



# Morpho-anatomy in the flower-to-fruit transition in Andean Loranthaceae



Valentina Botero Castaño

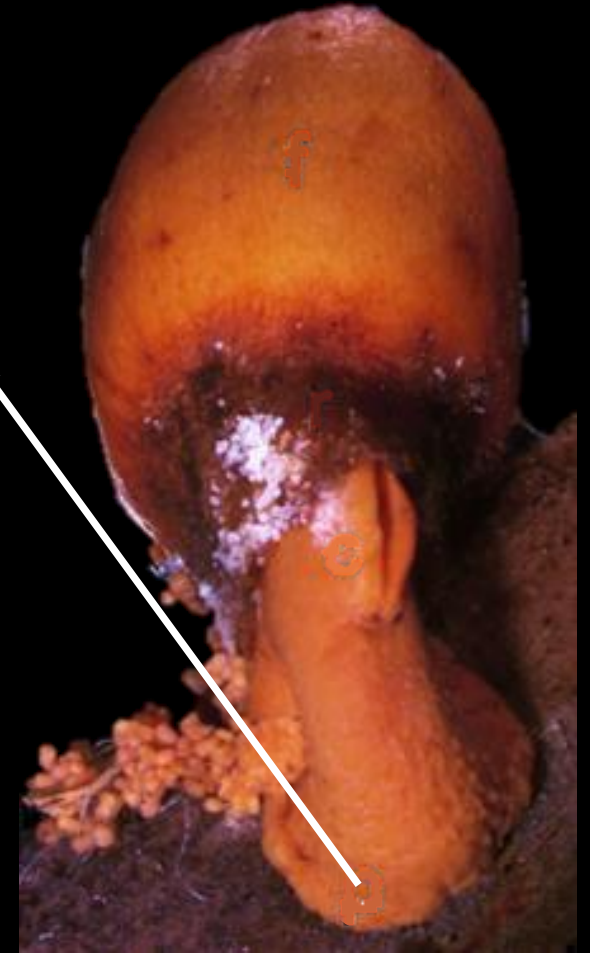
Favio González, Cecilia Zumajo-Cardona & Natalia Pabón-Mora



# Loranthaceae: an hemiparasitic family



haustorium



# Loranthaceae: an hemiparasitic family

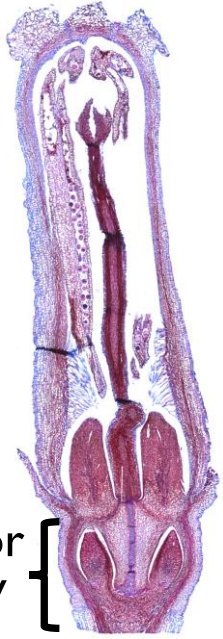


Conventional flowers: locules, ovules, integuments, nucellus, endosperm and embryo

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Loranthaceae flowers: viscin and reduced carpels and ovules

Conventional flowers: locules, ovules, integuments, nucellus, endosperm and embryo

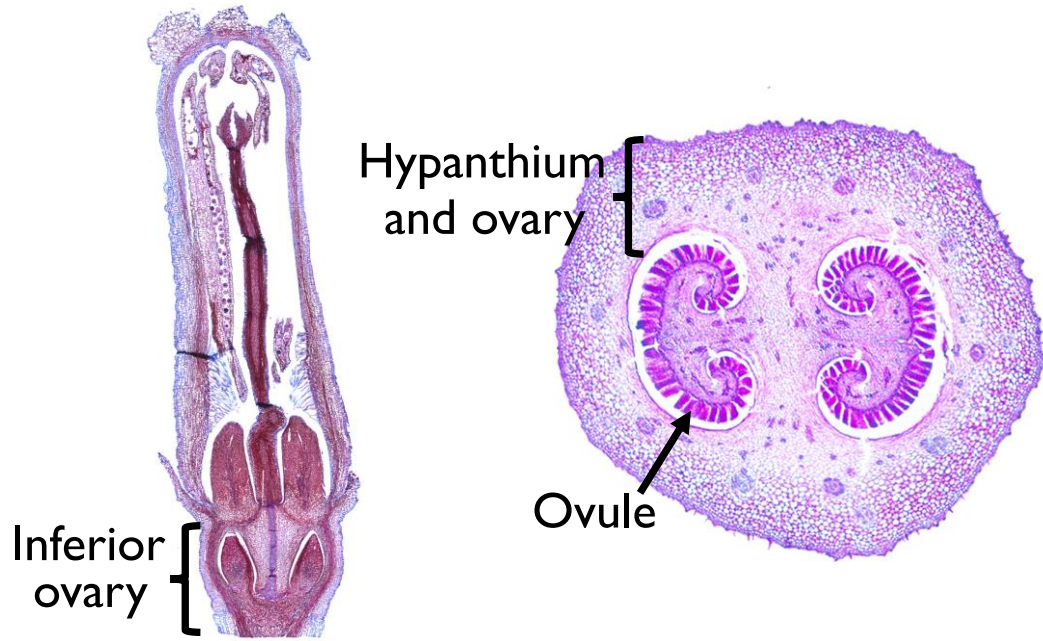


Inferior  
ovary {

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Loranthaceae flowers: viscin and reduced carpels and ovules

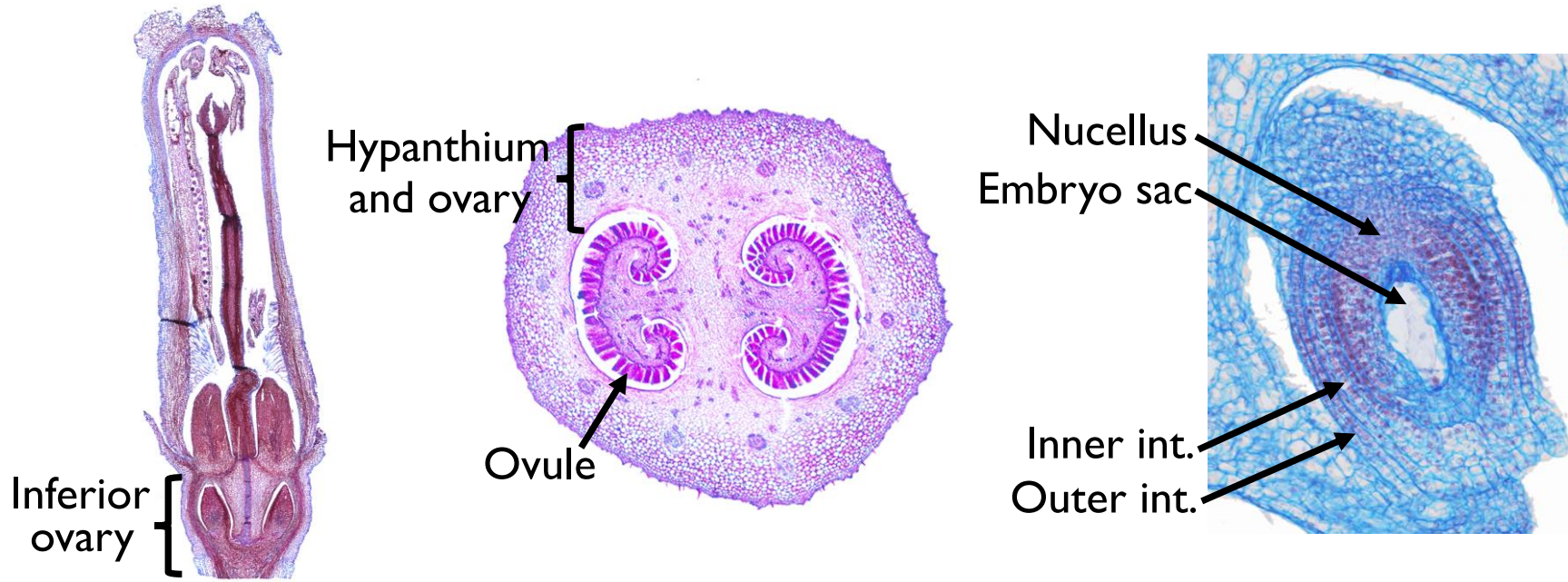
Conventional flowers: locules, ovules, integuments, nucellus, endosperm and embryo



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Loranthaceae flowers: viscin and reduced carpels and ovules

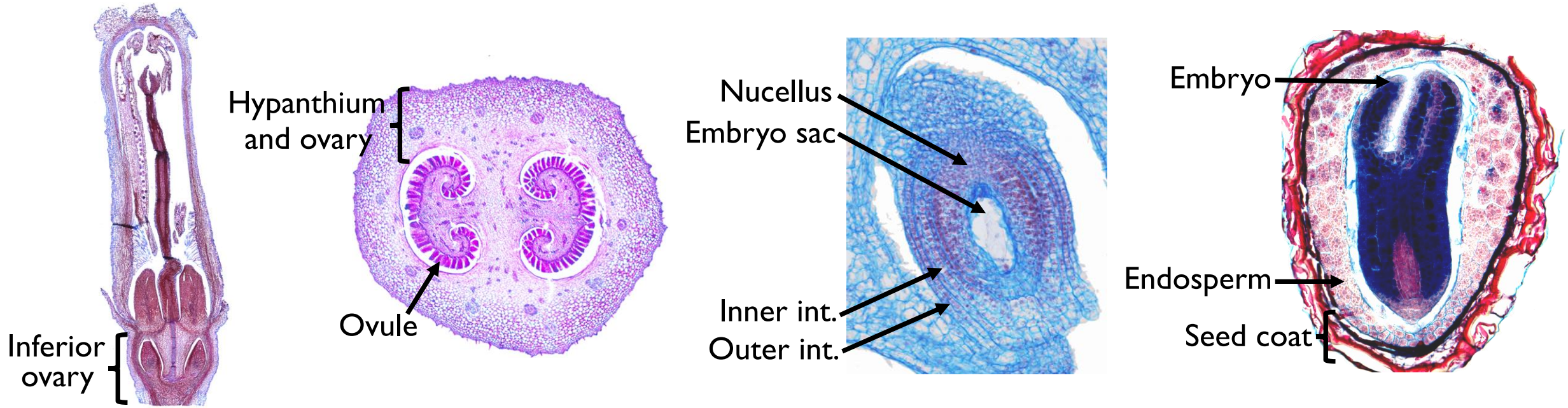
# Conventional flowers: locules, ovules, integuments, nucellus, endosperm and embryo



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# Loranthaceae flowers: viscin and reduced carpels and ovules

# Conventional flowers: locules, ovules, integuments, nucellus, endosperm and embryo

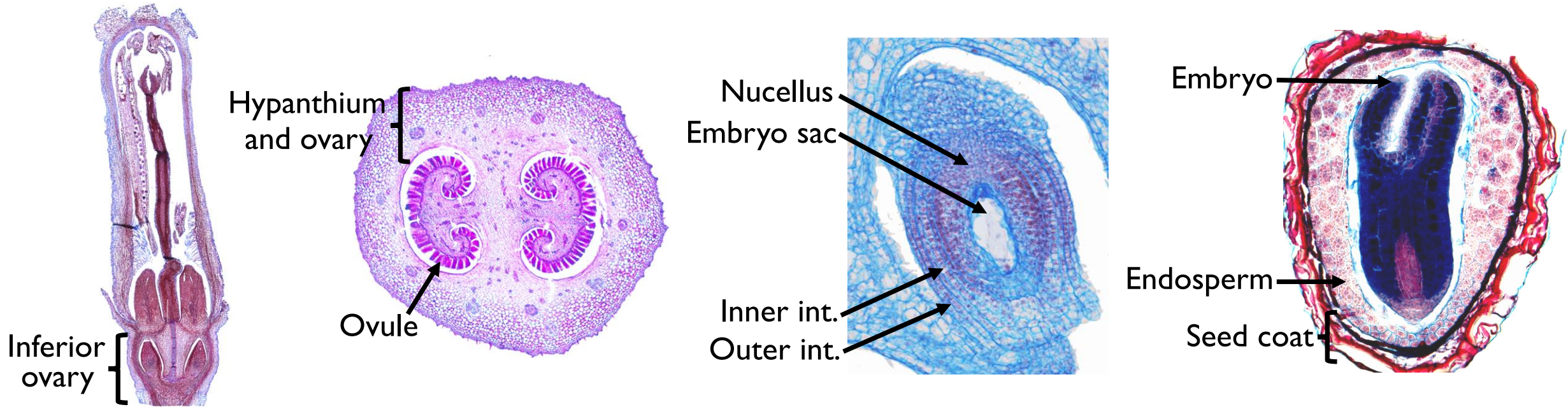


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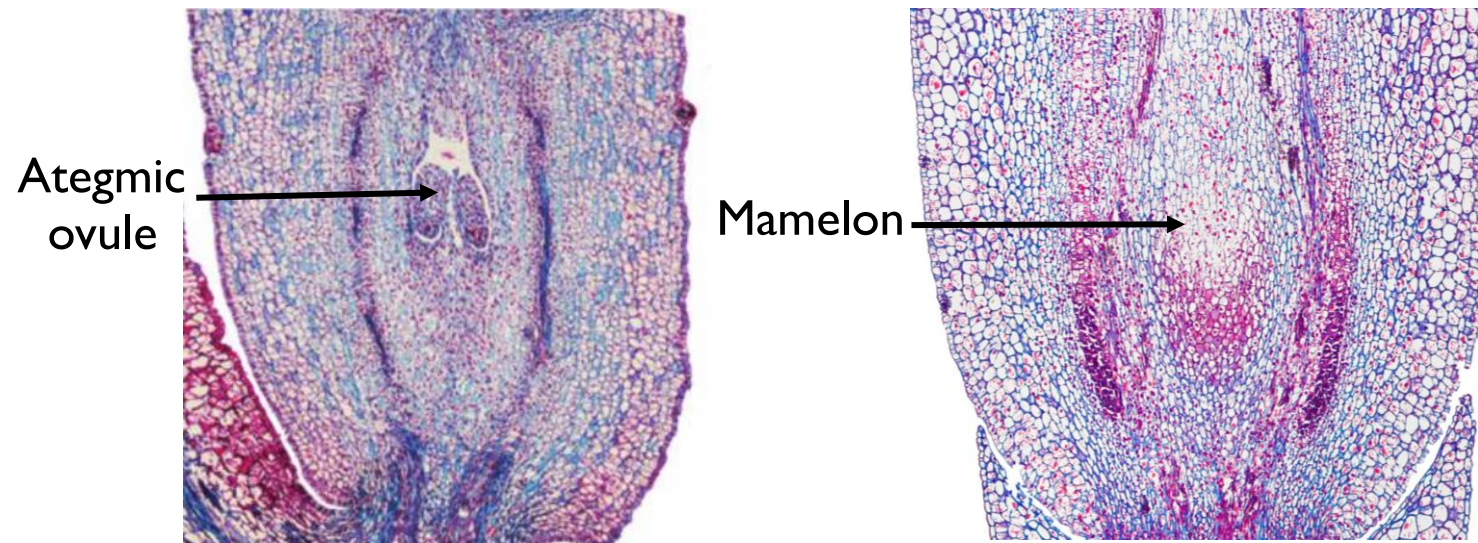
# Loranthaceae flowers: viscin and reduced carpels and ovules



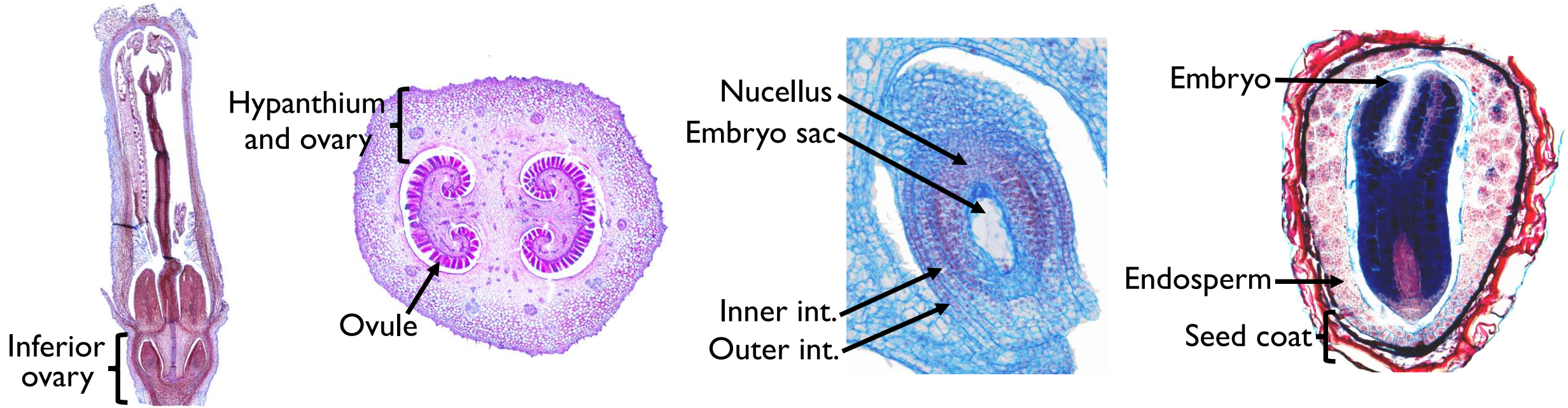
# Conventional flowers: locules, ovules, integuments, nucellus, endosperm and embryo



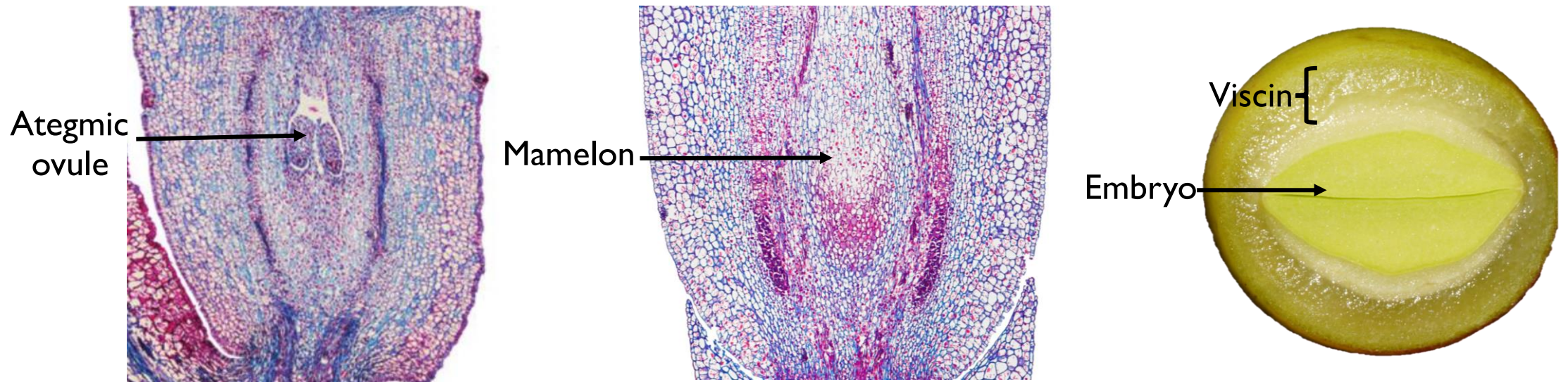
# Loranthaceae flowers: viscin and reduced carpels and ovules



# Conventional flowers: locules, ovules, integuments, nucellus, endosperm and embryo

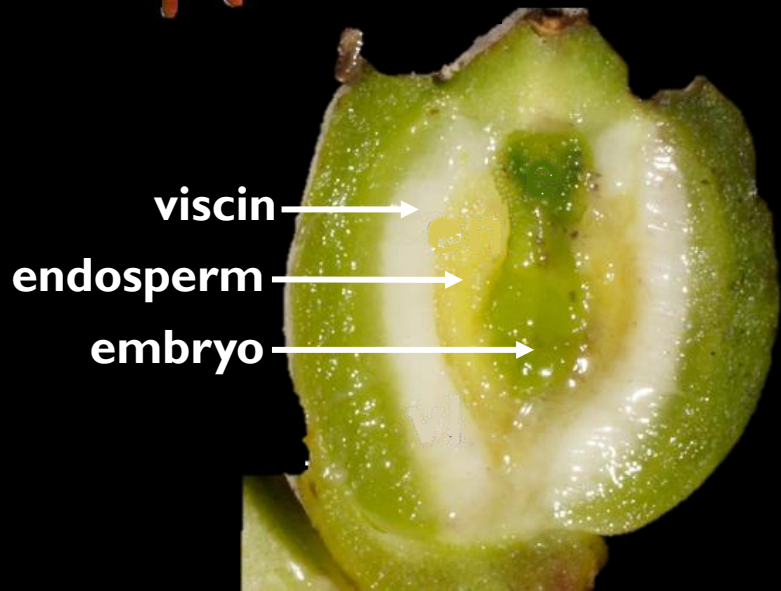


# Loranthaceae flowers: viscin and reduced carpels and ovules

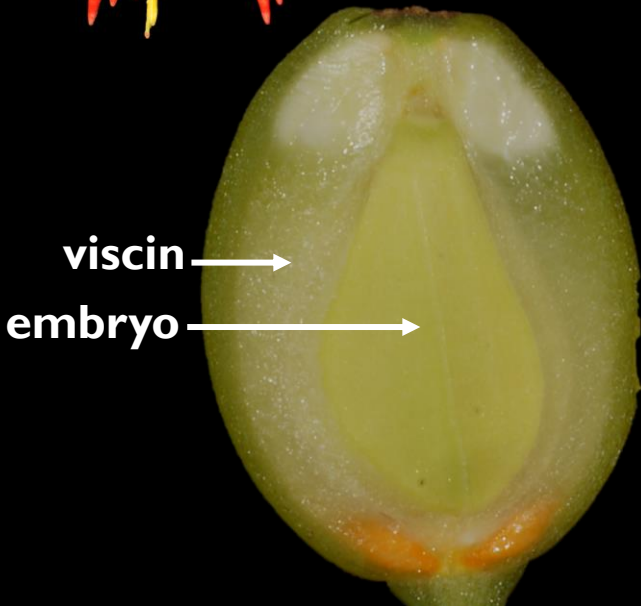


# Loranthaceae: 950 species

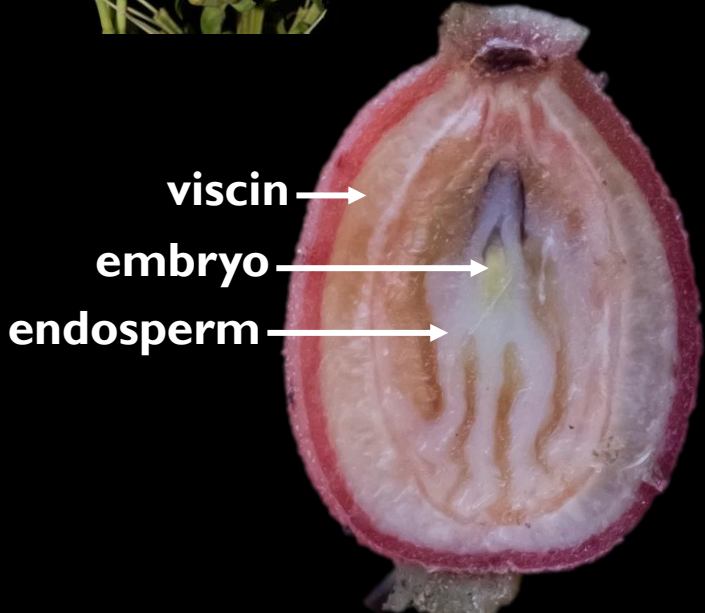
*Tristerix secundus*



*Aetanthus colombianus*



*Gaiadendron punctatum*



# Main questions

What tissues correspond to the ovary wall and the hypanthium in the selected species?

What is the origin of the viscin in the selected species?

Can we establish homologous features for the endosperm in the three species?





# Methodology



# Selected species of Loranthaceae

*Aetanthus  
colombianus*



Preanthesis



Anthesis



Fruit stage 3



Fruit stage 6

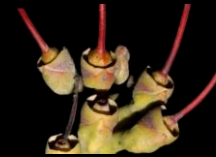
*Tristerix  
secundus*



Preanthesis



Anthesis



Postanthesis



Fruit stage 5

*Gaiadendron  
punctatum*



Preanthesis



Anthesis



Postanthesis

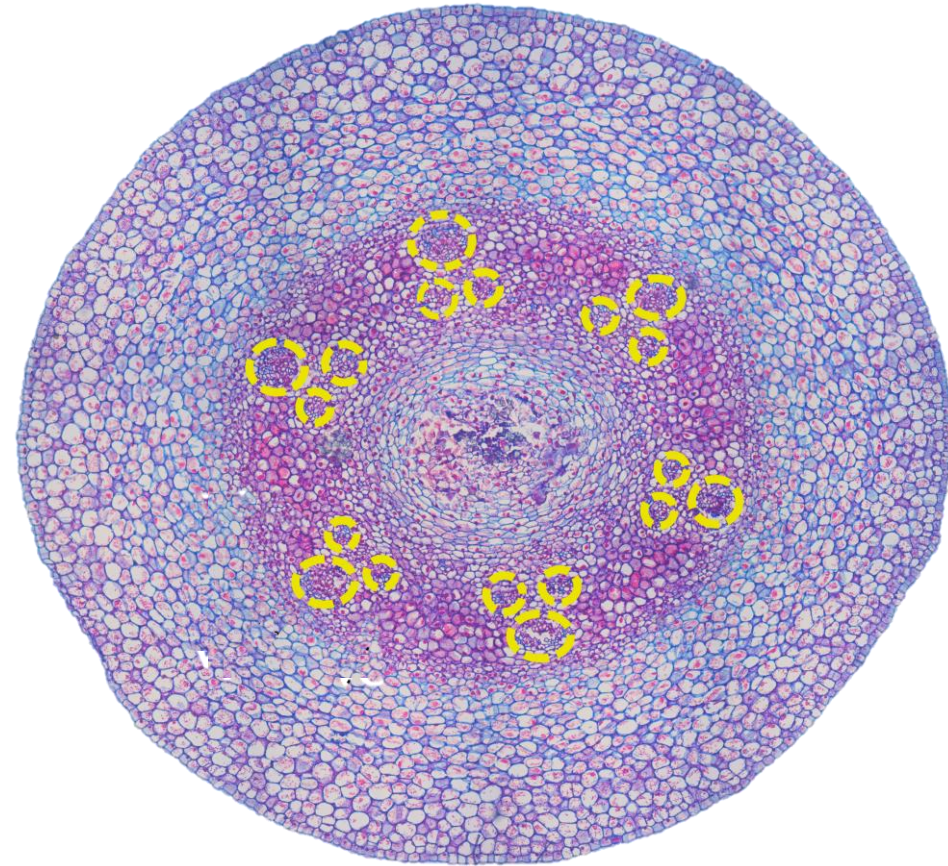


Fruit stage 5

# Vascular traces are hereafter used as positional references



Vascular traces of  
petals and stamens



Vascular traces of  
the carpel



*Tristerix secundus*

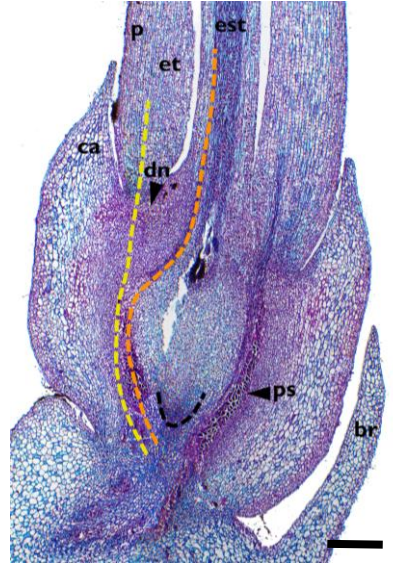


# Morpho-anatomical changes

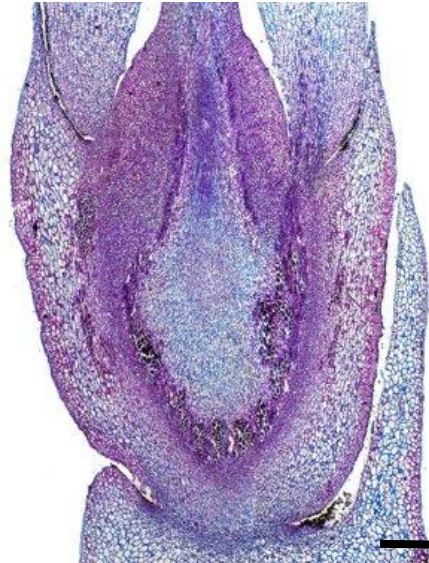
Vascular traces of  
petals and stamens

Vascular traces of  
carpels

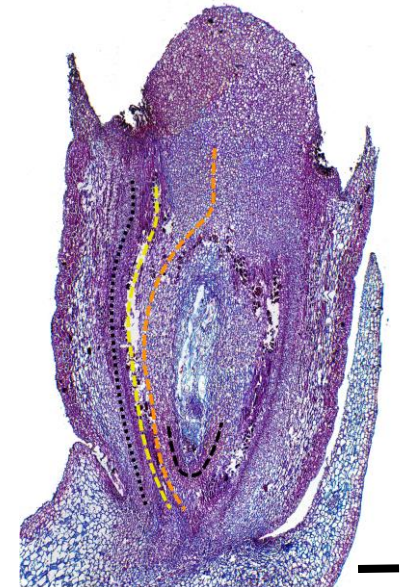
Bar = 300  $\mu$ m



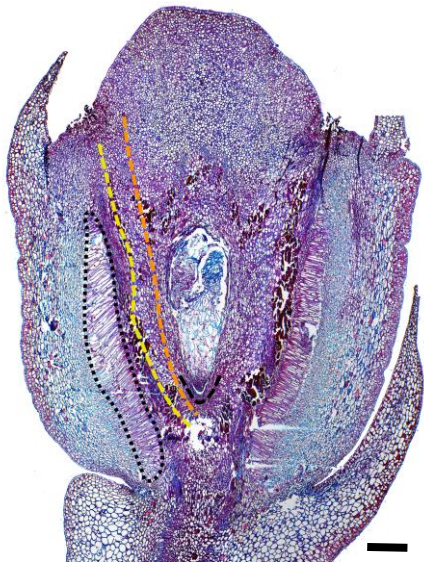
Preanthesis



Anthesis



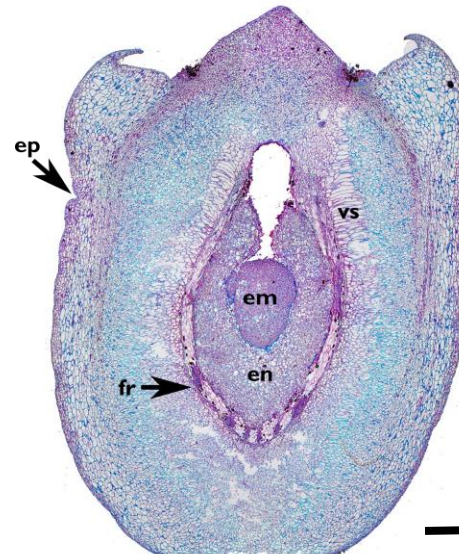
Postanthesis



Fruit stage 1



Fruit stage 2



Fruit stage 4



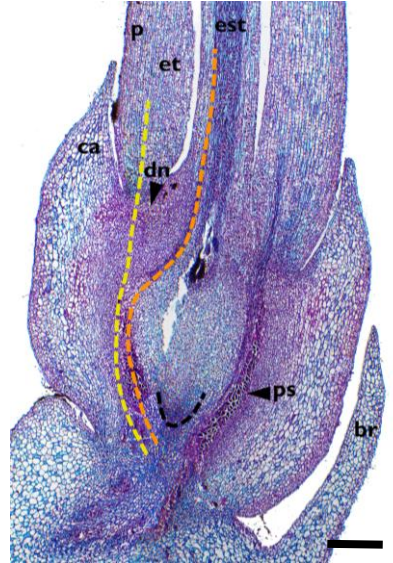
Fruto stage 5

# Morpho-anatomical changes

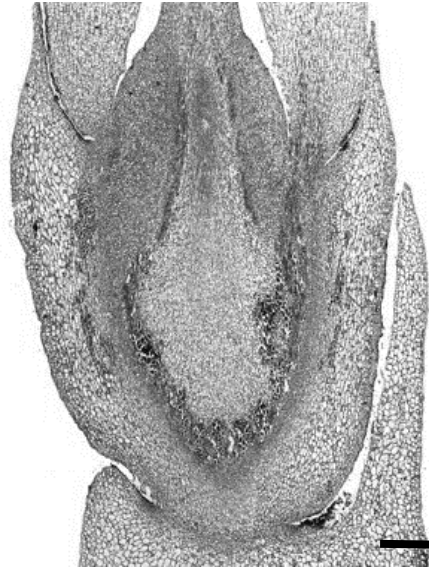
Vascular traces of  
petals and stamens

Vascular traces of  
carpels

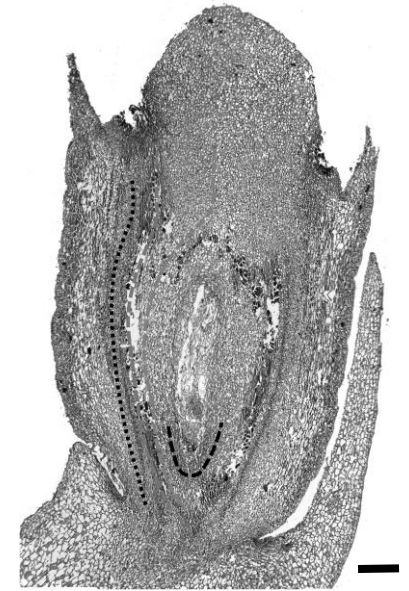
Bar = 300  $\mu$ m



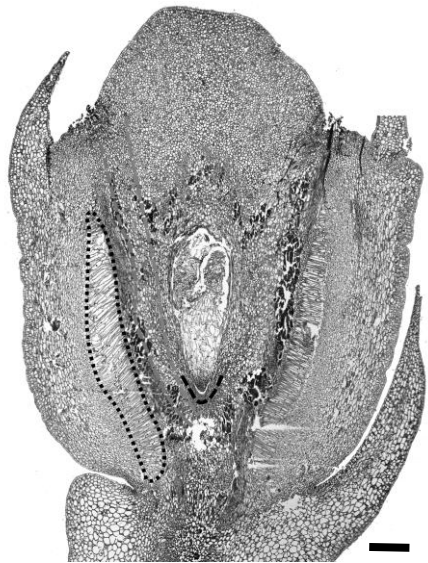
Preanthesis



Anthesis



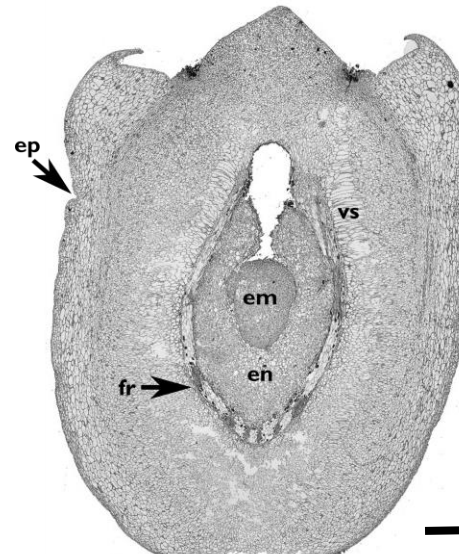
Postanthesis



Fruit stage 1



Fruit stage 2



Fruit stage 4



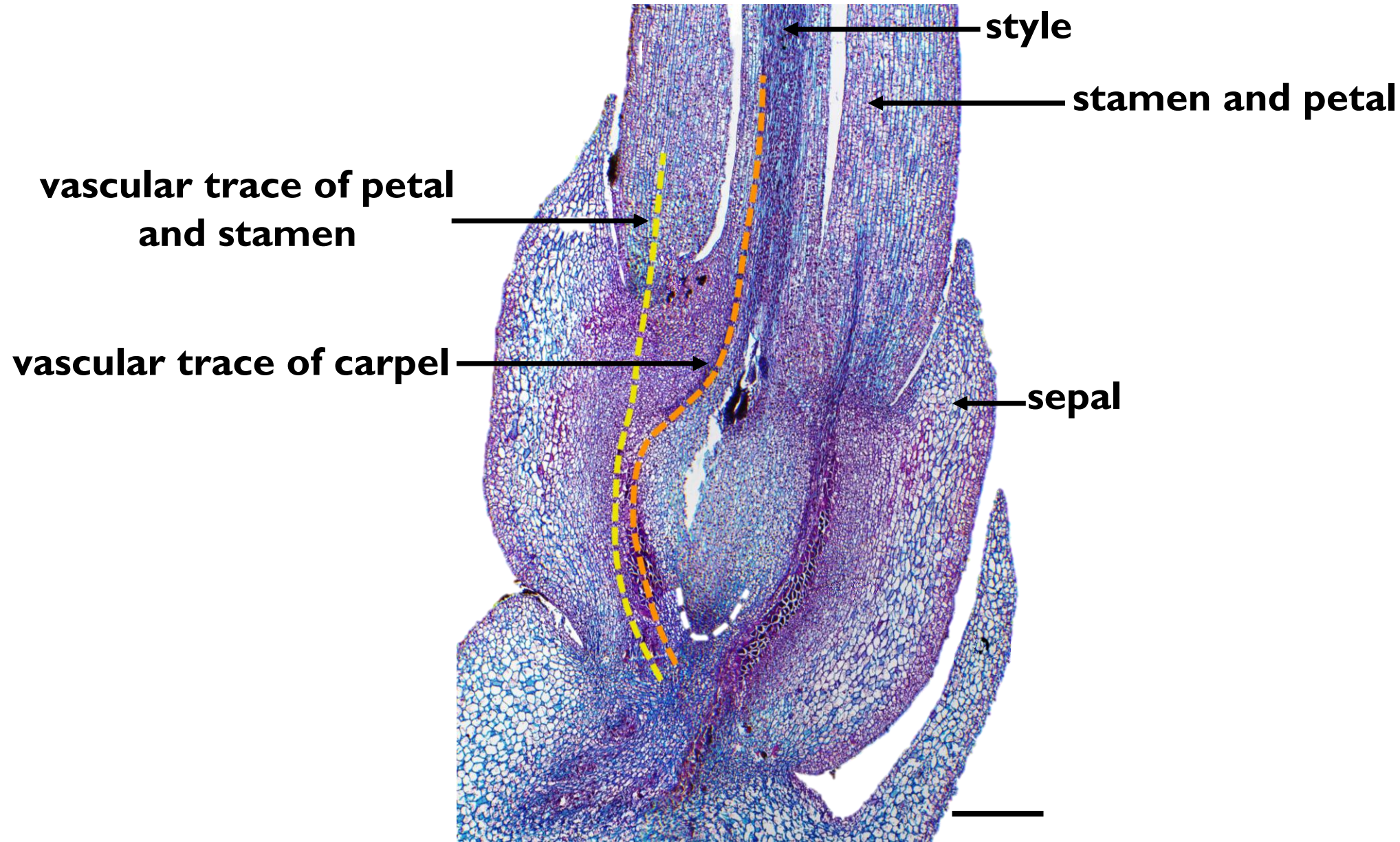
Fruto stage 5

# Preanthesis: first positional reference

Vascular traces of petals and stamens

Vascular traces of carpels

Bar = 300  $\mu$ m



style

stamen and petal

vascular trace of petal and stamen

vascular trace of carpel

sepal

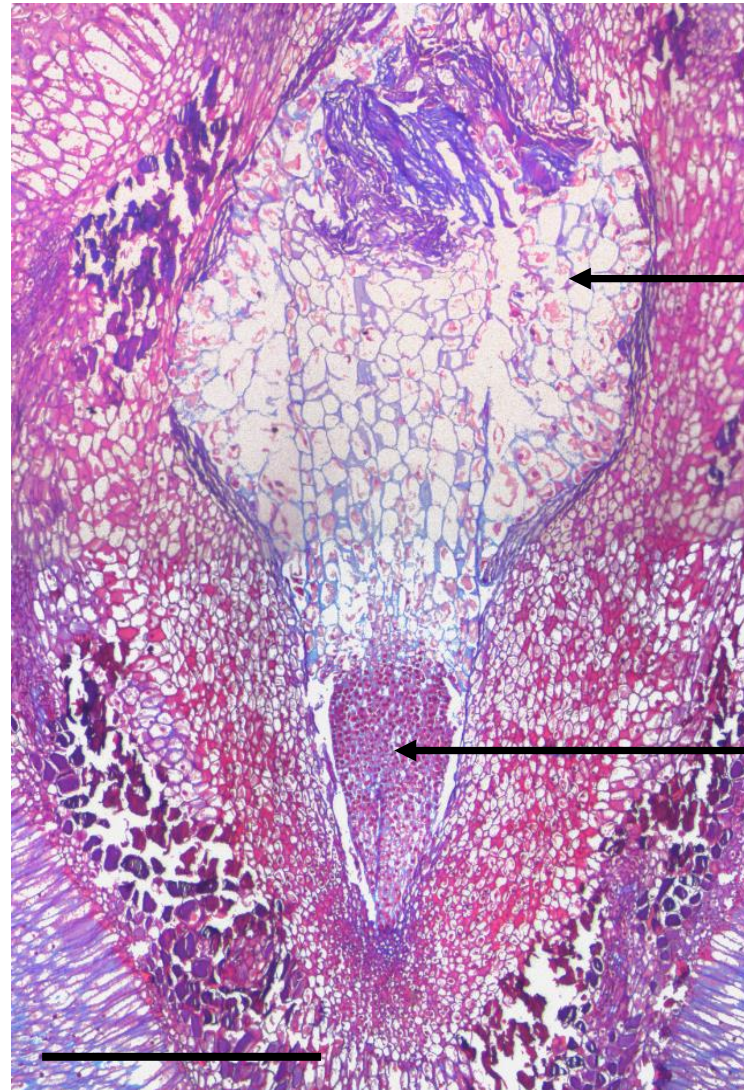


# Fruit stage 2: viscin, embryo and endosperm

Vascular traces of petals and stamens

Vascular traces of carpels

Bar = 300  $\mu$ m



← endosperm

← embryo

# Fruit stage 5: cotyledons and haustorium

Vascular traces of petals and stamens

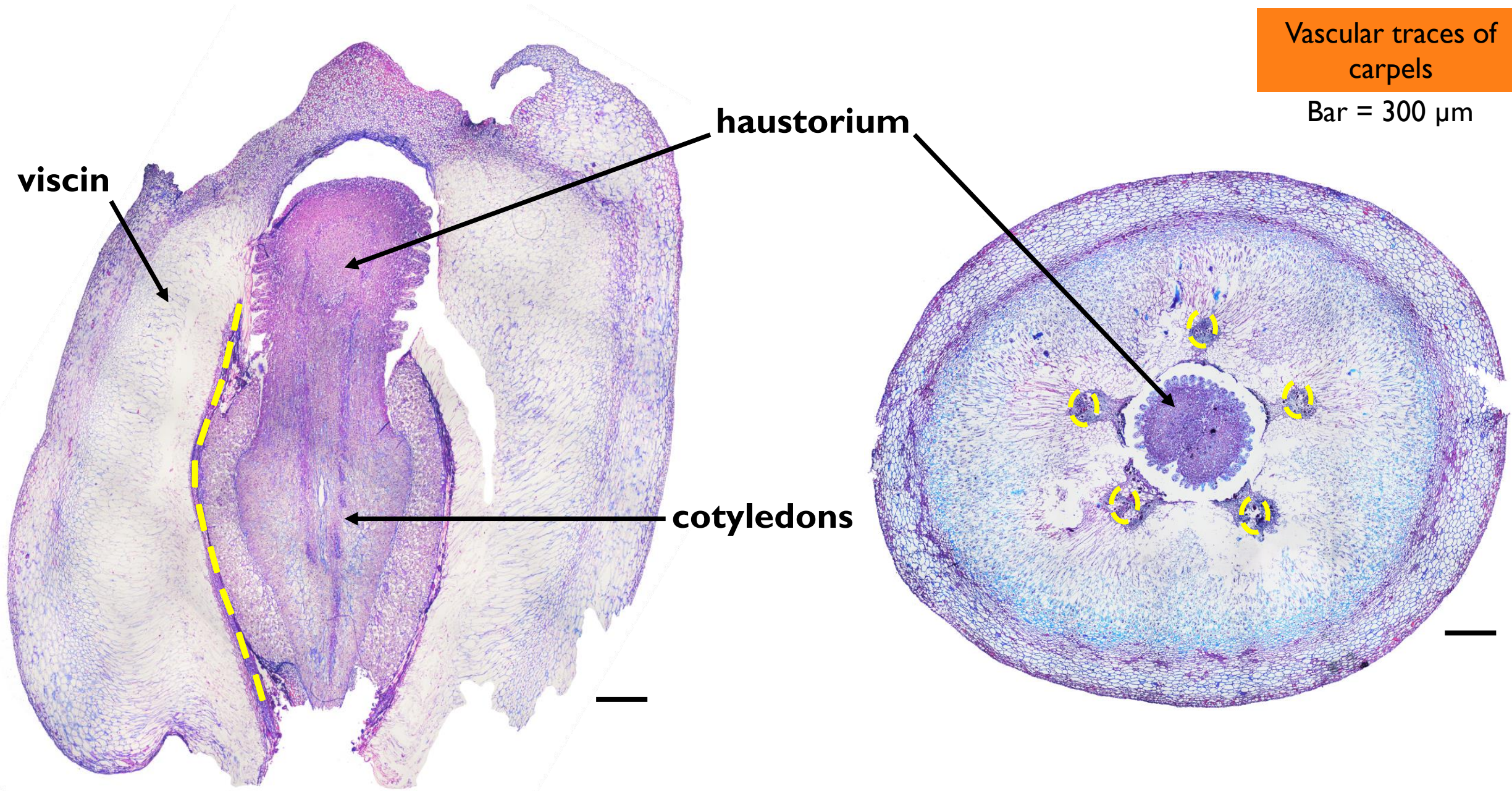
Vascular traces of carpels

Bar = 300  $\mu$ m

viscin

haustorium

cotyledons





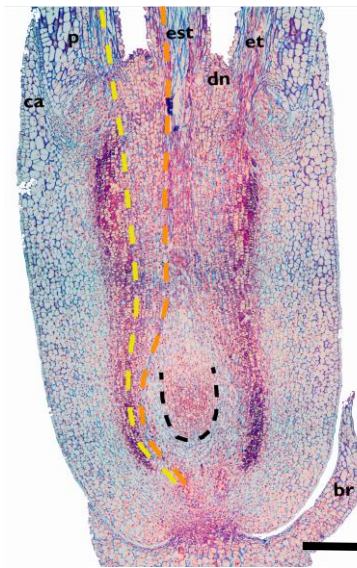
*Aetanthus  
colombianus*

# Morpho-anatomical changes

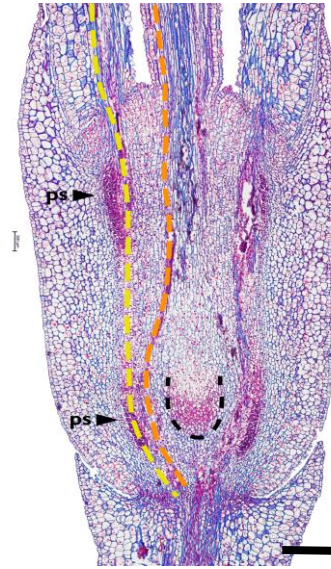
Vascular traces of  
petals and stamens

Vascular traces of  
carpels

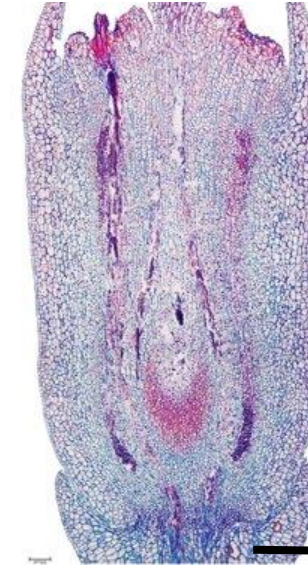
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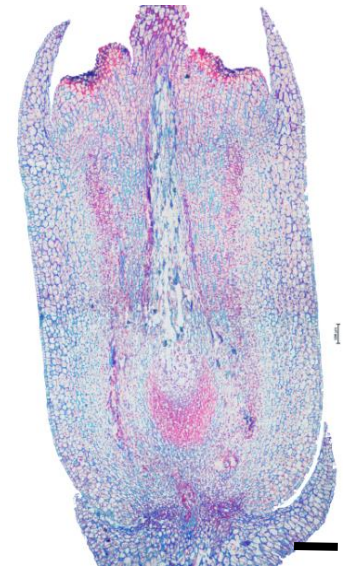
Preanthesis



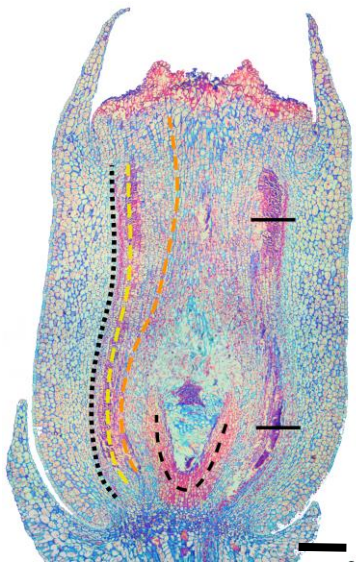
Anthesis



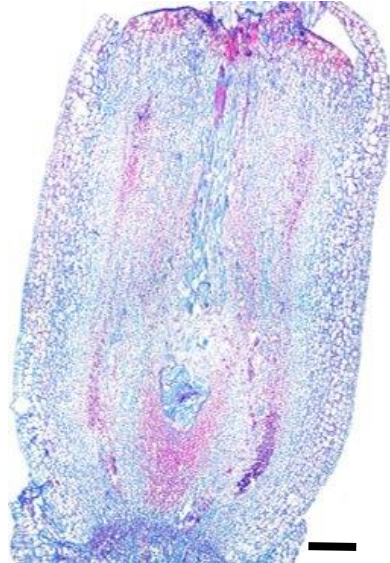
Postanthesis



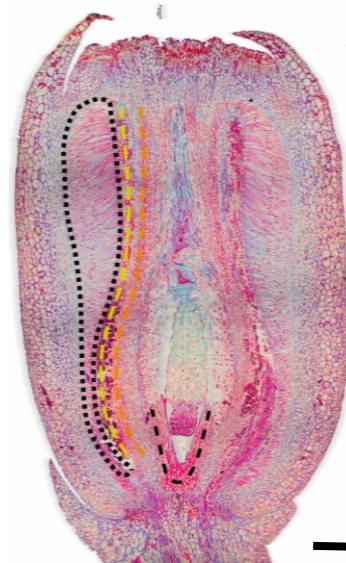
Fruit stage I



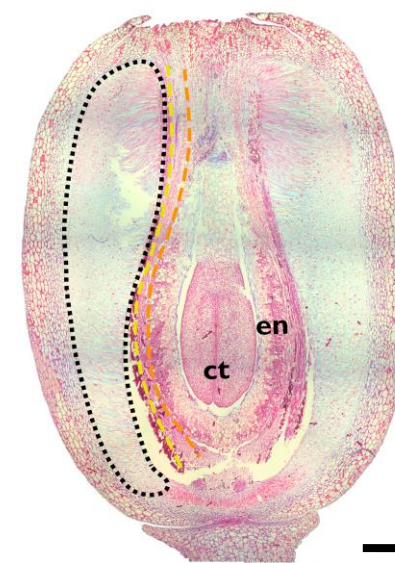
Fruit stage 2



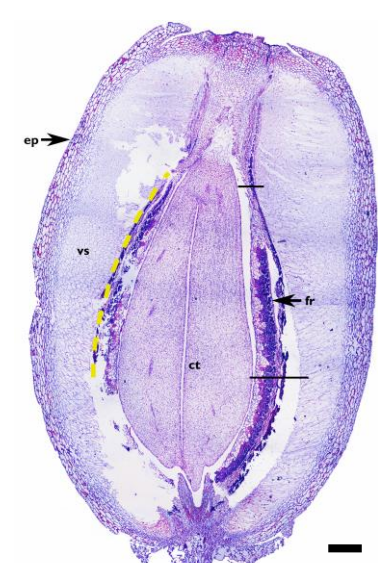
Fruit stage 3



Fruit stage 4



Fruit stage 5



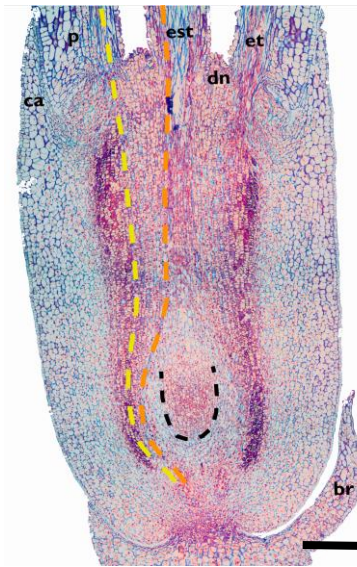
Fruit stage 6

# Morpho-anatomical changes

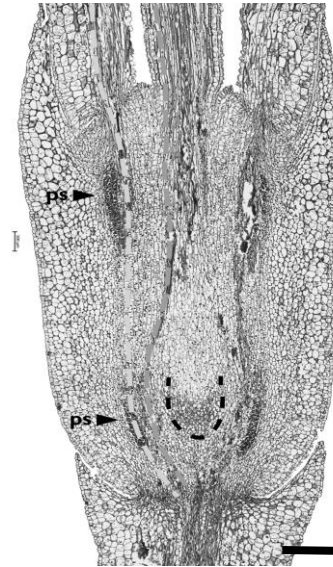
Vascular traces of  
petals and stamens

Vascular traces of  
carpels

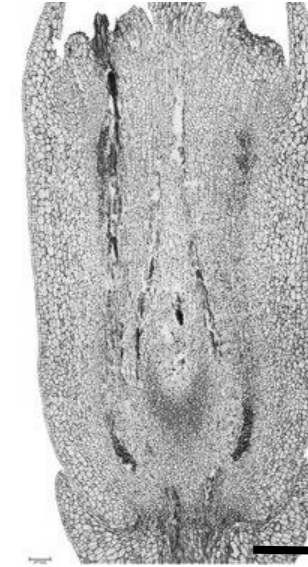
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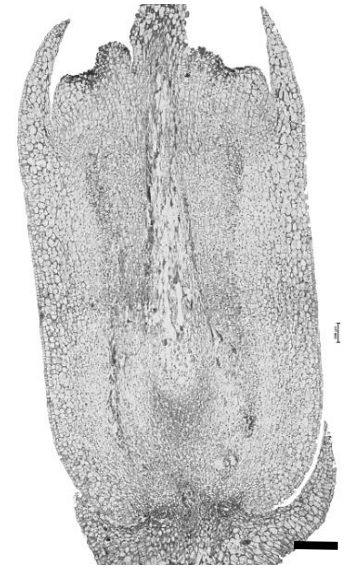
Preanthesis



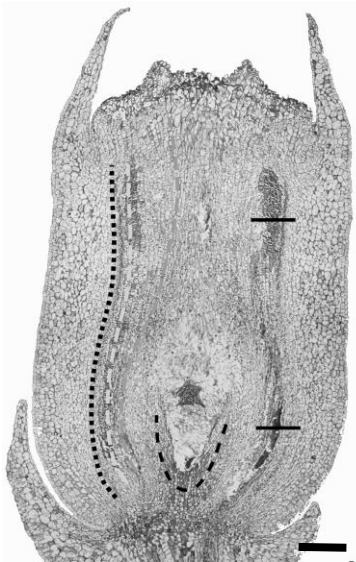
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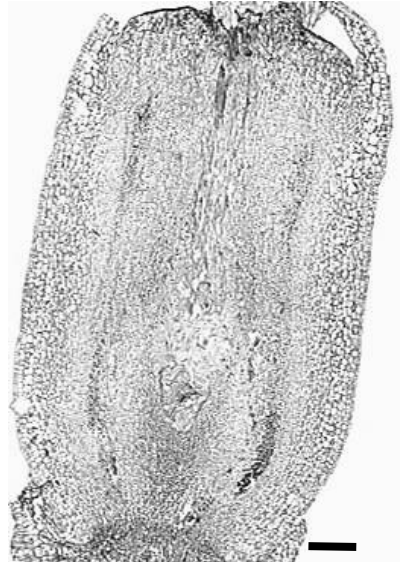
Postanthesis



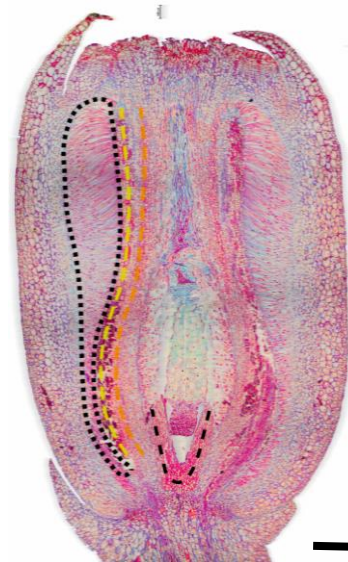
Fruit stage 1



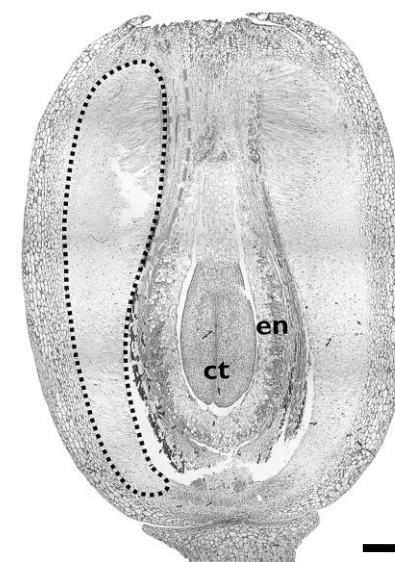
Fruit stage 2



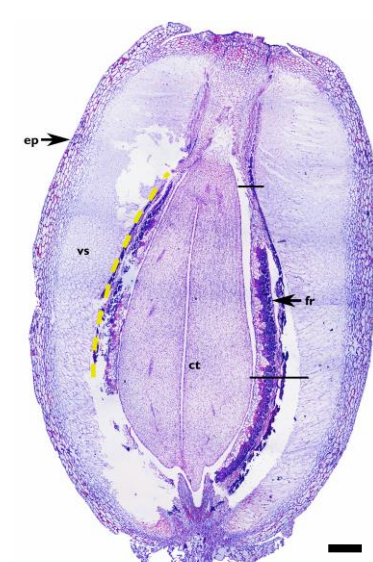
Fruit stage 3



Fruit stage 4



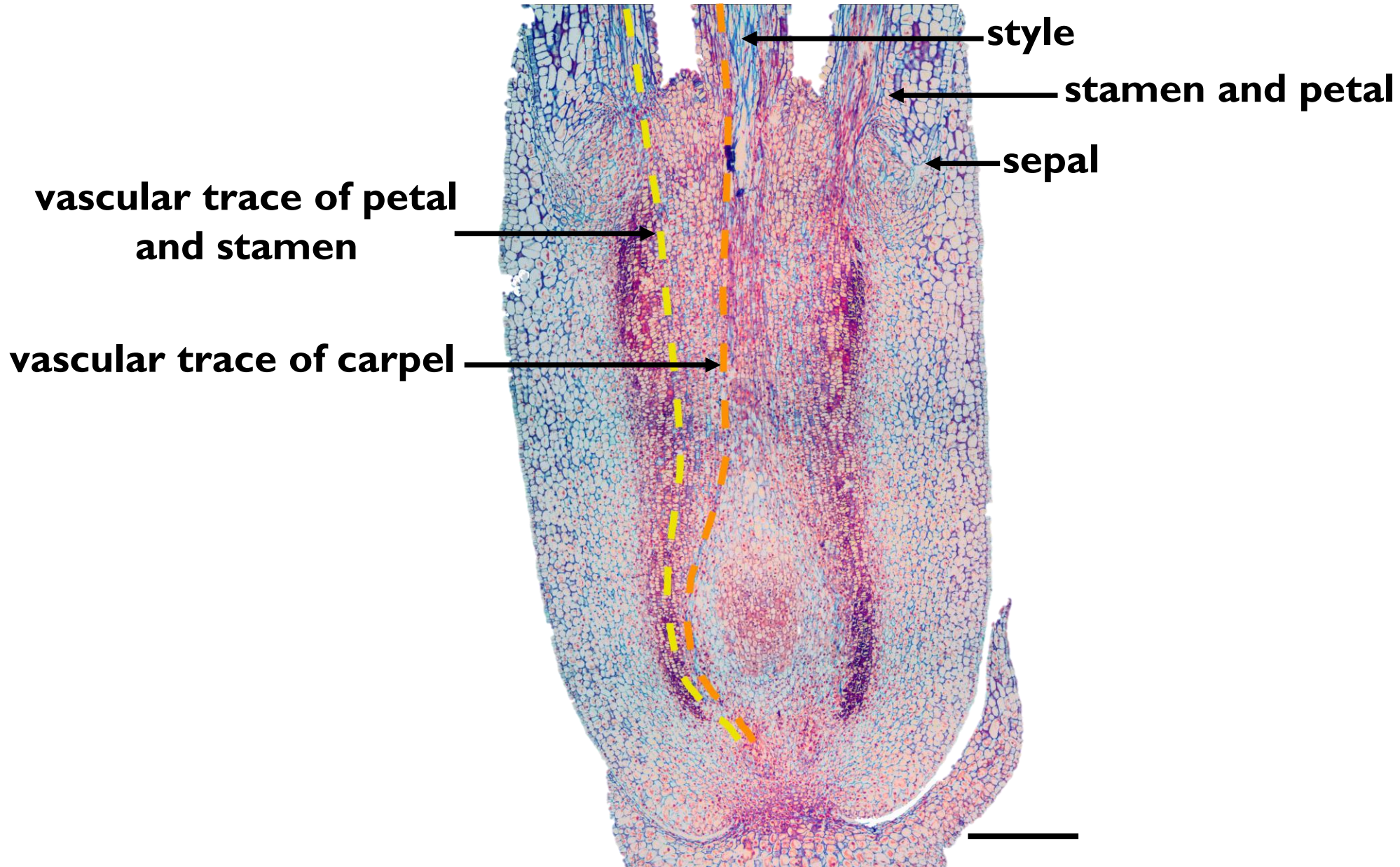
Fruit stage 5



Fruit stage 6



# Preanthesis: first positional reference



Vascular traces of petals and stamens

Vascular traces of carpels

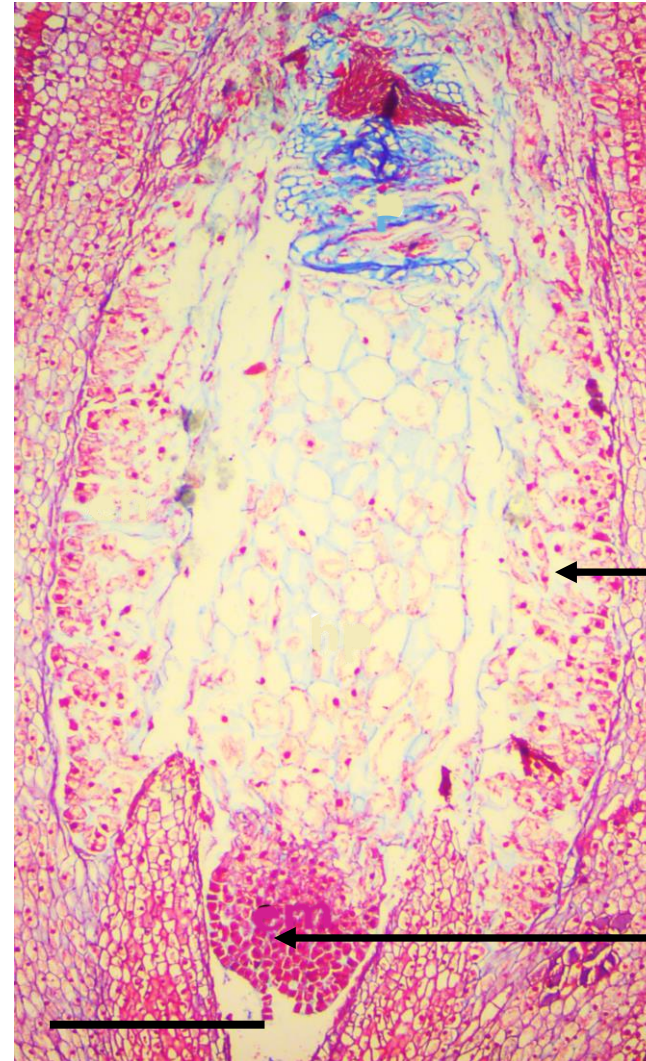
Bar = 300  $\mu$ m

# Fruit stage 4: embryo and endosperm (in *Aetanthus*!)

Vascular traces of  
petals and stamens

Vascular traces of  
carpels

Bar = 300  $\mu$ m



endosperm

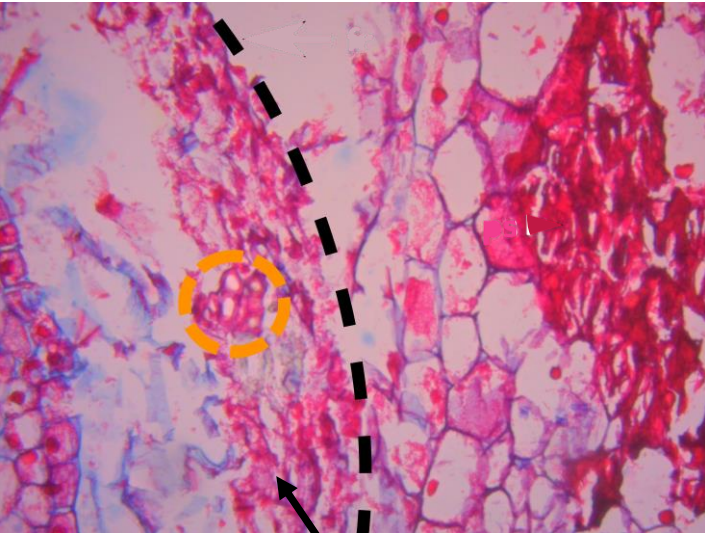
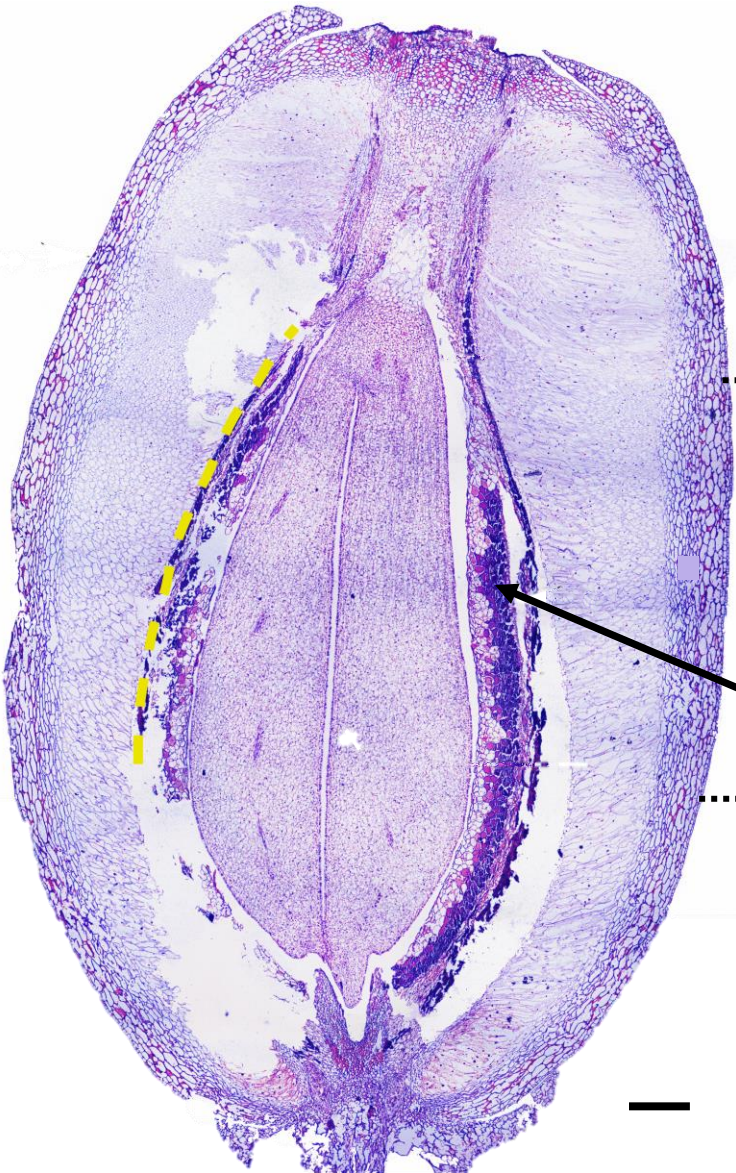
embryo

# Fruit stage 6: embryo growth and endosperm absorption

Vascular traces of petals and stamens

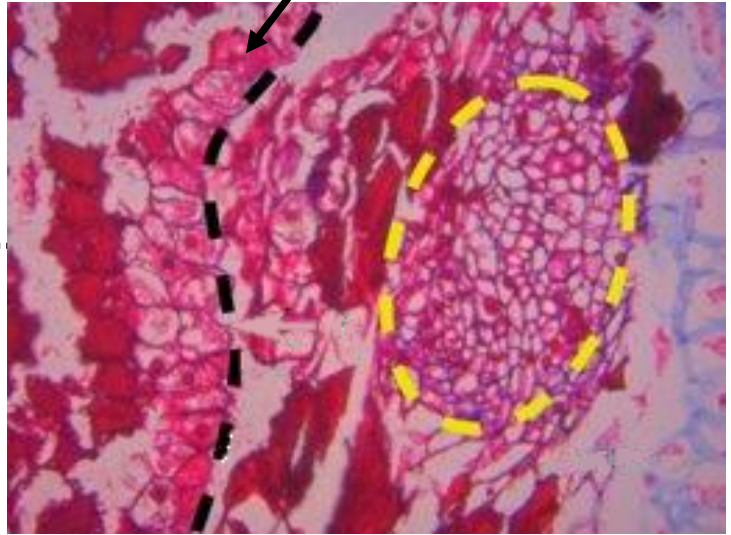
Vascular traces of carpels

Bar = 300  $\mu$ m



fruit

fruit



fruit

*Gaiadendron  
punctatum*



# Morpho-anatomical changes

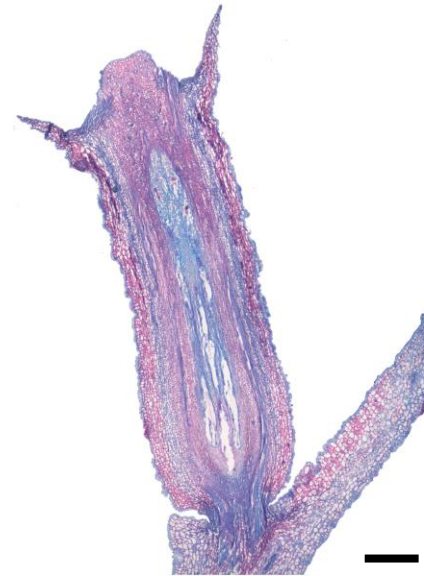
Vascular traces of  
petals and stamens

Vascular traces of  
carpels

Bar = 300  $\mu$ m



Preanthesis



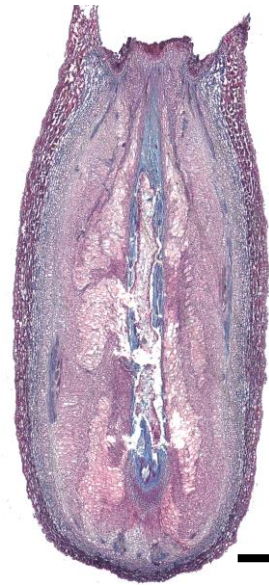
Anthesis



Postanthesis



Fruit stage 1



Fruit stage 2



Fruit stage 3



Fruit stage 4

# Morpho-anatomical changes

Vascular traces of  
petals and stamens

Vascular traces of  
carpels

Bar = 300  $\mu$ m



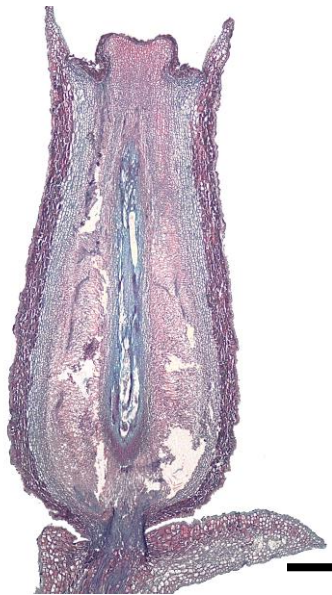
Preanthesis



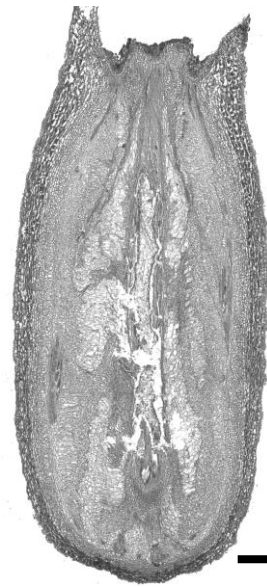
Anthesis



Postanthesis



Fruit stage 1



Fruit satage 2

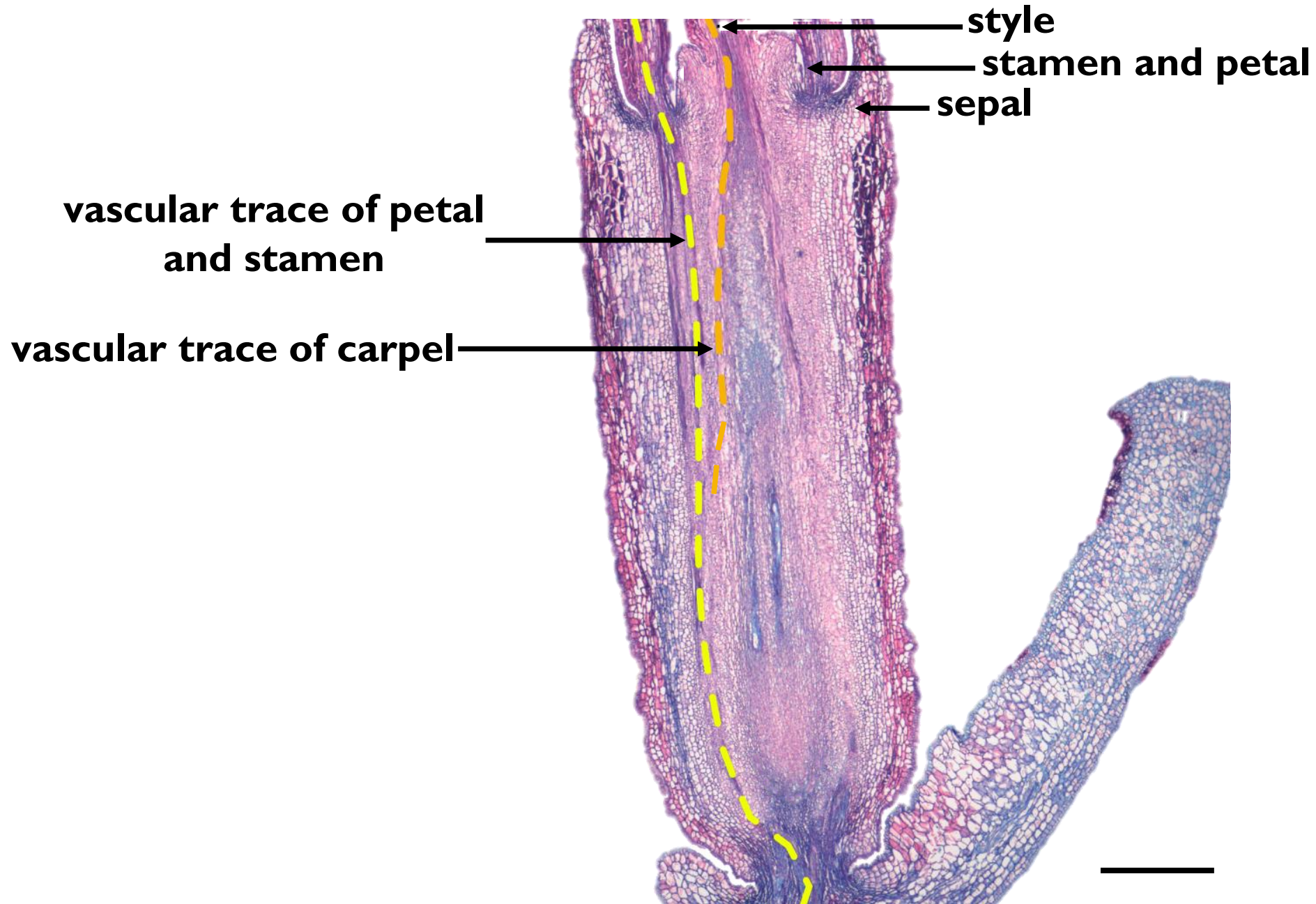


Fruit stage 3



Fruit stage 4

# Preanthesis: first positional reference



Vascular traces of petals and stamens

Vascular traces of carpels

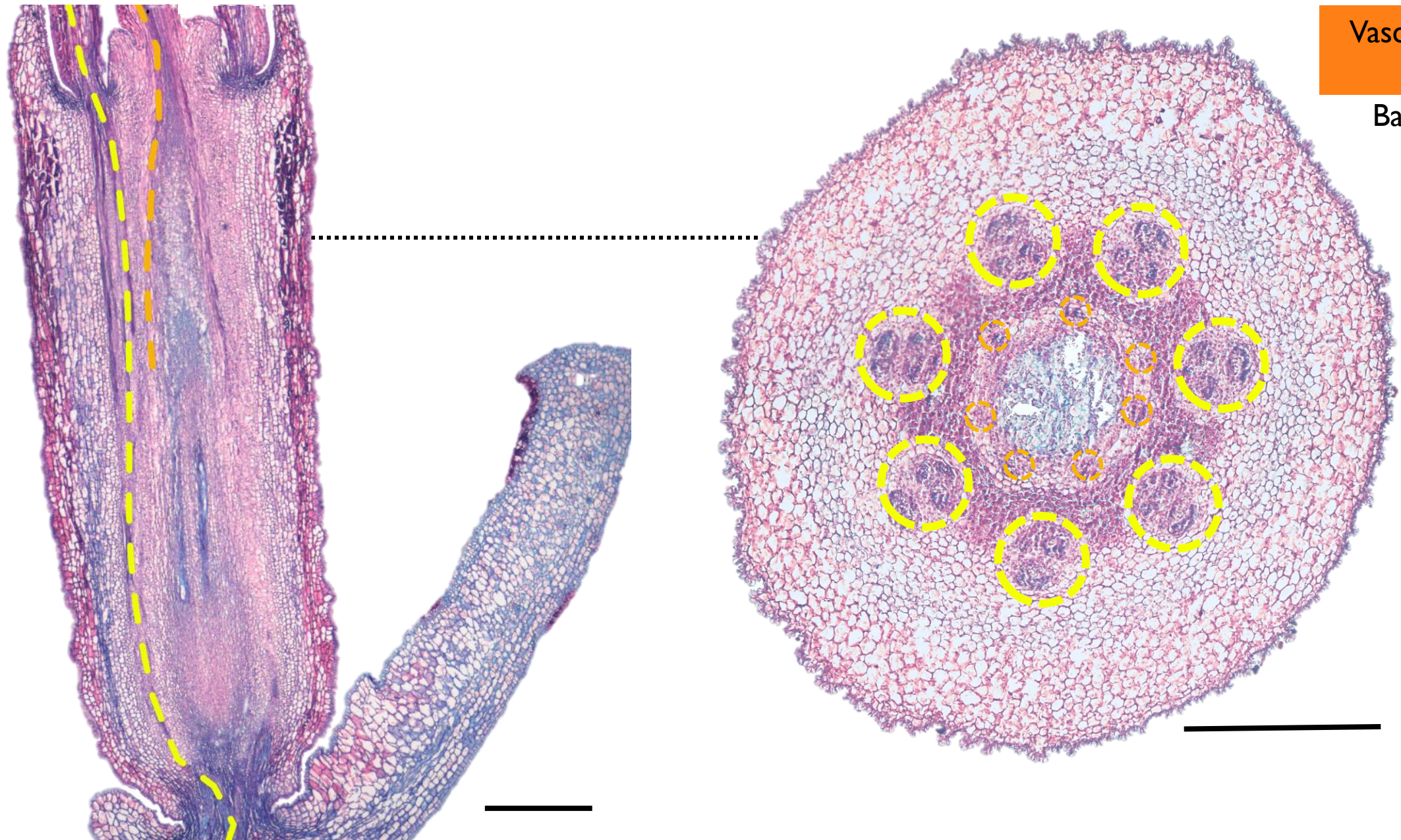
Bar = 300  $\mu$ m

# Preanthesis: first positional reference

Vascular traces of  
petals and stamens

Vascular traces of  
carpels

Bar = 300  $\mu$ m



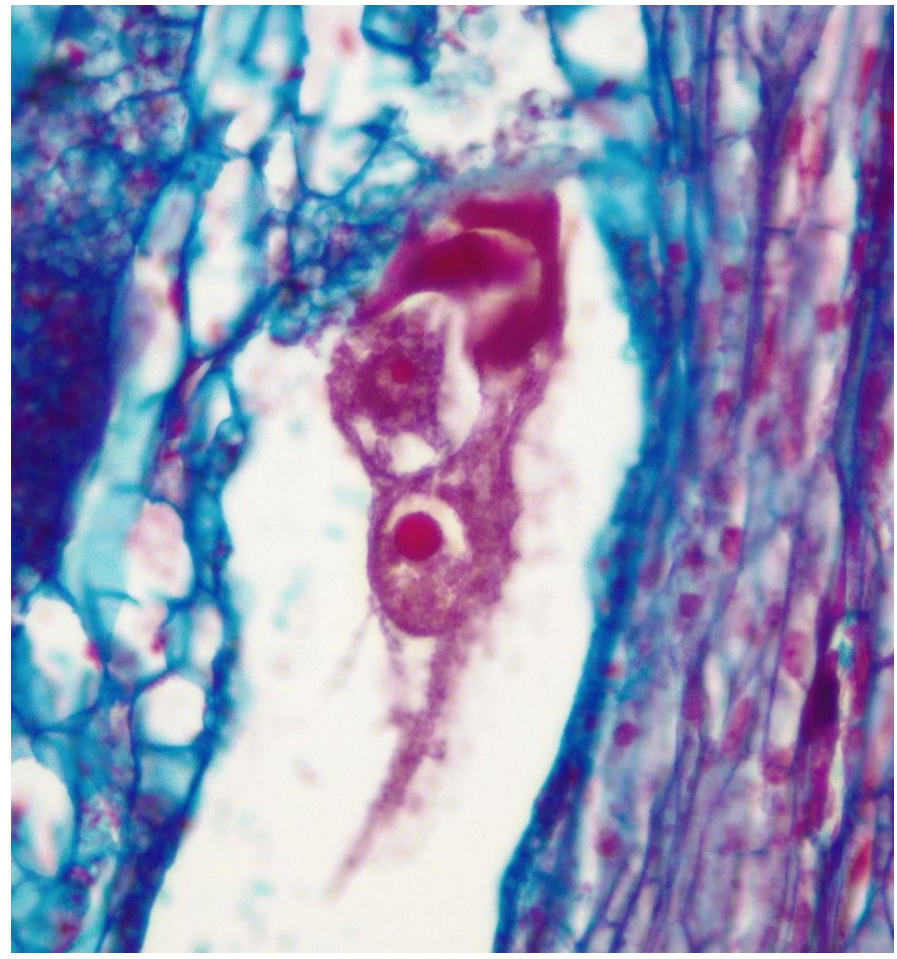
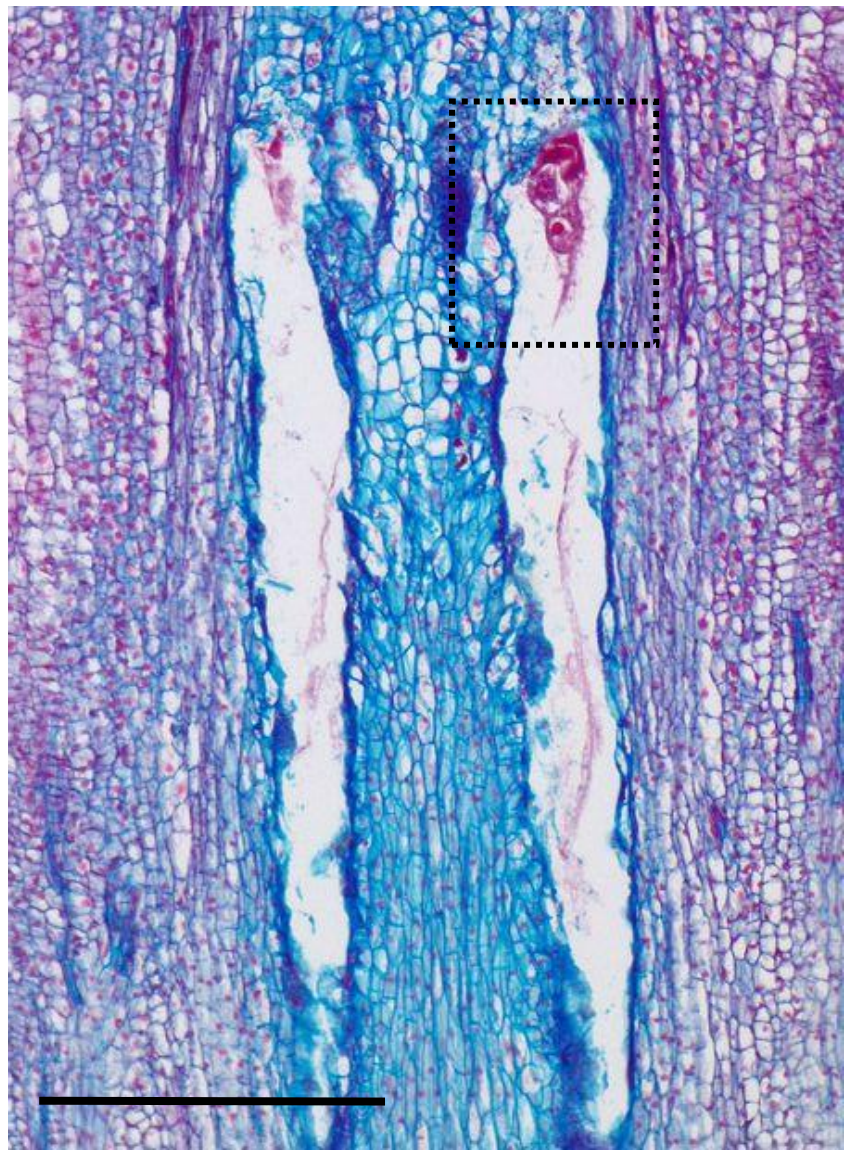
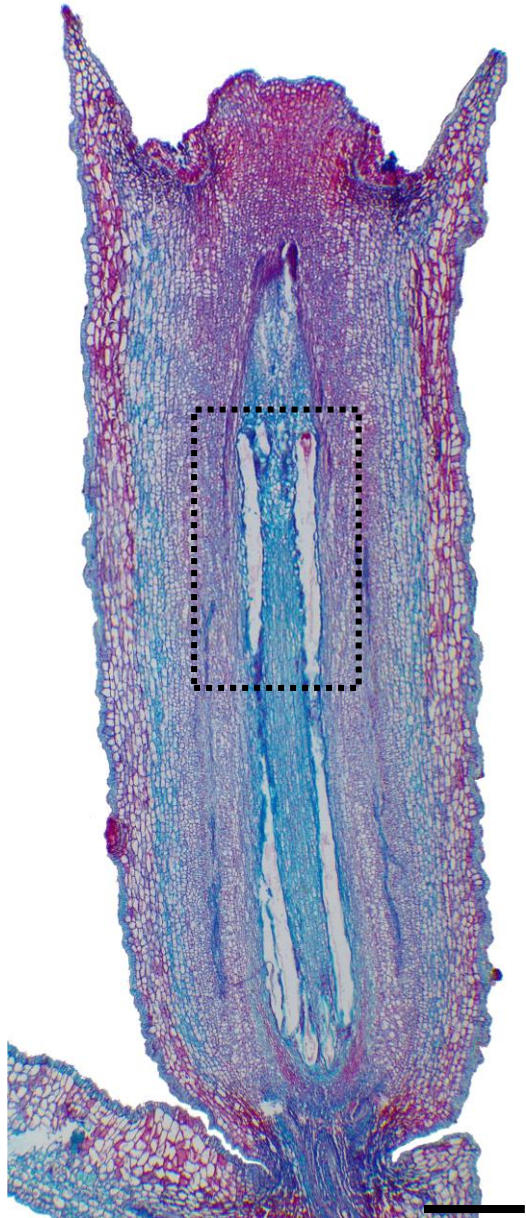


# Postanthesis: elongation of the embryo sac

Vascular traces of  
petals and stamens

Vascular traces of  
carpels

Bar = 300  $\mu$ m

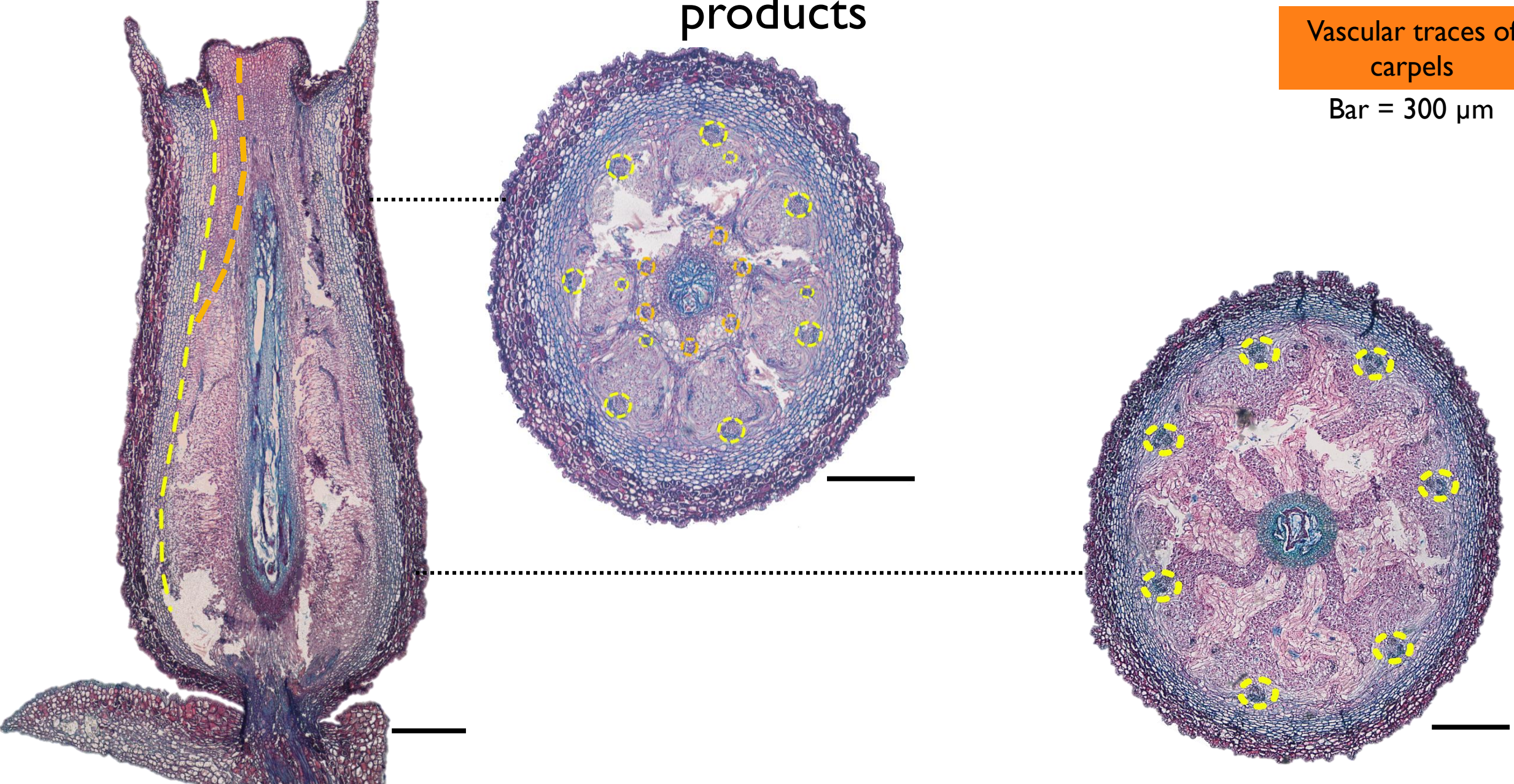


# Fruit stage I: double fertilization products

Vascular traces of petals and stamens

Vascular traces of carpels

Bar = 300  $\mu$ m



# Fruit stage 4: viscin and embryo

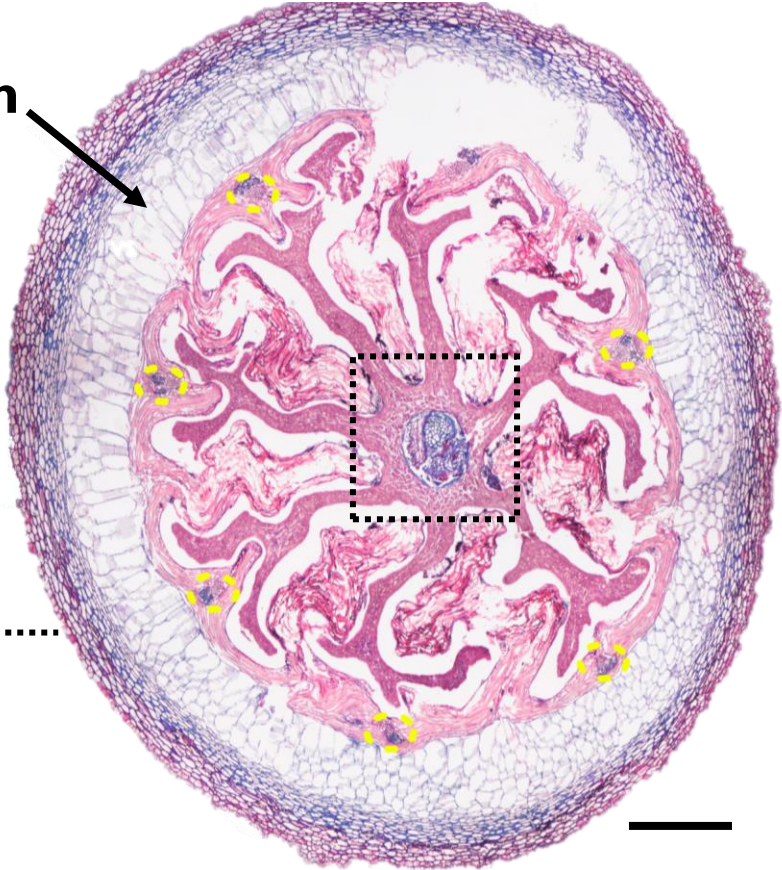
Vascular traces of petals and stamens

Vascular traces of carpels

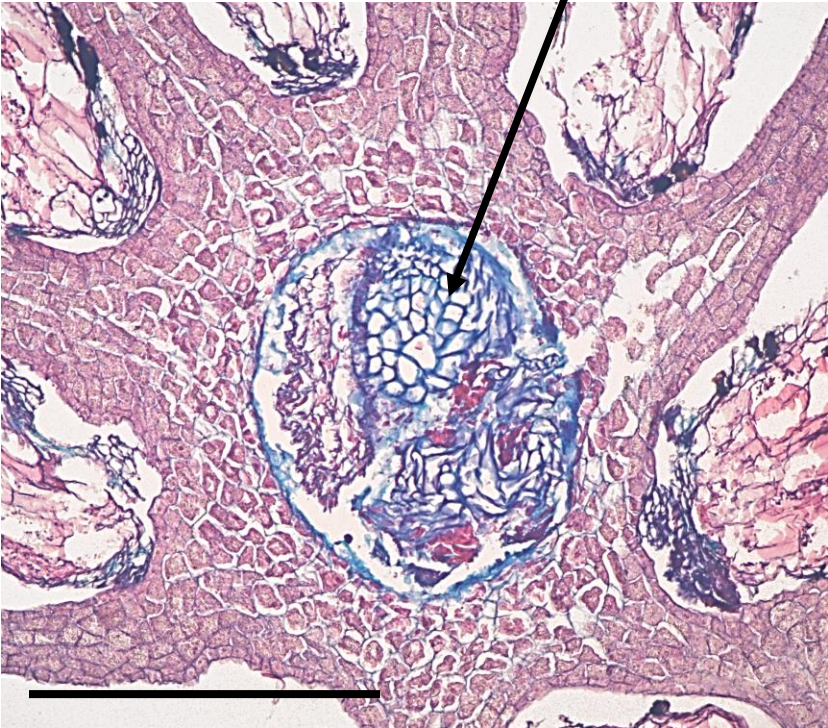
Bar = 300  $\mu$ m



viscin



embryo



# Main questions

What tissues correspond to the ovary wall and the hypanthium in the selected species?

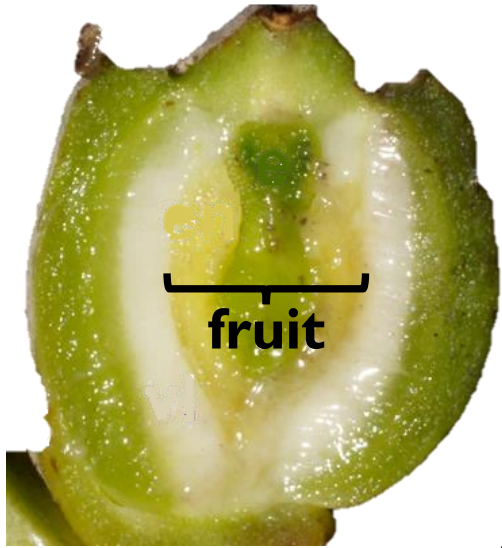
What is the origin of the viscin in the selected species?

Can we establish homologous features for the endosperm in the three species?

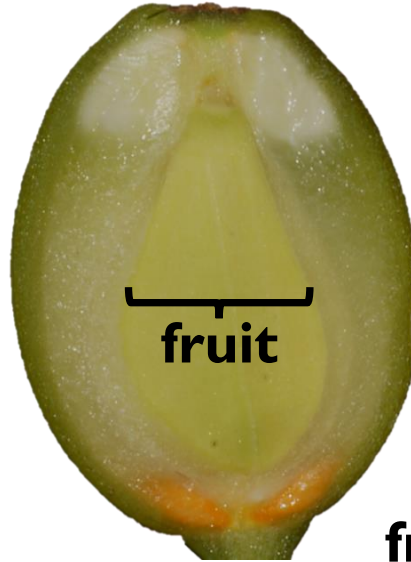


# Massive hypanthium surrounds the fruit

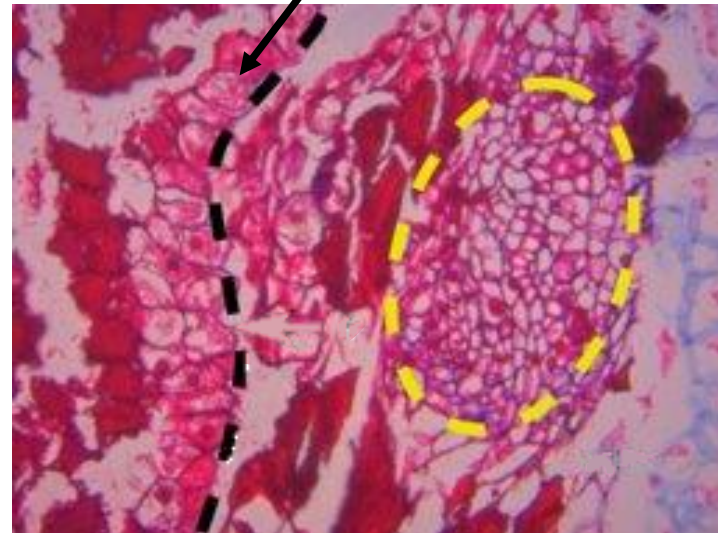
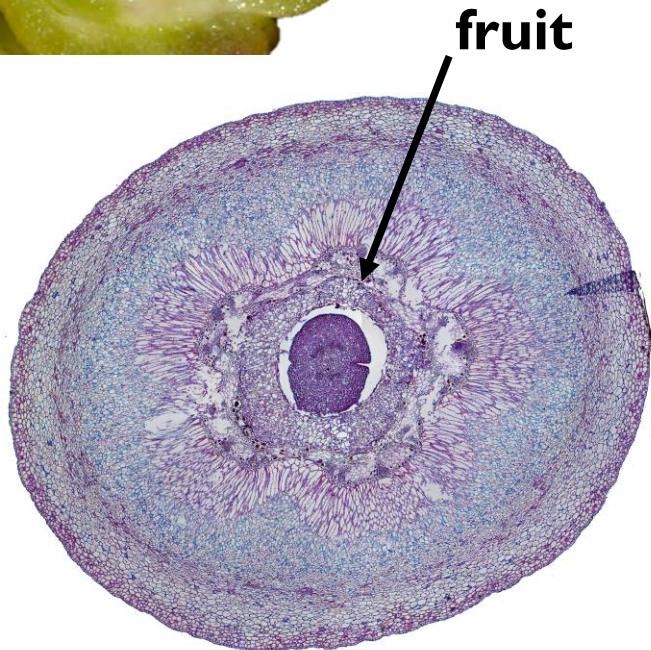
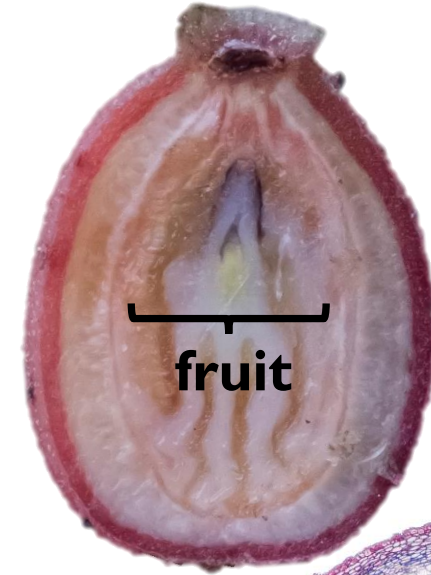
*Tristerix secundus*



*Aetanthus colombianus*



*Gaiadendron punctatum*



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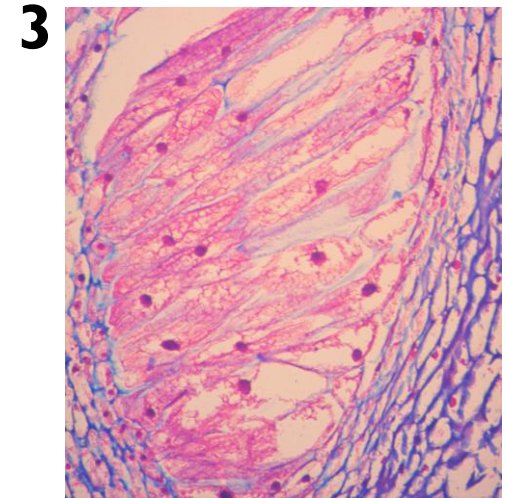
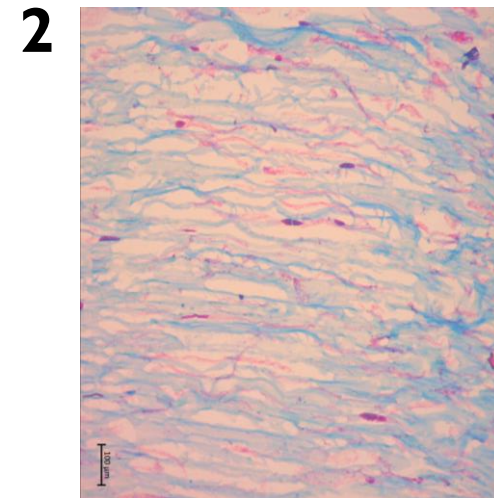
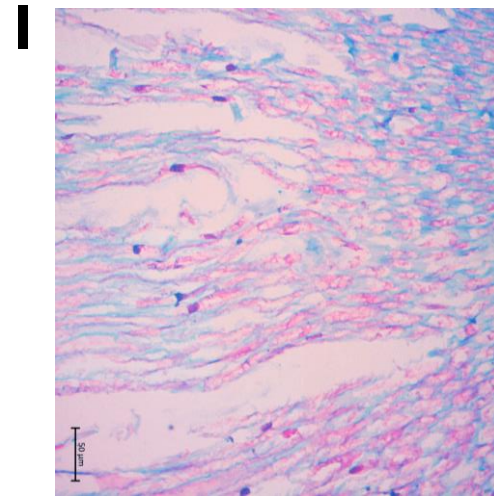
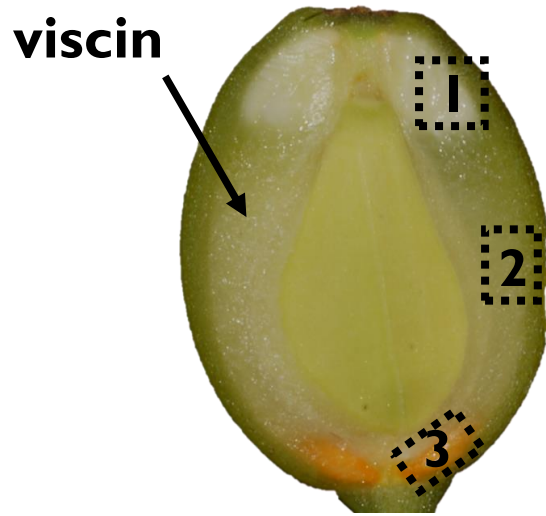
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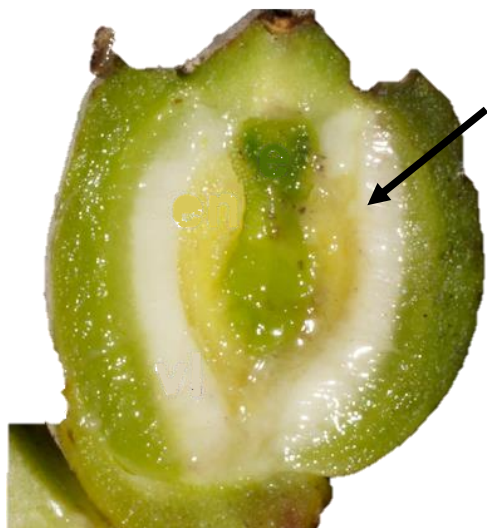


# Viscin derives from the hypanthium

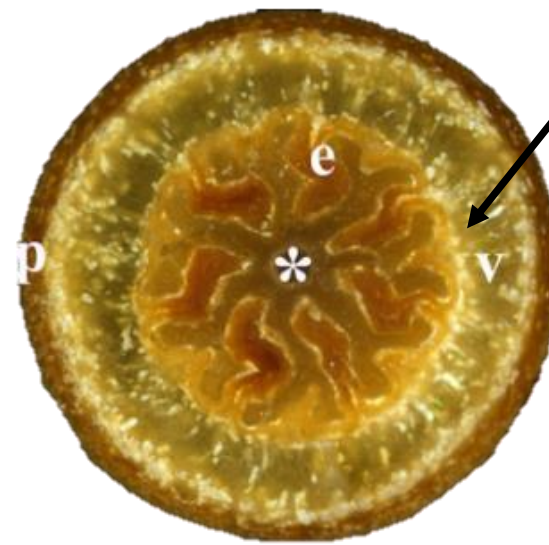
*Aetanthus colombianus*



*Tristerix secundus*



*Gaidendron punctatum*



# Main questions

Which tissues correspond to the ovary wall and the hypanthium in the selected species?

Which is the origin of the viscin in the selected species?

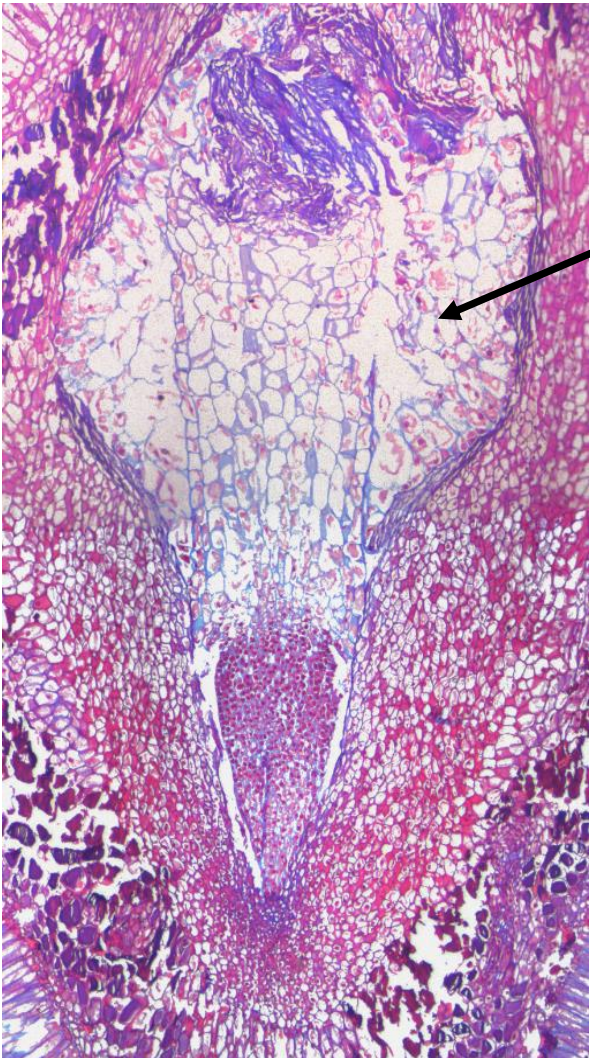
Can we establish homologous features for the endosperm in the three species?





# Endosperm features

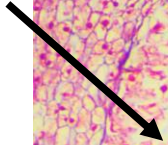
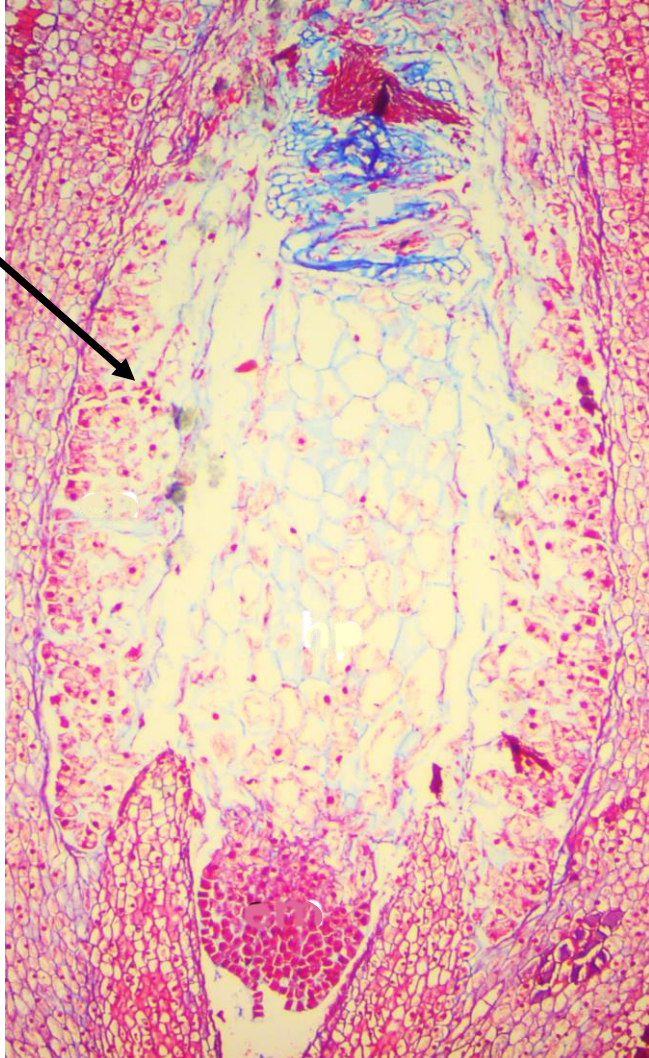
*Tristerix secundus*



endosperm

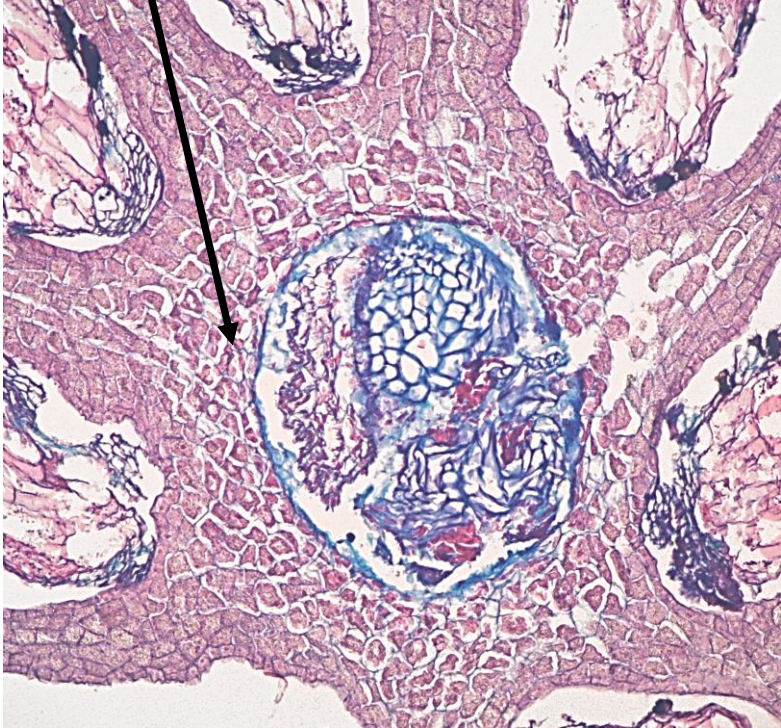


*Aetanthus colombianus*

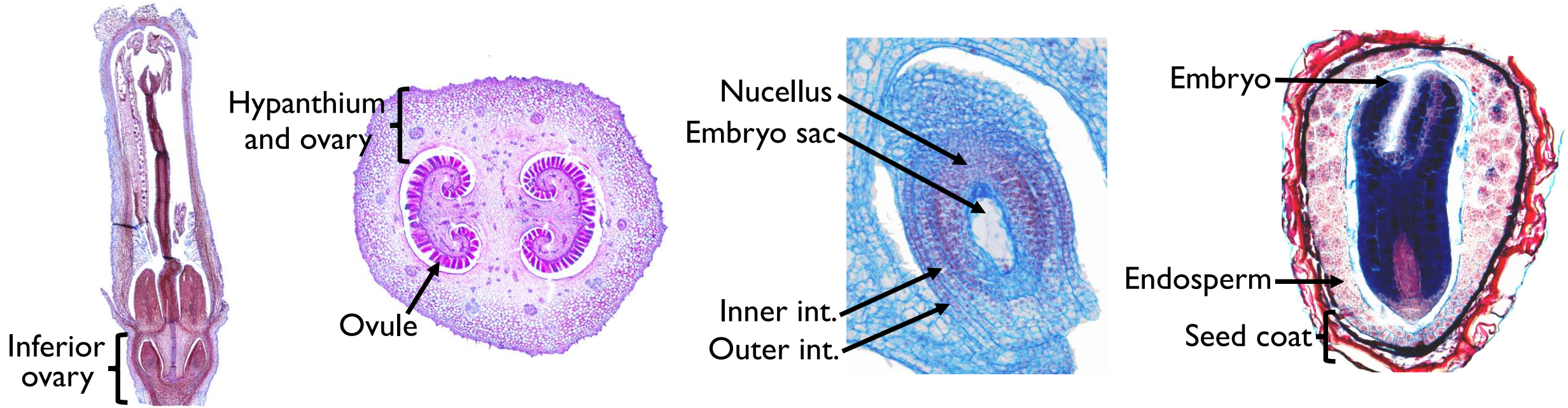


*Gaiadendron punctatum*

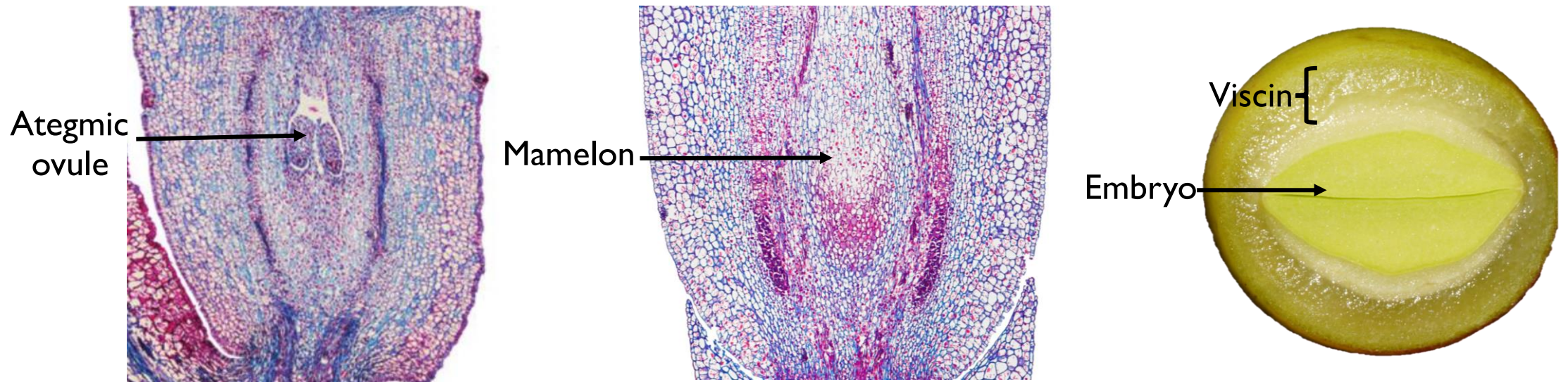
endosperm



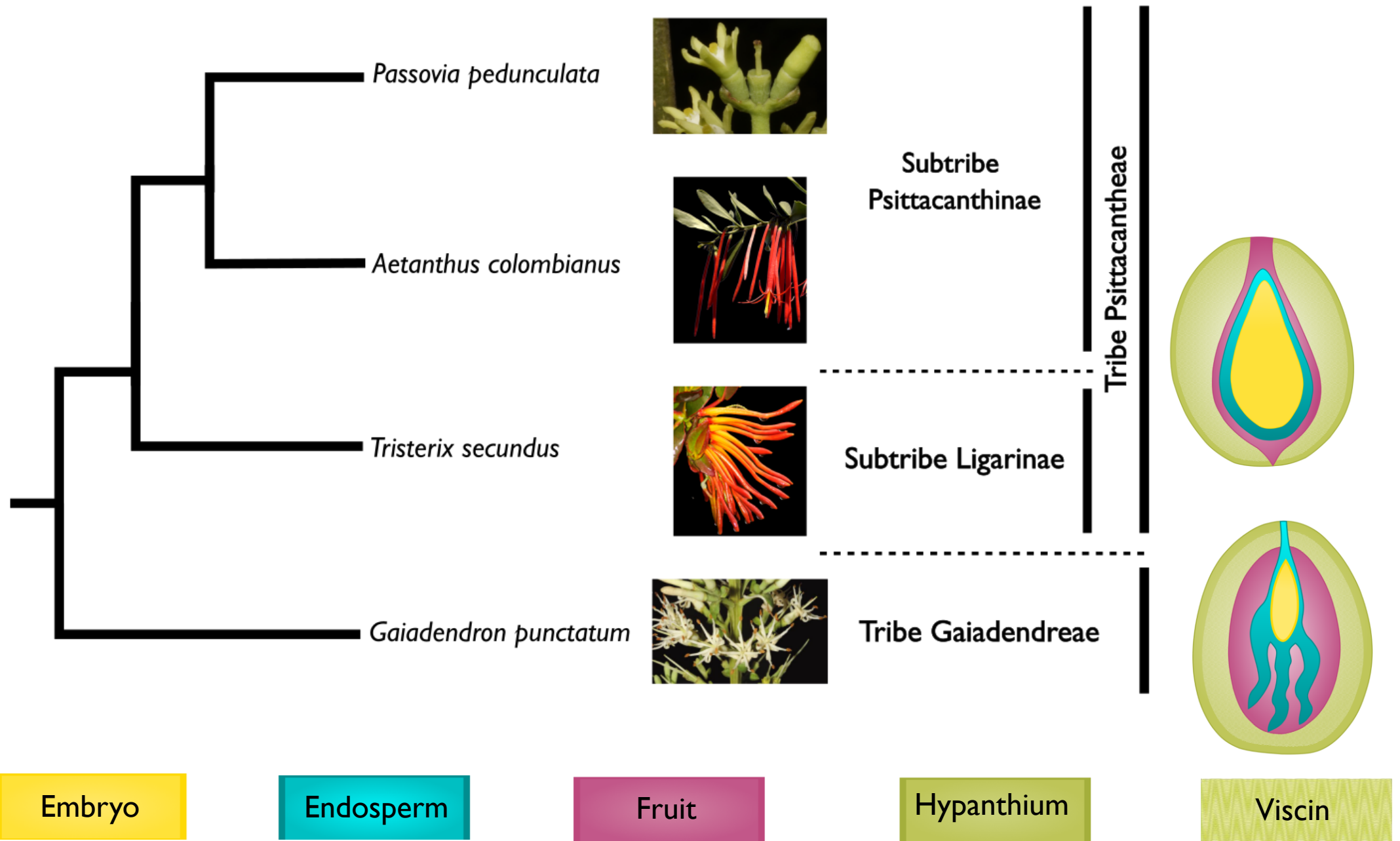
# Conventional flowers: locules, ovules, integuments, nucellus, endosperm and embryo



# Loranthaceae flowers: viscin and reduced carpels and ovules



# Loranthaceae fruits: viscid hypanthium + fruit + fertilization products



# Acknowledgements



**EVO  
DEVO**

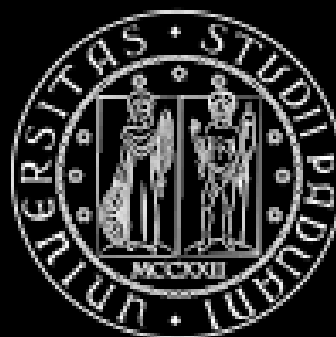


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