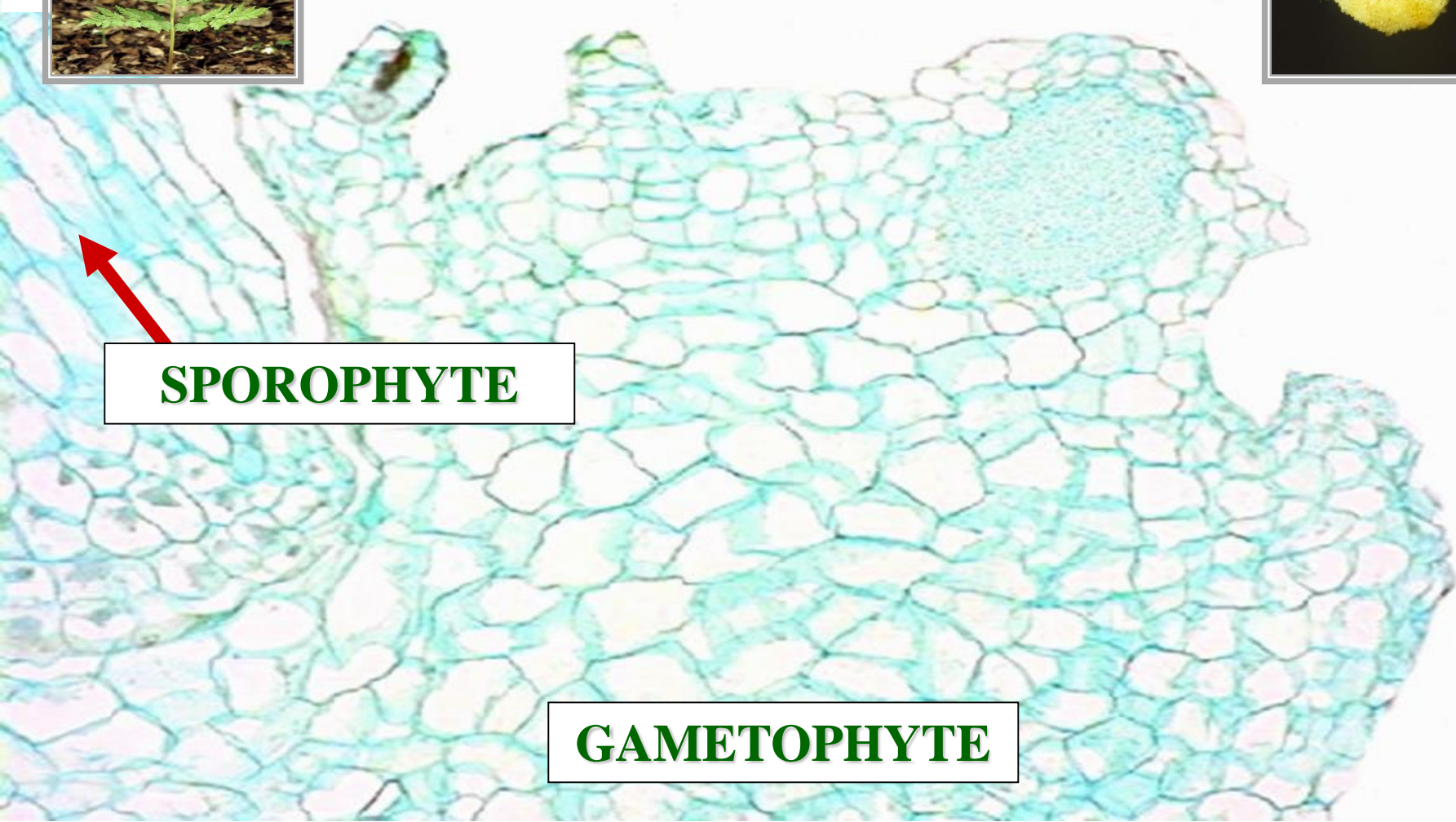
# VASCULAR PLANTS LABORATORY #5

S



***BOTRYCHIUM / GAMETOPHYTE / L. S.***

# VASCULAR PLANTS LABORATORY #5



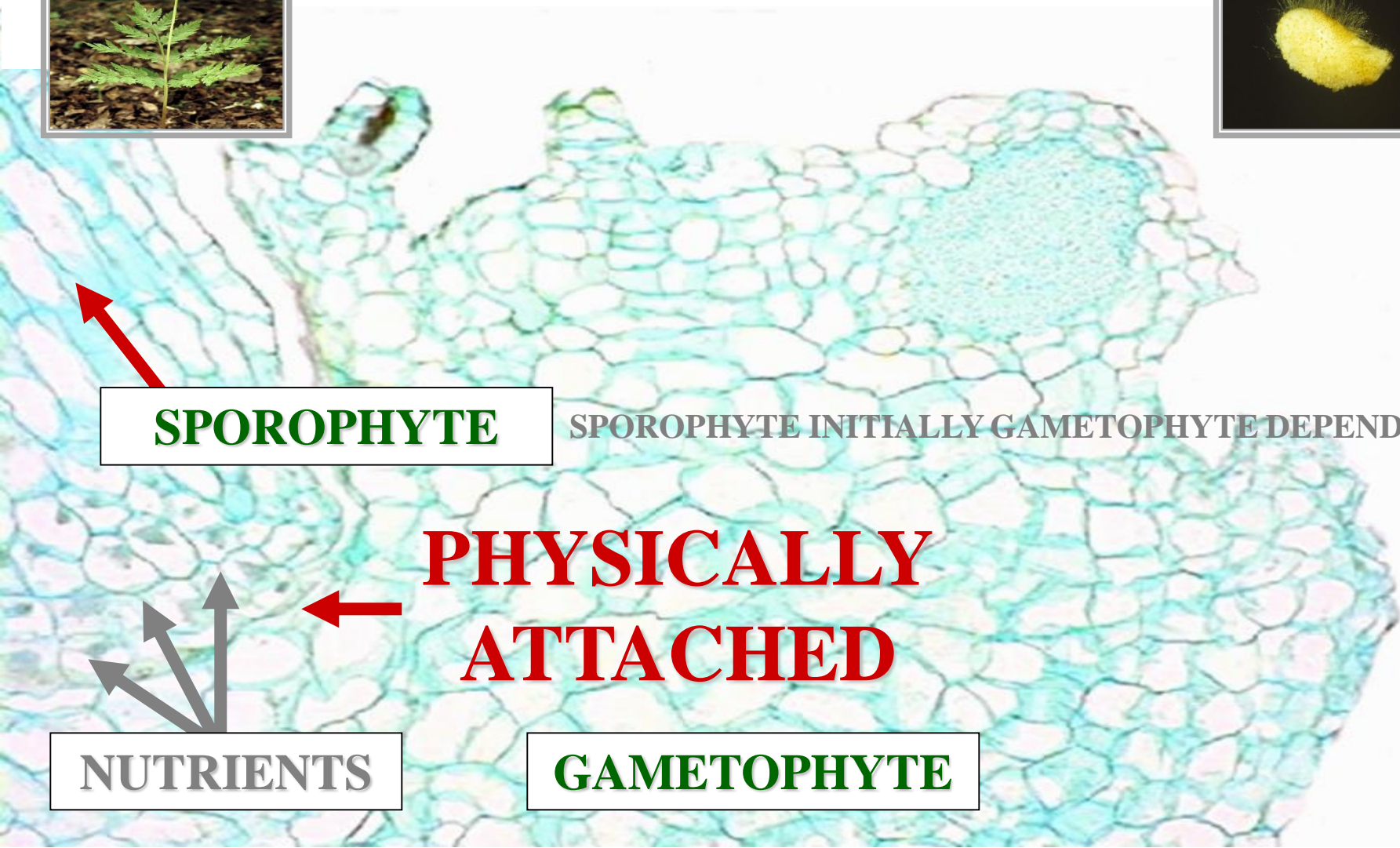
**SPOROPHYTE**

**GAMETOPHYTE**

***BOTRYCHIUM / GAMETOPHYTE / L. S.***

# VASCULAR PLANTS LABORATORY #5

AT



**SPOROPHYTE**

SPOROPHYTE INITIALLY GAMETOPHYTE DEPENDENT

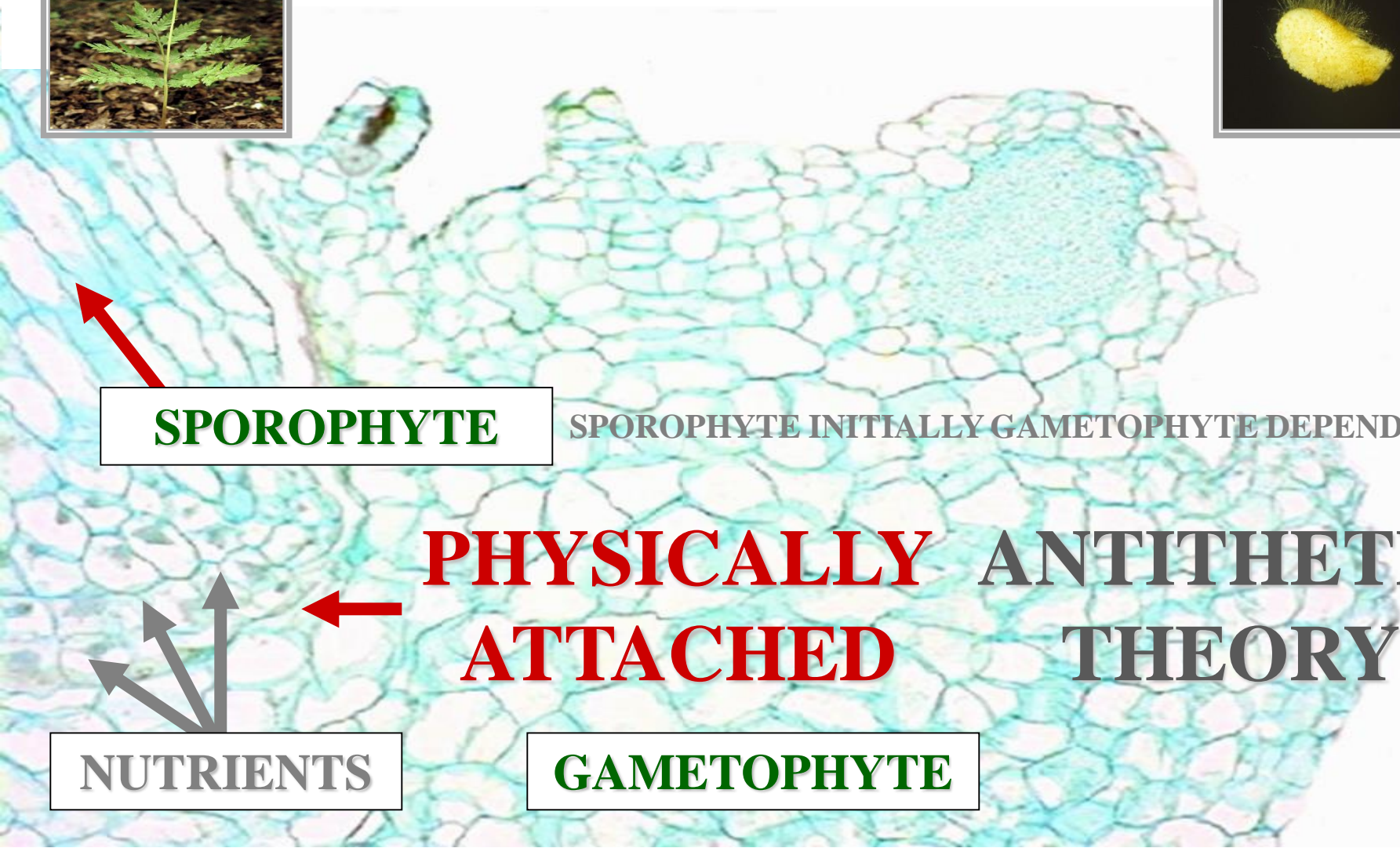
**PHYSICALLY  
ATTACHED**

**NUTRIENTS**

**GAMETOPHYTE**

***BOTRYCHIUM / GAMETOPHYTE / L. S.***

# VASCULAR PLANTS LABORATORY #5



**SPOROPHYTE**

SPOROPHYTE INITIALLY GAMETOPHYTE DEPENDENT

**PHYSICALLY ATTACHED** **ANTITHETIC THEORY**

**NUTRIENTS**

**GAMETOPHYTE**

***BOTRYCHIUM / GAMETOPHYTE / L. S.***

# VASCULAR PLANTS LABORATORY #5

?



**GAMETANGIUM**

**GAMETANGIUM**

**SPOROPHYTE**

SPOROPHYTE INITIALLY GAMETOPHYTE DEPENDENT

**PHYSICALLY ANTITHETIC  
ATTACHED THEORY**

**NUTRIENTS**

**GAMETOPHYTE**

***BOTRYCHIUM / GAMETOPHYTE / L. S.***



# VASCULAR PLANTS LABORATORY #5

A



**GAMETANGIUM**

?

**SPOROPHYTE**

SPOROPHYTE INITIALLY GAMETOPHYTE DEPENDENT

**PHYSICALLY ANTITHETIC  
ATTACHED THEORY**

**NUTRIENTS**

**GAMETOPHYTE**

***BOTRYCHIUM / GAMETOPHYTE / L. S.***

# VASCULAR PLANTS LABORATORY #5

?



**GAMETANGIUM**

**ANTHERIDIUM**

**SPOROPHYTE**

SPOROPHYTE INITIALLY GAMETOPHYTE DEPENDENT

**PHYSICALLY ATTACHED** **ANTITHETIC THEORY**

**NUTRIENTS**

**GAMETOPHYTE**

***BOTRYCHIUM / GAMETOPHYTE / L. S.***

# VASCULAR PLANTS LABORATORY #5

S



GAMETANGIUM

ANTHERIDIUM

?

SPOROPHYTE

SPOROPHYTE INITIALLY GAMETOPHYTE DEPENDENT

PHYSICALLY ANTITHETIC  
ATTACHED THEORY

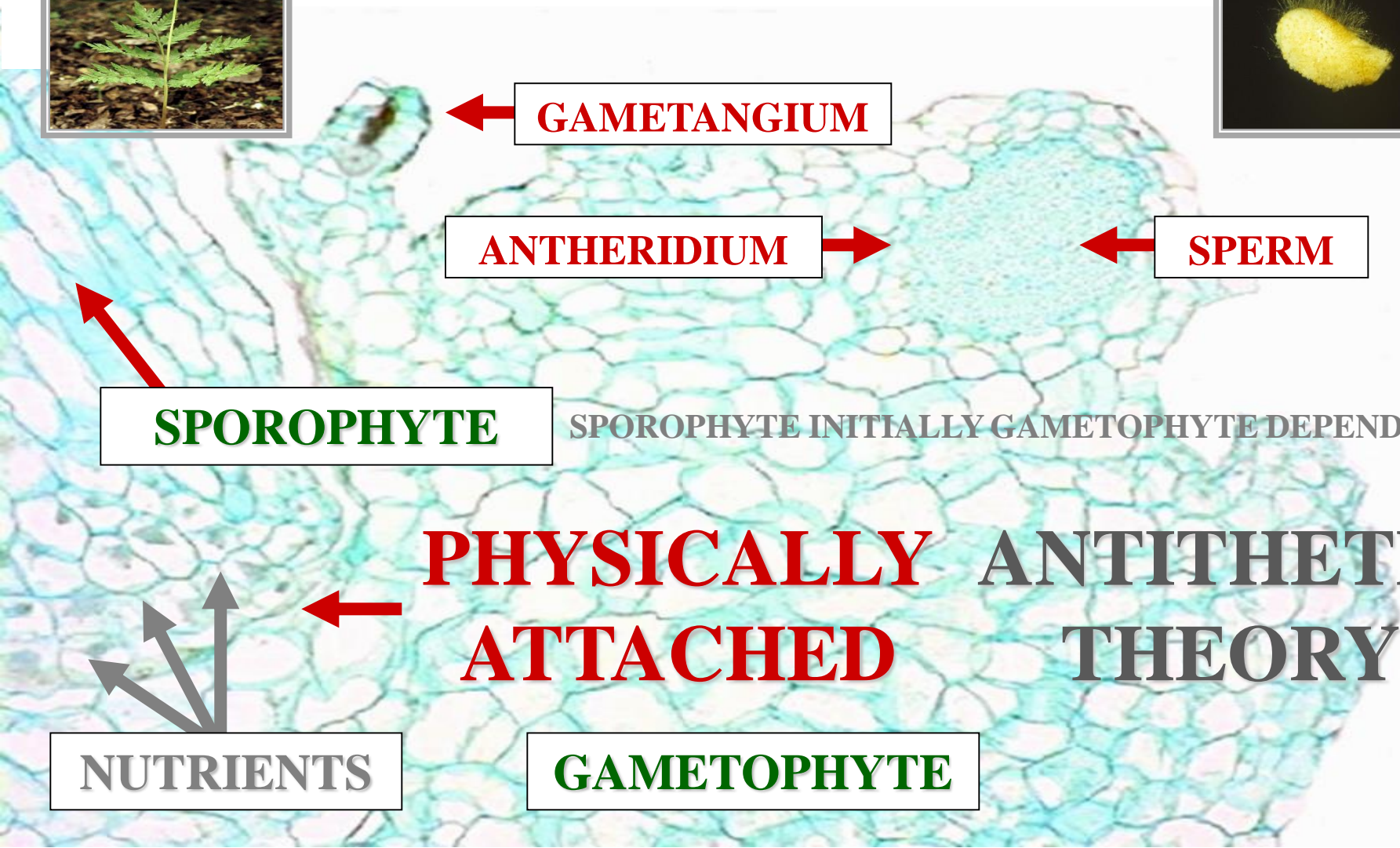
NUTRIENTS

GAMETOPHYTE

*BOTRYCHIUM* / GAMETOPHYTE / L. S.

# VASCULAR PLANTS LABORATORY #5

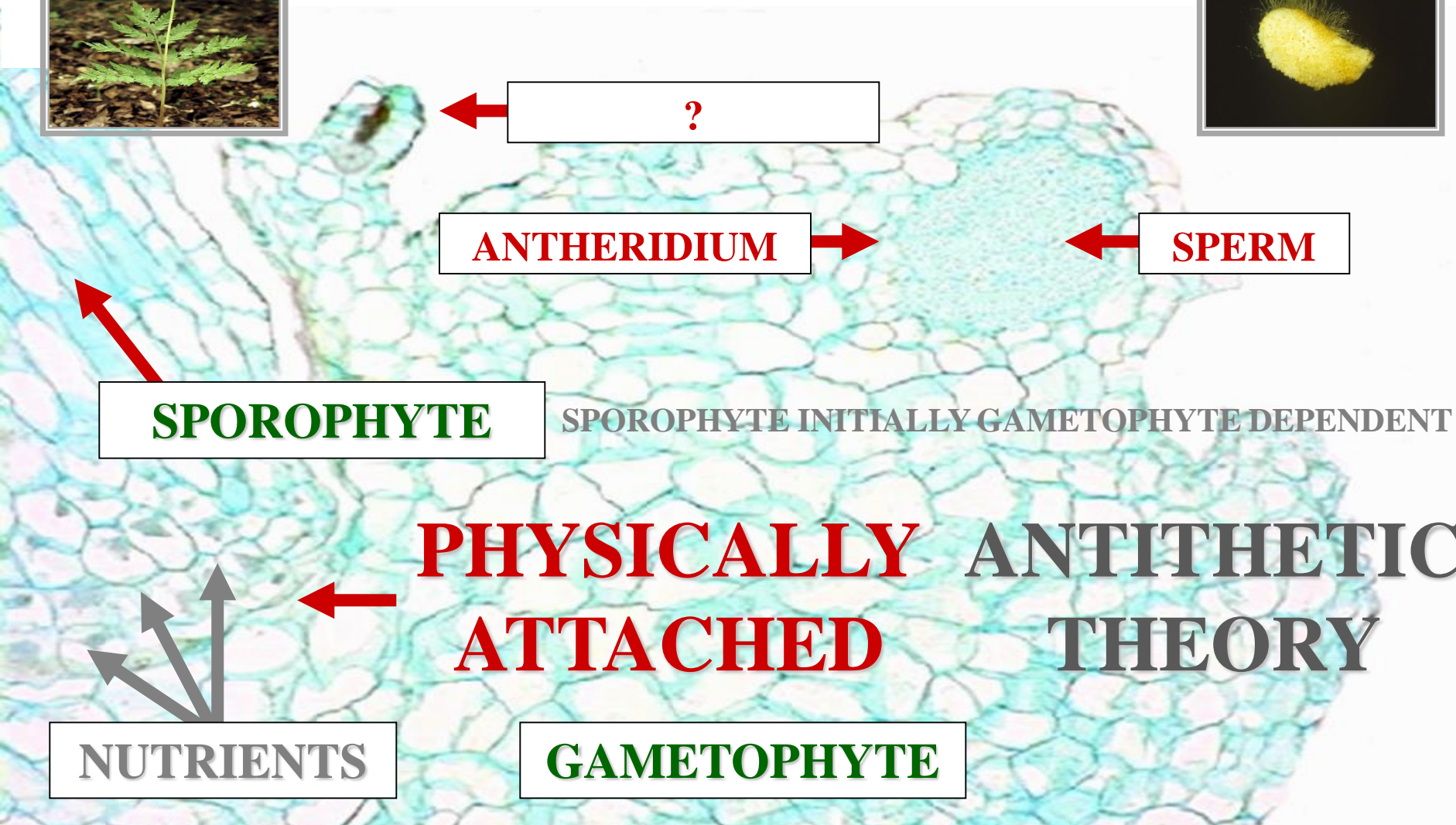
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*BOTRYCHIUM / GAMETOPHYTE / L. S.*

# VASCULAR PLANTS LABORATORY #5

A



**SPOROPHYTE**

**ANTHERIDIUM**

**SPERM**

**?**

SPOROPHYTE INITIALLY GAMETOPHYTE DEPENDENT

**PHYSICALLY ATTACHED** **ANTITHETIC THEORY**

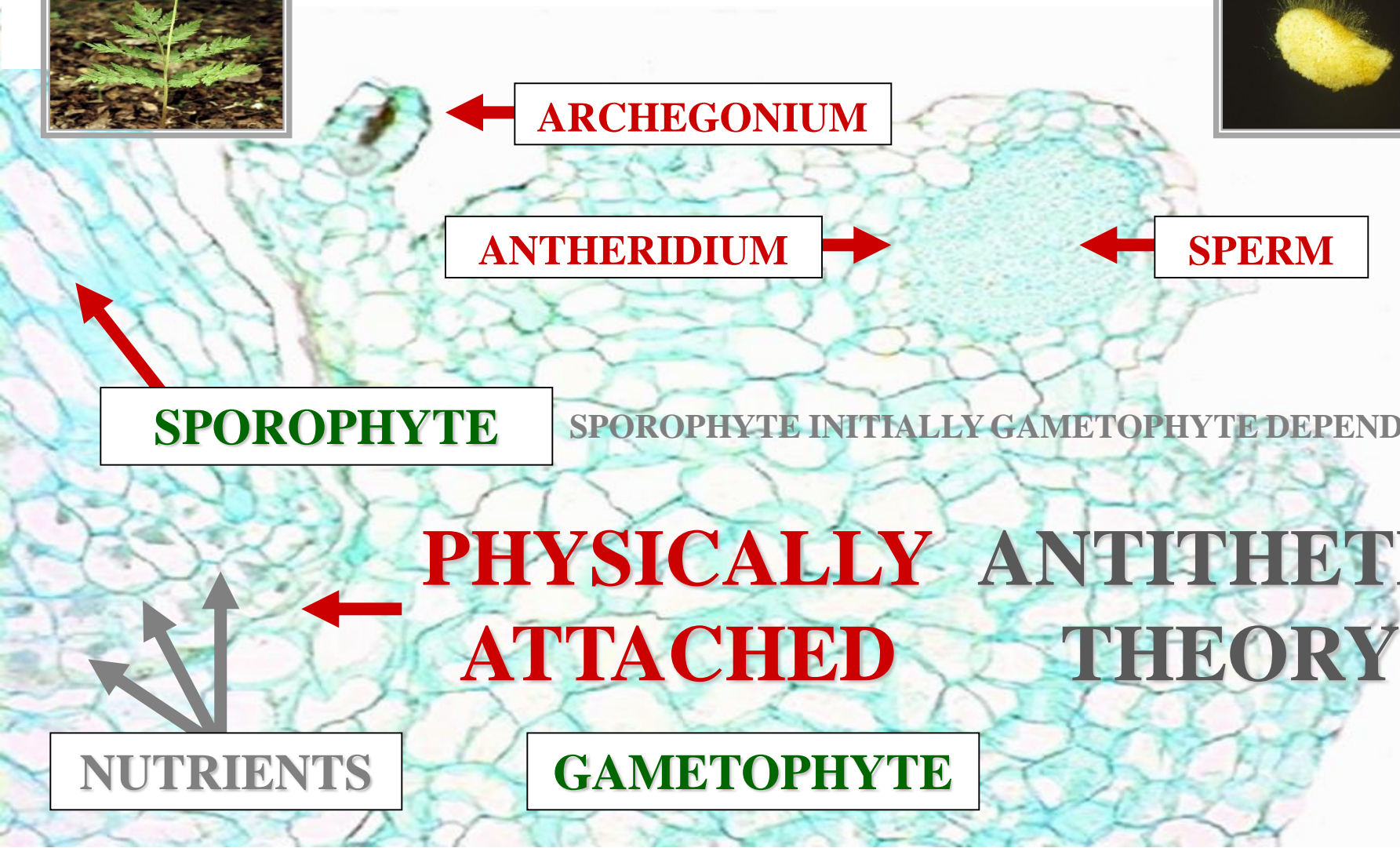
**NUTRIENTS**

**GAMETOPHYTE**

***BOTRYCHIUM / GAMETOPHYTE / L. S.***

# VASCULAR PLANTS LABORATORY #5

?



SPOROPHYTE INITIALLY GAMETOPHYTE DEPENDENT

**PHYSICALLY ATTACHED** **ANTITHETIC THEORY**

*BOTRYCHIUM / GAMETOPHYTE / L. S.*

# VASCULAR PLANTS LABORATORY #5

E



← **ARCHEGONIUM**

**ANTHERIDIUM** →

← **SPERM**

?

**SPOROPHYTE**

SPOROPHYTE INITIALLY GAMETOPHYTE DEPENDENT

**PHYSICALLY ATTACHED**      **ANTITHETIC THEORY**

← **NUTRIENTS**

**GAMETOPHYTE**

***BOTRYCHIUM / GAMETOPHYTE / L. S.***

# VASCULAR PLANTS LABORATORY #5



**ARCHEGONIUM**

**EGG**

**ANTHERIDIUM**

**SPERM**

**SPOROPHYTE**

SPOROPHYTE INITIALLY GAMETOPHYTE DEPENDENT

**PHYSICALLY ATTACHED**      **ANTITHETIC THEORY**

**NUTRIENTS**

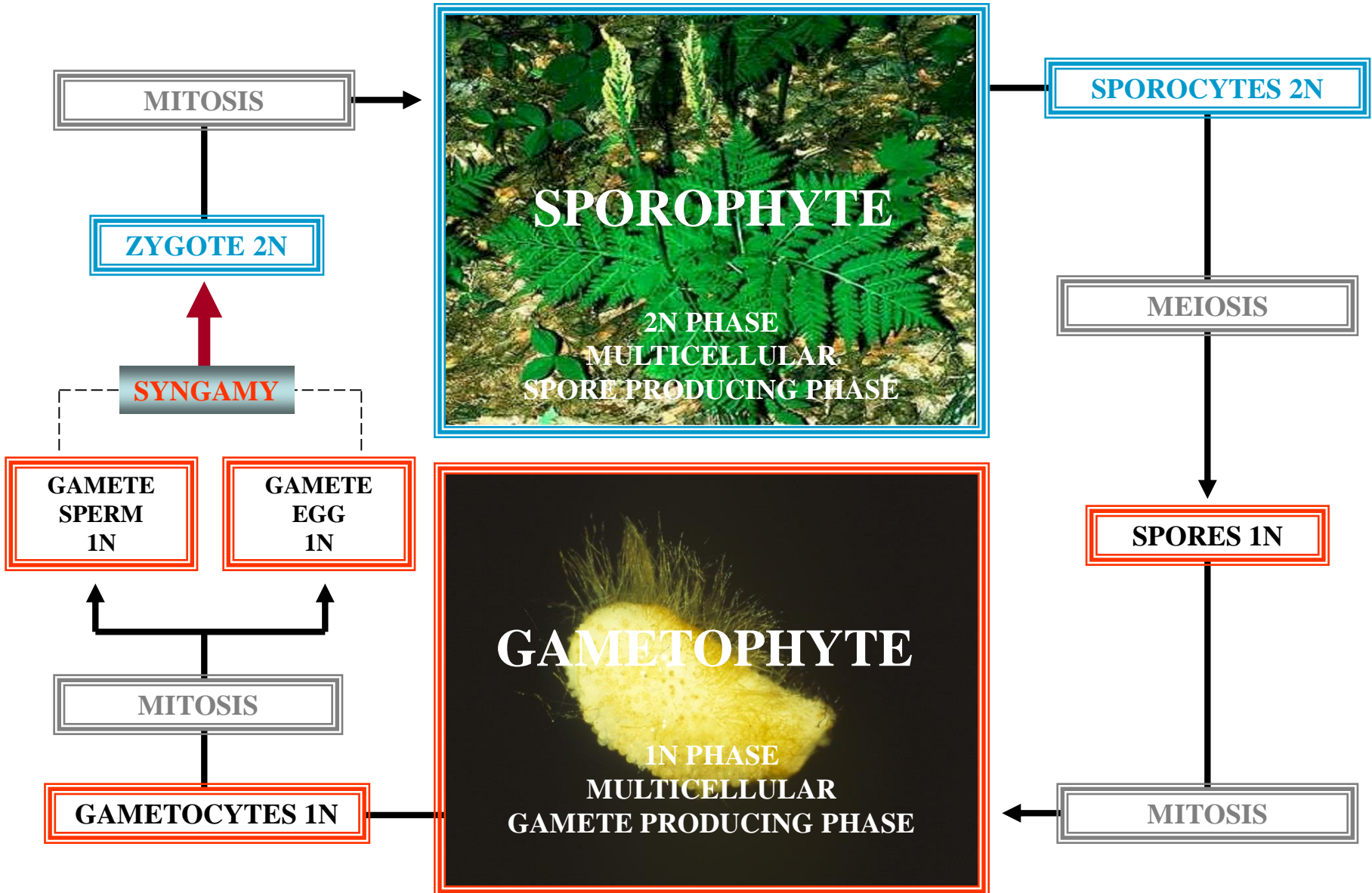
**GAMETOPHYTE**

***BOTRYCHIUM / GAMETOPHYTE / L. S.***



# OPHIOGLOSSALES

## LIFE CYCLE

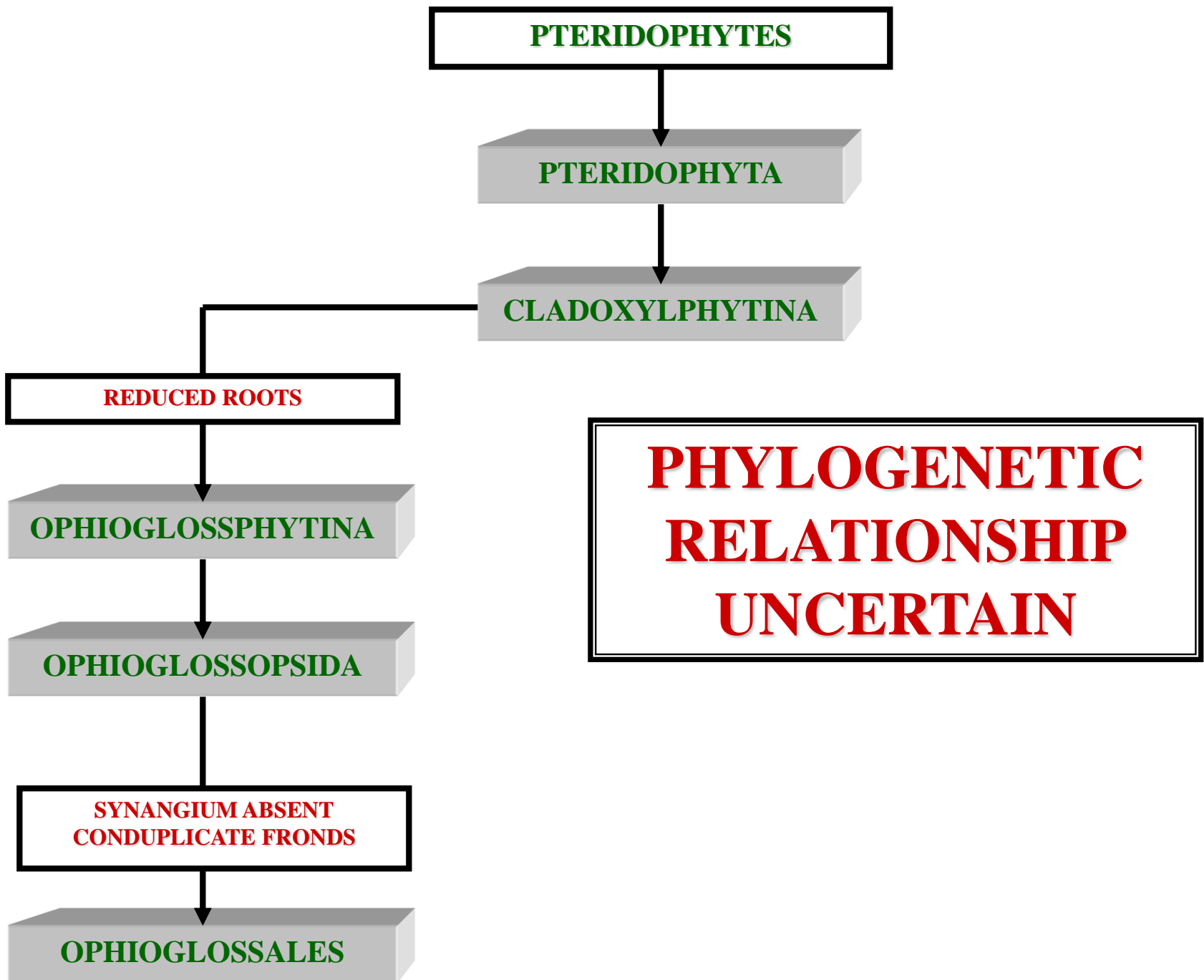


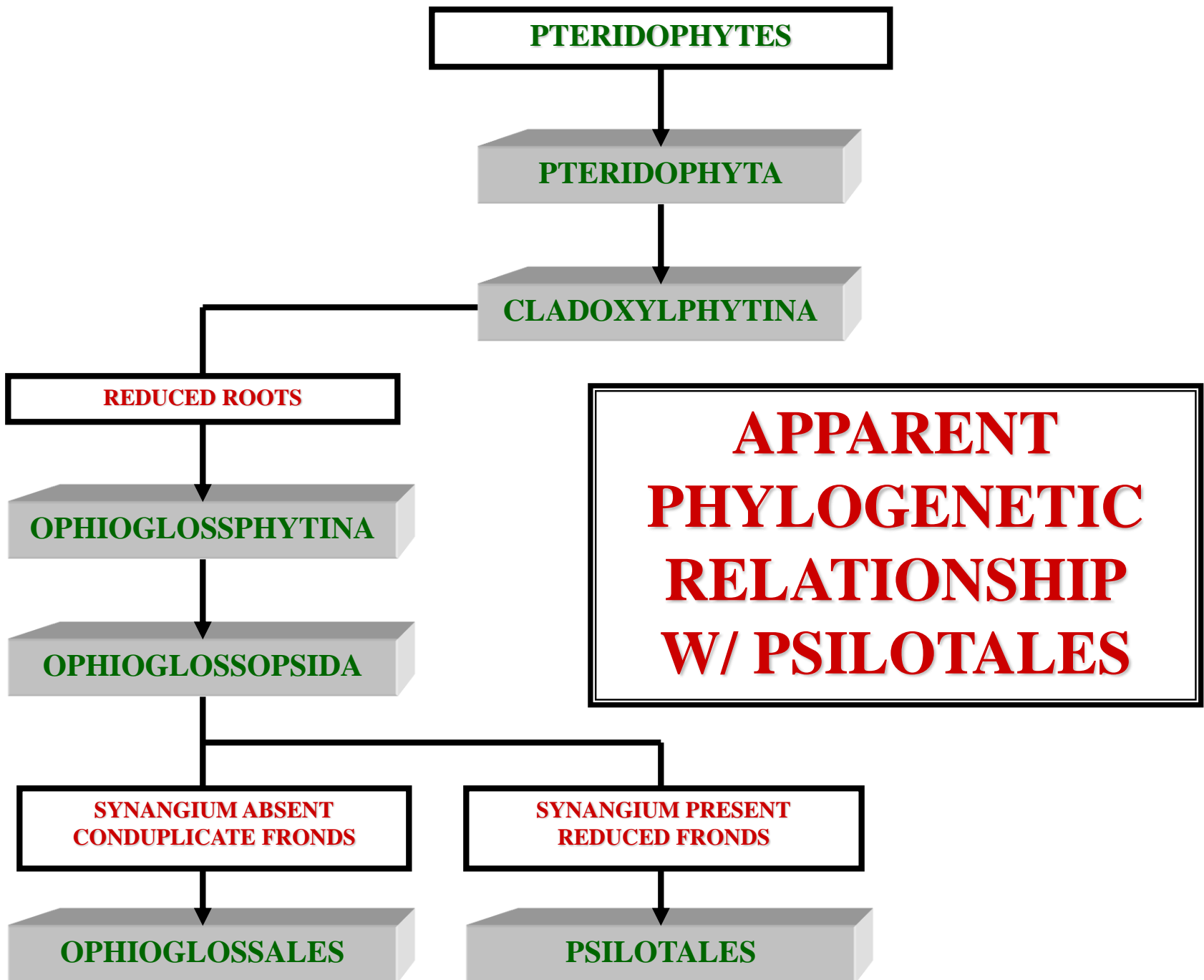
# FOSSIL RECORD



# FOSSIL RECORD LIMITED

# PHYLOGENETIC RELATIONSHIP





EXTANT  
ORDER


PSILOTALES

EXTANT  
ORDER



**PSILOTALES  
RECENTLY  
RECOGNIZED  
FERNS**





**PSILOTALES**  
**PREVIOUSLY**  
**ASSIGNED**  
**OWN PHYLUM**  
**PSILOTOPHYTA**

# SYNONYM



# PSILOTOPHYTA



# COMMON NAMES

A composite image showing two different types of green algae. The left side features several thin, upright, branching stems with small, yellowish-green, bead-like structures. The right side shows a more complex, bushy structure with numerous small, green, leaf-like branches and clusters of small, brownish, spherical structures. A central white banner with a black border contains the text 'PSILOPHYTES' in green, serif, all-caps font.

# PSILOPHYTES

The image is a composite of four photographs. The top-left and bottom-left photos show thin, green, upright stems of whisk ferns with small, yellowish-green buds. The top-right and bottom-right photos show a different variety of whisk fern with broader, green, pinnate leaves and small, reddish-brown buds. A central white banner with a black border contains the text 'WHISK FERNS' in a green, serif font.

# WHISK FERNS





*PSILOTUM*



**WHISK  
BROOM**





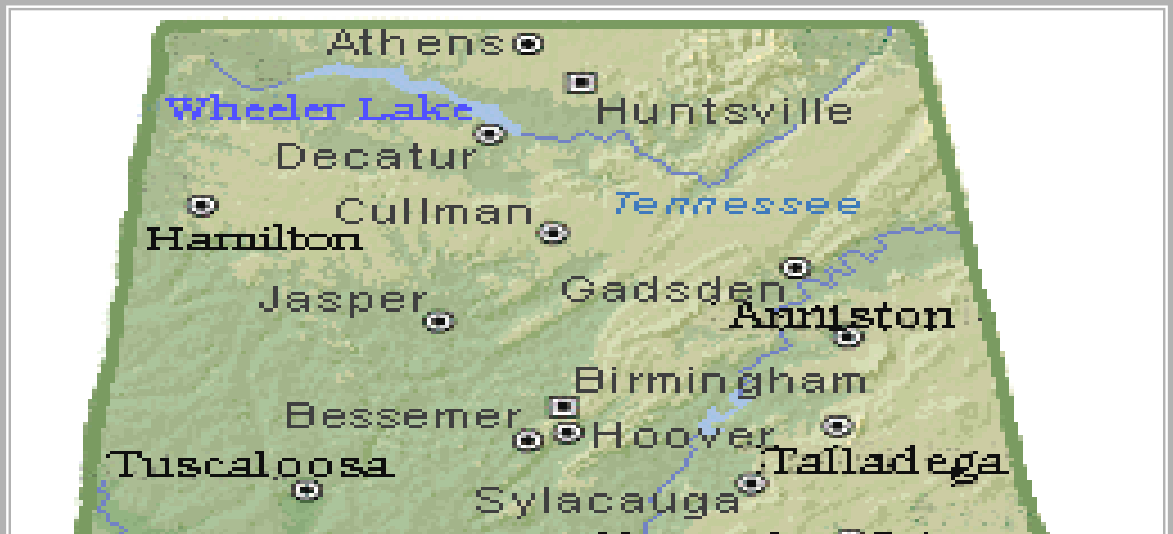
# DIVERSITY





**~12 SPECIES**

**EARTH**



# 1 SPECIES





# REPRESENTATIVE GENERA



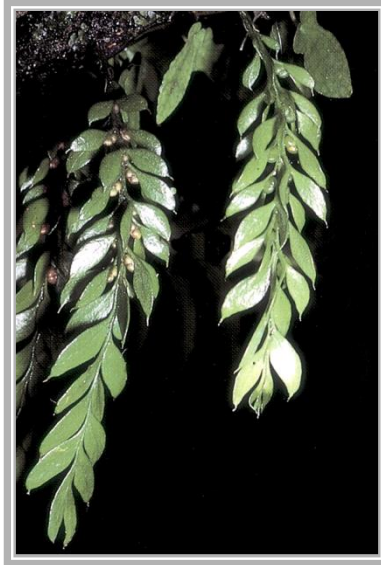
*PSILOTUM*



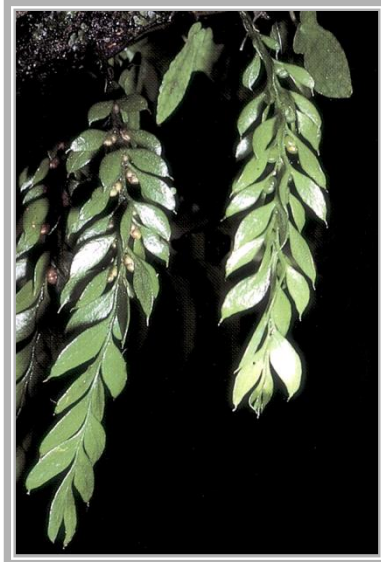
*TMESIPTERIS*



# DISTRIBUTION & HABITAT

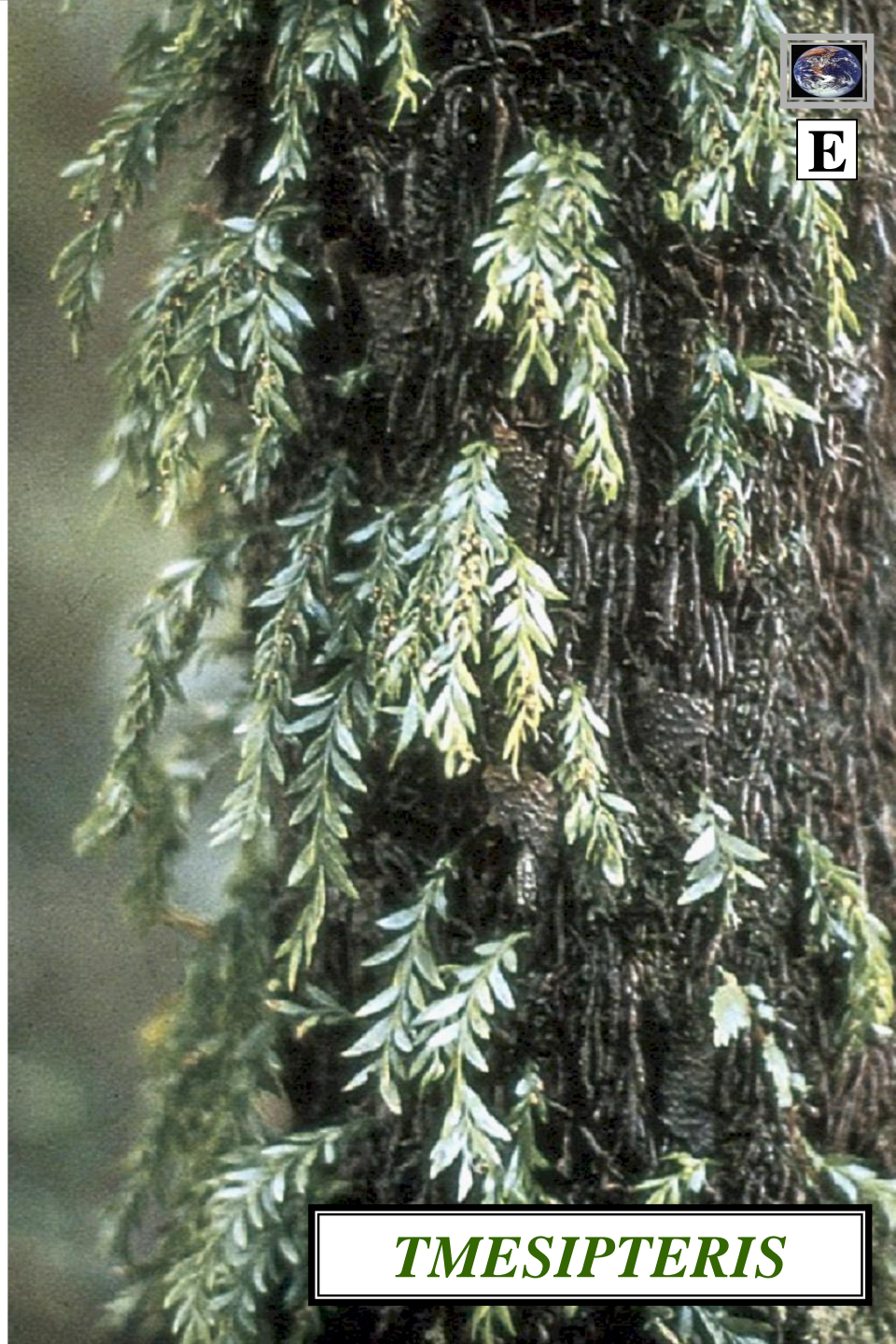


# ***TMESIPTERIS***





***TMESIPTERIS***



**E**

***TMESIPTERIS***



# **ENDEMIC SOUTH PACIFIC**

**EARTH**



# ENDEMIC SOUTH PACIFIC



Northern  
Marianas

Asia

Philippines

Micronesia

Pacific Ocean

Indonesia

Papua New  
Guinea

Solomon  
Islands

*TMESIPTERIS*

Vanuatu

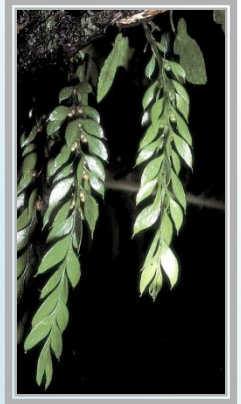
Fiji Islands

New Caledonia

Australia

New Zealand

**E**



**ENDEMIC**



**ENDEMIC**

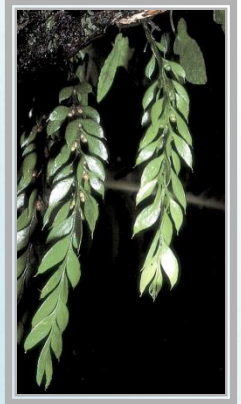
**GEOGRAPHICALLY  
RESTRICTED**

**ENDEMIC**

# SOUTH PACIFIC REGION



*TMESIPTERIS*

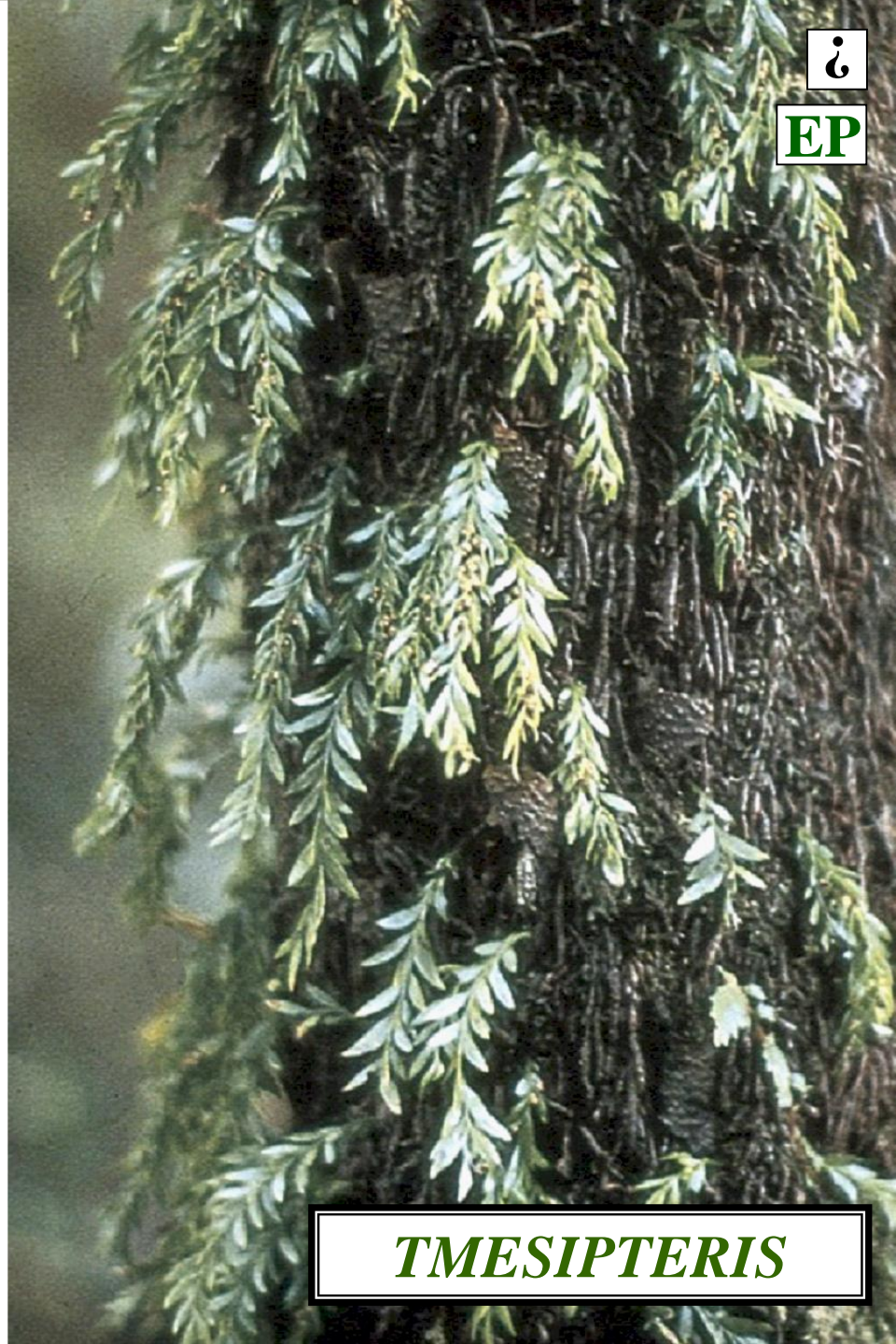




**TROPICAL RAINFOREST**



***TMESIPTERIS***



***TMESIPTERIS***

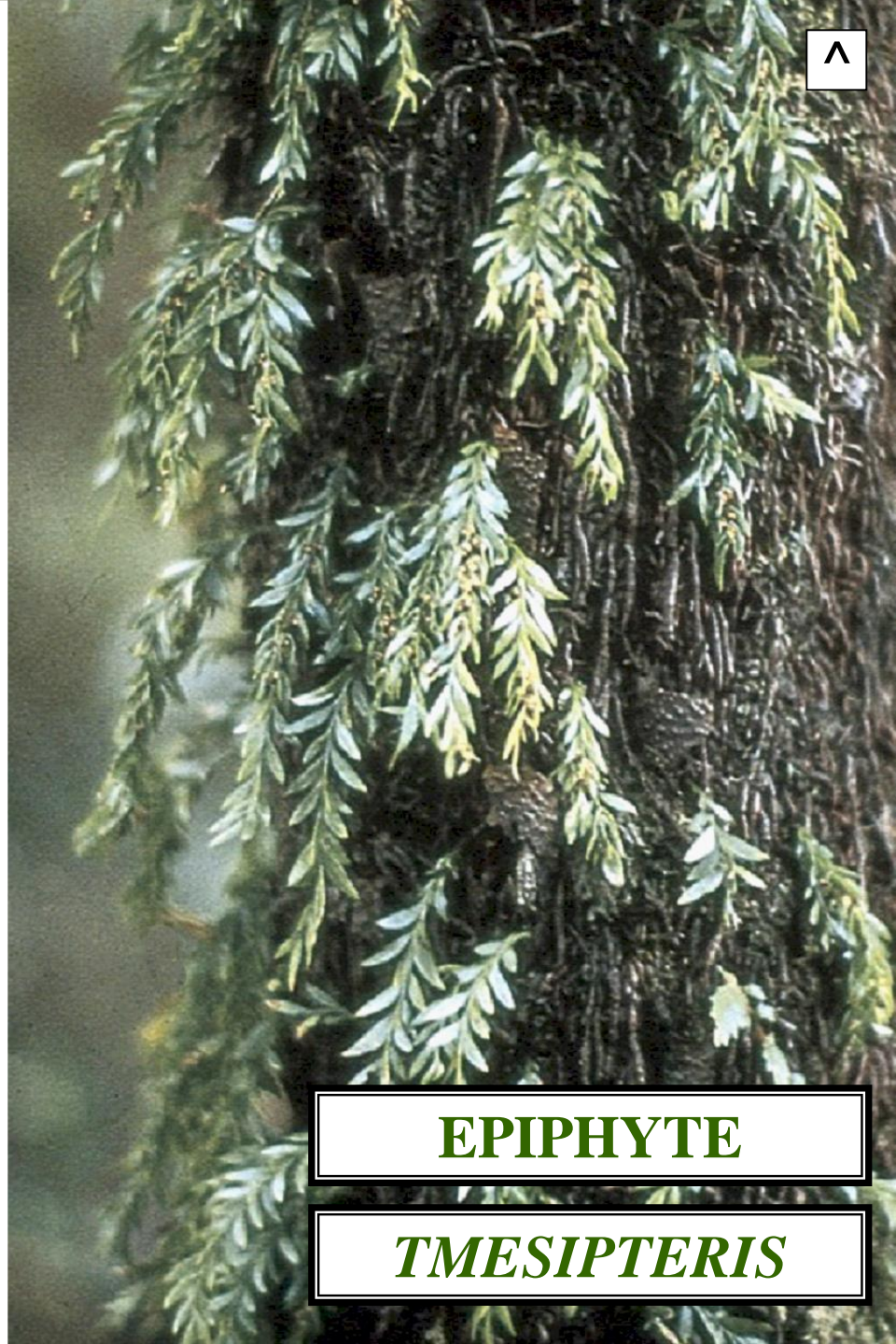
?

**EP**



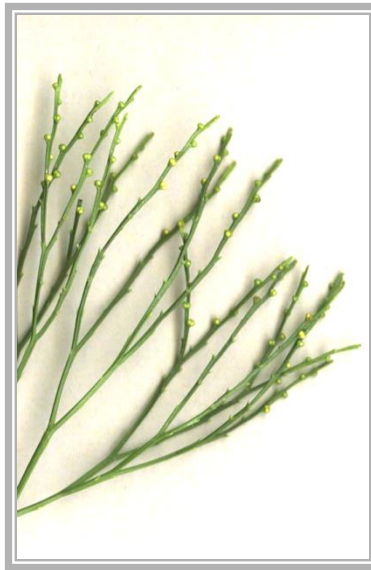
**EPIPHYTE**

***TMESIPTERIS***

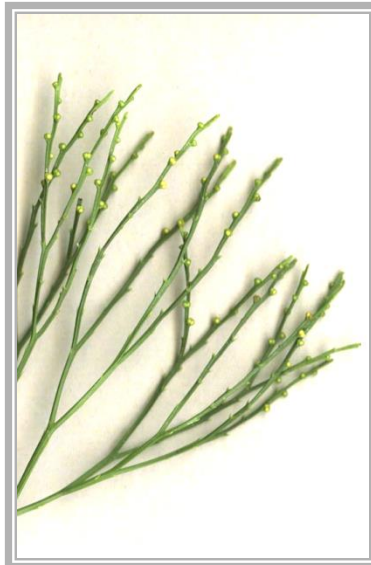


**EPIPHYTE**

***TMESIPTERIS***



# ***PSILOTUM***







*PSILOTUM*

**TROPICAL**

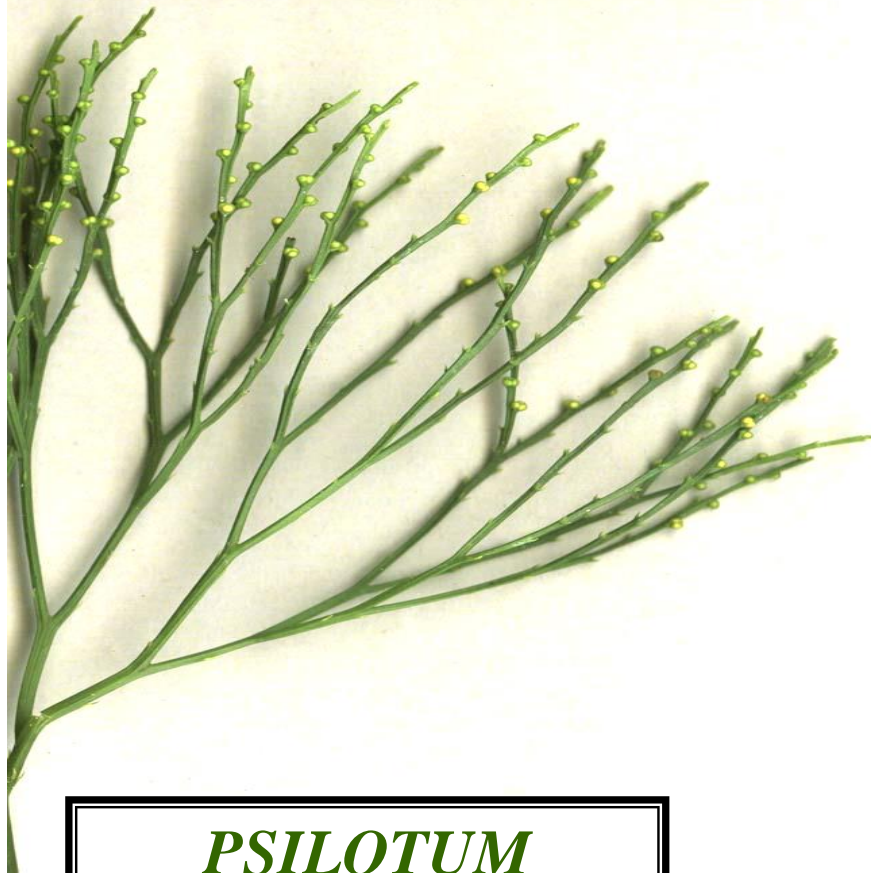
**EARTH**



**WARM TEMPERATE**

**EARTH**

*PSILOTUM*  
**INDIGENOUS  
ALABAMA**



*PSILOTUM*



**INDIGENOUS**



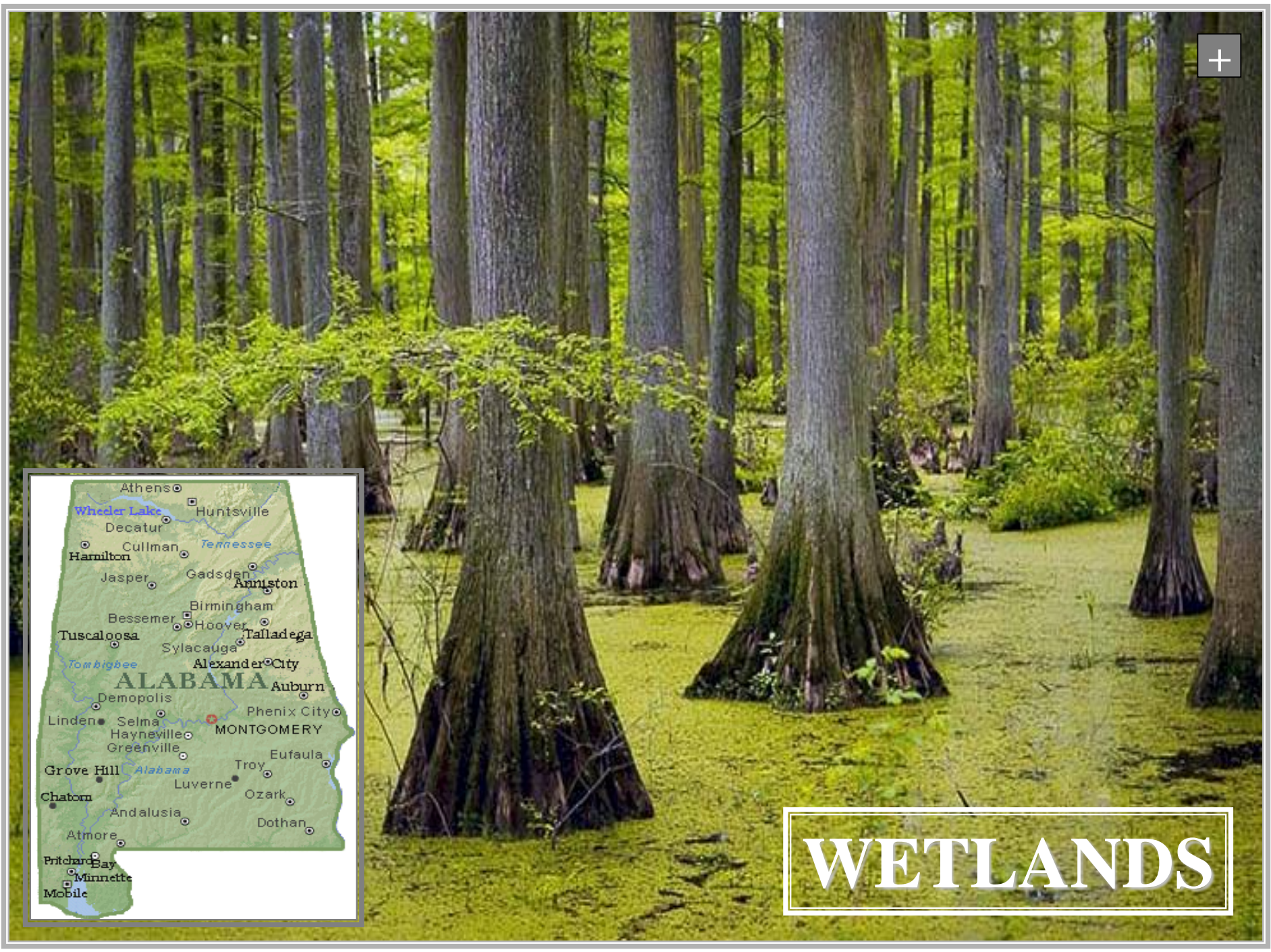
**INDIGENOUS**

**GEOGRAPHICALLY  
NATIVE**

**INDIGENOUS**



# WETLANDS





**NON-EPIPHYTE**

***PSILOTUM***

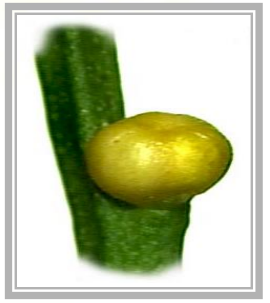




# GENERAL CHARACTERS



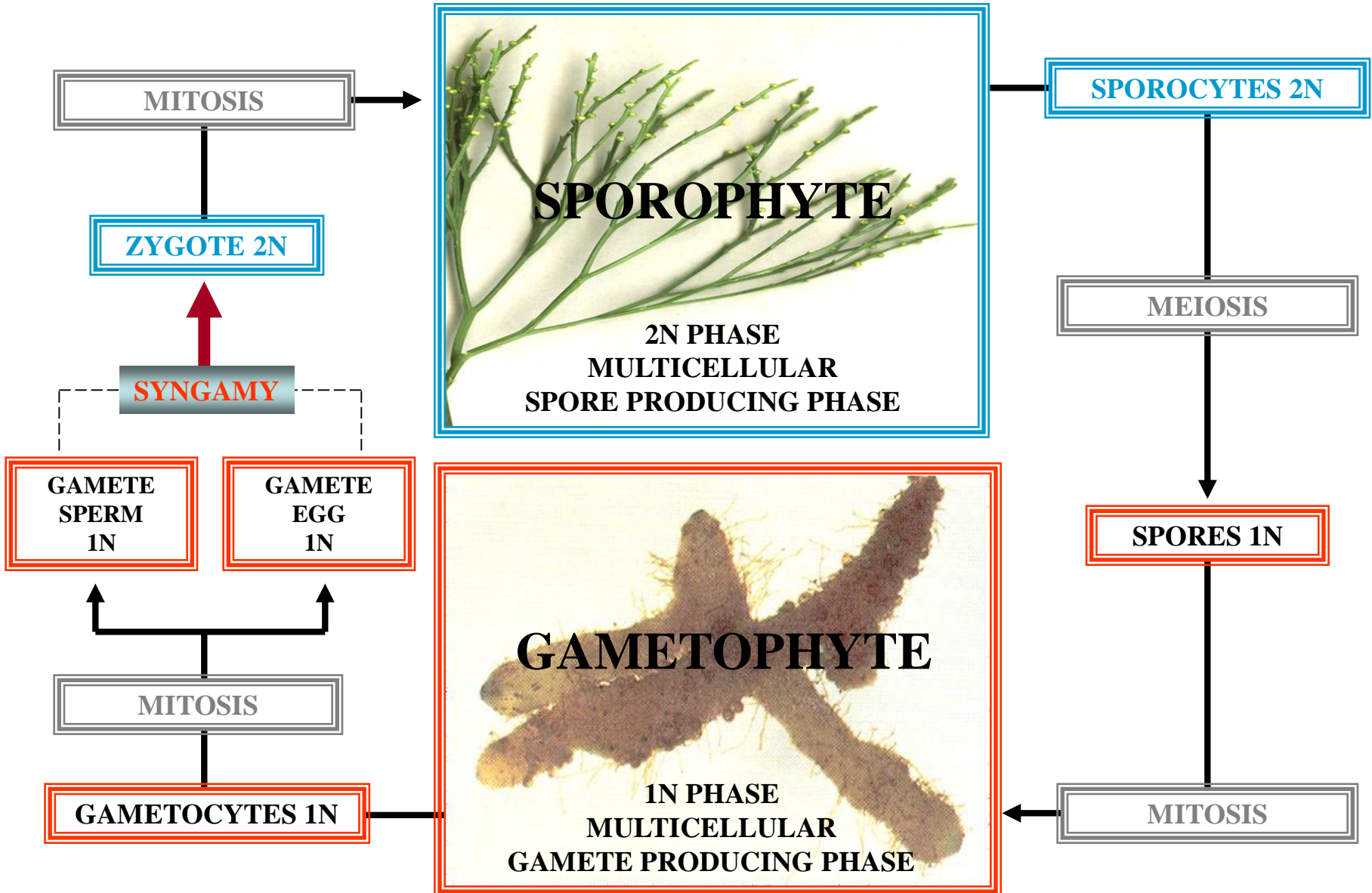
*PSILOTUM*  
CHARACTERIZE  
PSILOTALES



*PSILOTUM*



# PSILOTALES LIFE CYCLE





# SPOROPHYTE CHARACTERS



# MORPHOLOGY



**HR**

**MORPHOLOGY**

*PSILOTUM*

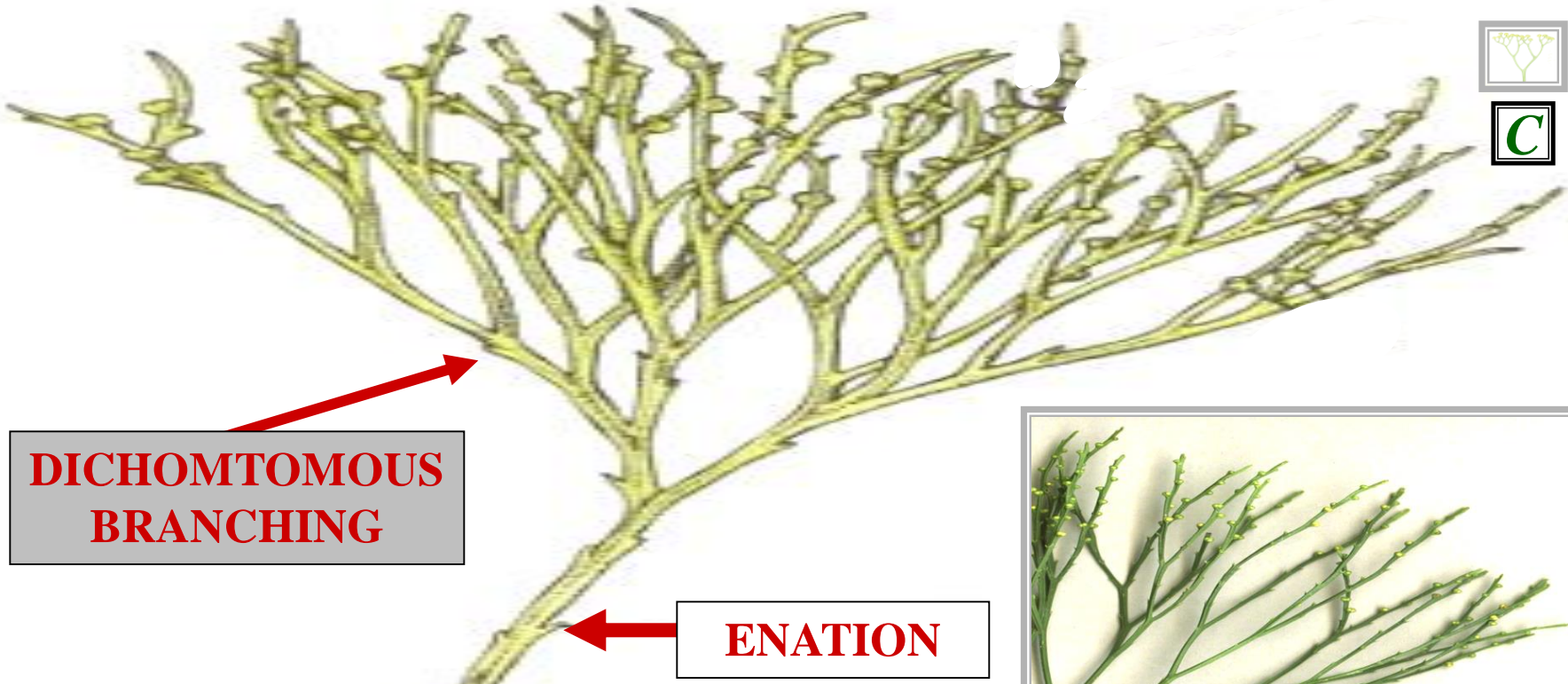


**HIGHLY REDUCED  
MORPHOLOGY**

*PSILOTUM*



C



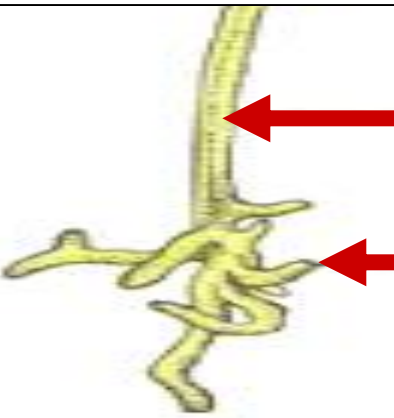
**DICHOTOMOUS BRANCHING**

**ENATION**

**HIGHLY REDUCED MORPHOLOGY**



*PSILOTUM*



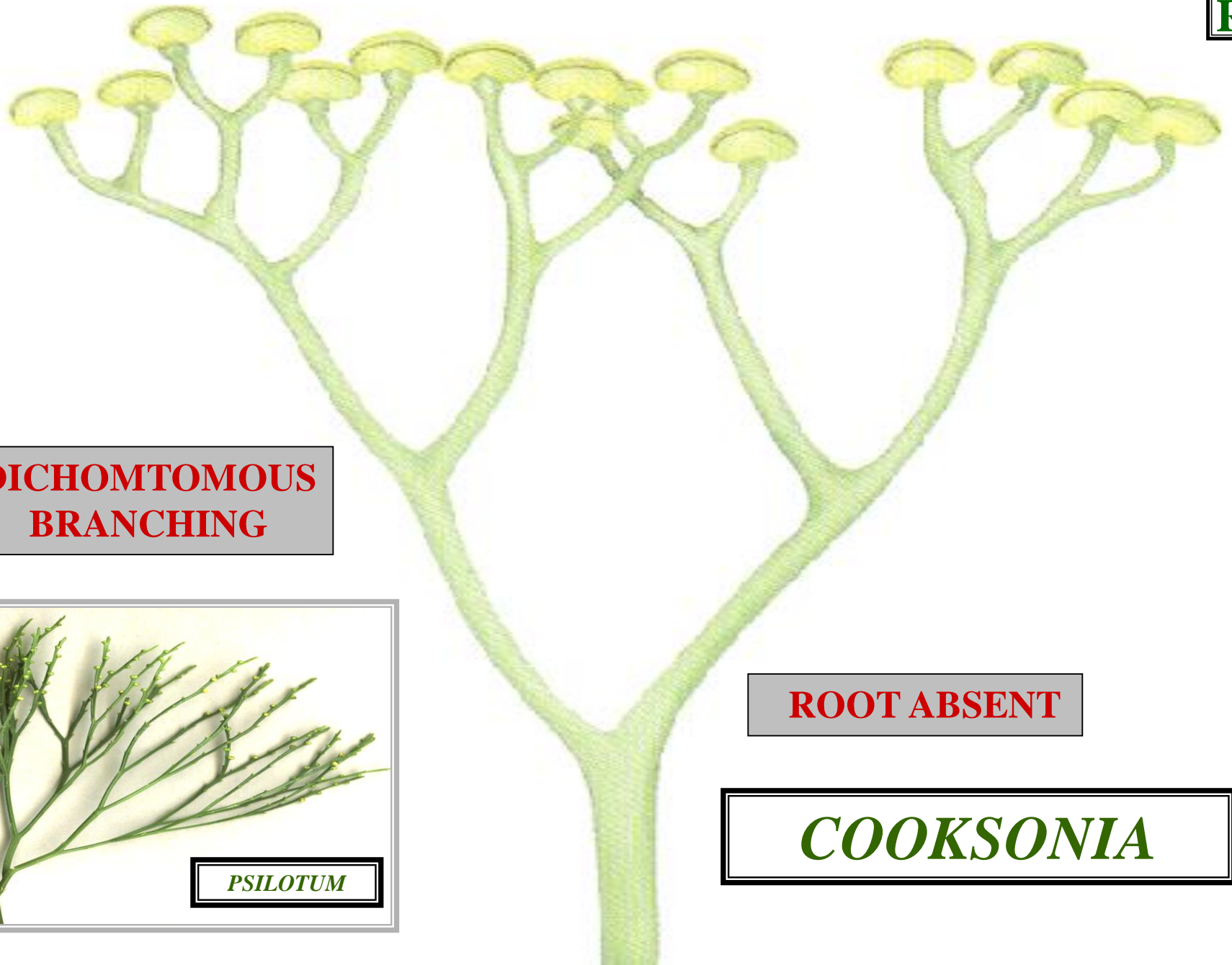
**AERIAL STEM**

**RHIZOME**

**ROOT ABSENT**

*PSILOTUM*





**DICHOTOMOUS  
BRANCHING**

**ROOT ABSENT**

***COOKSONIA***



***PSILOTUM***

# RHYNIOPHYTA



*PSILOTUM*

*COOKSONIA*



P

+

**HIGHLY REDUCED  
FERN**

*PSILOTUM*



# PTERIDOPHYTA

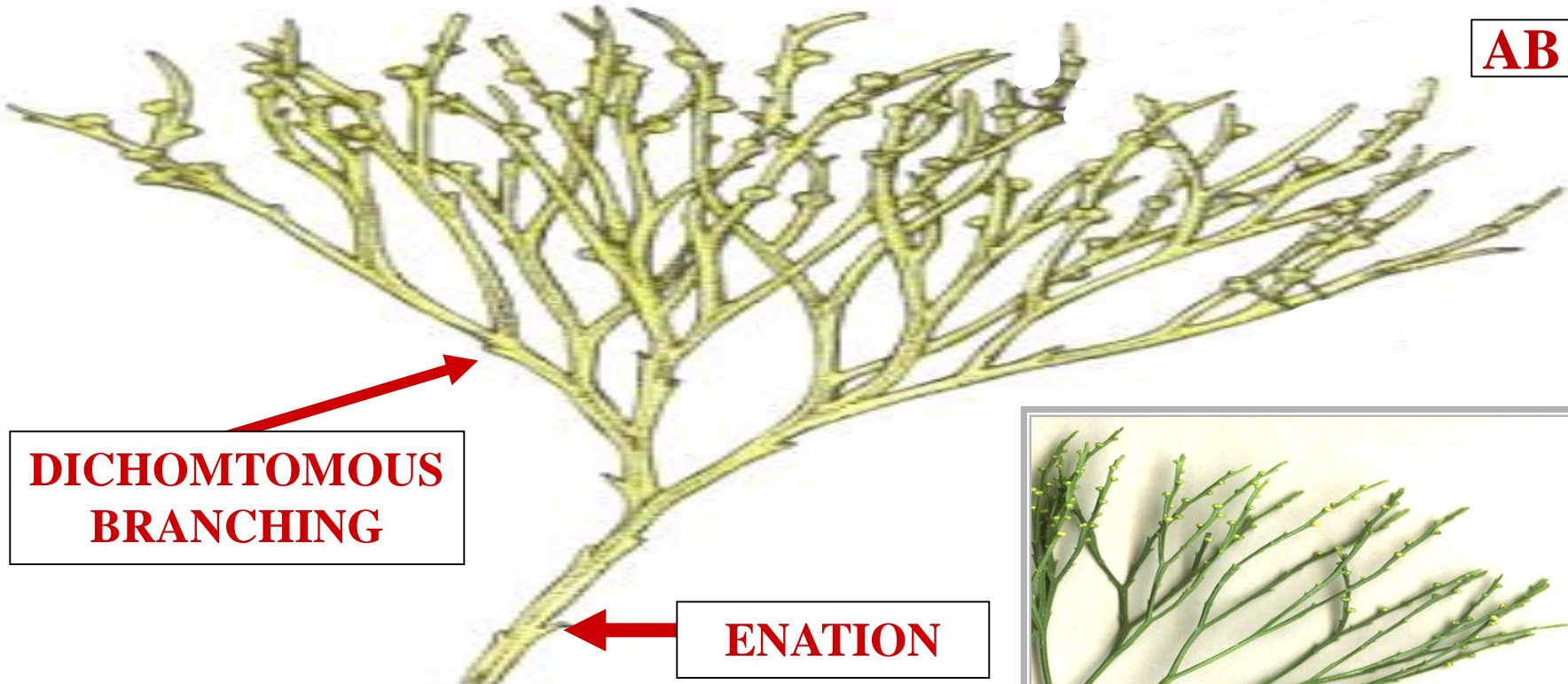
**HIGHLY REDUCED  
FERN**

*PSILOTUM*



**ROOT**

**AB**



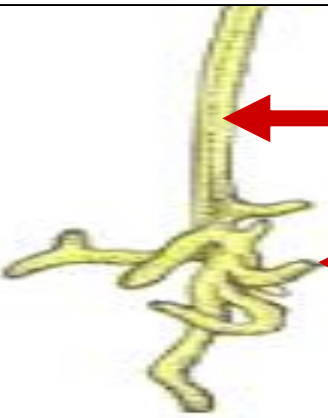
**DICHOTOMOUS  
BRANCHING**

**ENATION**

**HIGHLY REDUCED  
MORPHOLOGY**



*PSILOTUM*

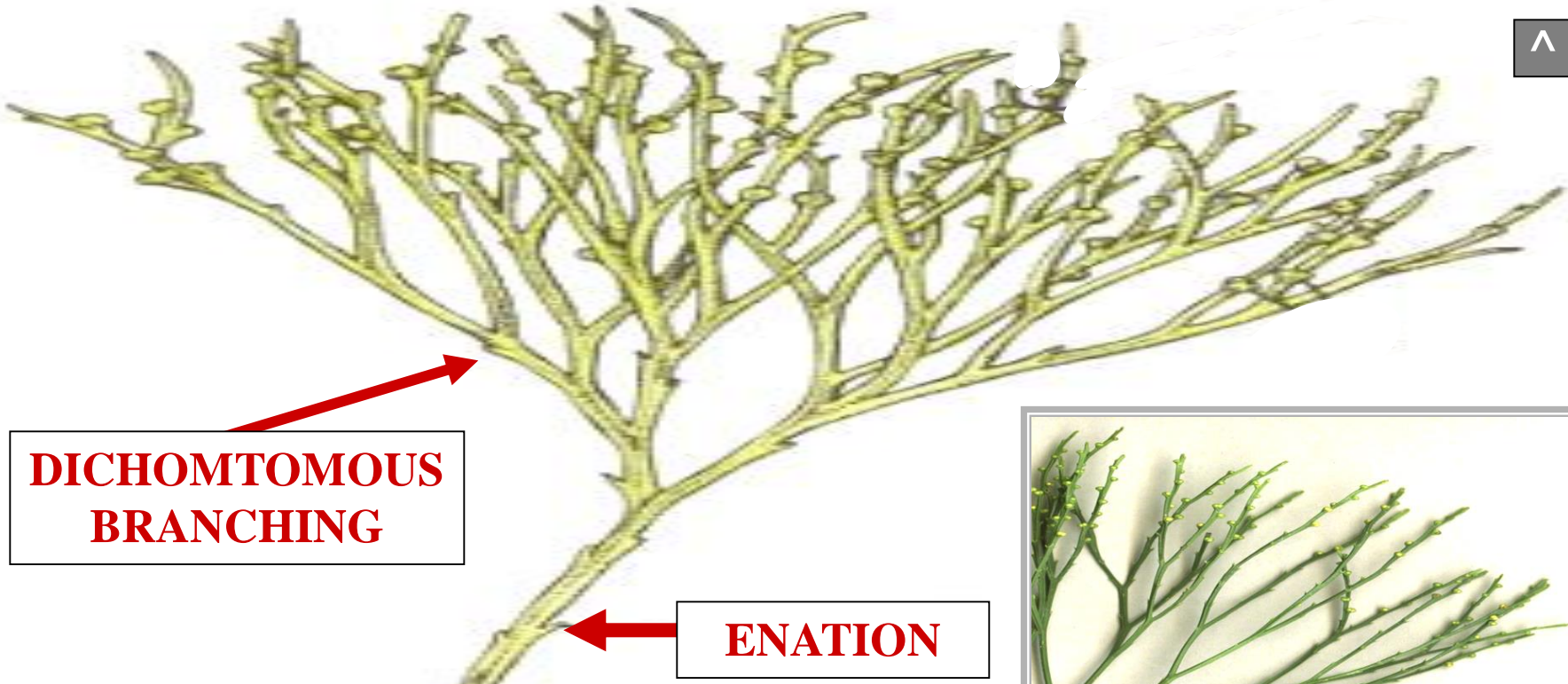


**AERIAL  
STEM**

**RHIZOME**

**TRUE ROOT**

*PSILOTUM*



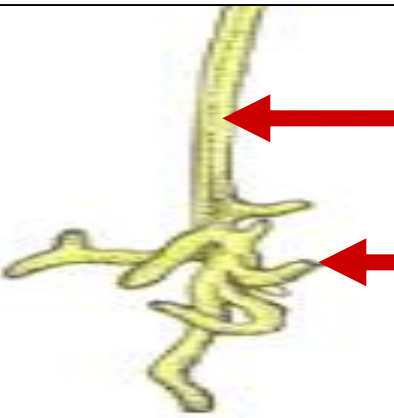
**DICHOTOMOUS  
BRANCHING**

**ENATION**

**HIGHLY REDUCED  
MORPHOLOGY**



*PSILOTUM*



**AERIAL  
STEM**

**RHIZOME**

**TRUE ROOT: ABSENT  
LOST VIA REDUCTION**

*PSILOTUM*



**STEM**



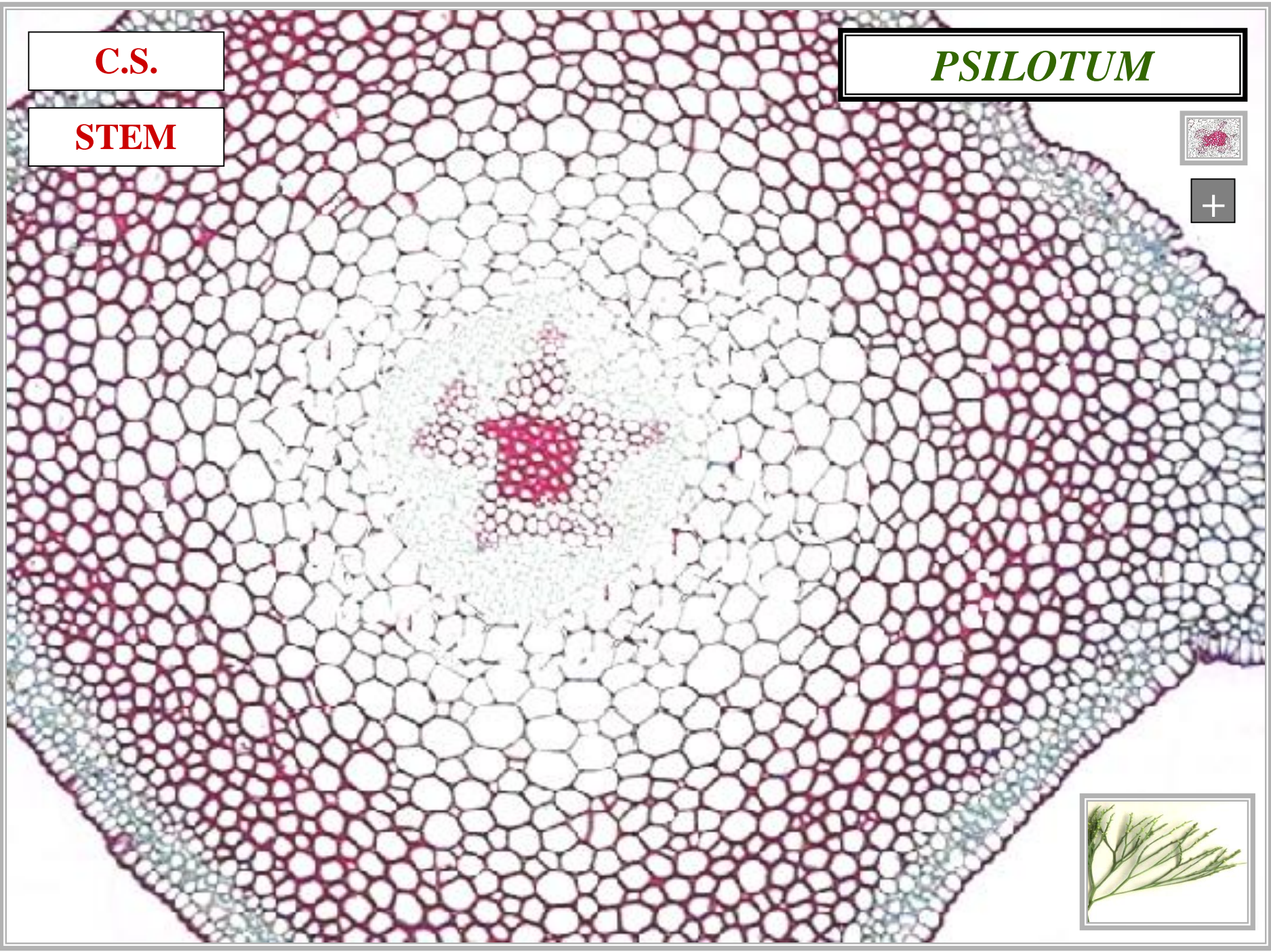


# STEM STELE

**C.S.**

**STEM**

***PSILOTUM***

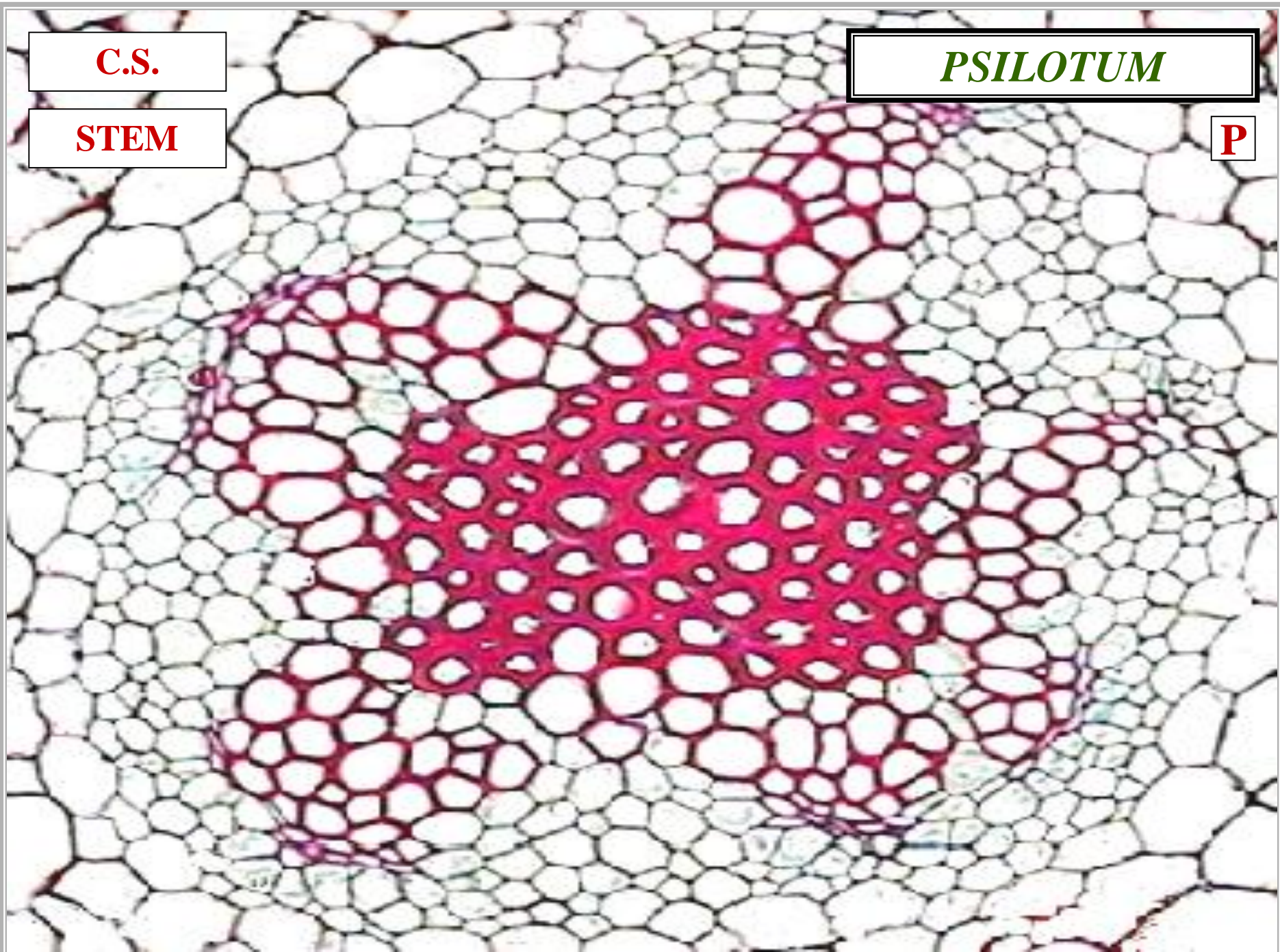


**C.S.**

**STEM**

***PSILOTUM***

**P**



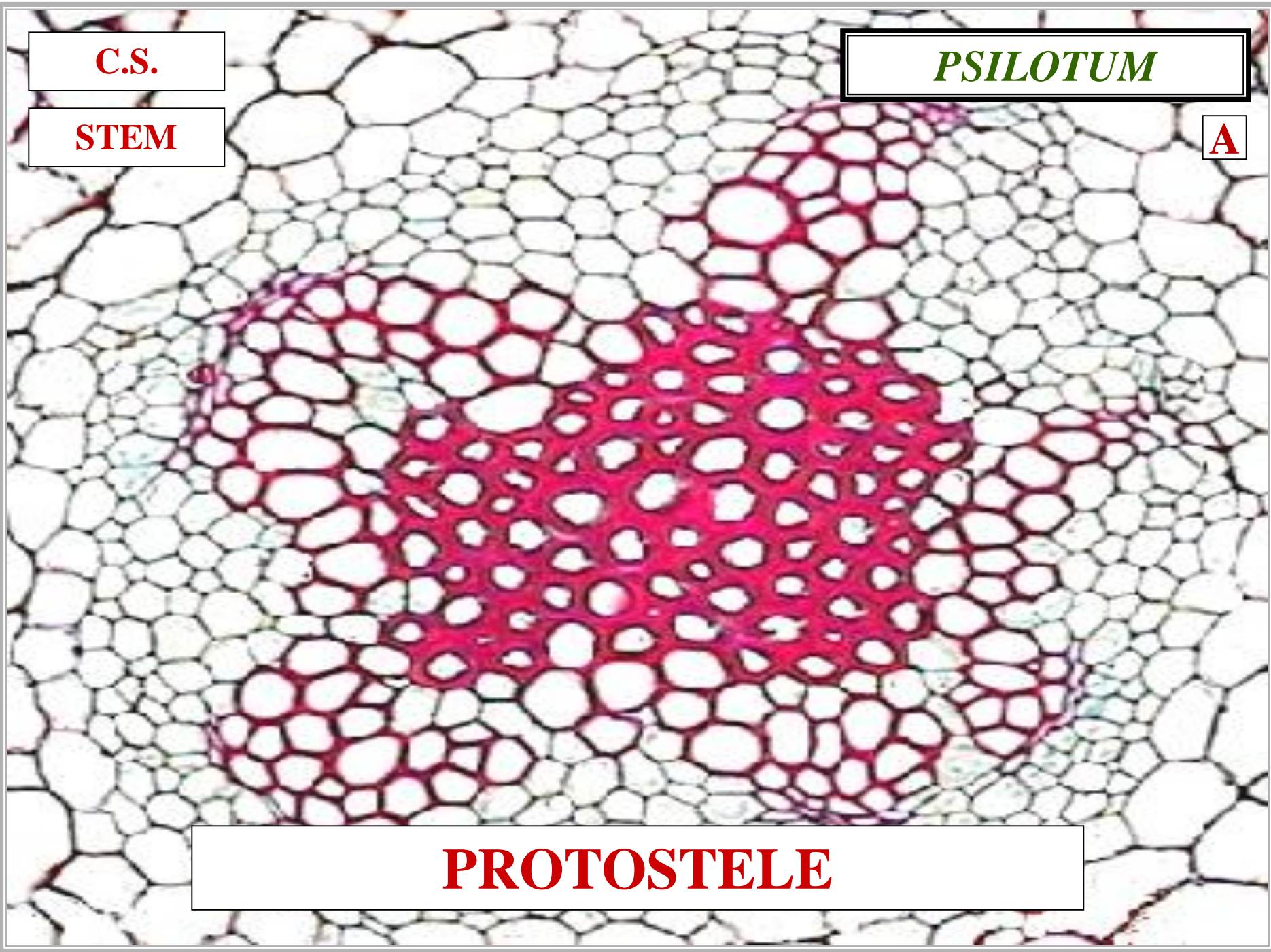
**C.S.**

**STEM**

***PSILOTUM***

**A**

**PROTOSTELE**



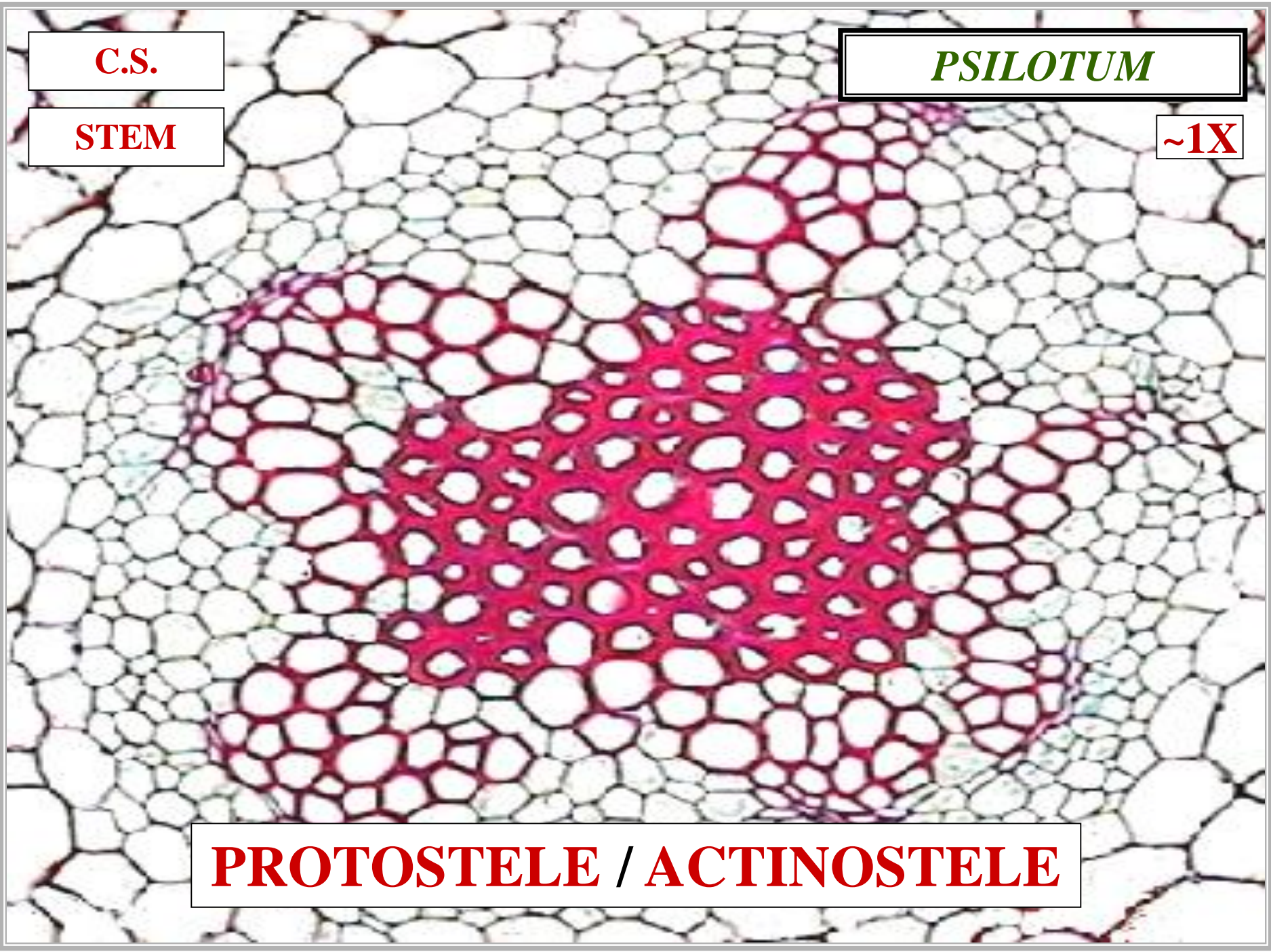
**C.S.**

**STEM**

***PSILOTUM***

**~1X**

**PROTOSTELE / ACTINOSTELE**



**C.S.**

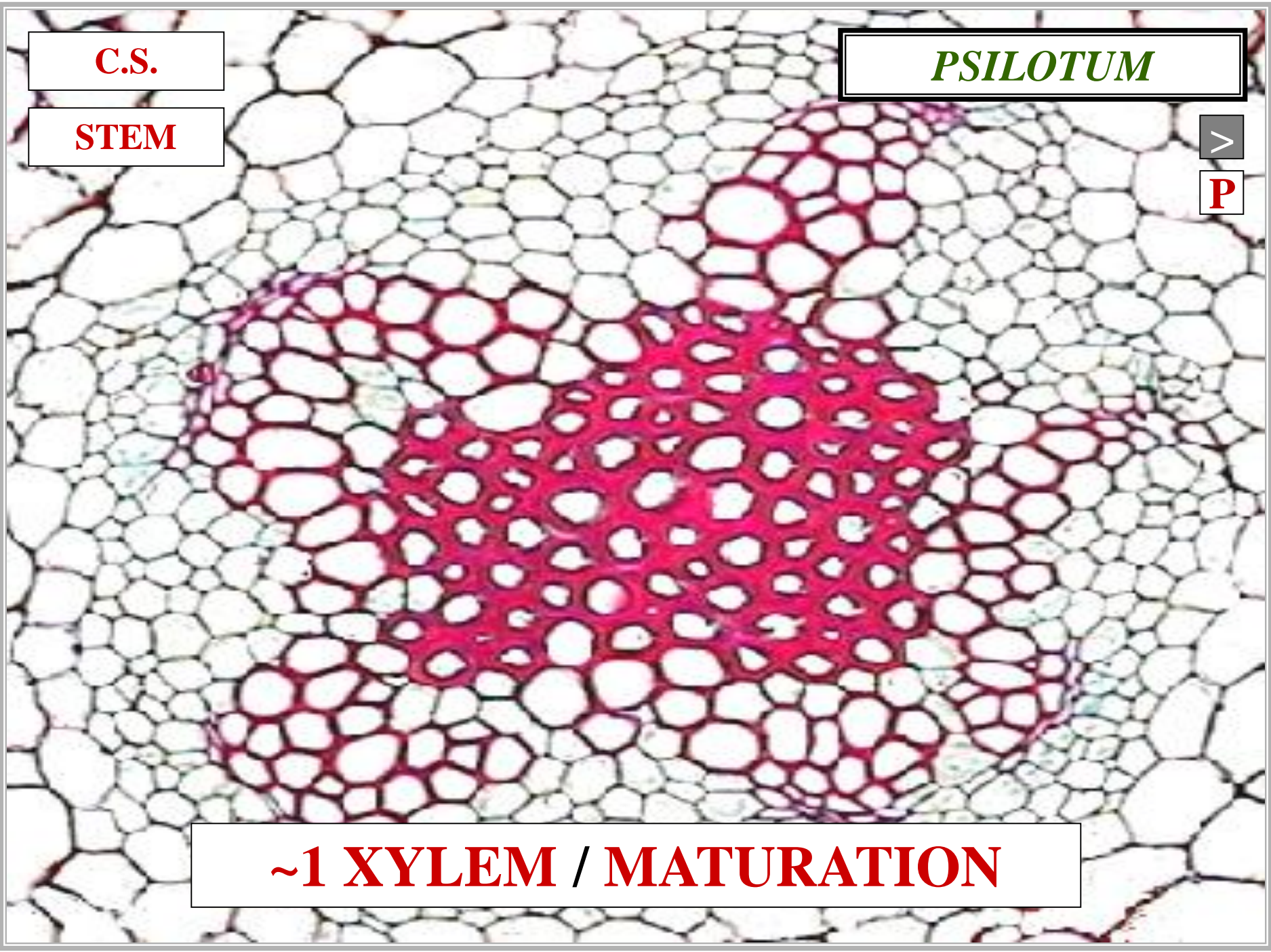
**STEM**

***PSILOTUM***

>

**P**

**~1 XYLEM / MATURATION**



**C.S.**

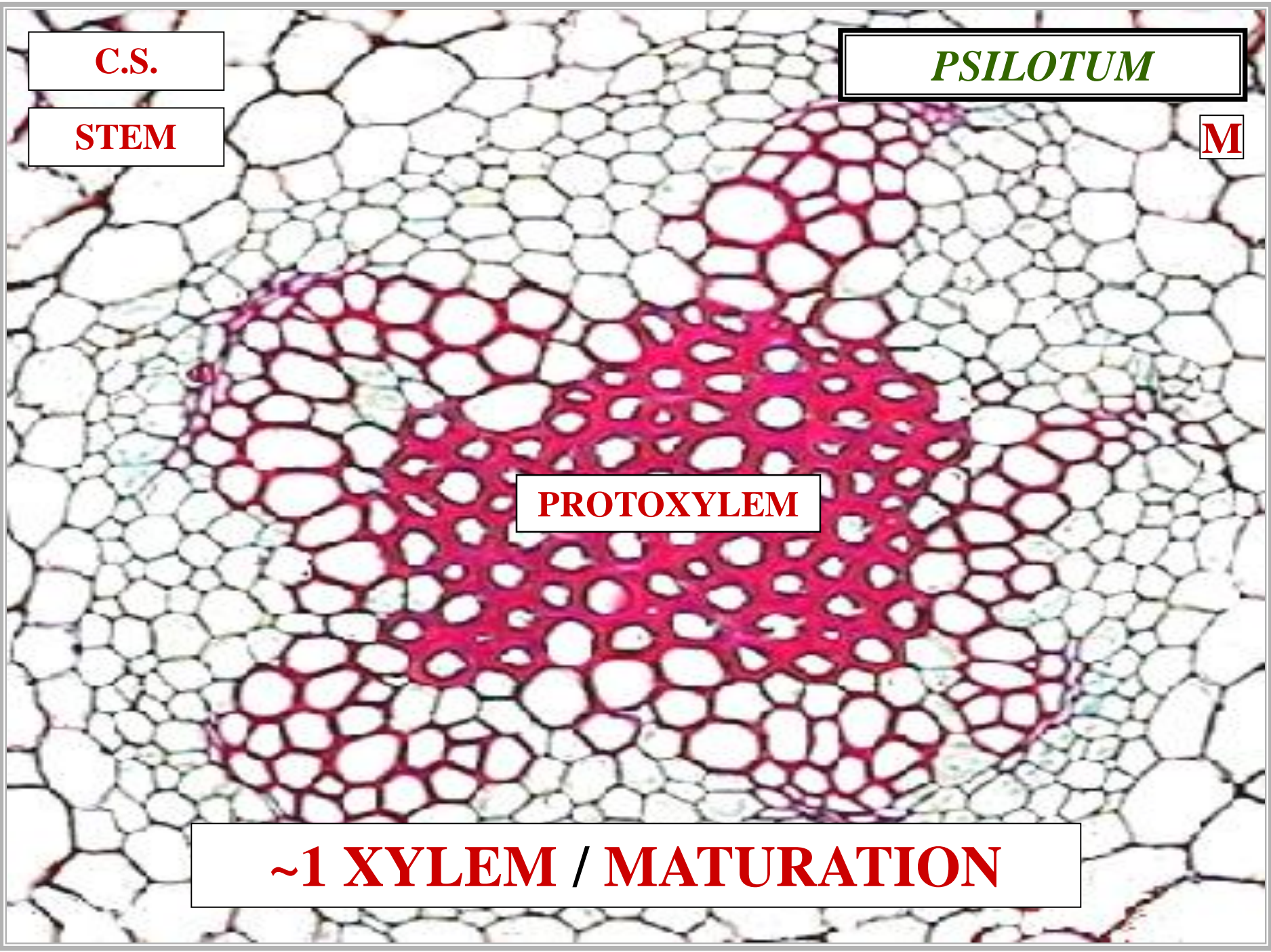
**STEM**

***PSILOTUM***

**M**

**PROTOXYLEM**

**~1 XYLEM / MATURATION**



**C.S.**

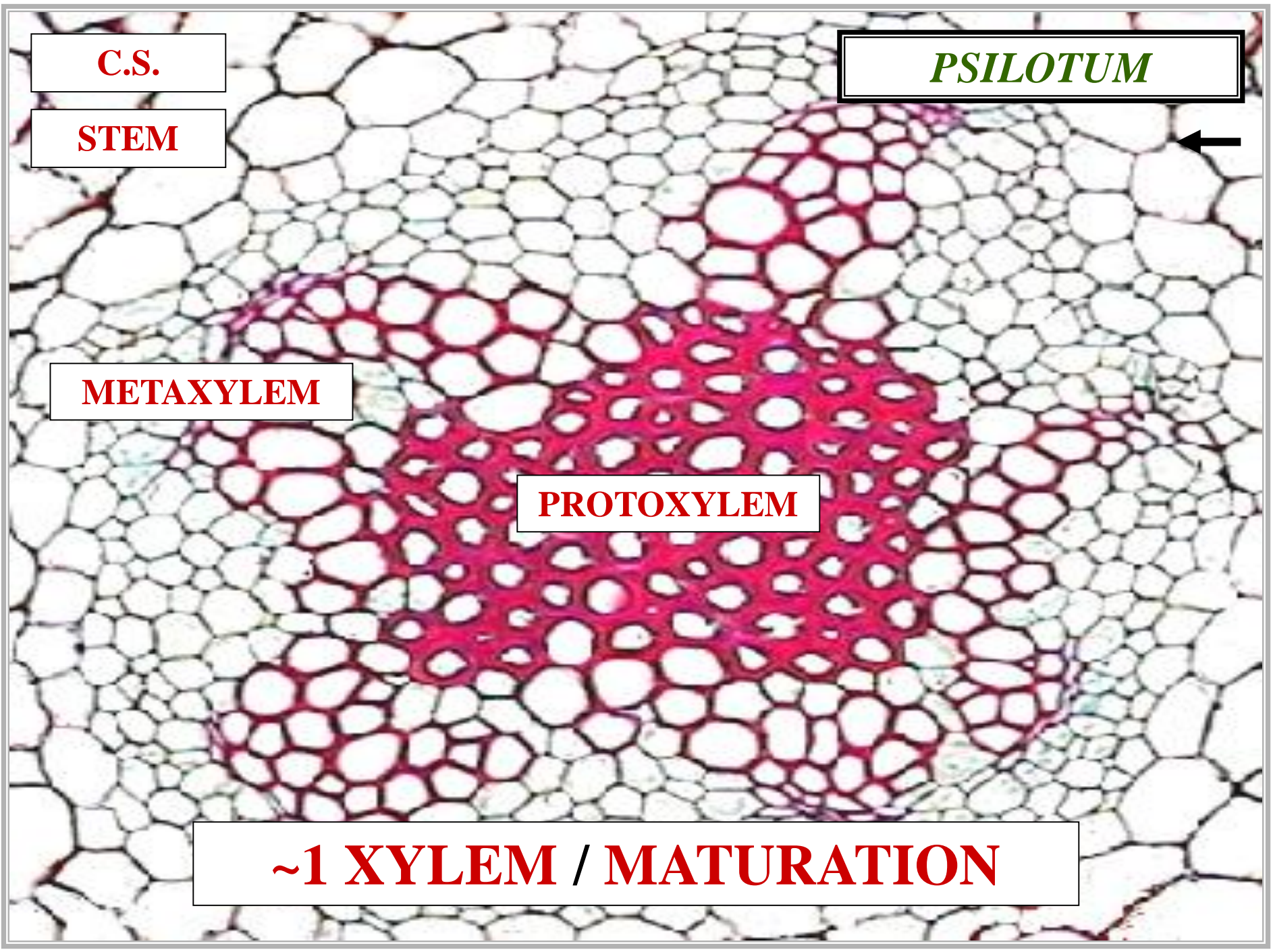
**STEM**

***PSILOTUM***

**METAXYLEM**

**PROTOXYLEM**

**~1 XYLEM / MATURATION**





**C.S.**

**STEM**

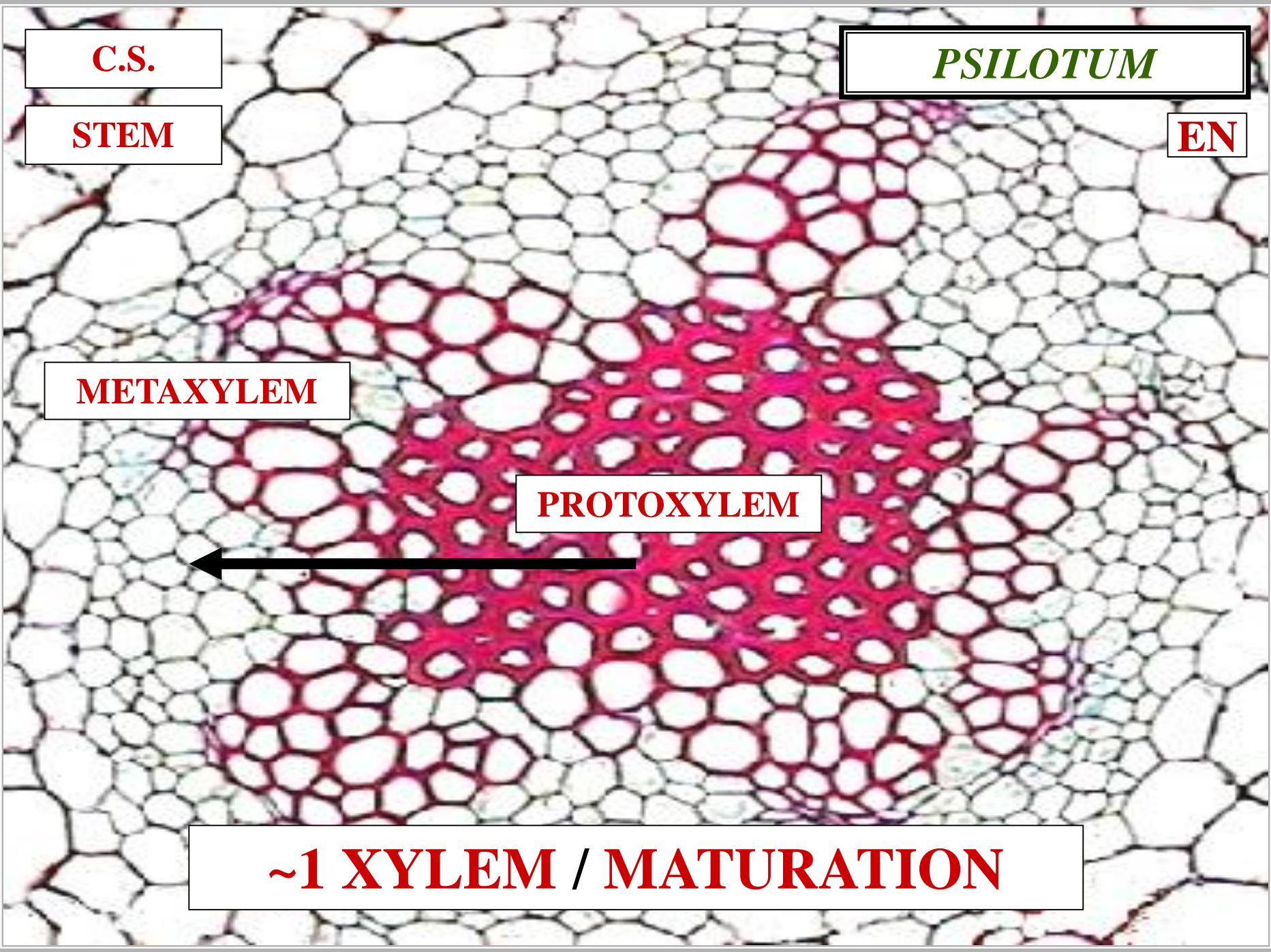
***PSILOTUM***

**EN**

**METAXYLEM**

**PROTOXYLEM**

**~1 XYLEM / MATURATION**



**C.S.**

**STEM**

***PSILOTUM***

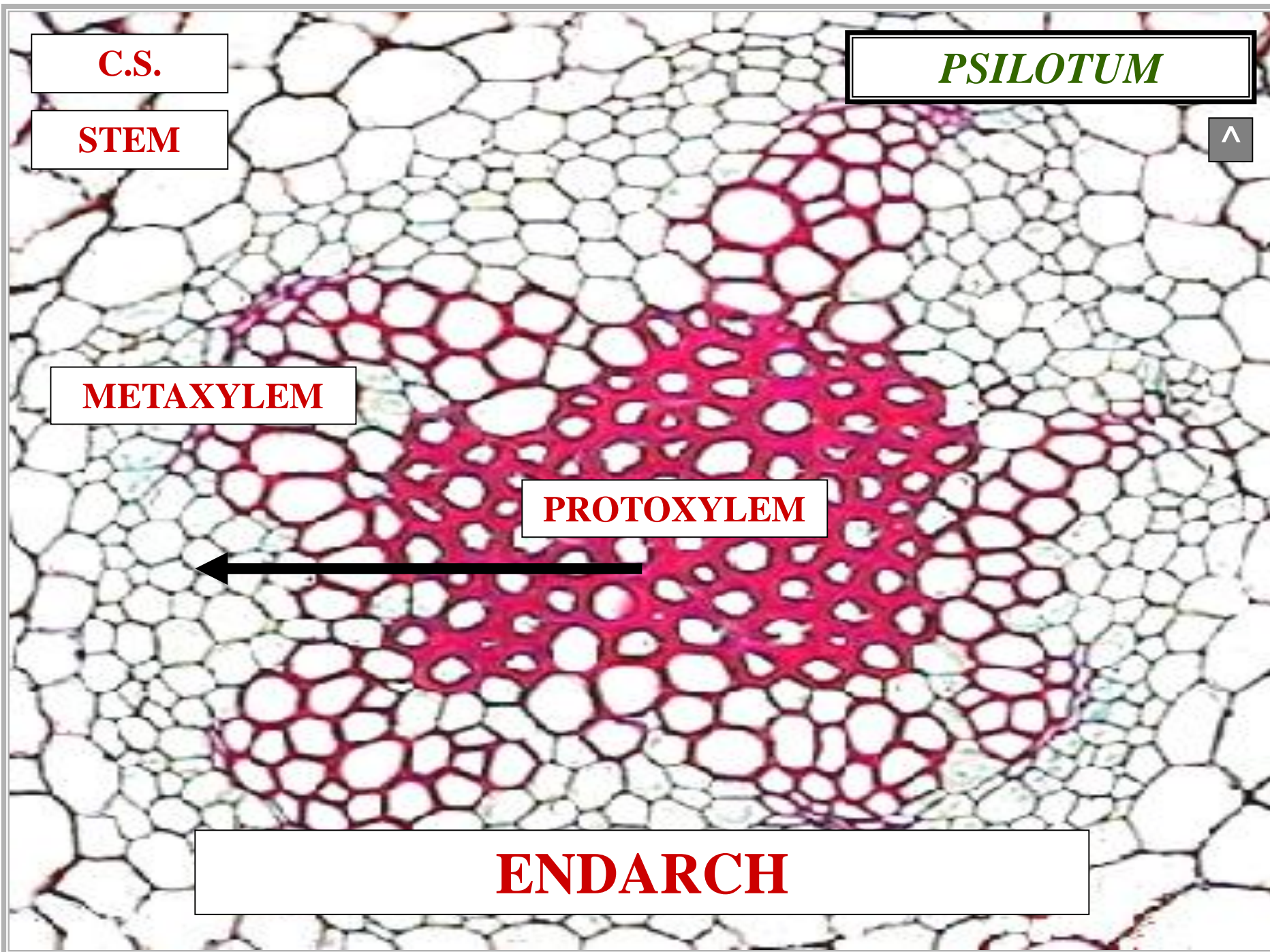


**METAXYLEM**

**PROTOXYLEM**

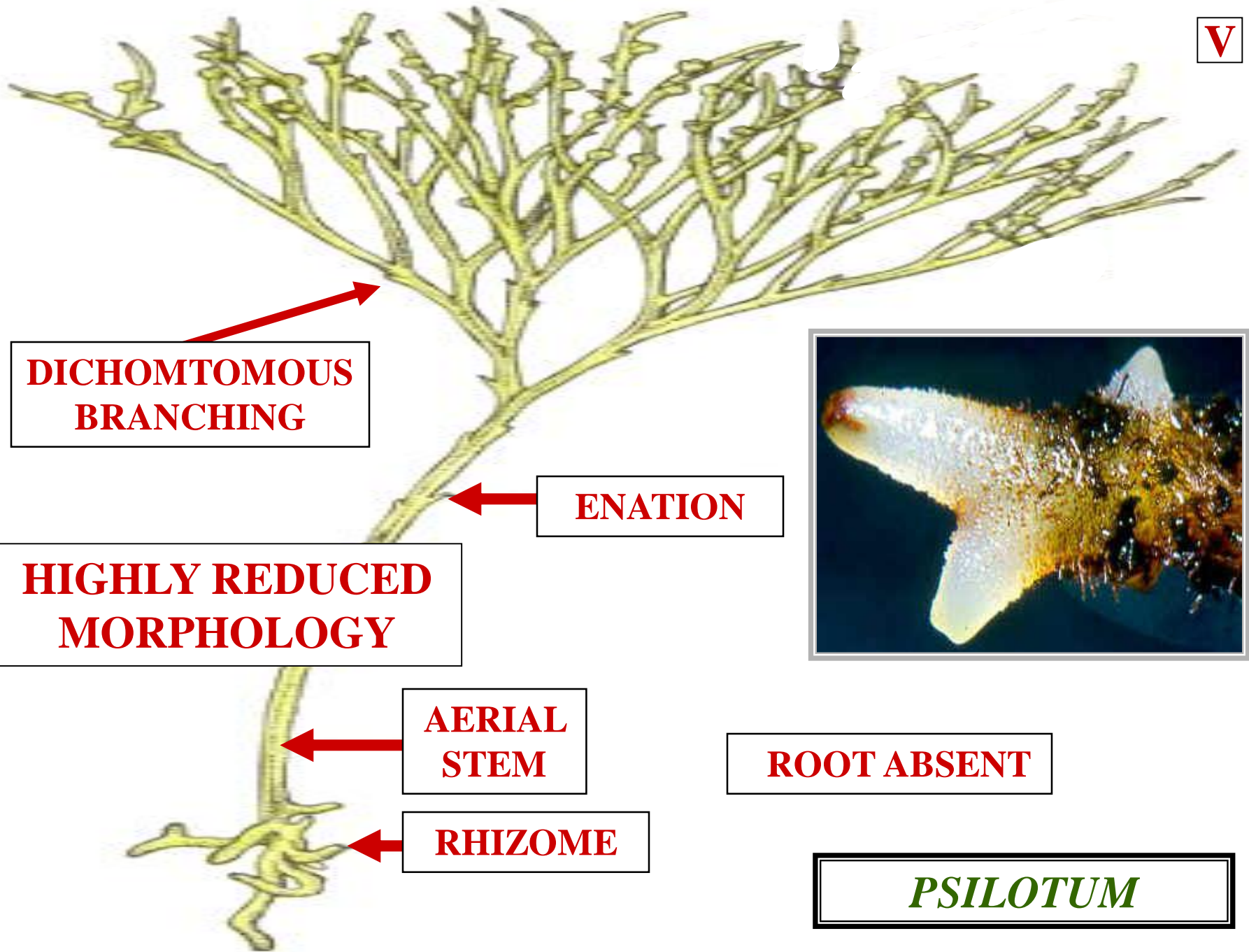


**ENDARCH**





# RHIZOME



**DICHOTOMOUS  
BRANCHING**

**ENATION**

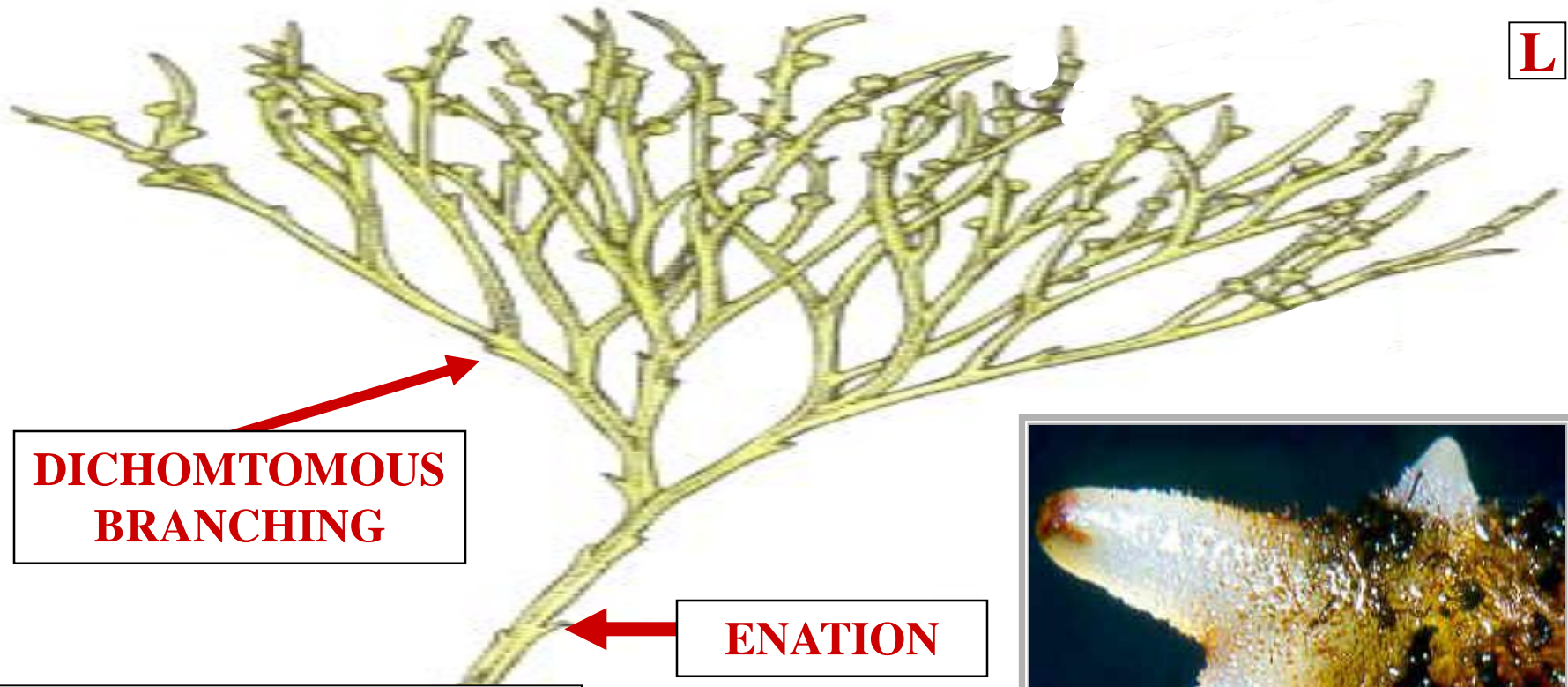
**HIGHLY REDUCED  
MORPHOLOGY**

**AERIAL  
STEM**

**RHIZOME**

**ROOT ABSENT**

***PSILOTUM***



**DICHOTOMOUS  
BRANCHING**

**ENATION**

**HIGHLY REDUCED  
MORPHOLOGY**

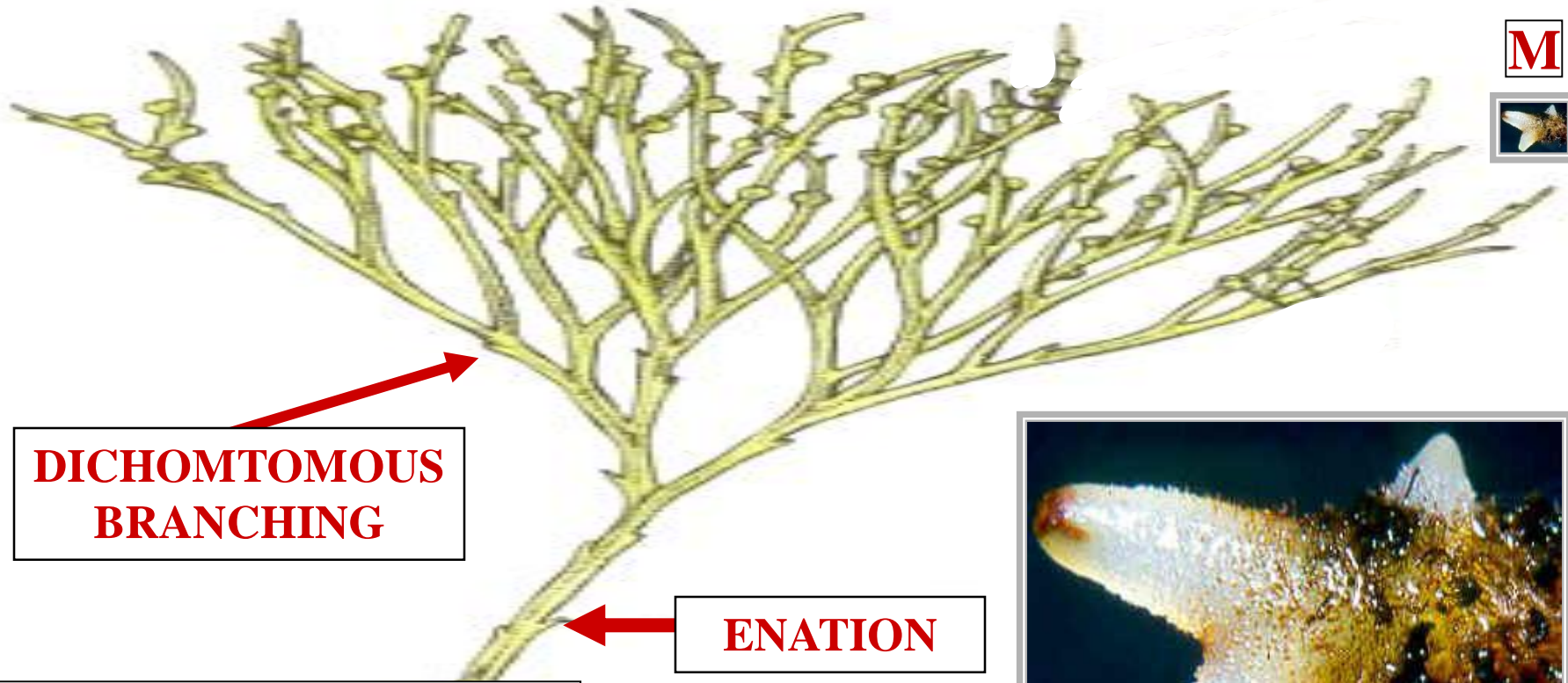


**AERIAL  
STEM**

**ROOT ABSENT**

**VERY SMALL  
RHIZOME**

***PSILOTUM***



**DICHOTOMOUS  
BRANCHING**

**ENATION**

**HIGHLY REDUCED  
MORPHOLOGY**

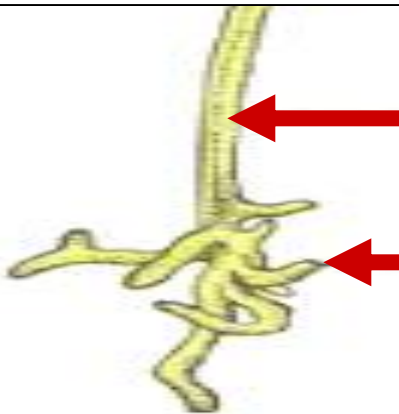


**AERIAL  
STEM**

**ROOT ABSENT**

**LIMITED  
LATERAL GROWTH**

***PSILOTUM***

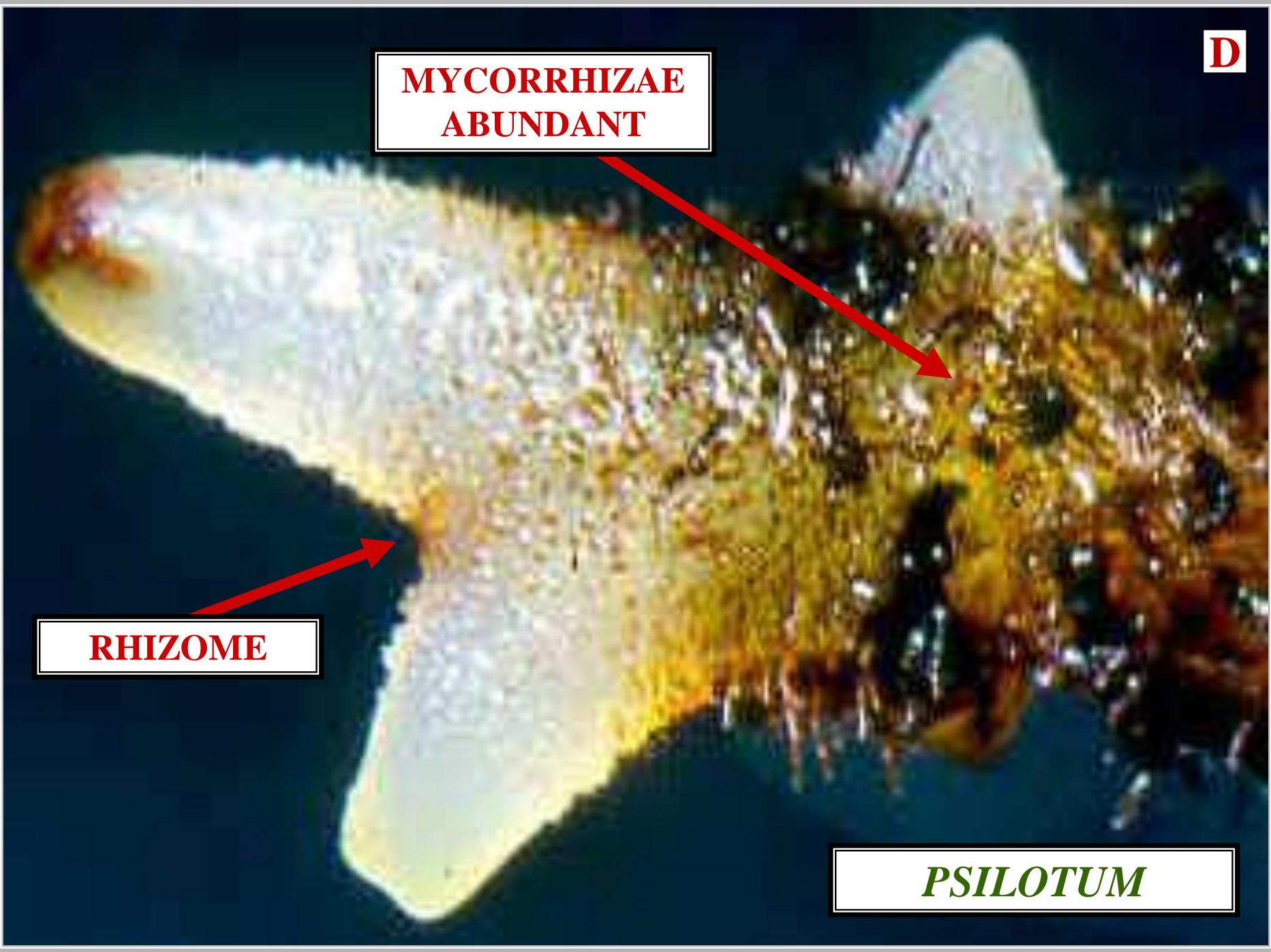


**D**

**MYCORRHIZAE  
ABUNDANT**

**RHIZOME**

***PSILOTUM***





**MYCORRHIZAE  
ABUNDANT**

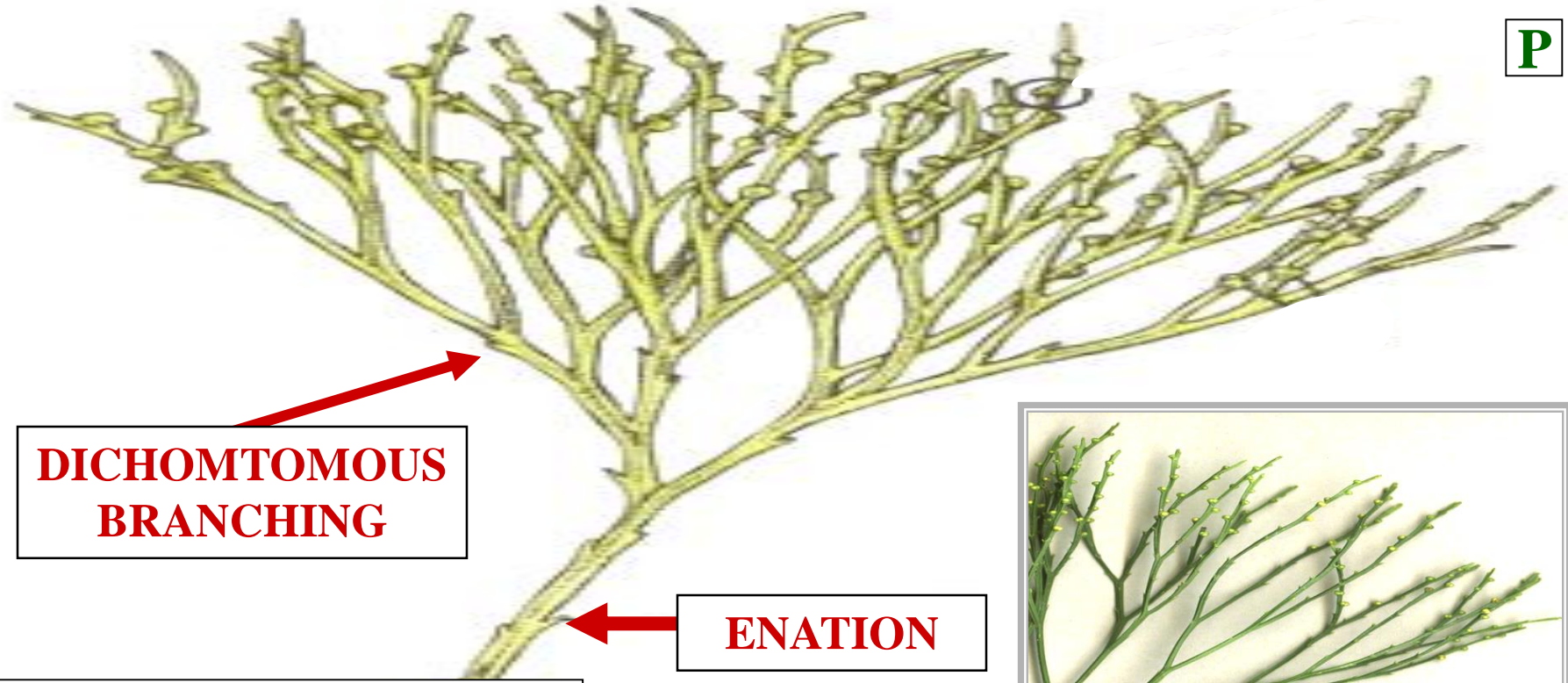
**RHIZOME  
DICHOTMOUS  
BRANCHING**

***PSILOTUM***





# AERIAL STEM



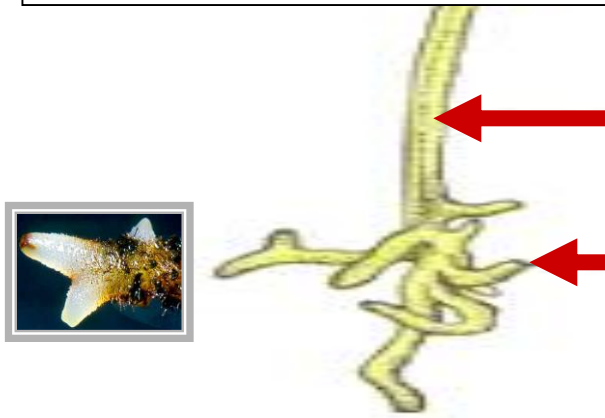
**DICHOTOMOUS BRANCHING**

**ENATION**

**HIGHLY REDUCED MORPHOLOGY**



*PSILOTUM*



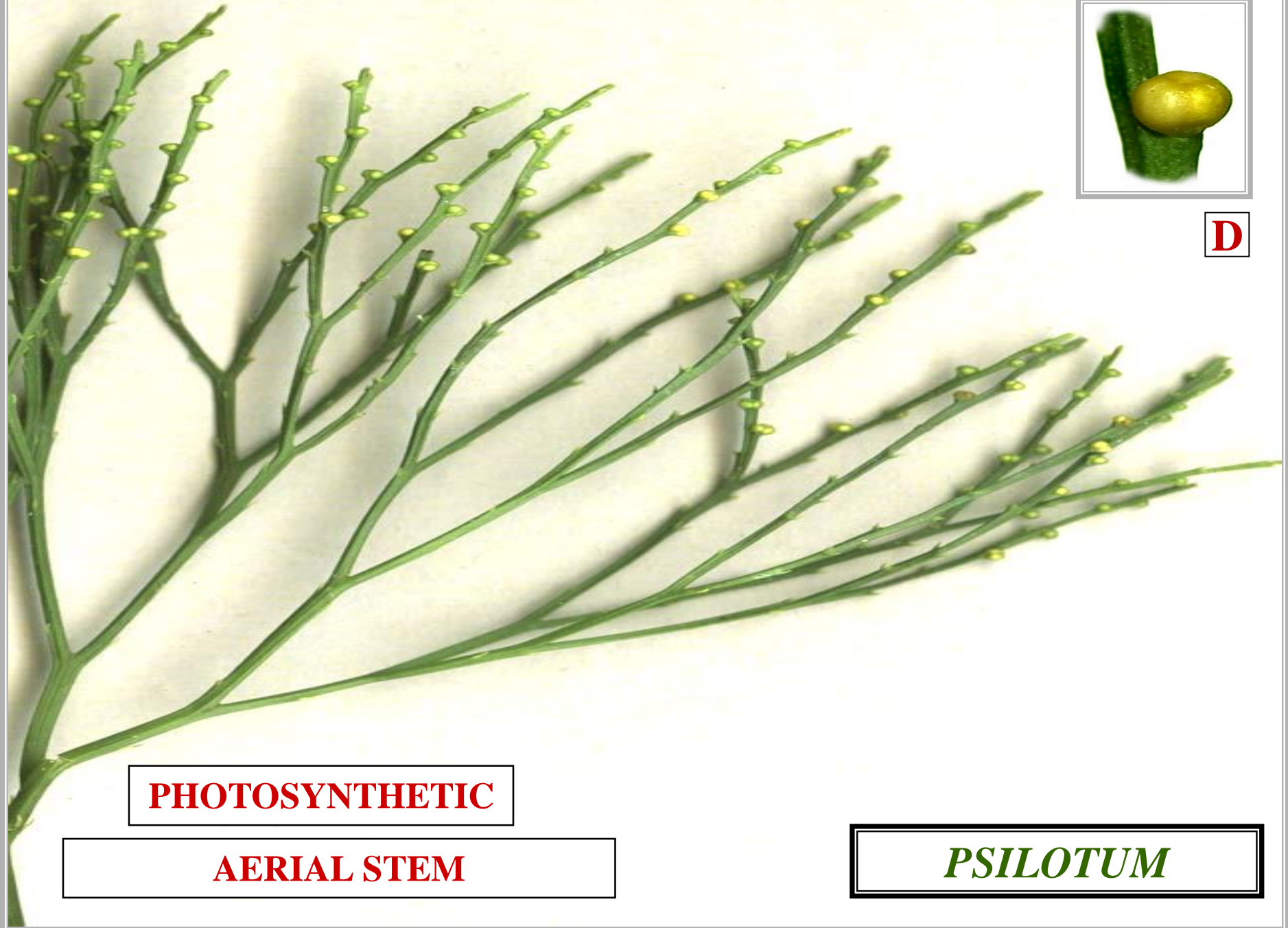
**AERIAL STEM**

**RHIZOME**

**ROOT ABSENT**

*PSILOTUM*



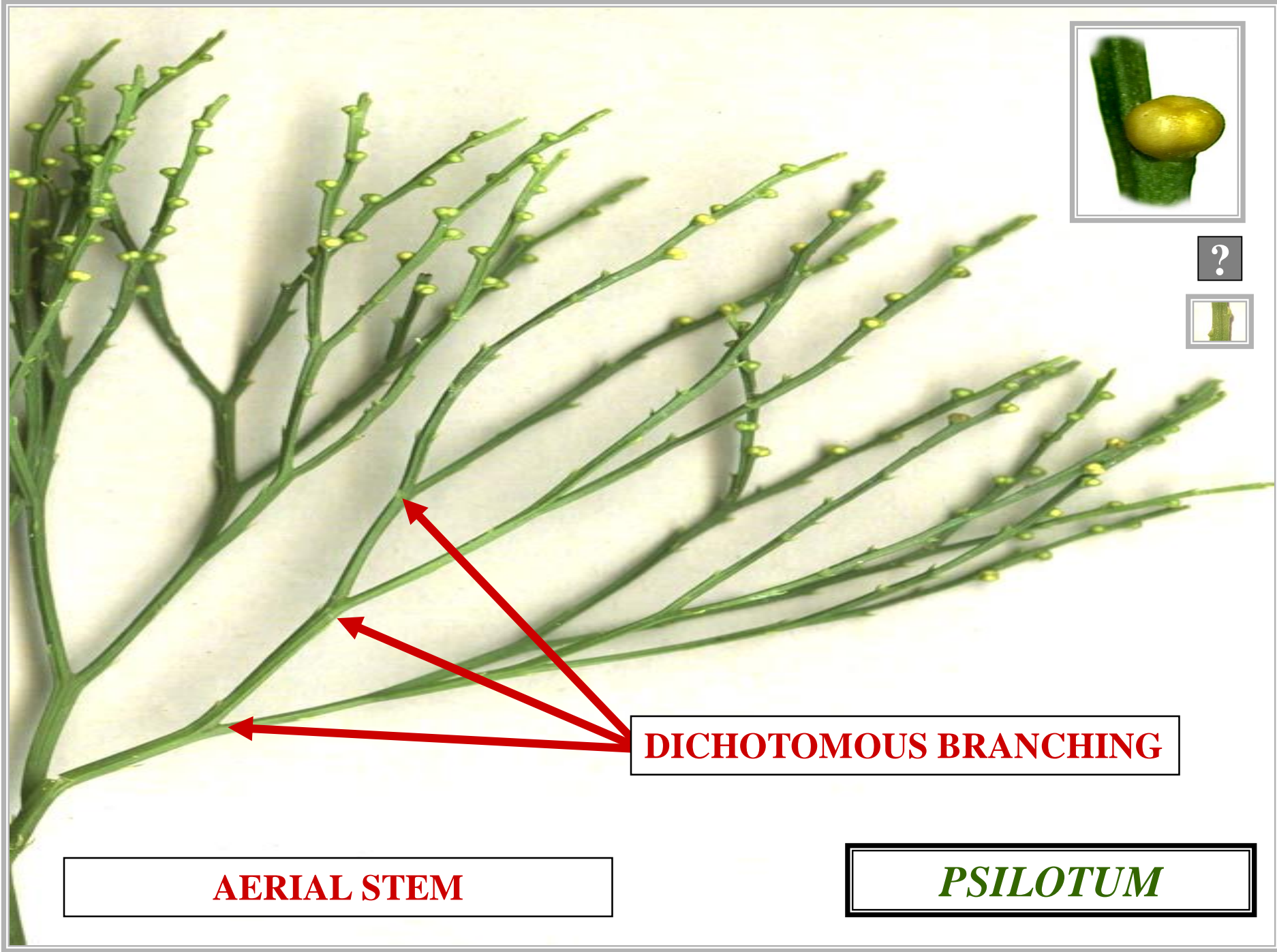


**D**

**PHOTOSYNTHETIC**

**AERIAL STEM**

***PSILOTUM***



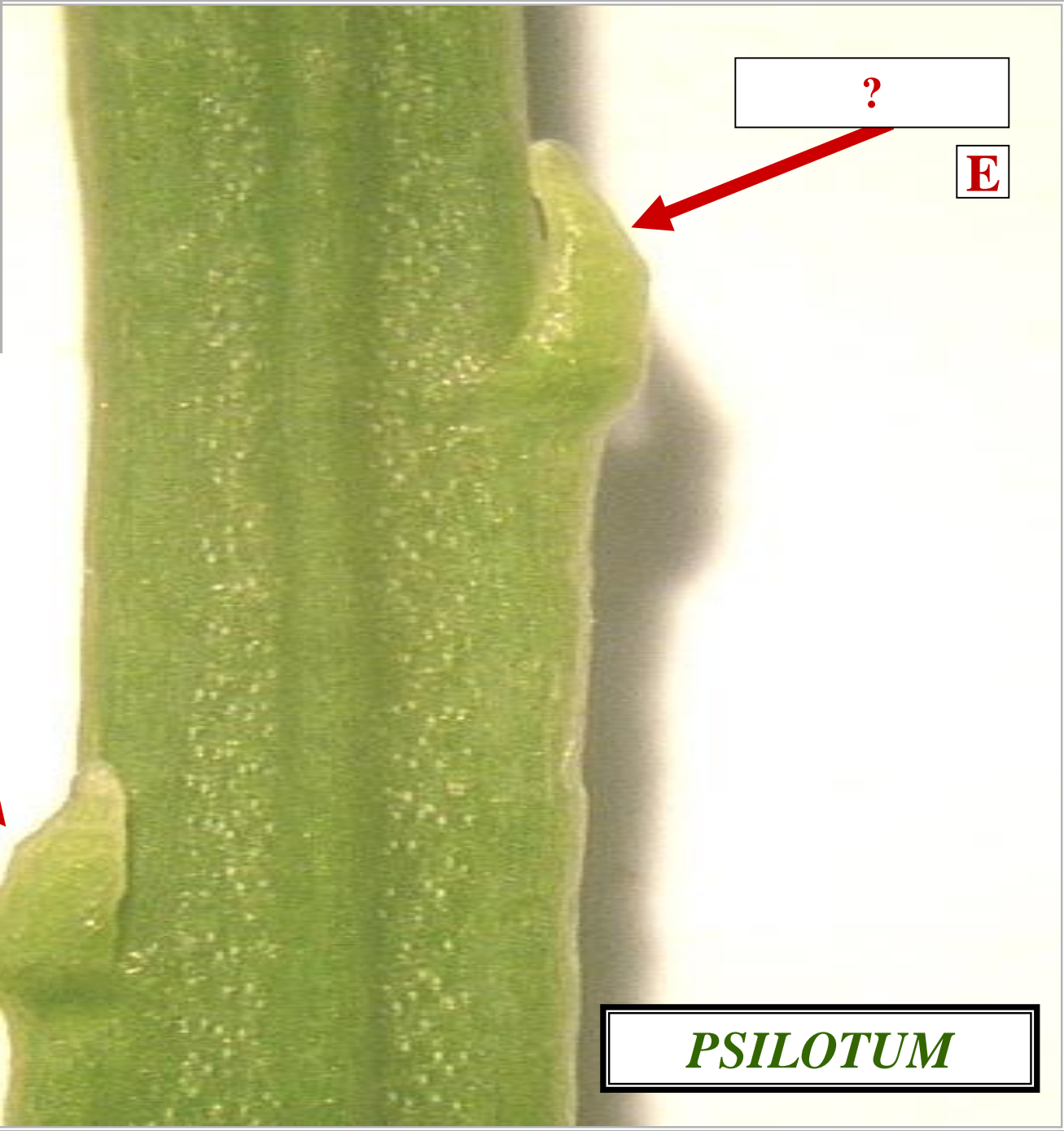
**AERIAL STEM**

**DICHOTOMOUS BRANCHING**

***PSILOTUM***



*PSILOTUM*



?

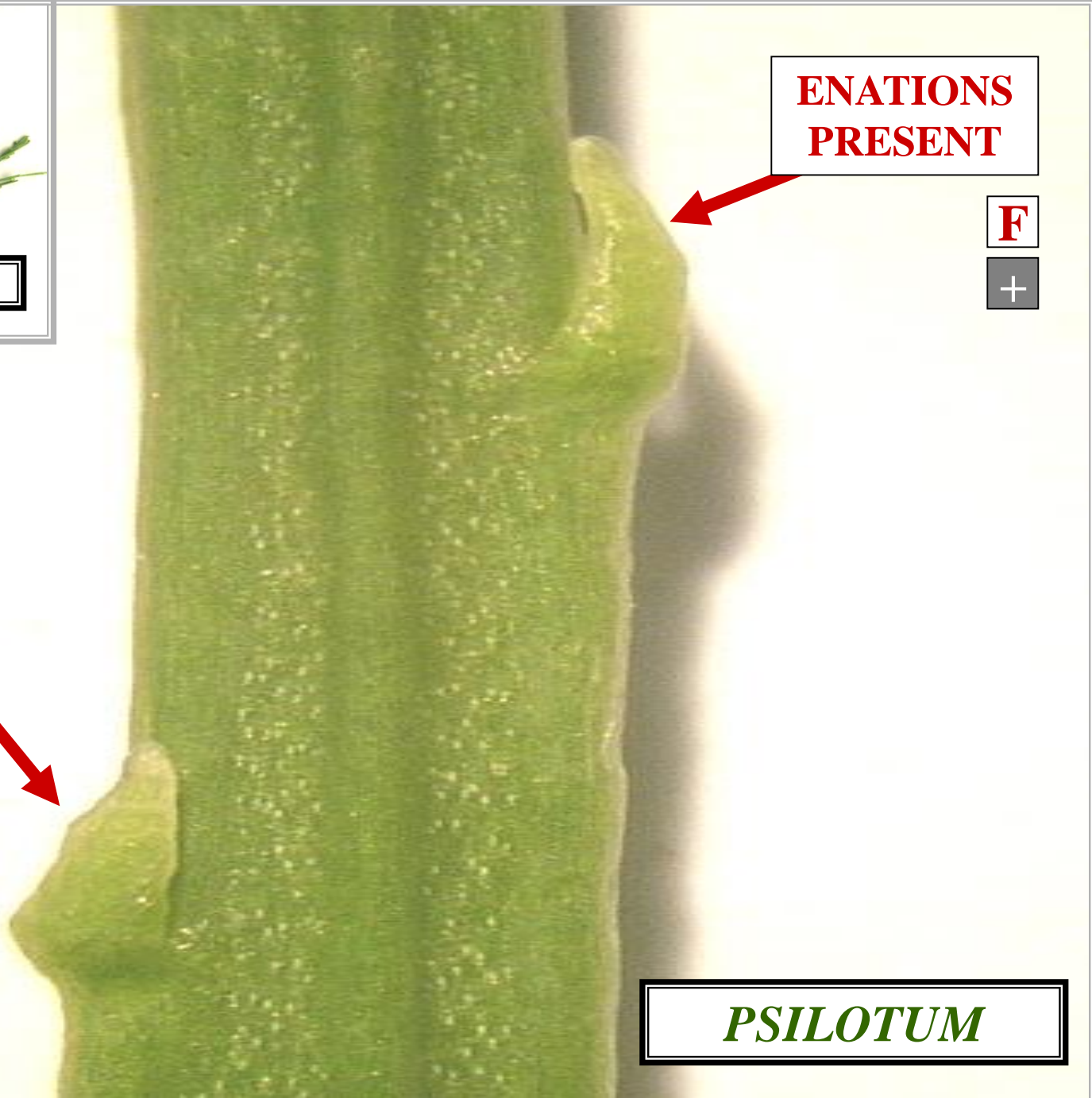
**E**

?

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**ENATIONS  
PRESENT**

**F**

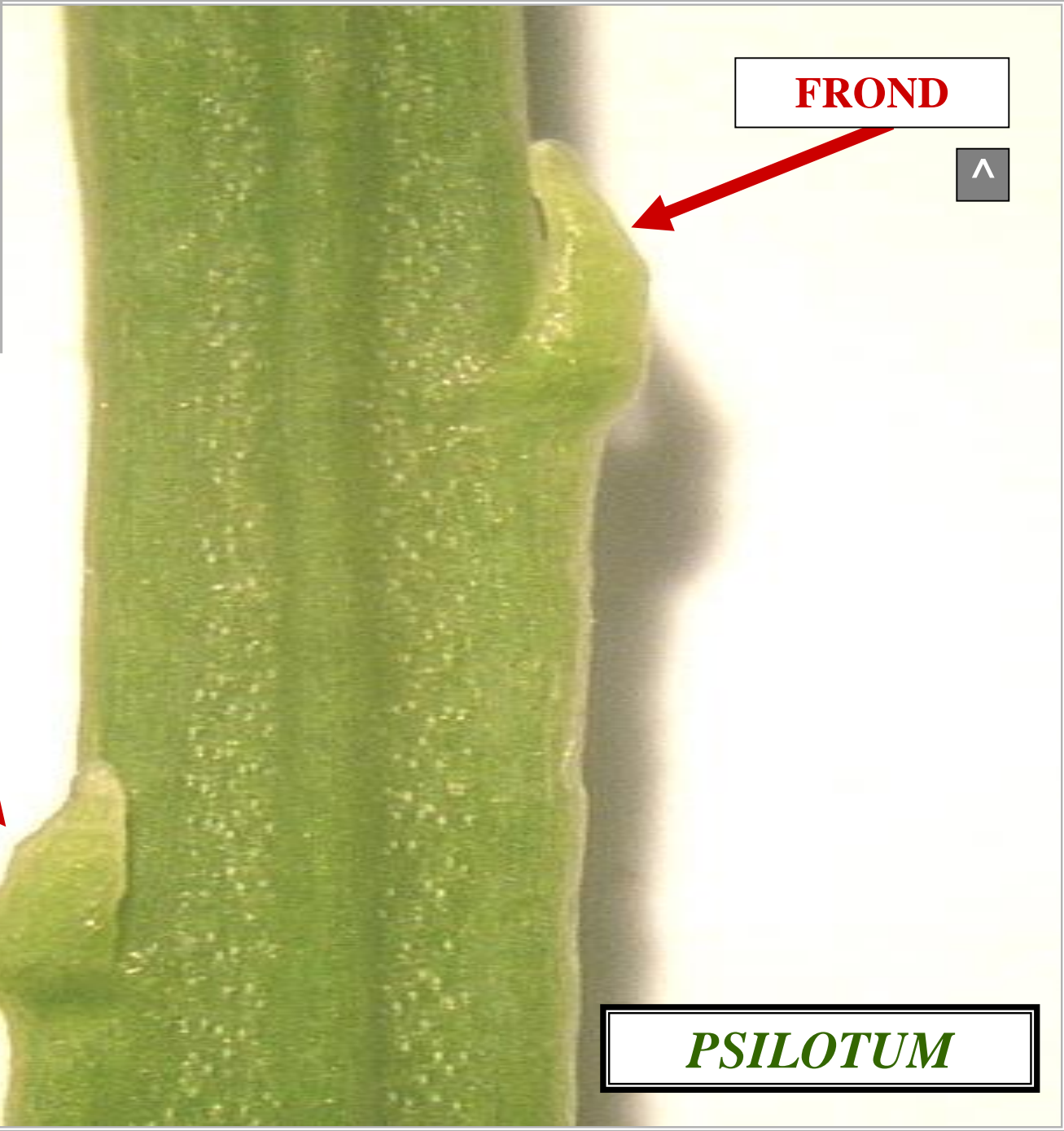
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**ENATIONS  
PRESENT**

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**FROND**

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**FROND**

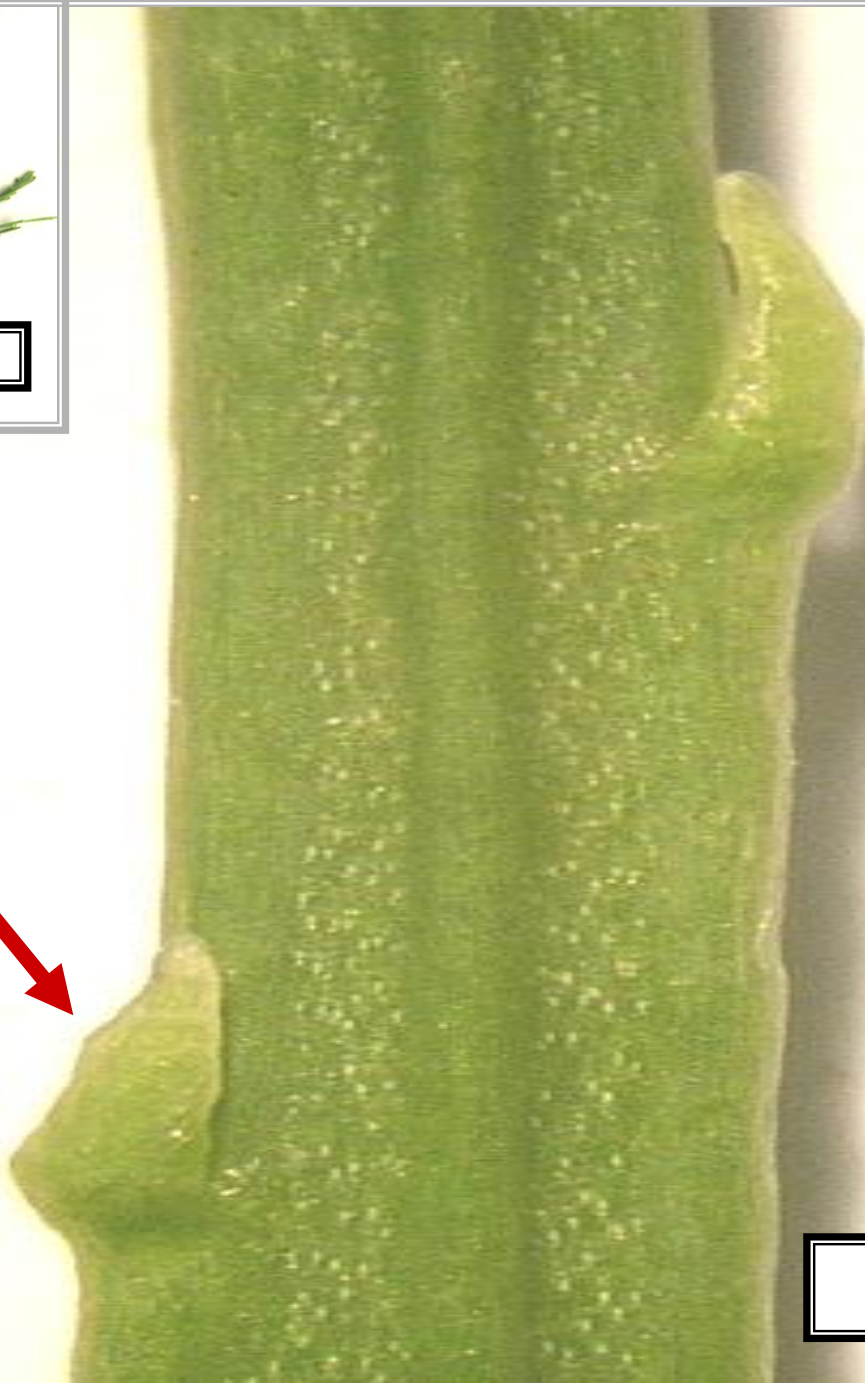




# MORPHOLOGY



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**SCALE-LIKE  
ENATION**

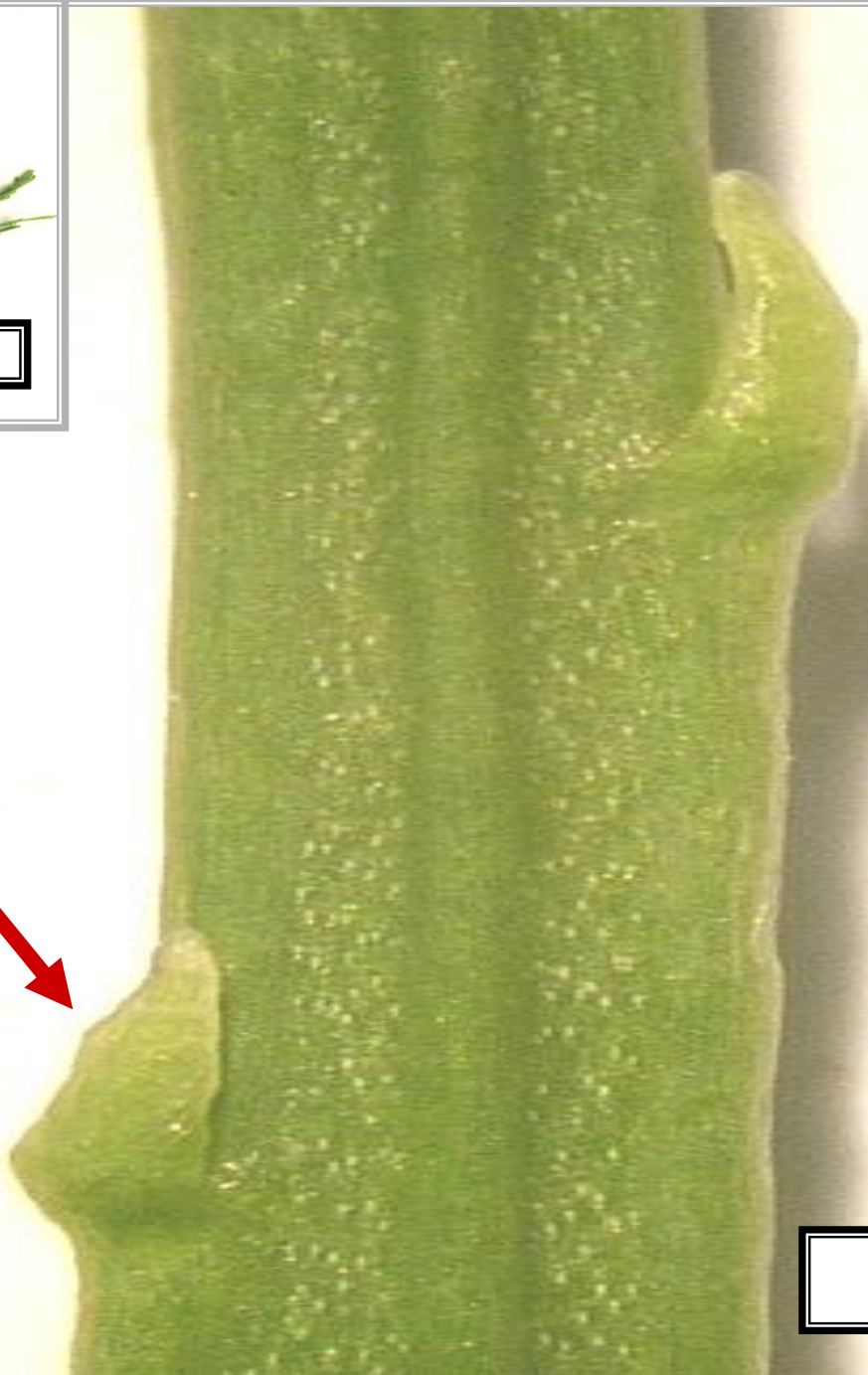
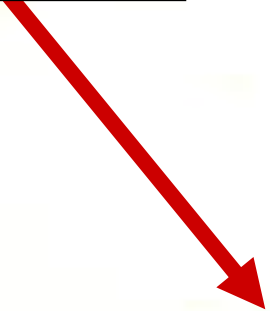


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