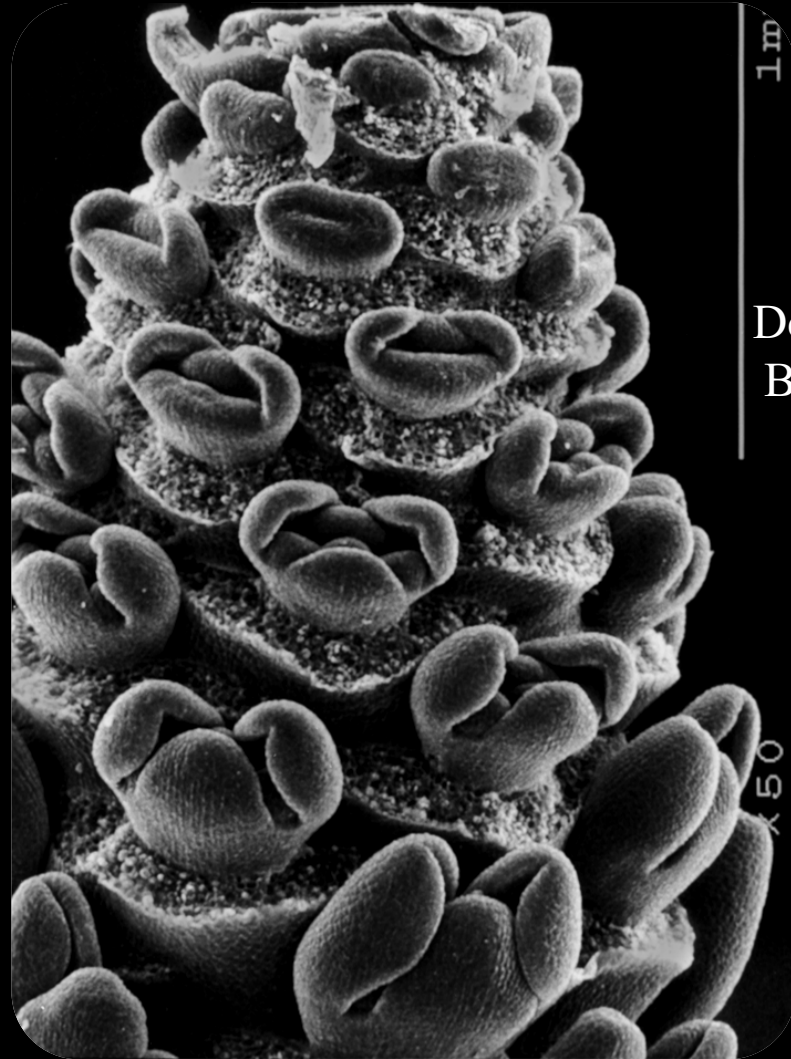




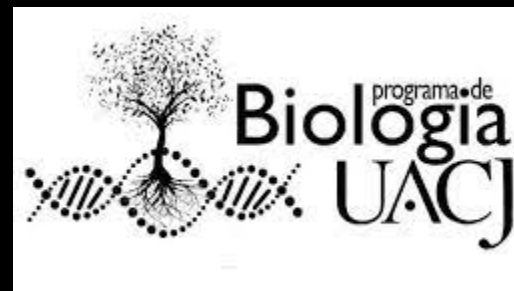
UACJ

Las asombrosas orquídeas: de la morfología al intrincado desarrollo floral.



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Batalla**

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cfigueroa@uacj.mx



Familia Orchidaceae

- Familia muy diversa (≈ 800 géneros y 25,000 especies conocidas).
- Distribución mundial, mayor diversidad en los trópicos.
- Gran variedad de hábitos y formas de vida.



¿Por qué las orquídeas son tan diversas?

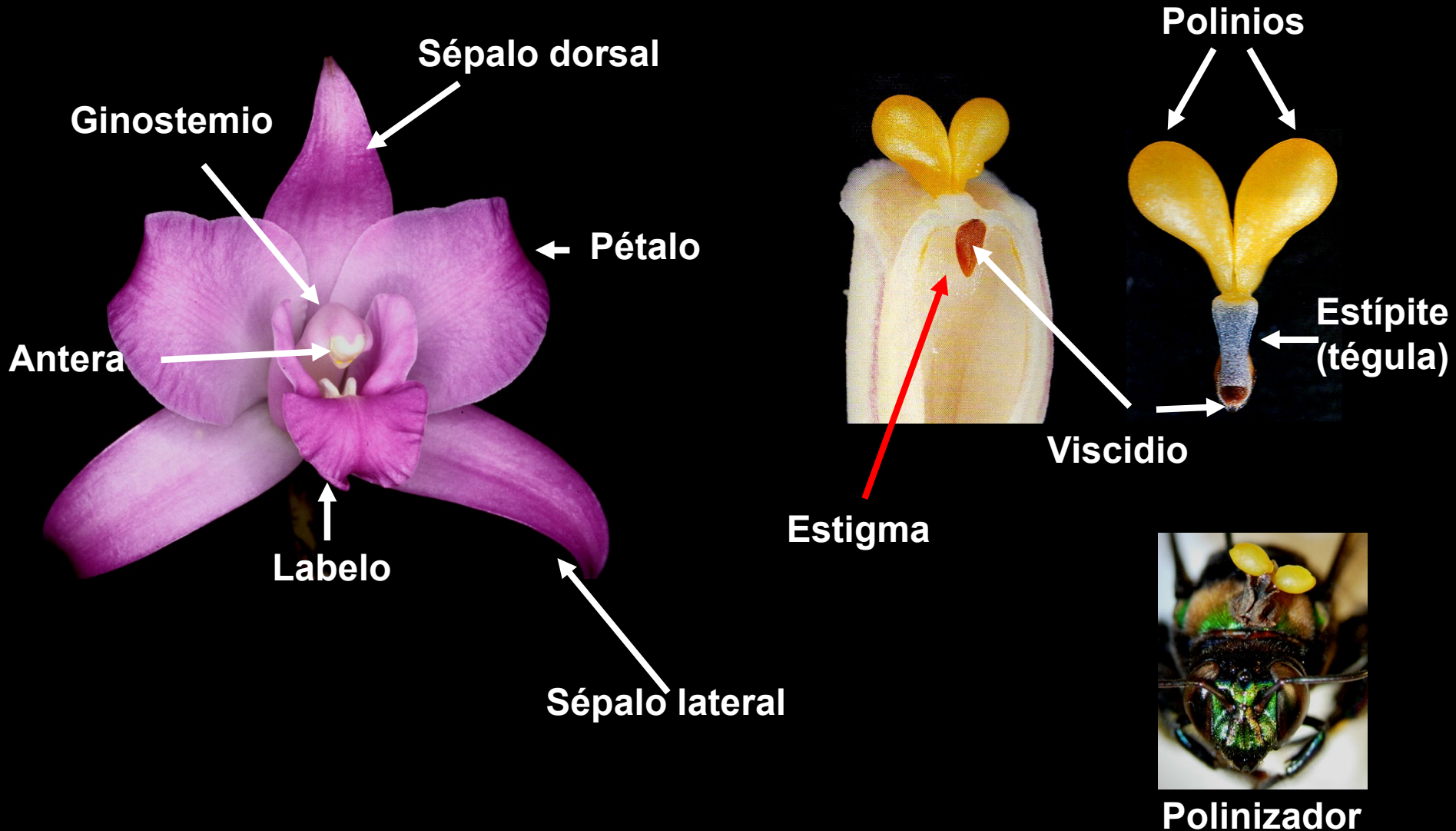


Innovaciones clave en las orquídeas:

- Zigomorfía
- Resupinación
- Estructuras existentes que se adaptan a funciones nuevas, por ejemplo el róstelo.
- Expresión ectópica de genes

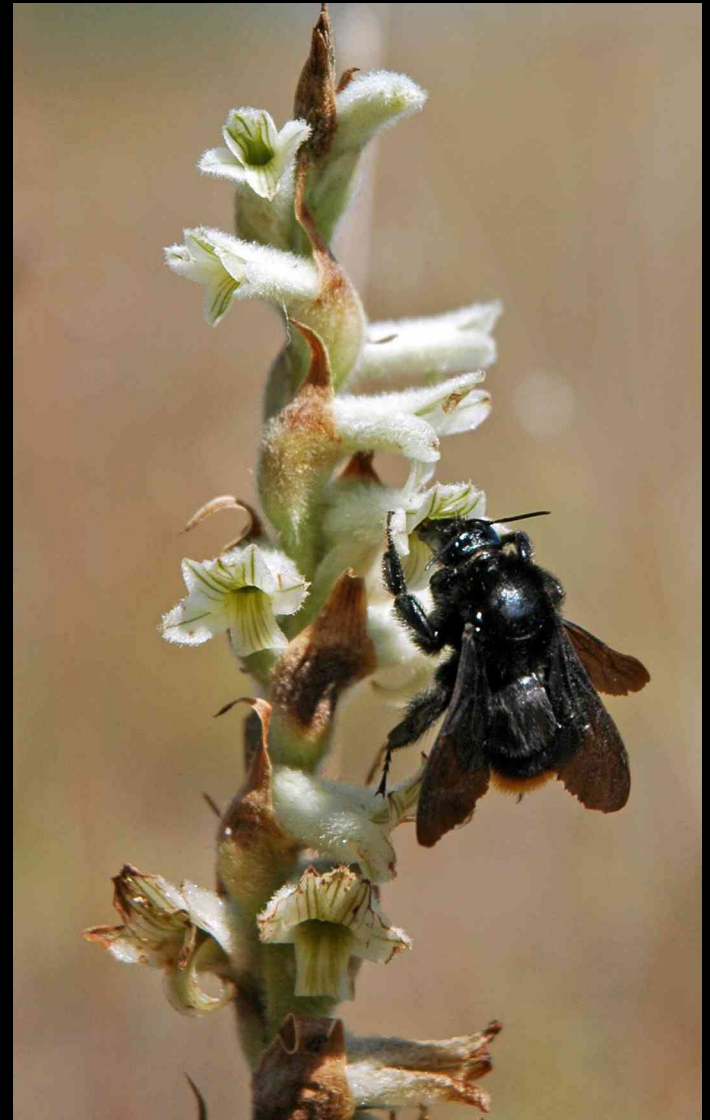


¿Qué es el ginostemio?

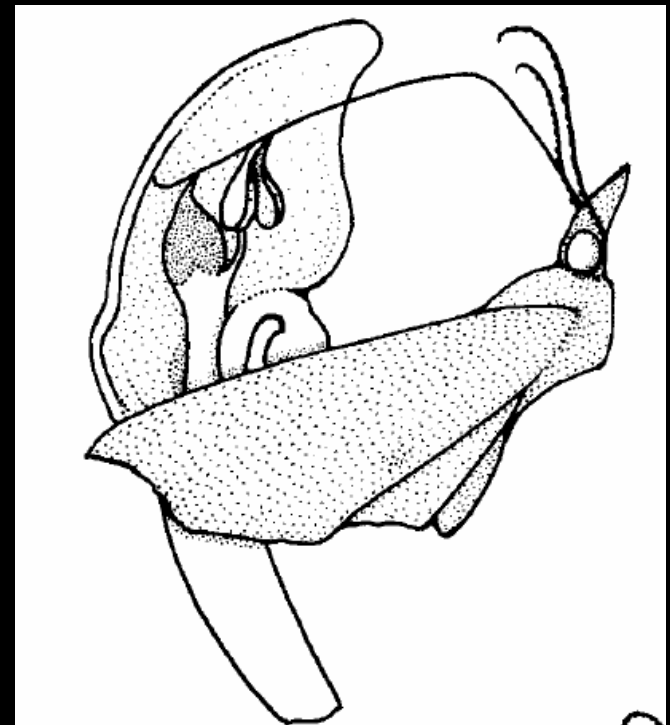
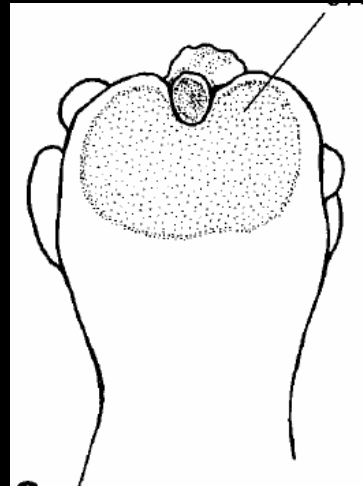
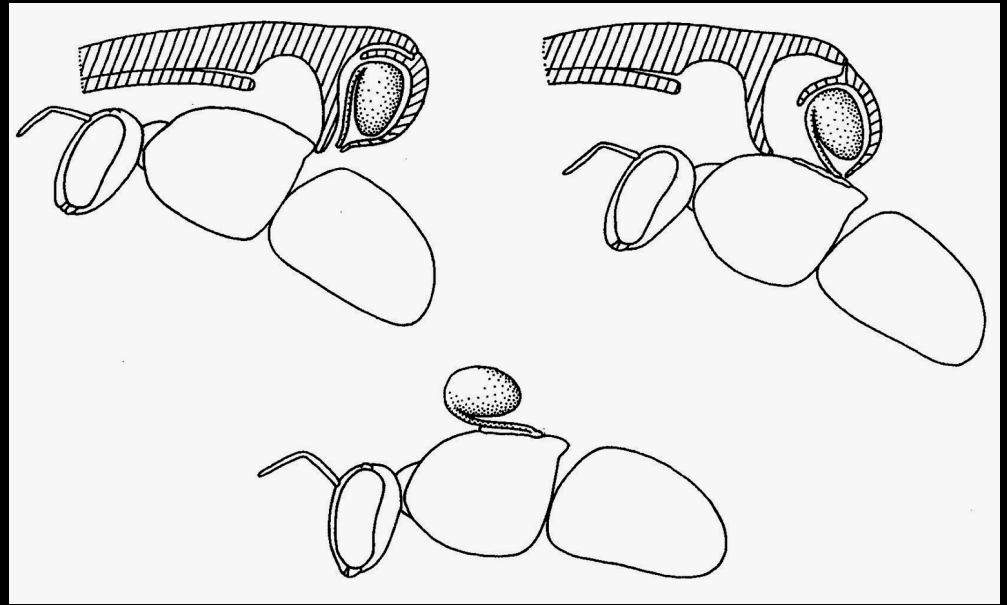


Las innovaciones clave que contribuyen en la radiación a bajos niveles taxonómicos tienen que ver con el polinizador:

- Características del polinario
- Aglomeración del polen
- Espolones
- Recompensas: nectarios, osmóforos, elaiforos, pseudopolen.



**Sinorganización
del labelo y el
ginostemio
determina la
Precisión de la
deposición del
polinario...**



Singer y Sazima, 2001.
Prescottia plantaginea.



Lycaste aromatica



Brassavola cucullata



Oncidium sphacelatum

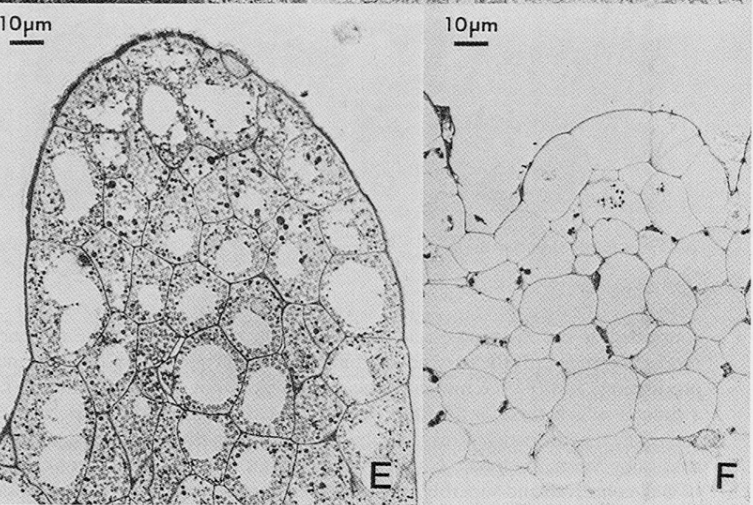
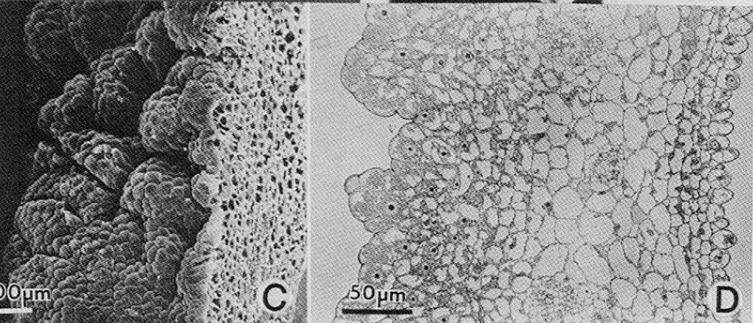
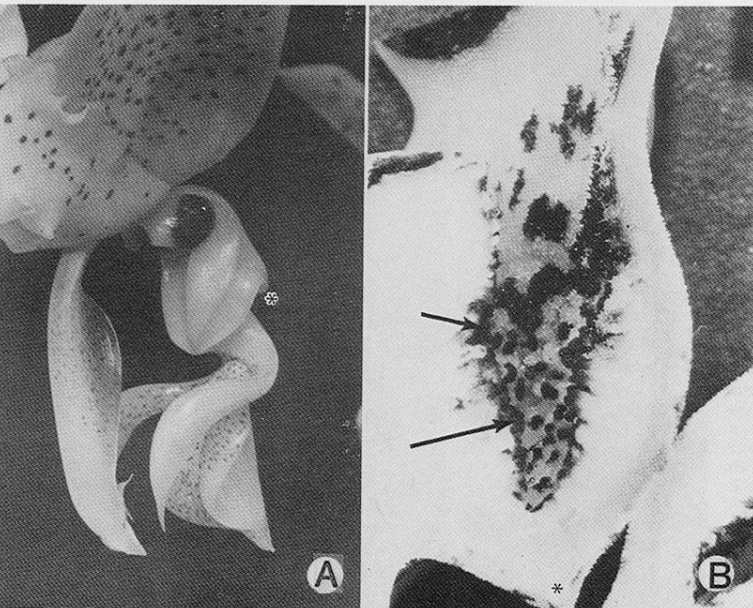
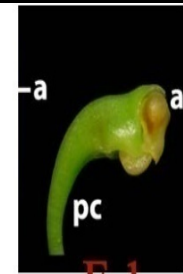
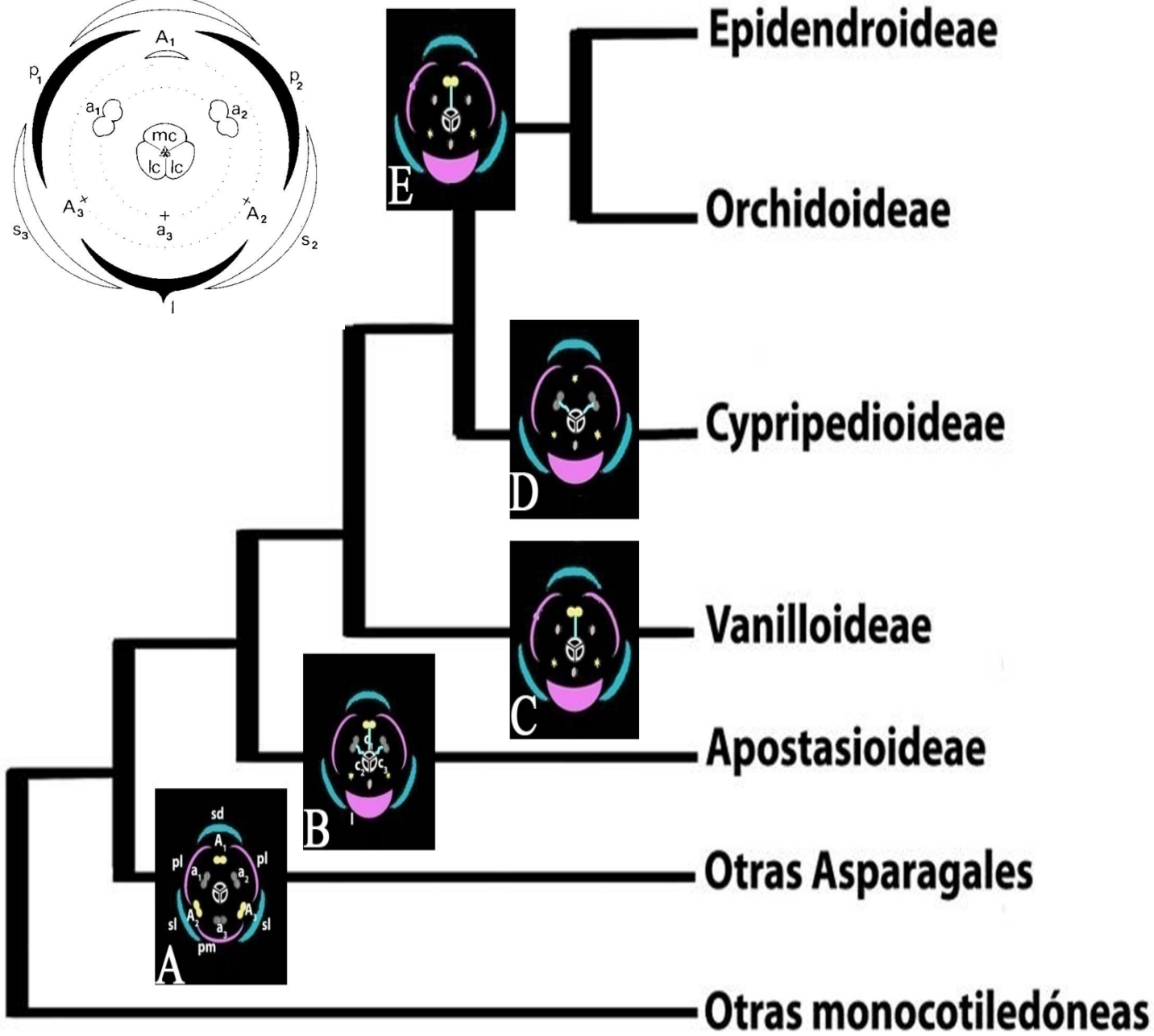
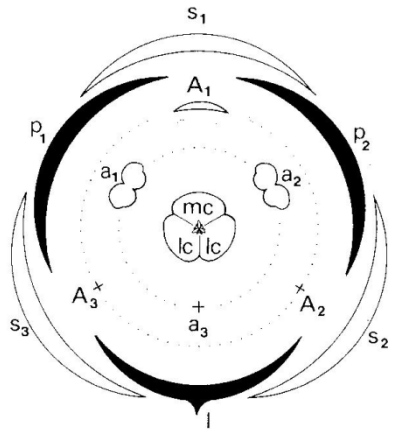


FIG. 8-80. Osmophores of *Stanhopea*. (A) Flower of *Stanhopea wardii*. (B) Papillate osmophore surface on a bisected hypocyle of *Stanhopea oculata*. (C) Scanning electron microscope photograph of the osmophore surface of *Stanhopea wardii* showing the varied morphology of papillae and rugae. (D) Section through the osmophore of *Stanhopea wardii* with the adaxial surface on the left. (E) A section through osmophore tissue at anthesis. (F) Postanthesis osmophore tissue. Explanation of symbols: arrows, papillate osmophore surface; asterisk, equivalent point on each hypocyle for orientation. Source: W. L. Stern, K. J. Curry, and A. M. Pridgeon. 1987. Osmophores of *Stanhopea* (Orchidaceae). *Amer. J. Bot.* 74:1323-1331.



Stanhopea hernandezii



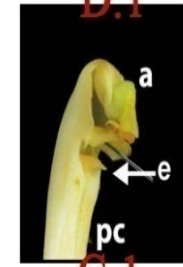
E.1

E.2



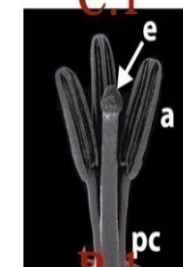
D.1

D.2



C.1

C.2



B.1

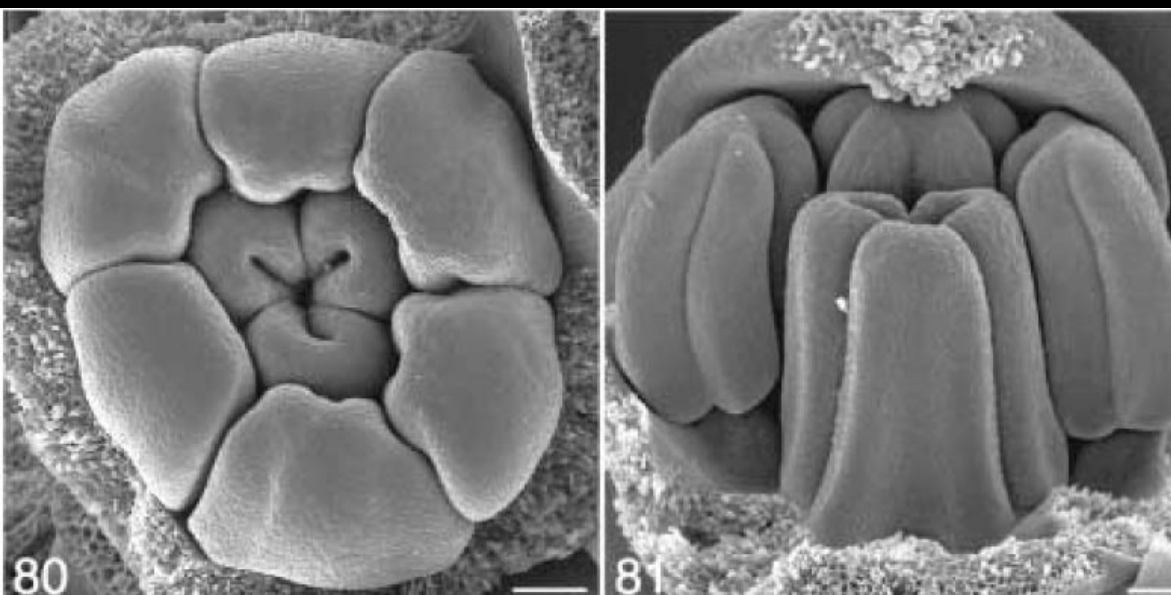
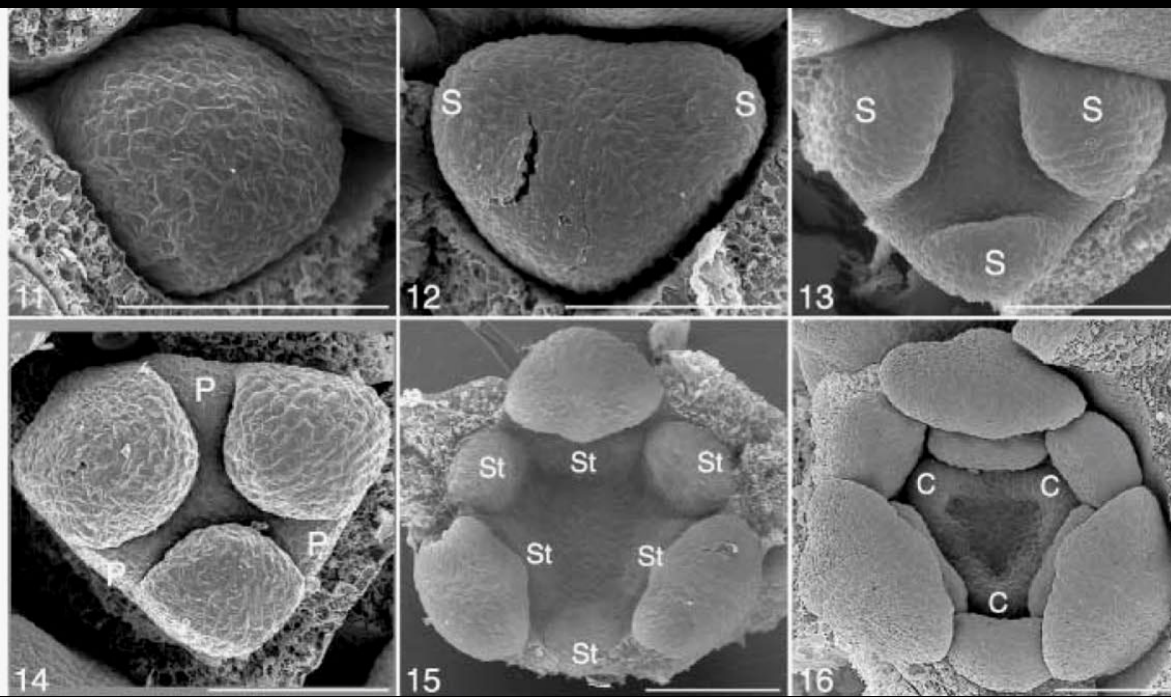
B.2



A.1

A.2

¿Cómo se forma una flor?



Hypoxis
(Hypoxidaceae)

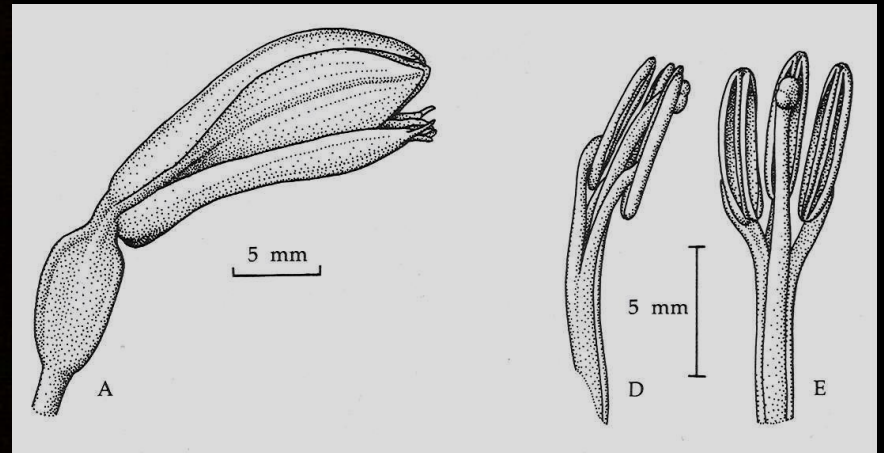
Apostasioideae (16/2)



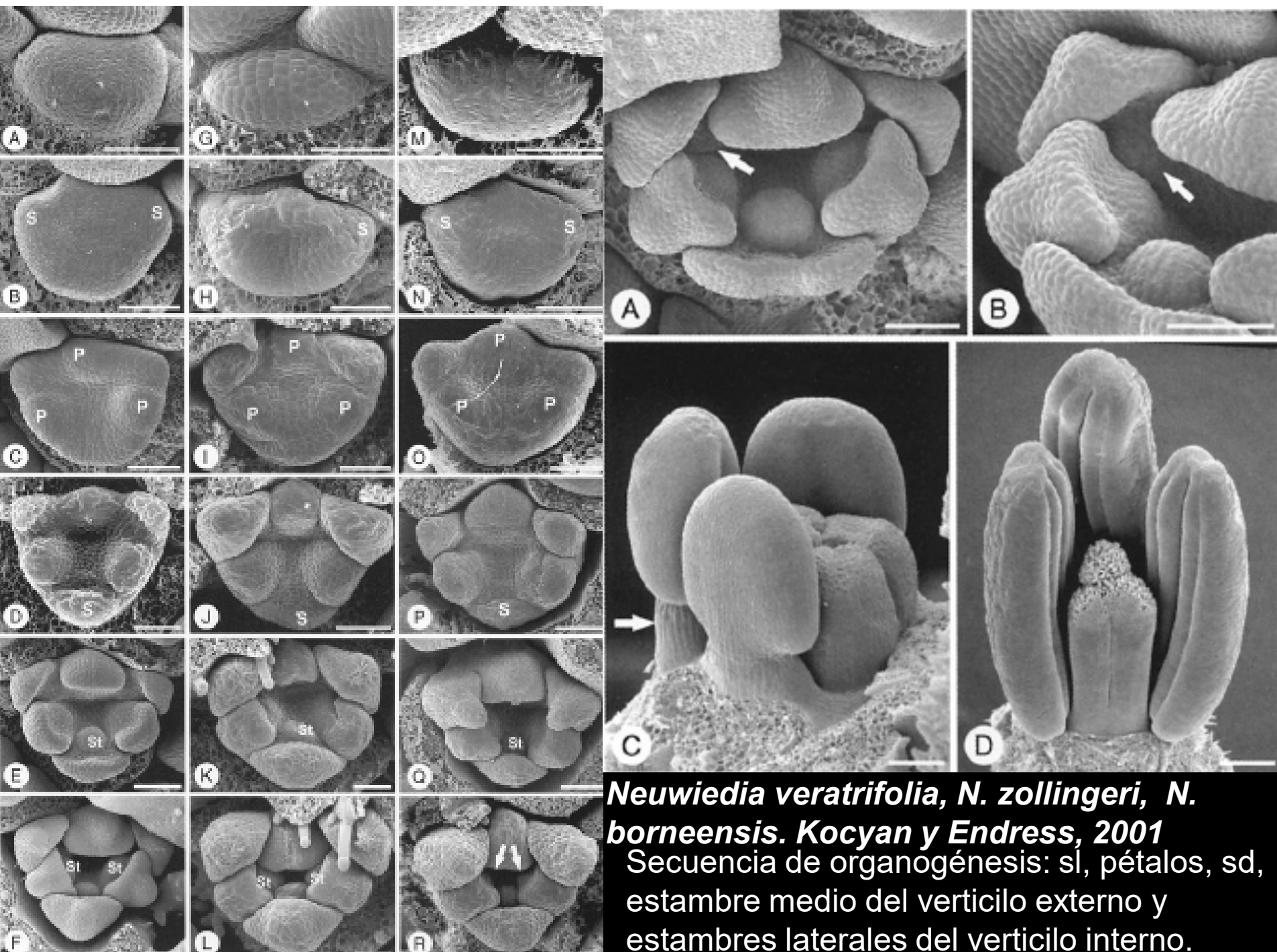
Neuwiedia veratrifolia

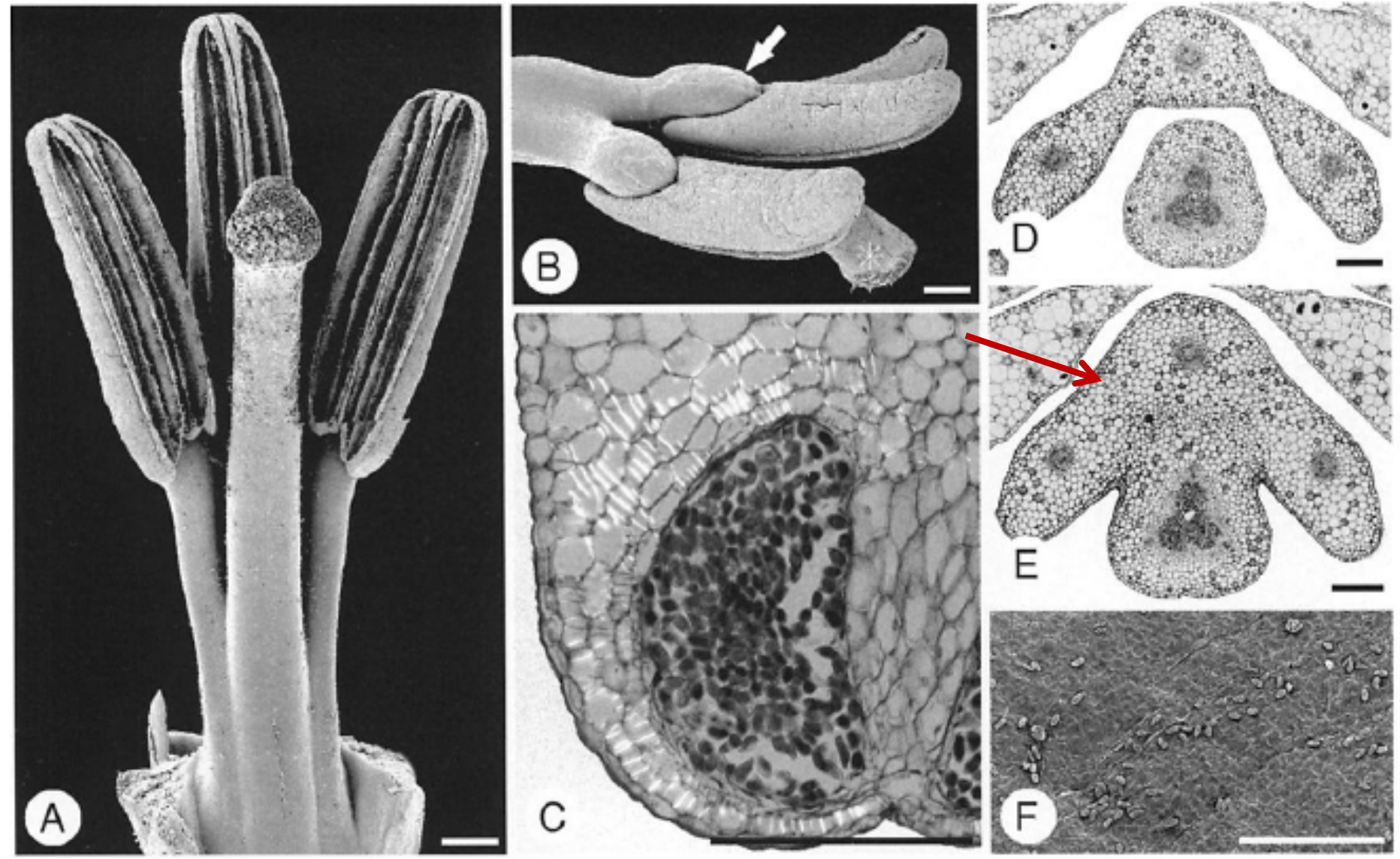


Distribución geográfica



Flor y detalle de la columna





Neuwiedia veratrifolia, Kocyan y Endress, 2001

Epidendroideae (19,800/570)

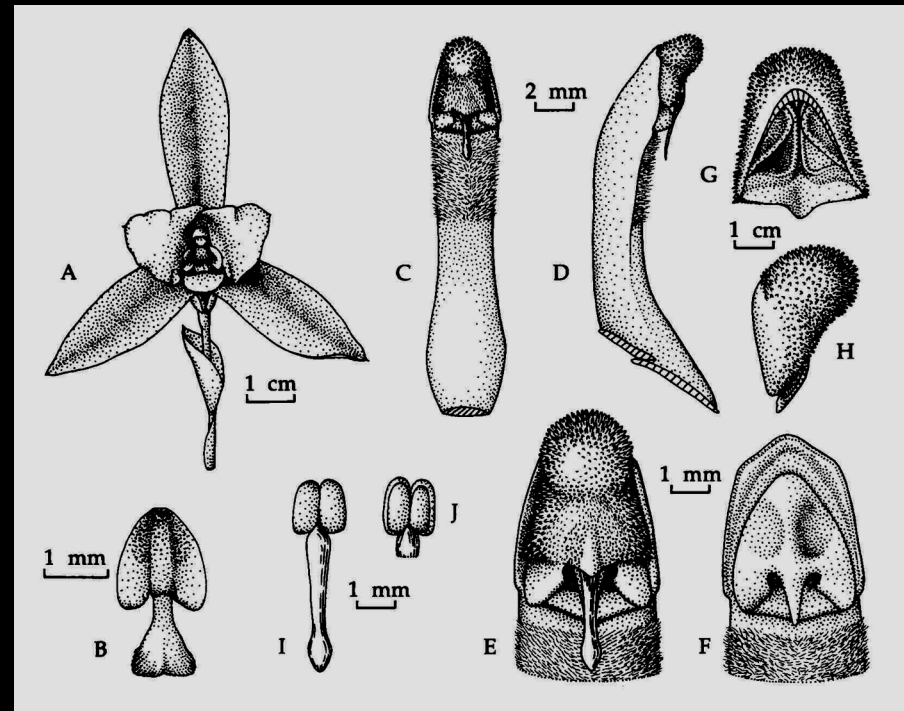


*Prosthechea
cochleata*

Flor y detalles de *Lycaste*



Distribución geográfica



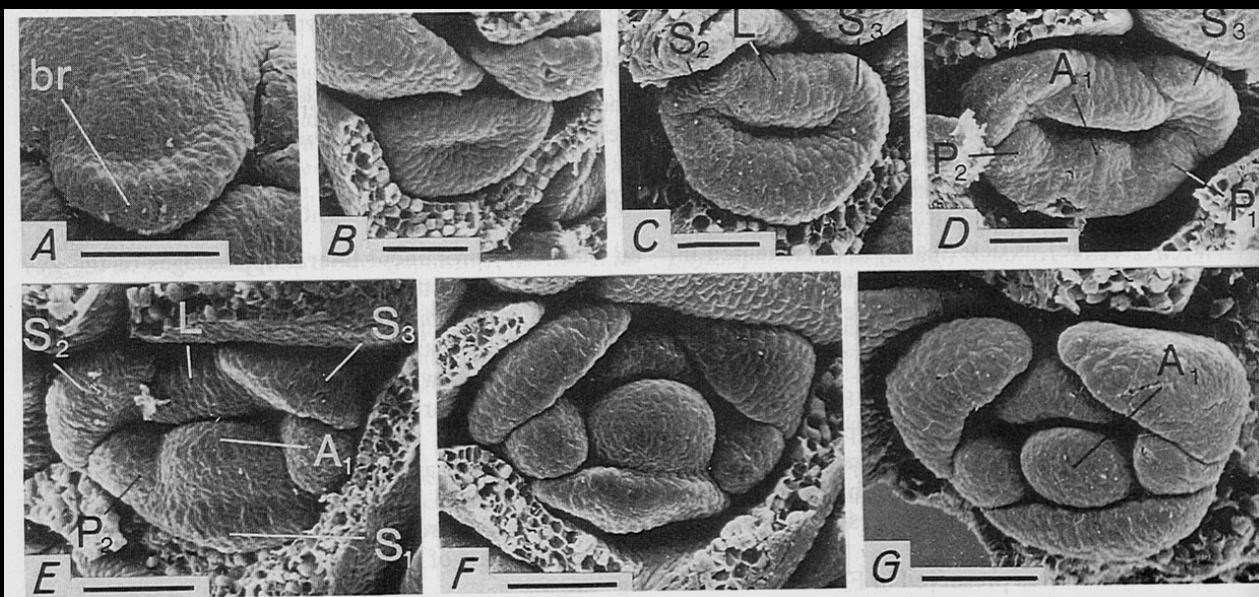


Fig. 1. *Dactylorhiza maculata*. Initial differentiation of the floral primordium. – SEM-micrographs, scales = 0.1mm. Floral bract are removed in B–G. All stages are shown in non-resupinate positions.

La secuencia de aparición de los órganos florales es la misma en las orquídeas monandras.

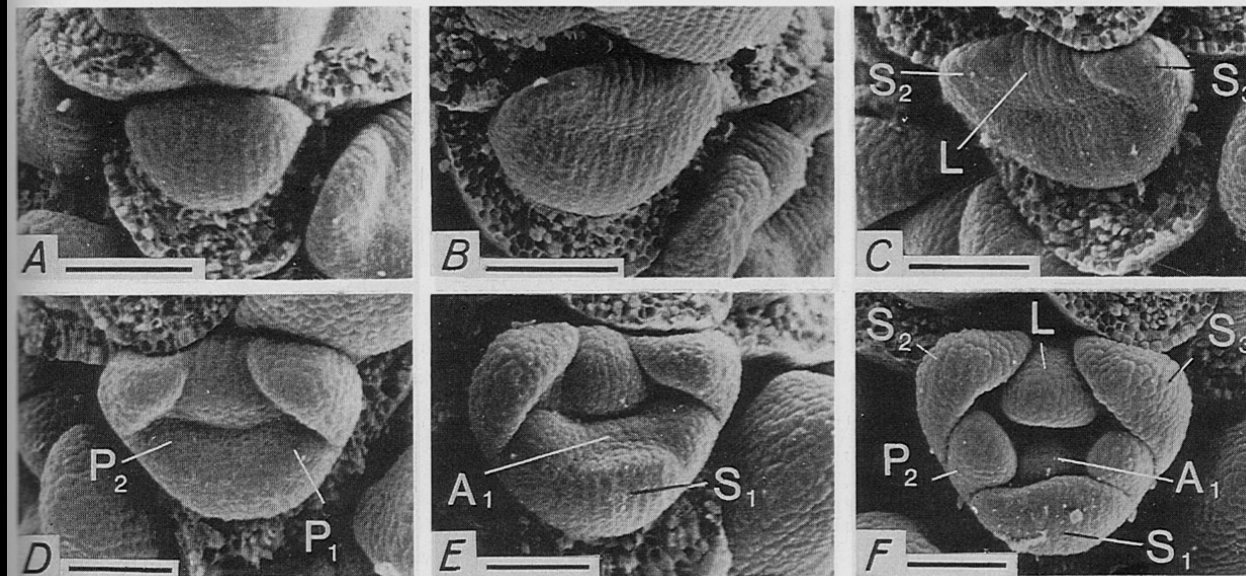


Fig. 2. *Bletia purpurea*. Initial differentiation of the flower primordium. – SEM-micrographs, scales = 0.1 mm. All primordia are shown in non-resupinate positions.

Kurzweil, 1987

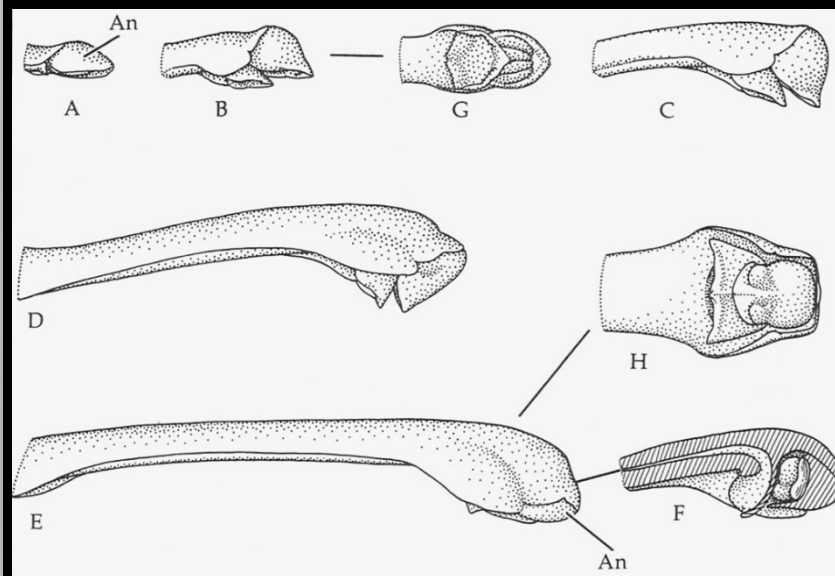
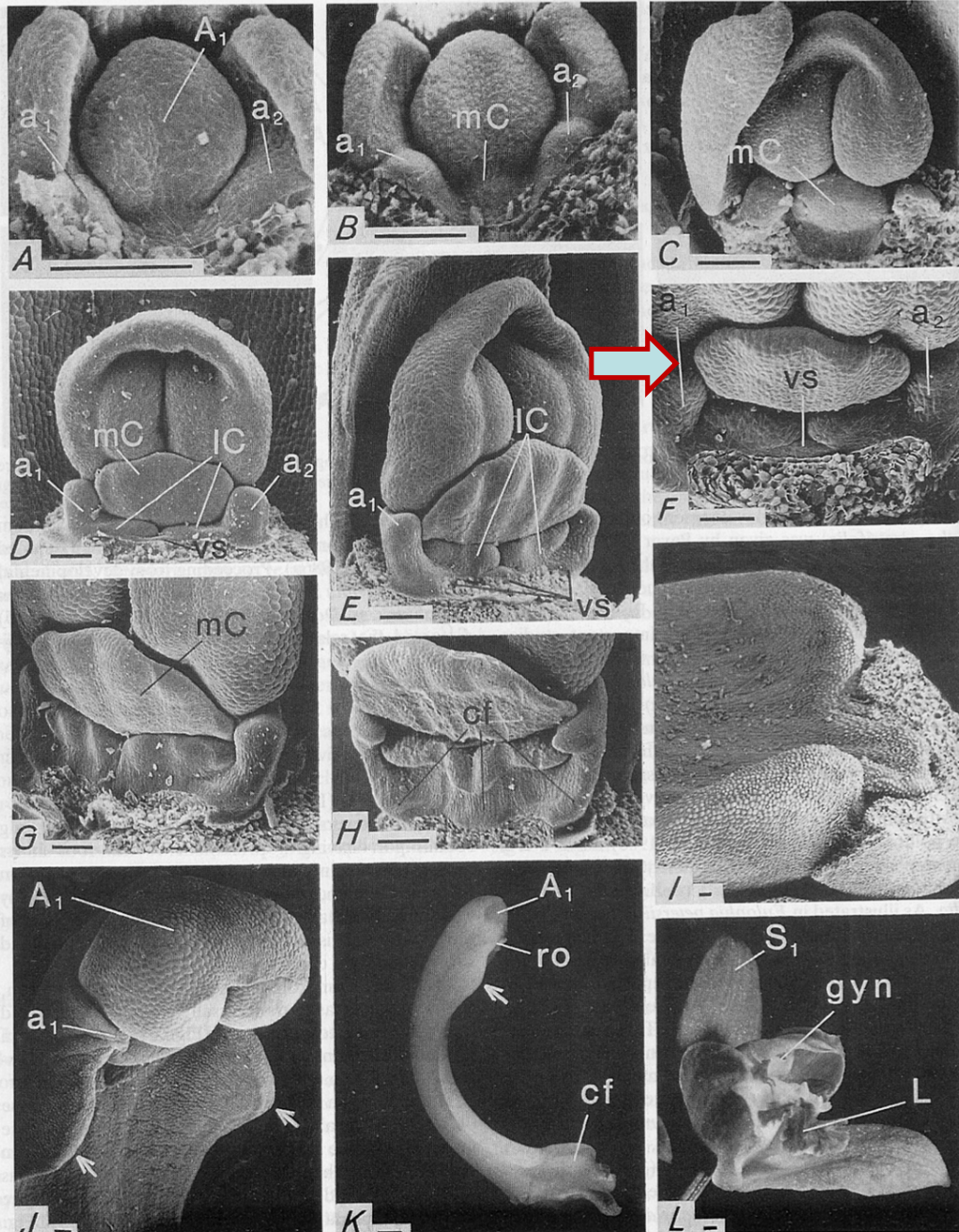


Fig. 3. *Bletia purpurea*. Development of the gynostemium. - A-C: Development of staminodes and median carpel. - D: Initiation of lateral carpel apices. Note the ventral structure vs. - E-G: Further development of the ventral structures. - H: Initiation of the column-foot. - I: Apex of column-foot of a mature gynostemium. - J: Top of gynostemium in a late stage. - K: Mature gynostemium in side view. - L: Flower. - A-J: SEM-micrographs, scales = 0.1mm; K-L: scales = 1 mm. All stages are shown in resupinate positions.

Tribu Spiranthinae como modelo de estudio



Schiedeella



Eurystyles



Dichromanthus

❖ Es uno de los linajes más diversos de orquídeas terrestres del Neotrópico.

❖ Consta de 480 especies agrupadas en 40 géneros.

Estudios con
secuencias ADN

Salazar *et al.* 2003.
Górniak *et al.* 2006.
Figueroa *et al.* 2008,
2021; Salazar *et al.*
2009, 2011; Salazar y
Dressler, 2011;
Salazar y Just 2012

VS

Estudios morfológicos

R. Schlechter, 1920.
L. Garay, 1982.
P. Balogh, 1982.
D. Szlachetko, 1995.

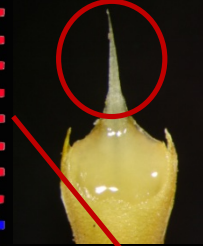


Spiranthes

Presencia de un remanente rostelar aguzado



Calliphlox bryantae
macho visitando
Stenorrhynchos
speciosum. Costa
Rica. Carol Siegel,
2011.



Dichromanthus yucundaa



Svenkoeltzia congestiflora



Stenorrhynchos speciosum



Stenorrhynchidinae Szlach.

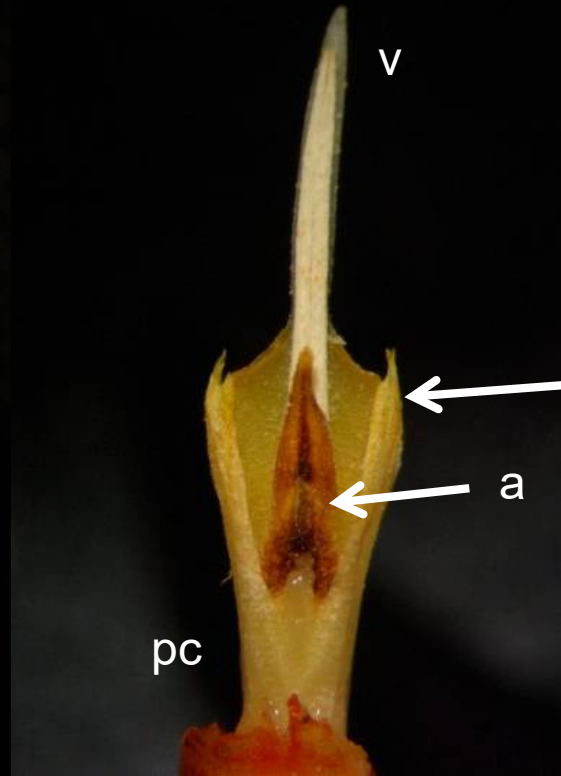
Grupo polifilético basado en un síndrome de polinización!



Ginostemio de Spiranthinae



Ginostemio
vista ventral



Ginostemio
vista dorsal



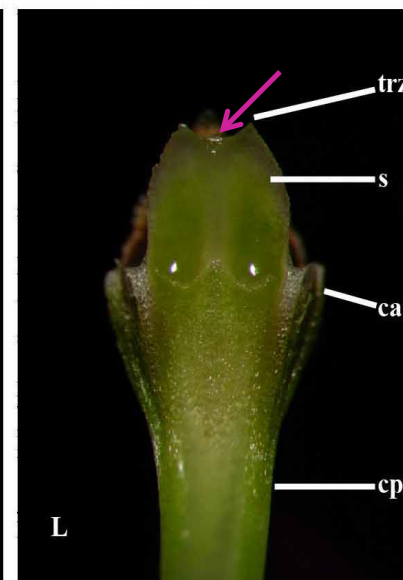
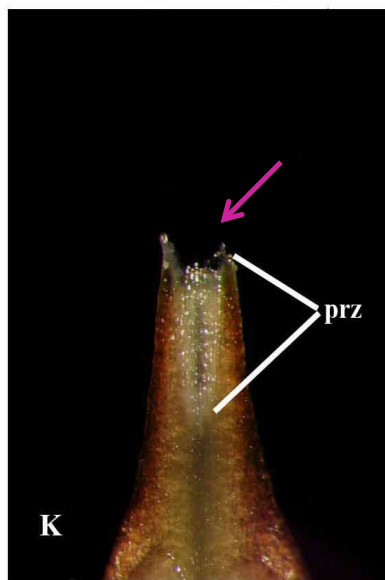
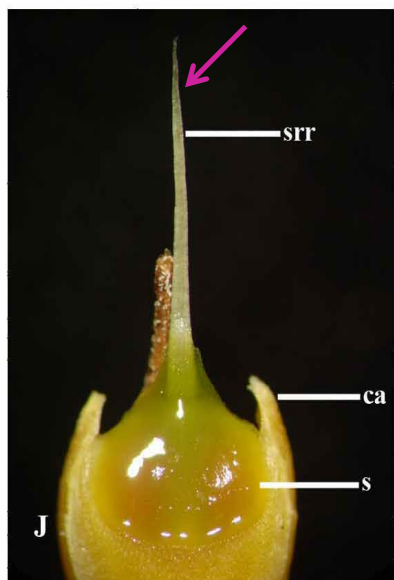
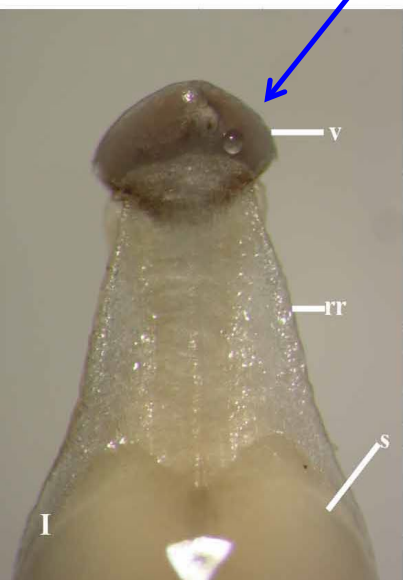
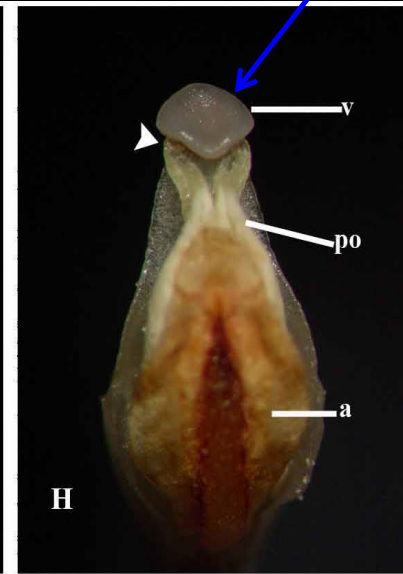
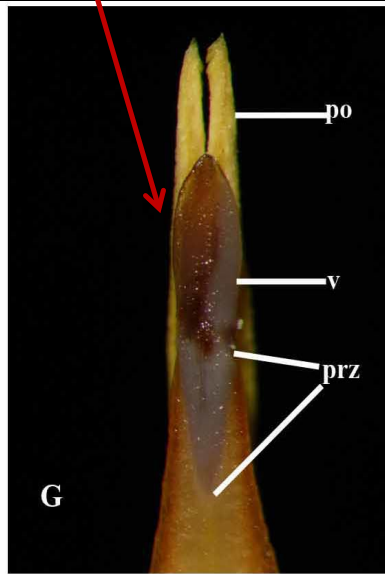
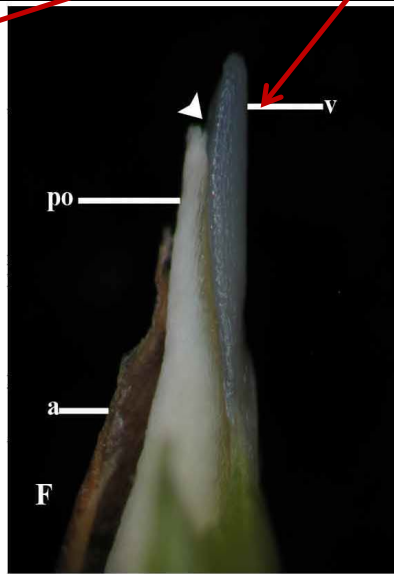
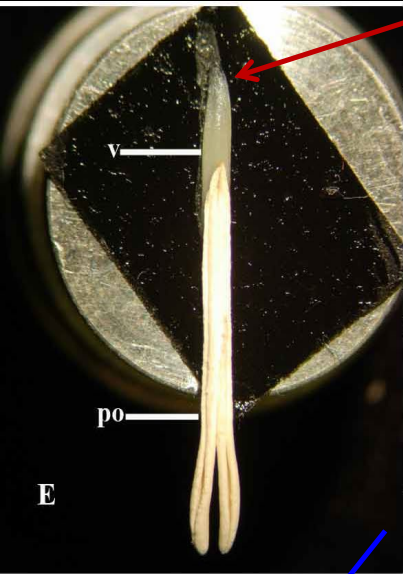
Remanente
rostelar

Dichromanthus yucundaa

¿Como se origina la variación morfológica del rosetelo?

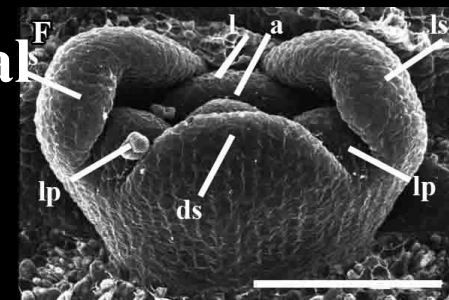
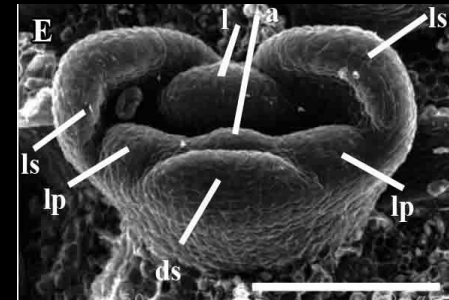
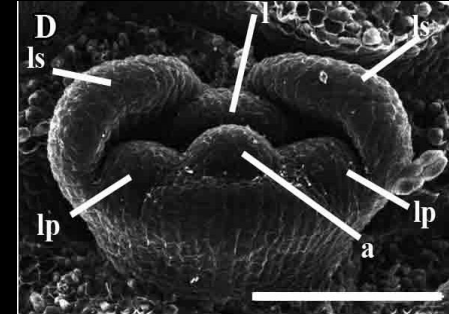
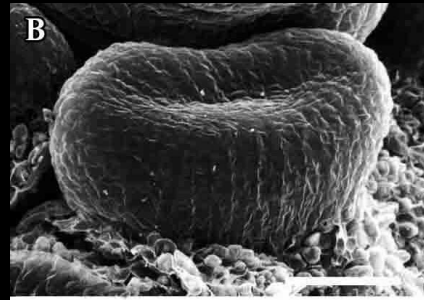
Viscidio tipo cojín
(Greenwood, 1982)

Viscidio tipo cuña
(Greenwood, 1982)



Mayor variación del remanente rosetelar !!!

Organogénesis inicial



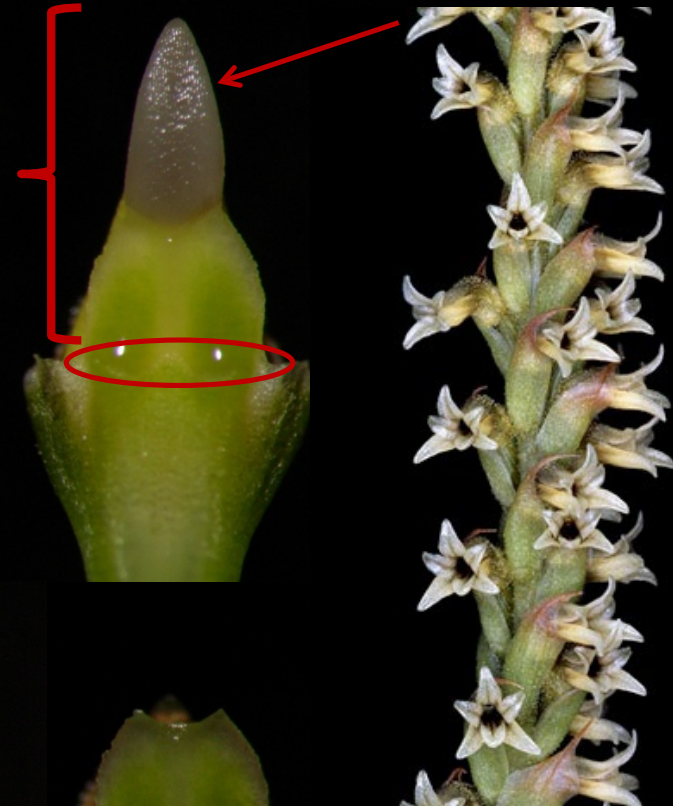
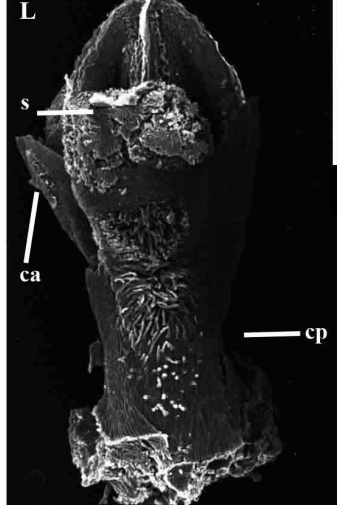
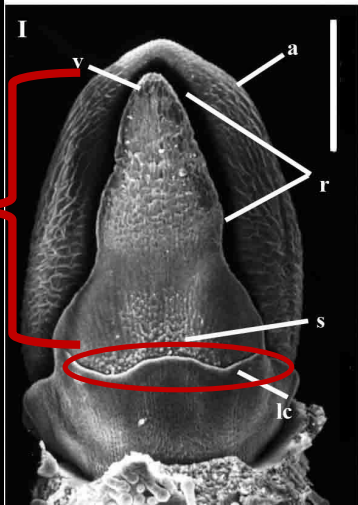
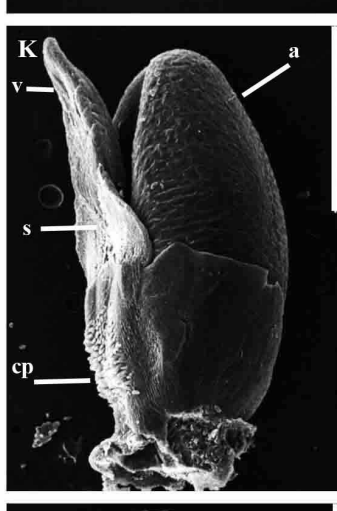
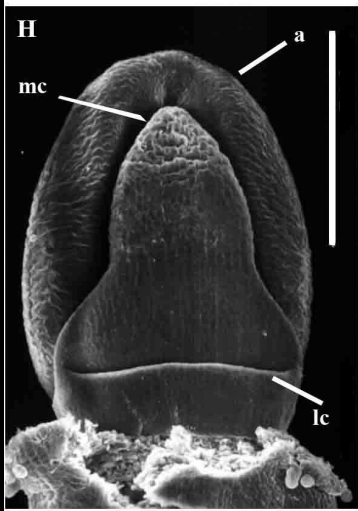
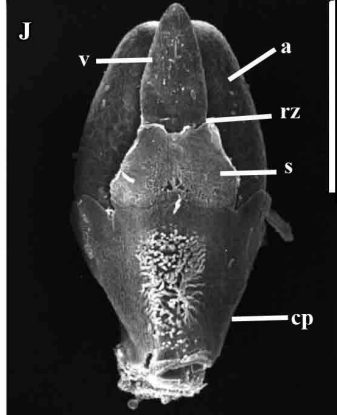
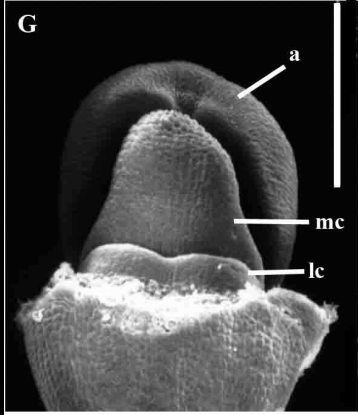
Adaxial

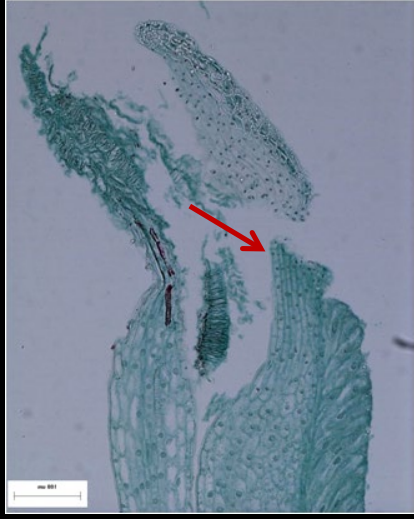
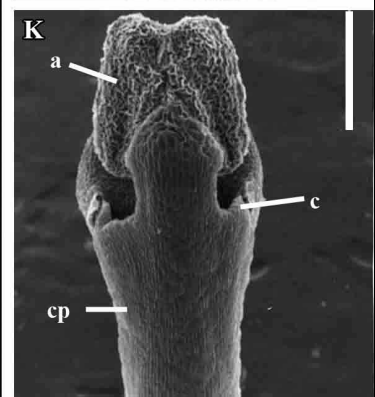
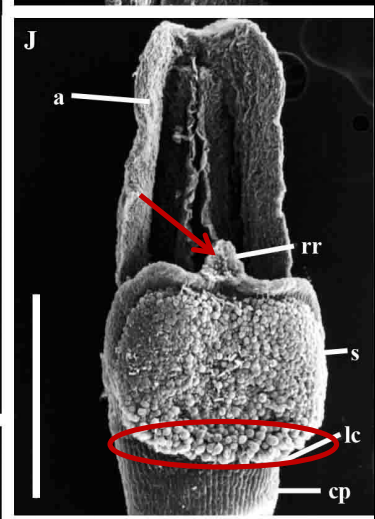
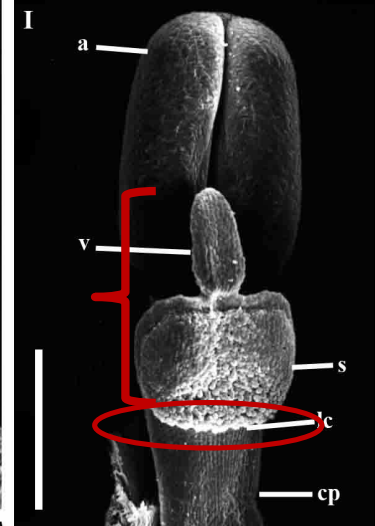
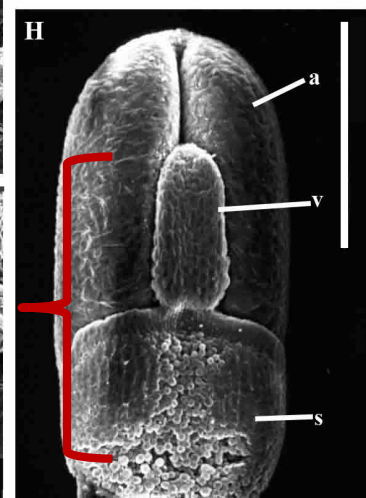
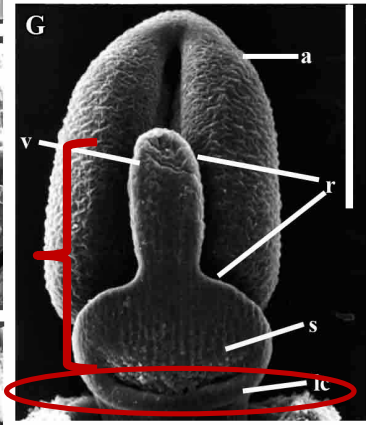
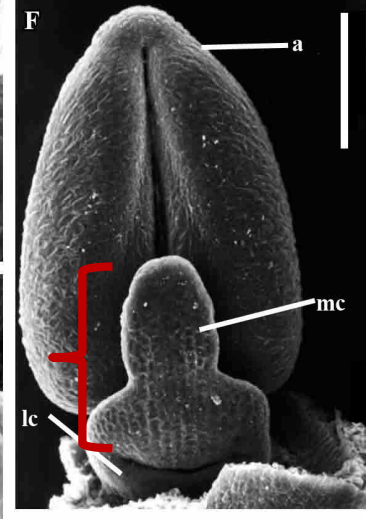
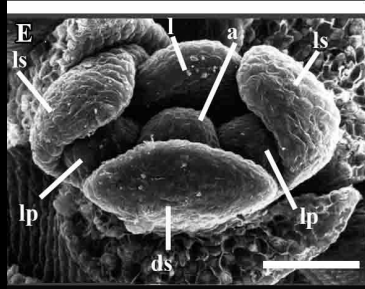
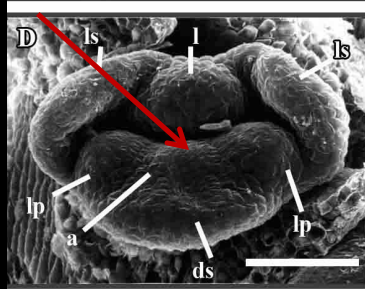
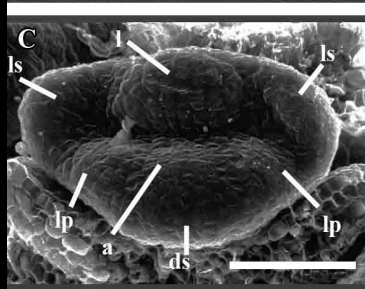
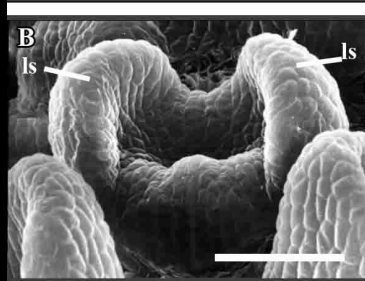
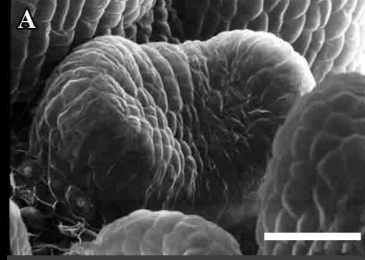


Abaxial

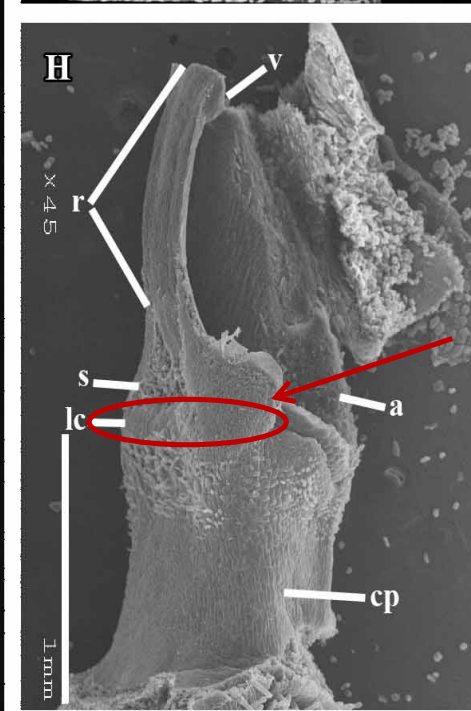
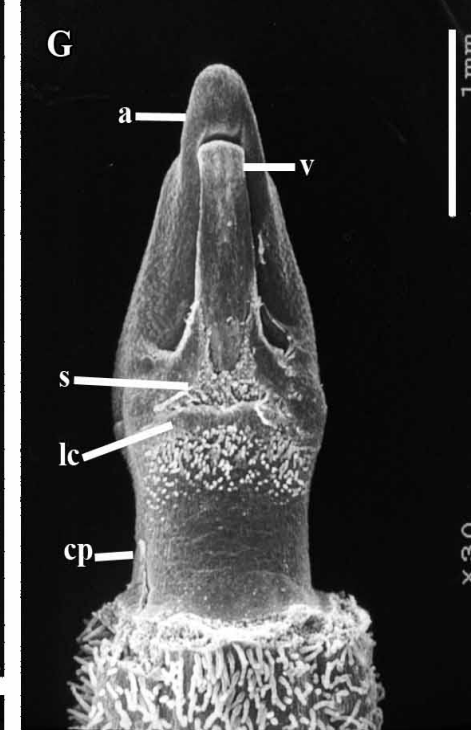
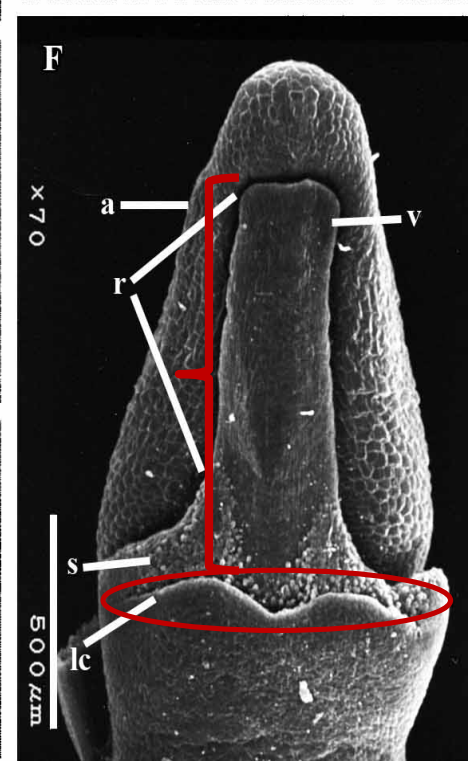
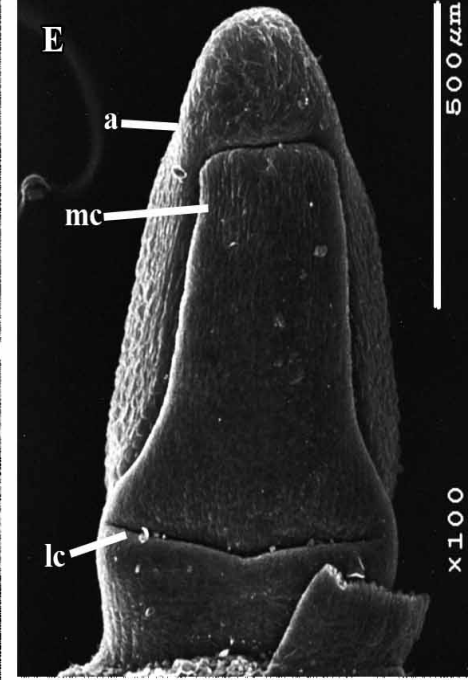
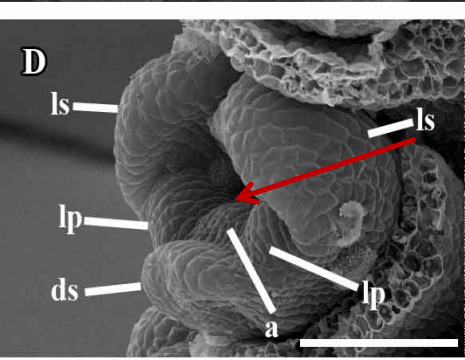
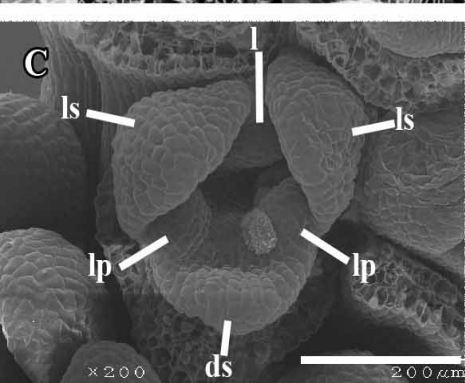
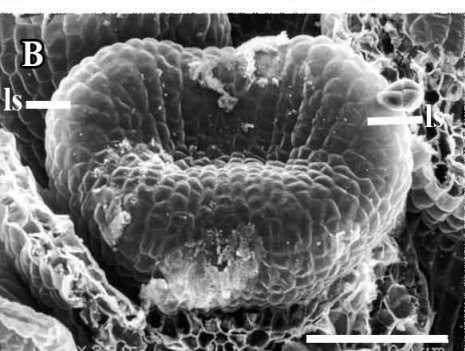
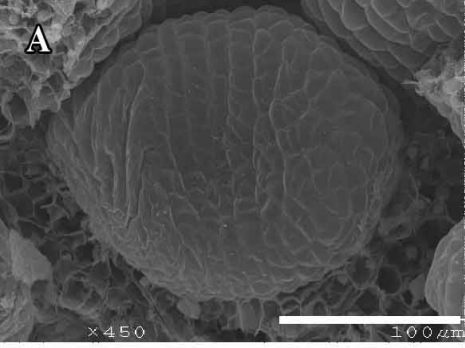
Aulosepalum pyramidale

Aulosepalum pyramidale

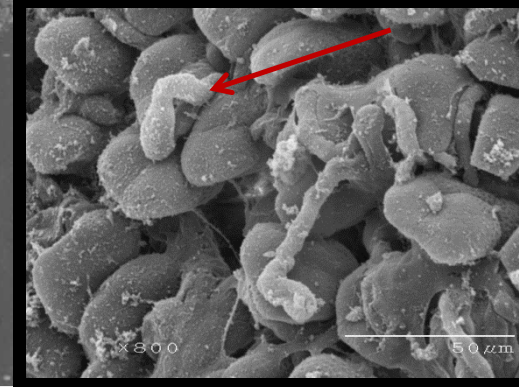


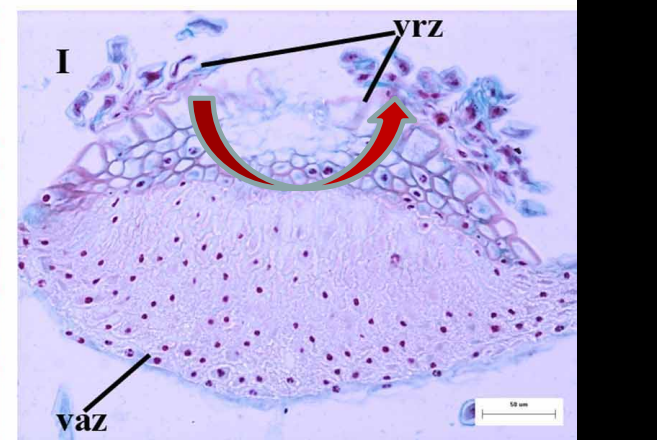
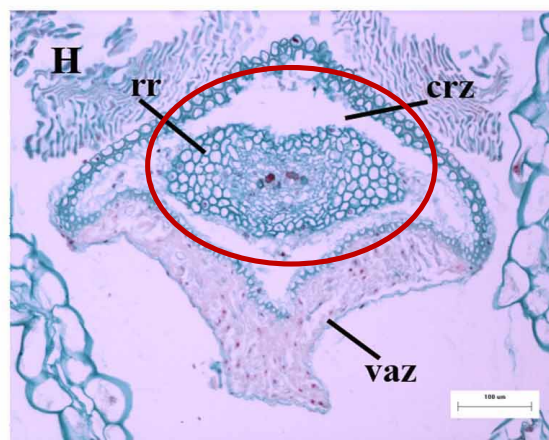
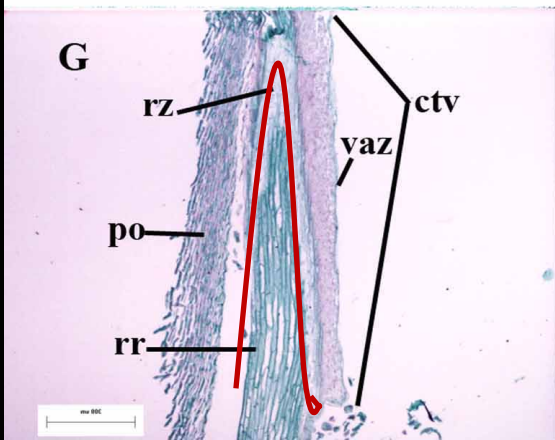
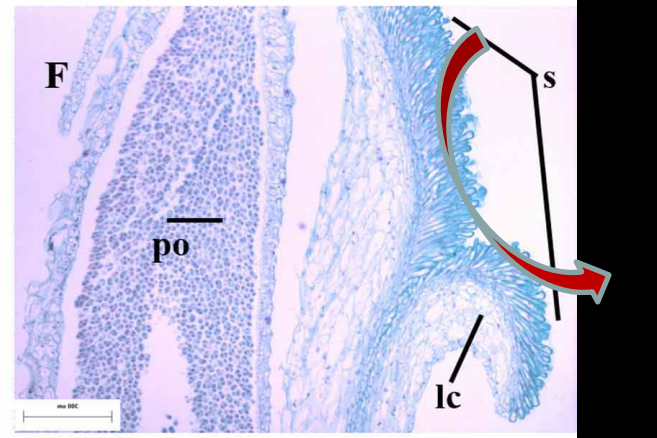
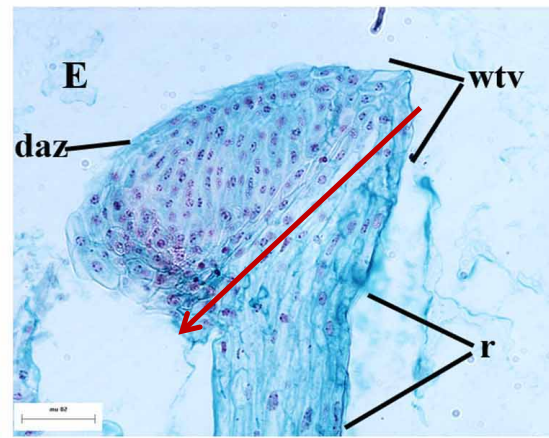
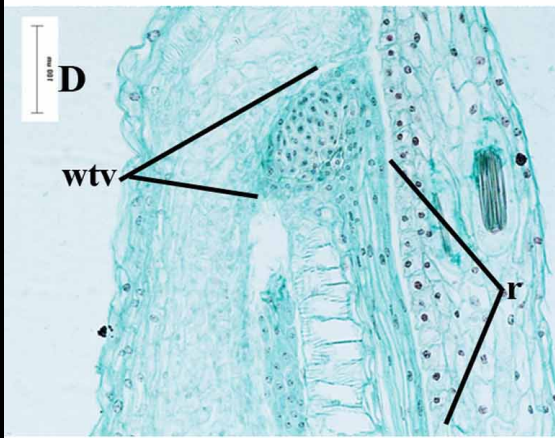
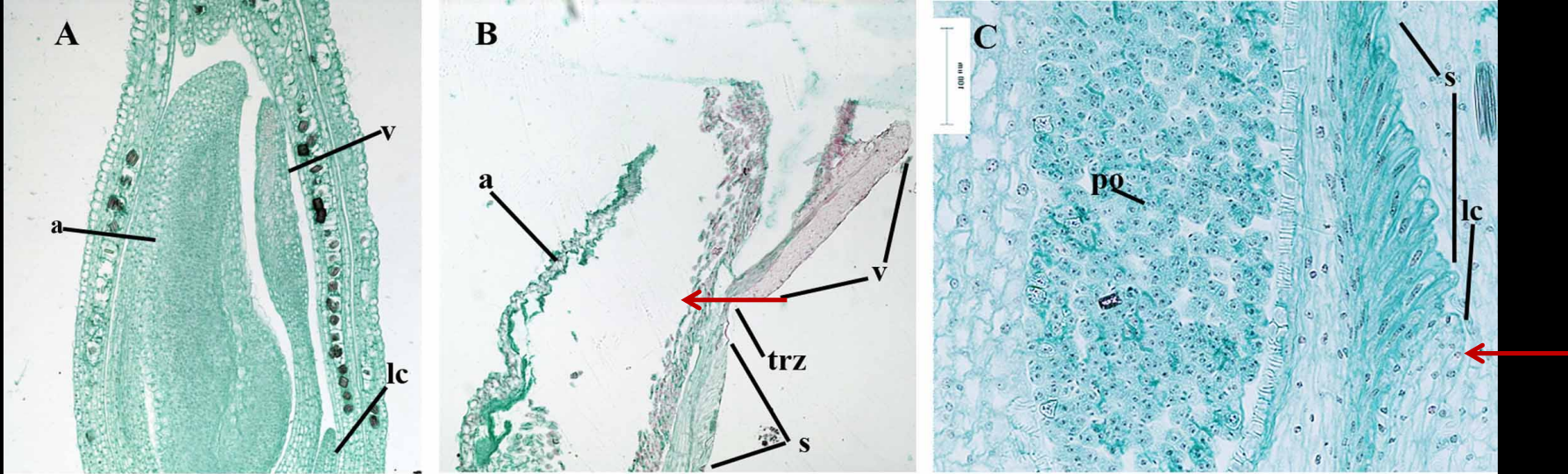


Mesadenus lucayanus

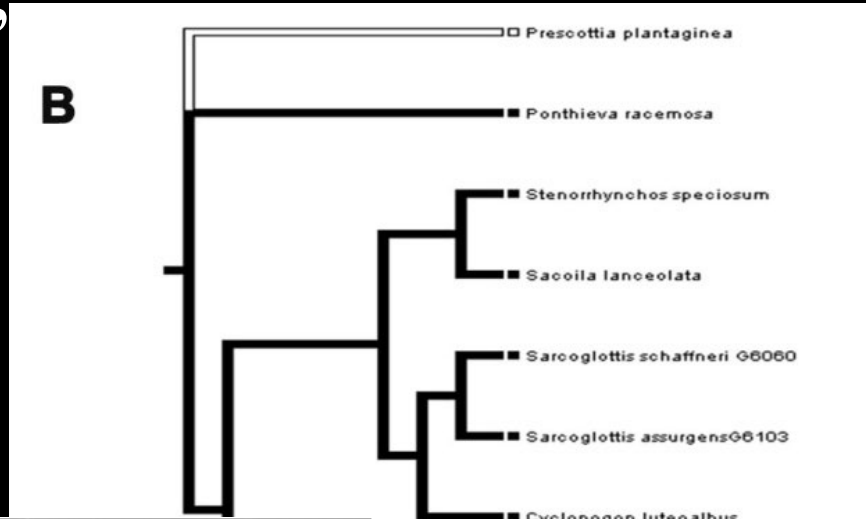
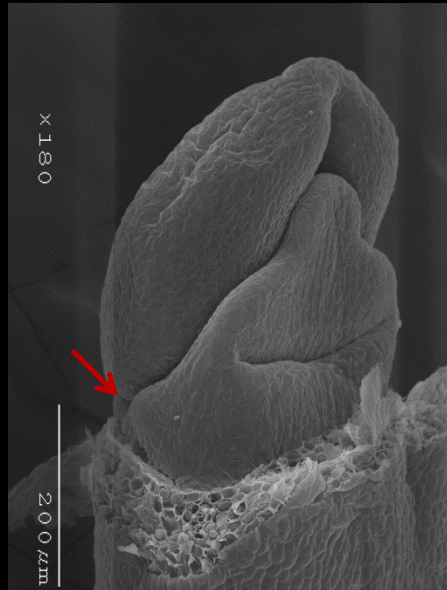


Cyclopogon luteoalbus





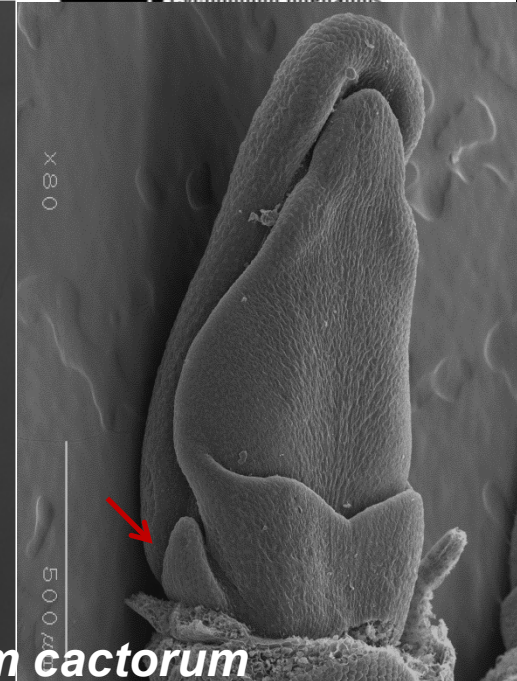
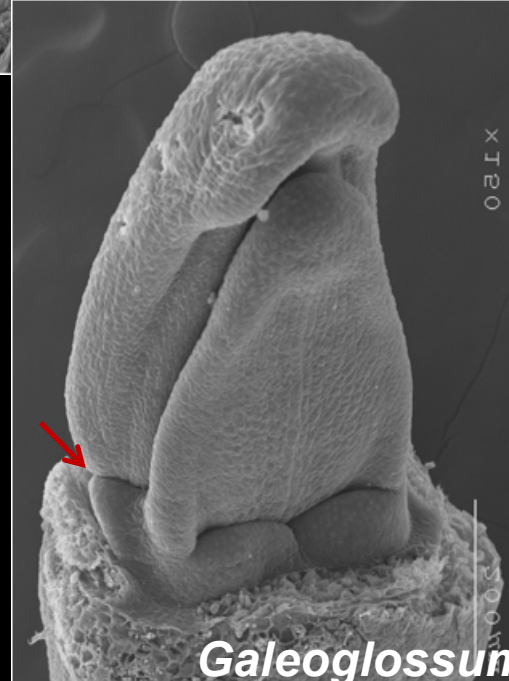
Mapeo del caracter “presencia o ausencia de estaminodios”



Prescottia plantaginea



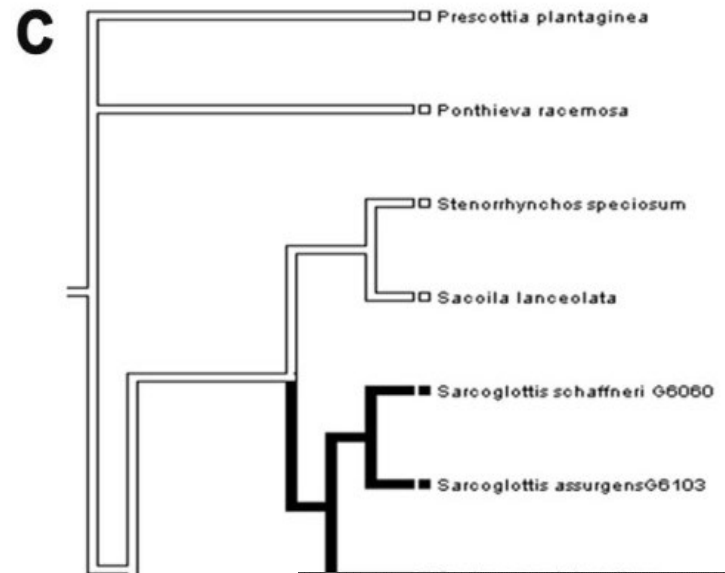
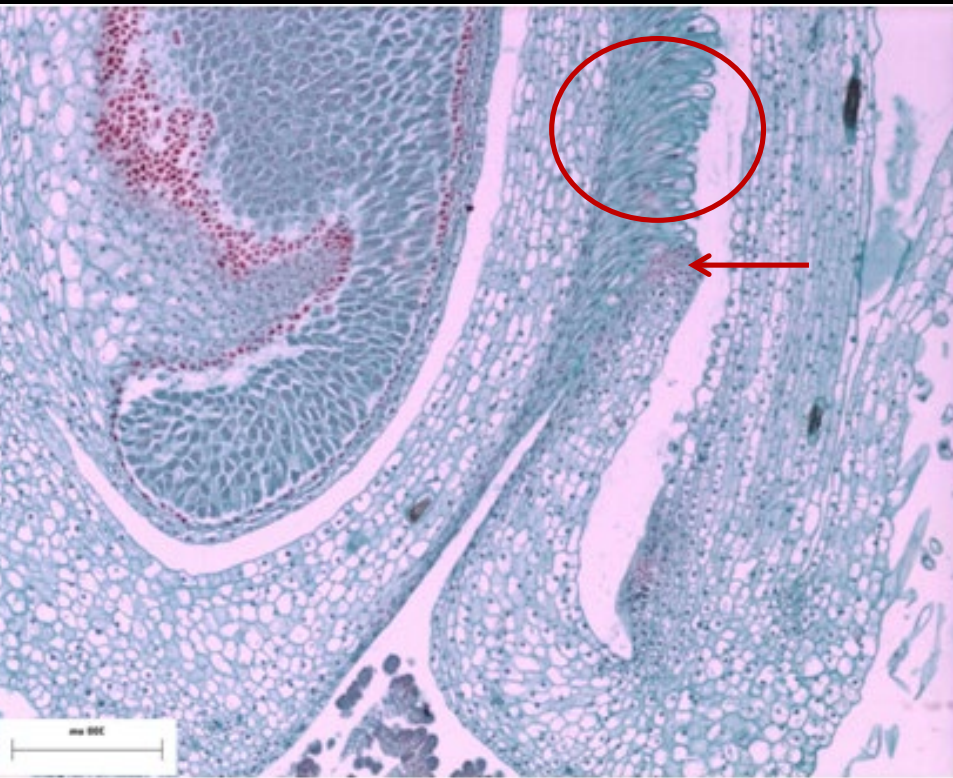
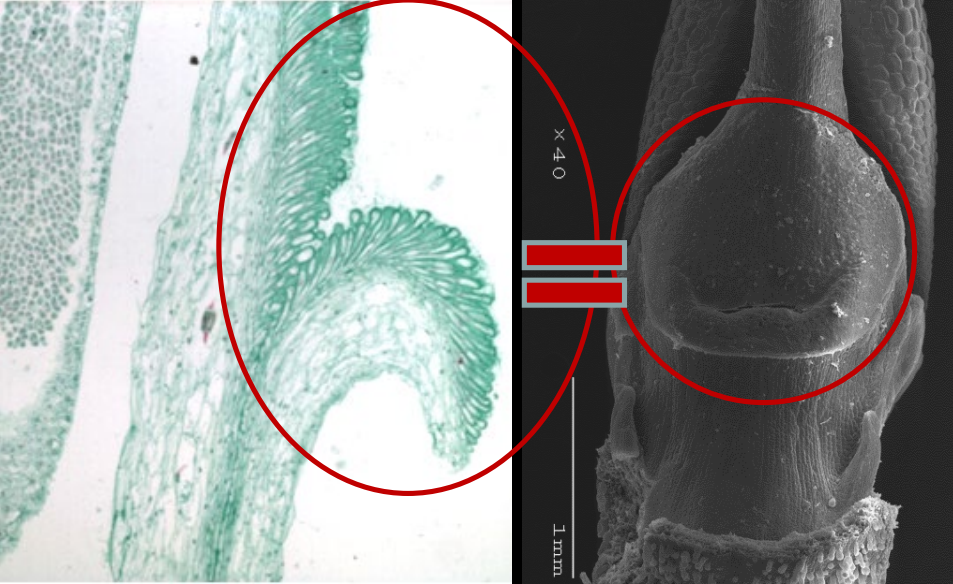
Aulosepalum pyramidale



Galeoglossum cactorum

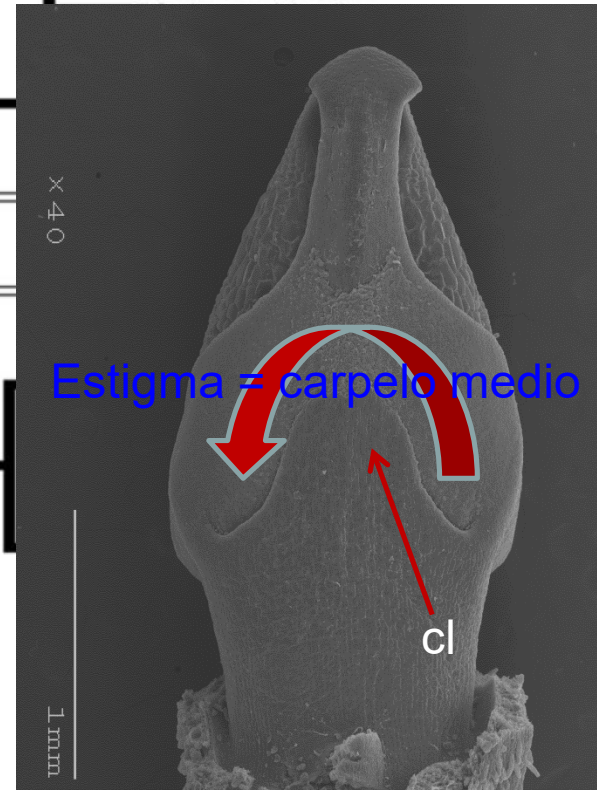
Árbol mas parsimonioso obtenido a partir del análisis combinado de caracteres moleculares (*nr/ITS*, *trnL/trnF*) mas 33 morfológicos.

Carácter “constitución del estigma”



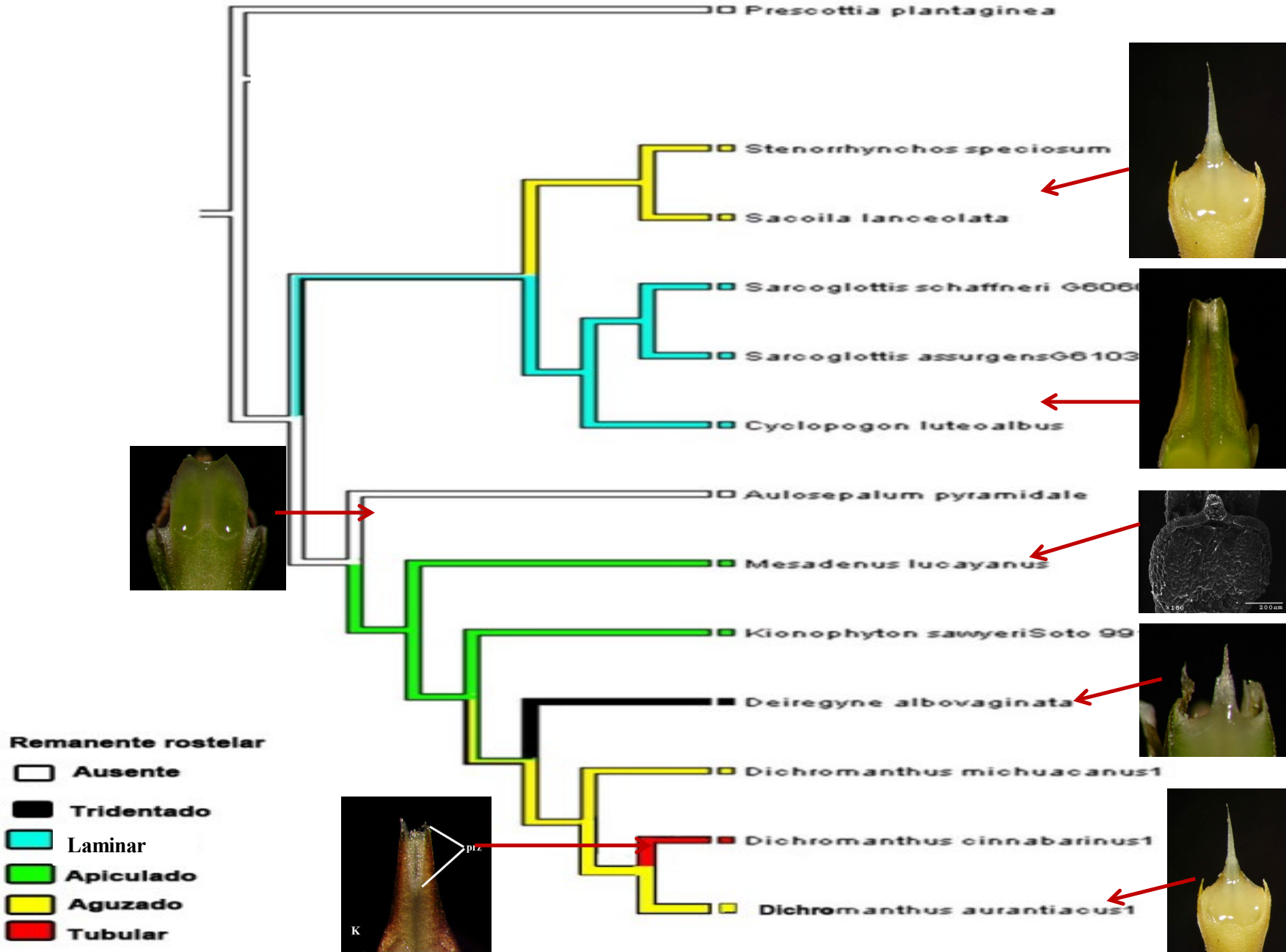
Estigma (constitución)

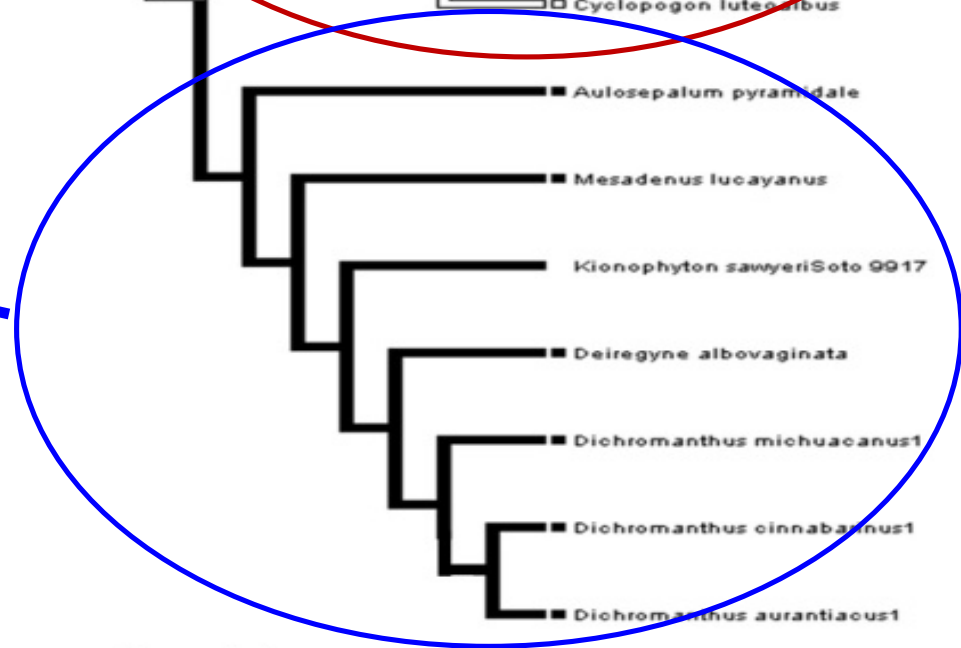
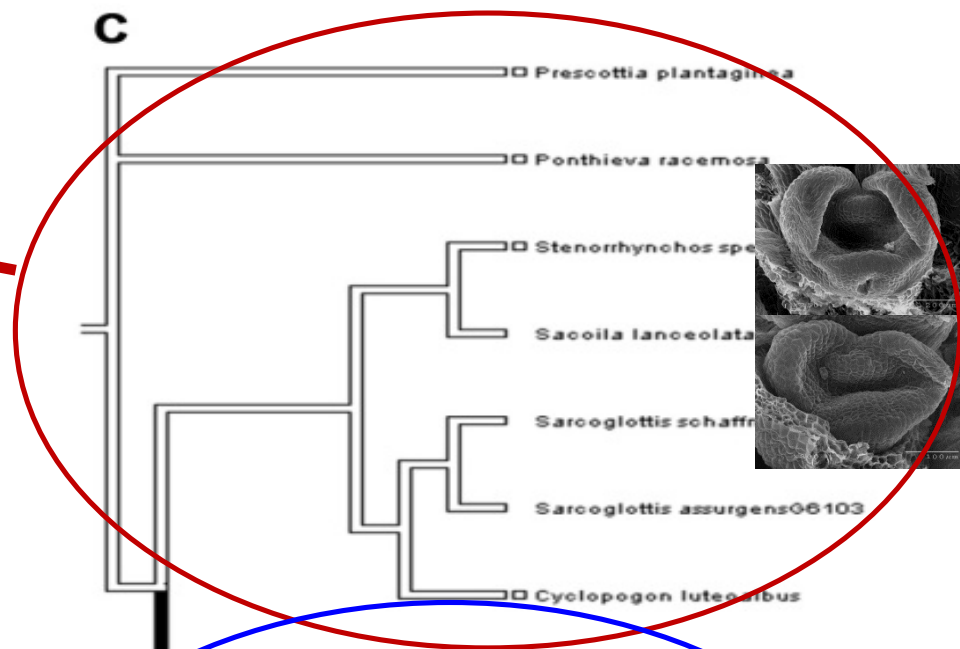
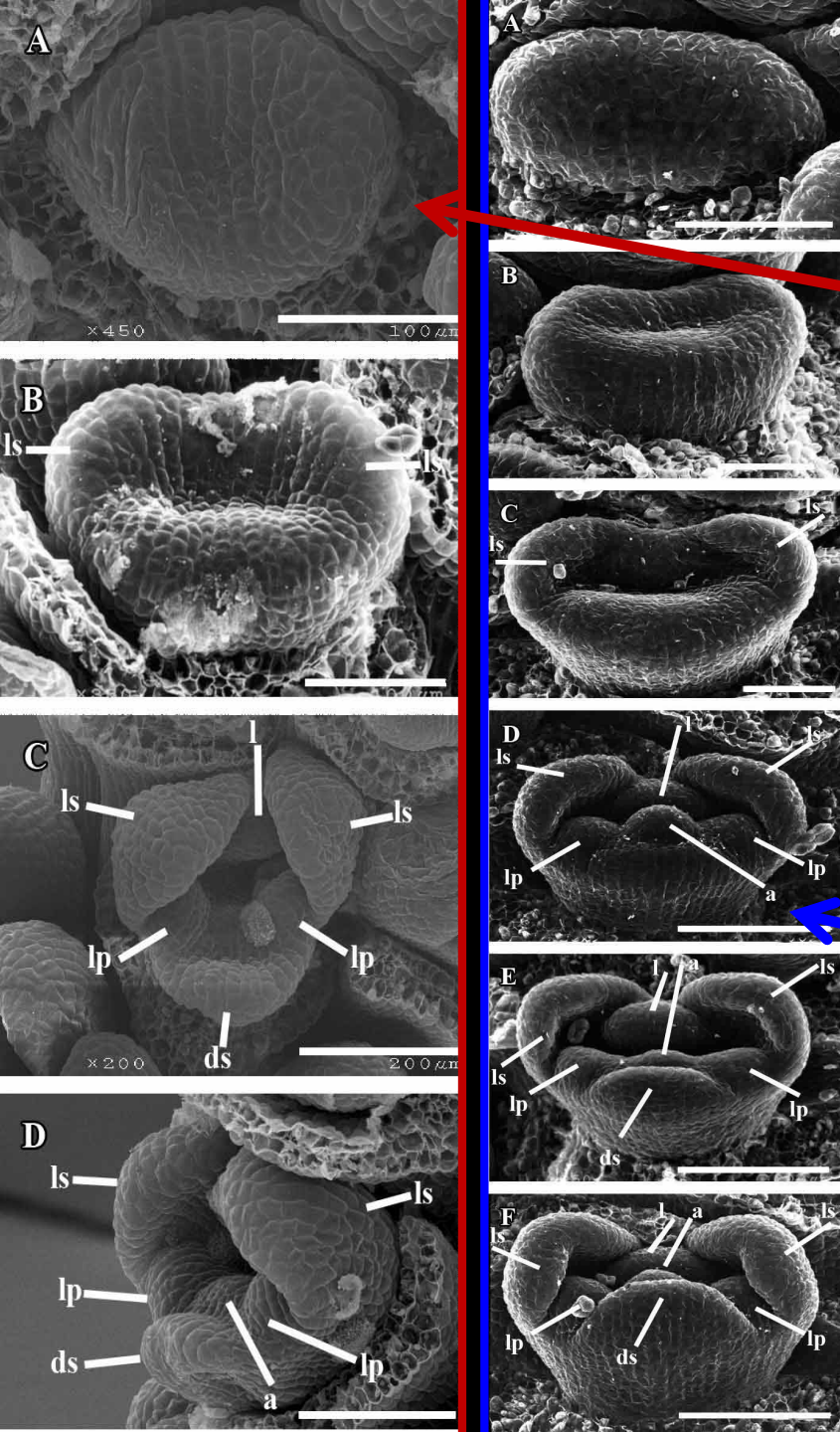
- tricarpelar
- unicarpelar



Carácter “remanente rostelar”

D

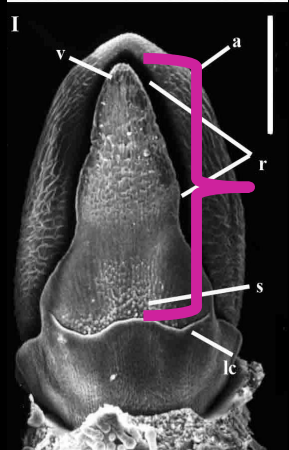
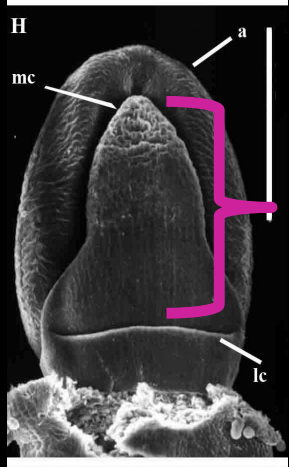
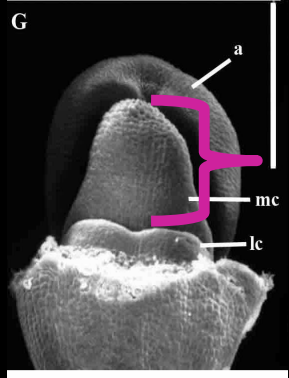




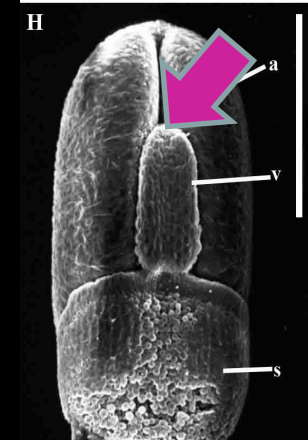
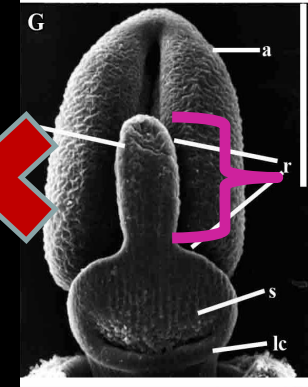
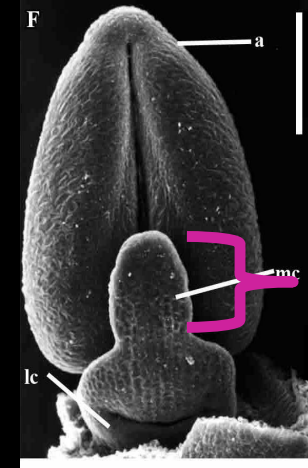
Organogénesis

- si-l-p-sd-a-cm-cl
- si-l-p-a-sd-cm-cl

Paedomorfosis



Aulosepalum pyramidale



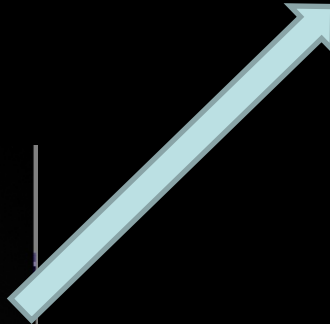
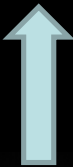
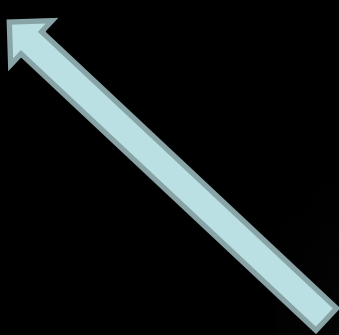
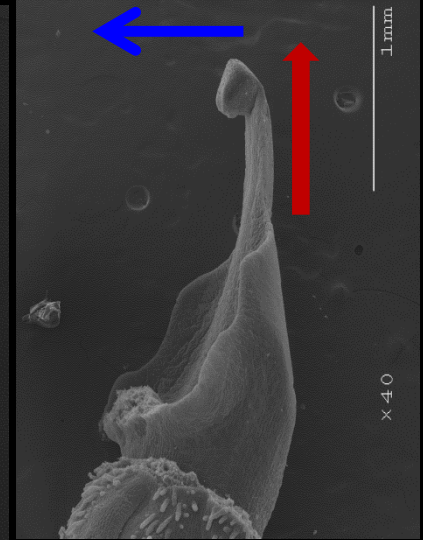
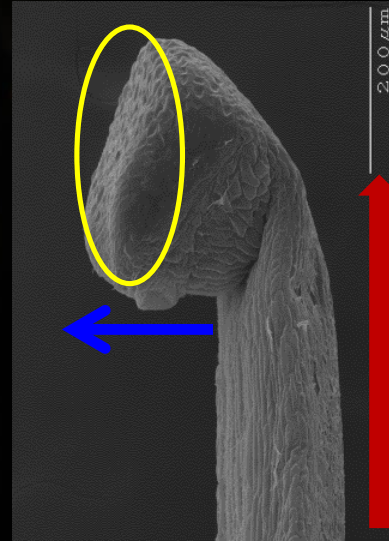
Mesadenus lucayanus

El alargamiento del rosetelo se detiene en *Mesadenus* durante fases tempranas del desarrollo!!

Crecimiento diferencial del rostelo

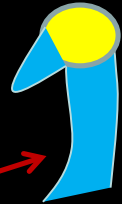
x 70

500 μm

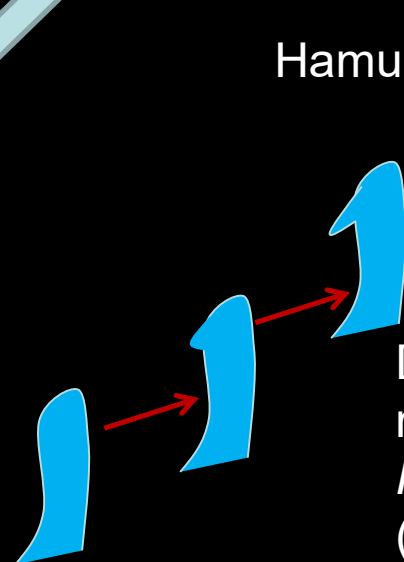


Viscidio

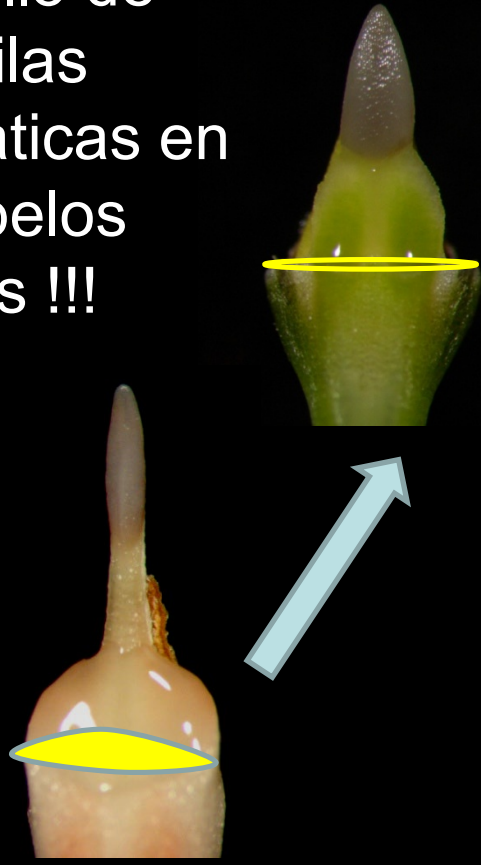
Hamulus



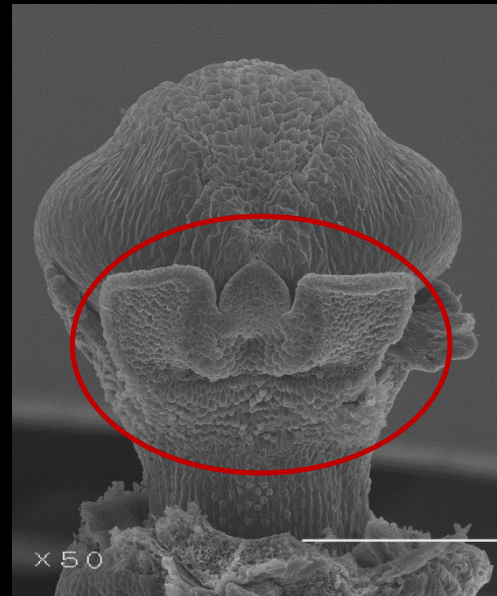
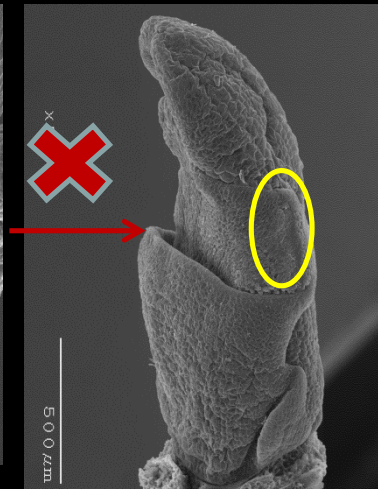
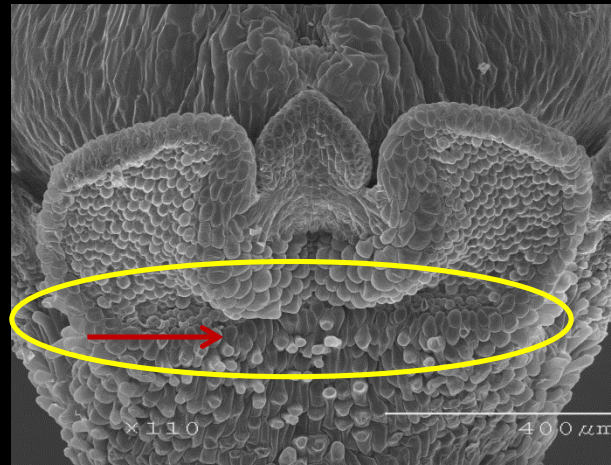
Desarrollo del
rostelo en
Ponthieva
(Cranichidinae)



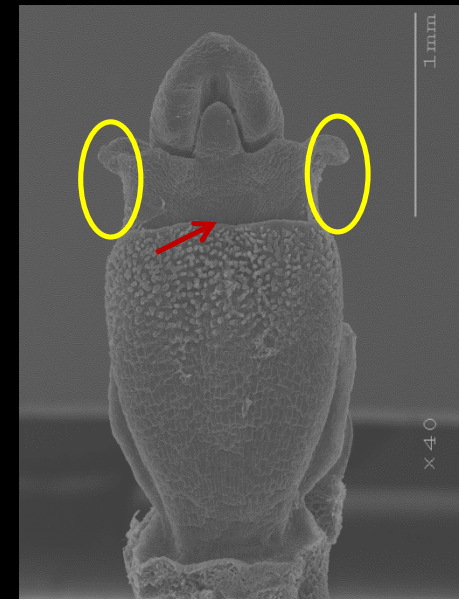
Supresión del desarrollo de las papilas estigmáticas en los carpelos laterales !!!



Reducción de la zona receptiva del estigma en las subtribus Spiranthinae y Cranichidinae



Prescottia plantaginea



Galeoglossum thysanochyllum

Conclusiones

- El desarrollo floral es un proceso complejo en el cual pequeños cambios heterocrónicos dan origen a diferencias morfológicas relevantes en las flores completamente desarrolladas.
- Los estudios de desarrollo son útiles para identificar el origen de las estructuras y por lo tanto para determinar la homología de los caracteres.



En Chihuahua también hay
orquídeas :D



El desierto en Juárez tiene
muchas maravillas!



Gracias