Making Diverse Flower Heads in Asteraceae

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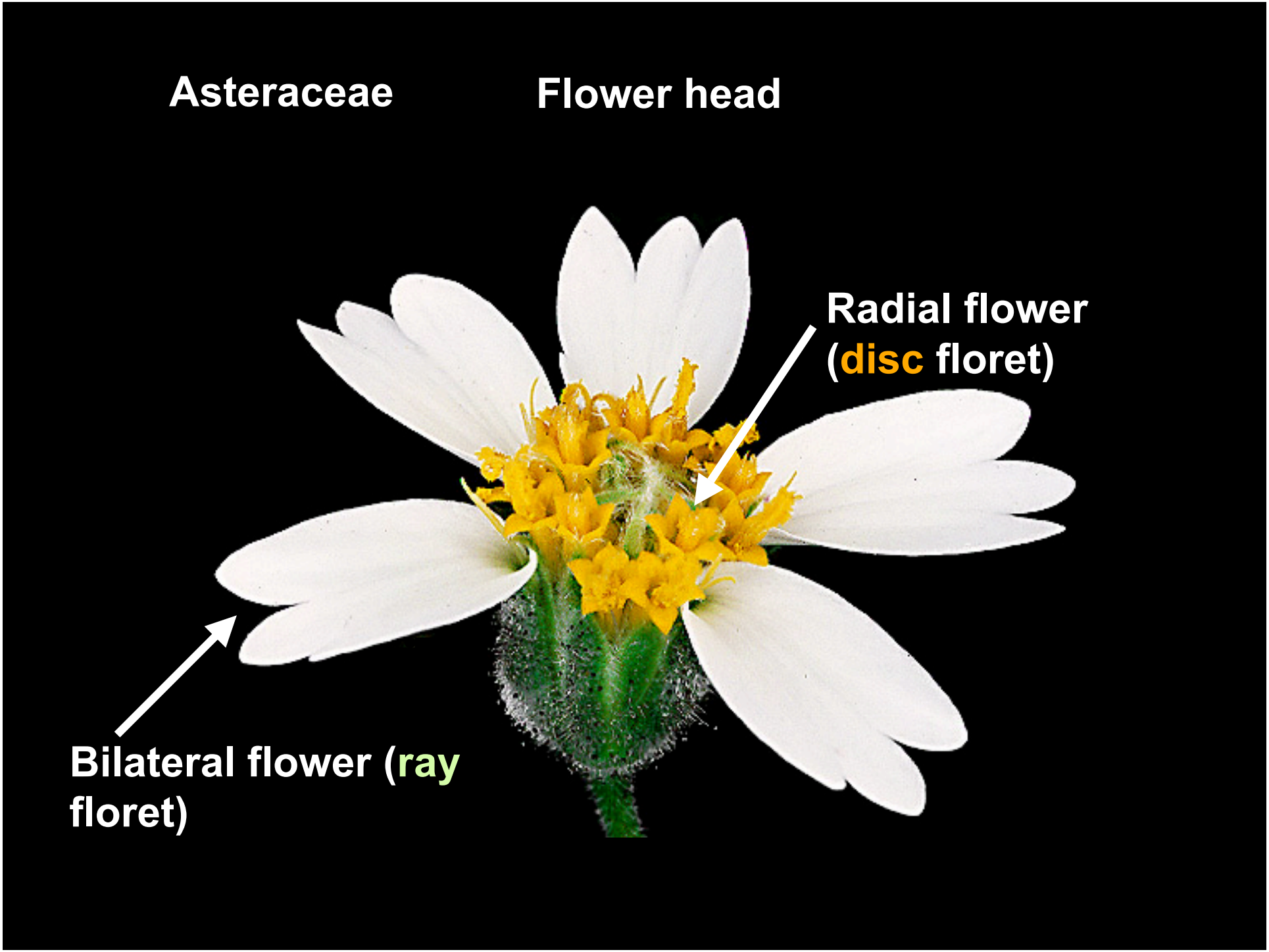

Asteraceae
Flower head
Radial flower (disc floret)
Bilateral flower (ray floret)

Radiate Head

disc florets
ray florets

Discoid Head

only disc florets

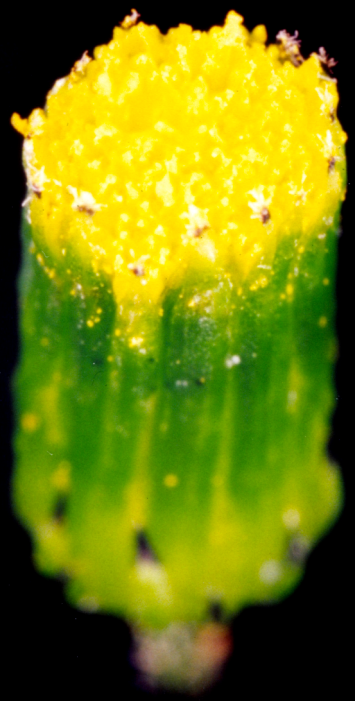
Ligulate Head

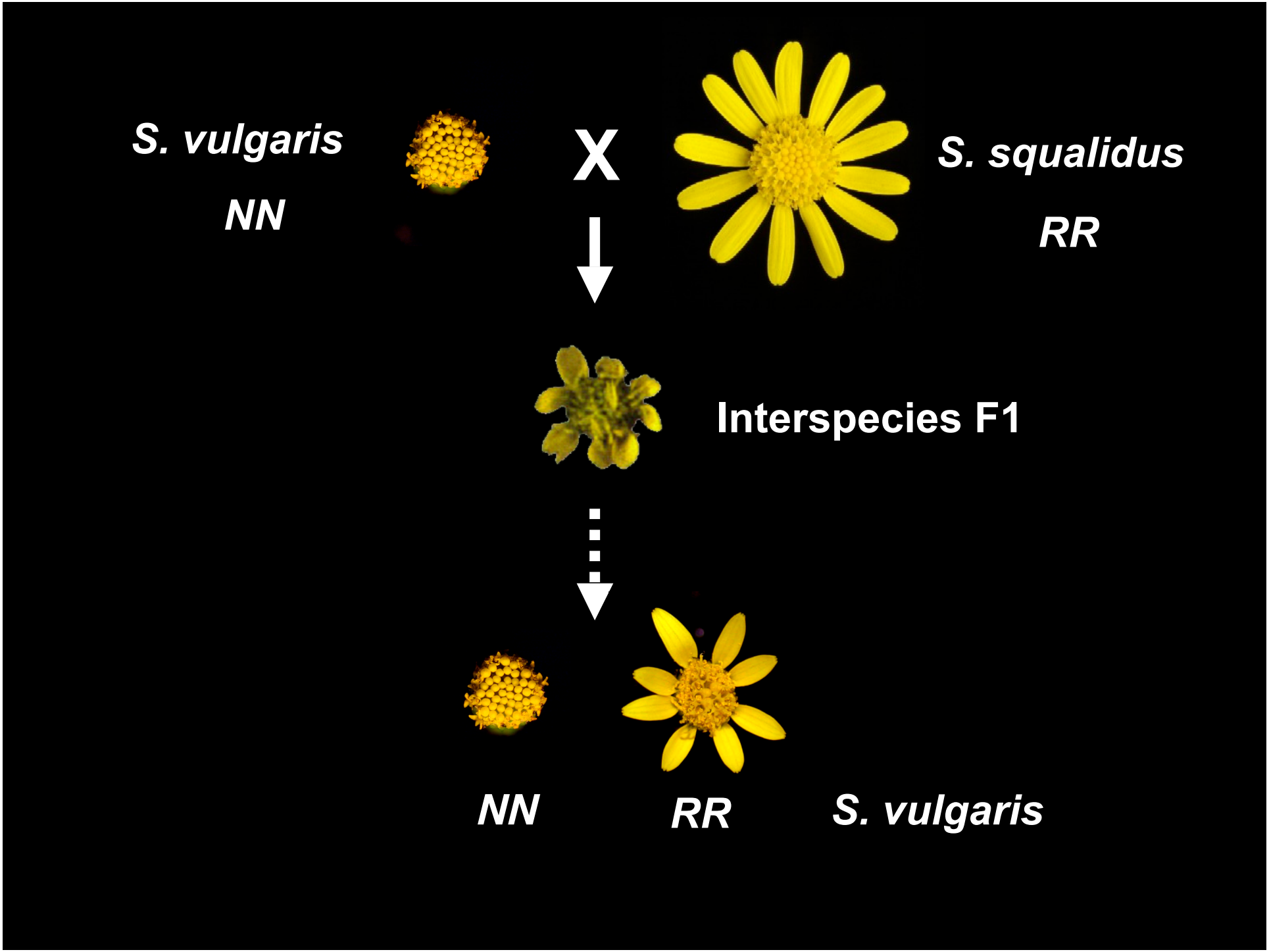
only ray florets

How are these flower head forms controlled?

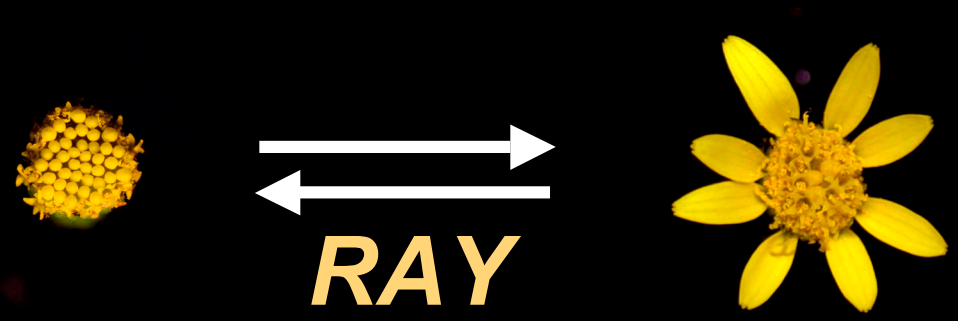
Senecio squalidus

Senecio vulgaris




S. vulgaris
NN
X
S. squalidus
RR
Interspecies F1
NN
RR
S. vulgaris

A single *RAY* locus determines flower head forms in *Senecio vulgaris*



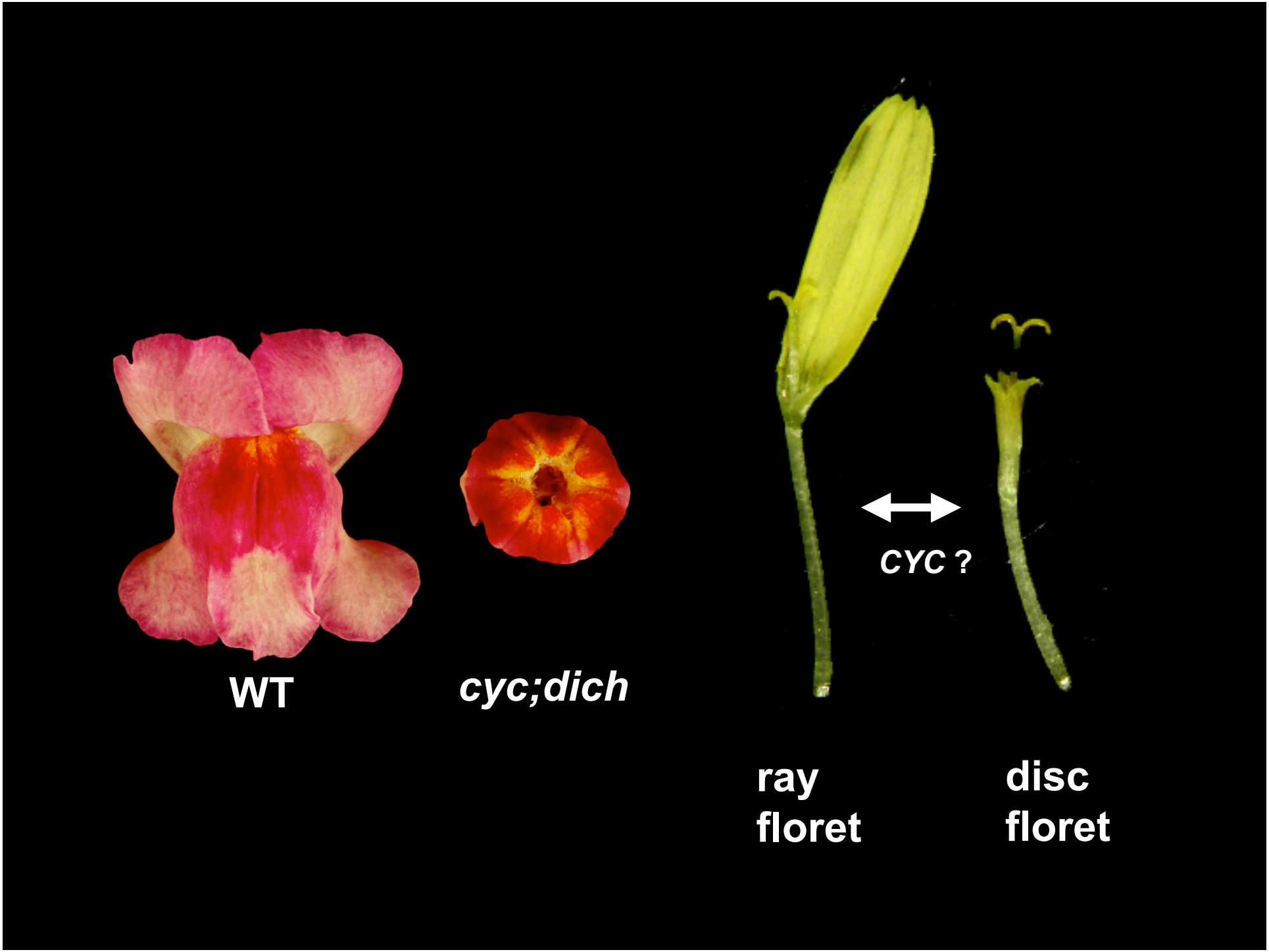
NN

discoid

RR

radiate

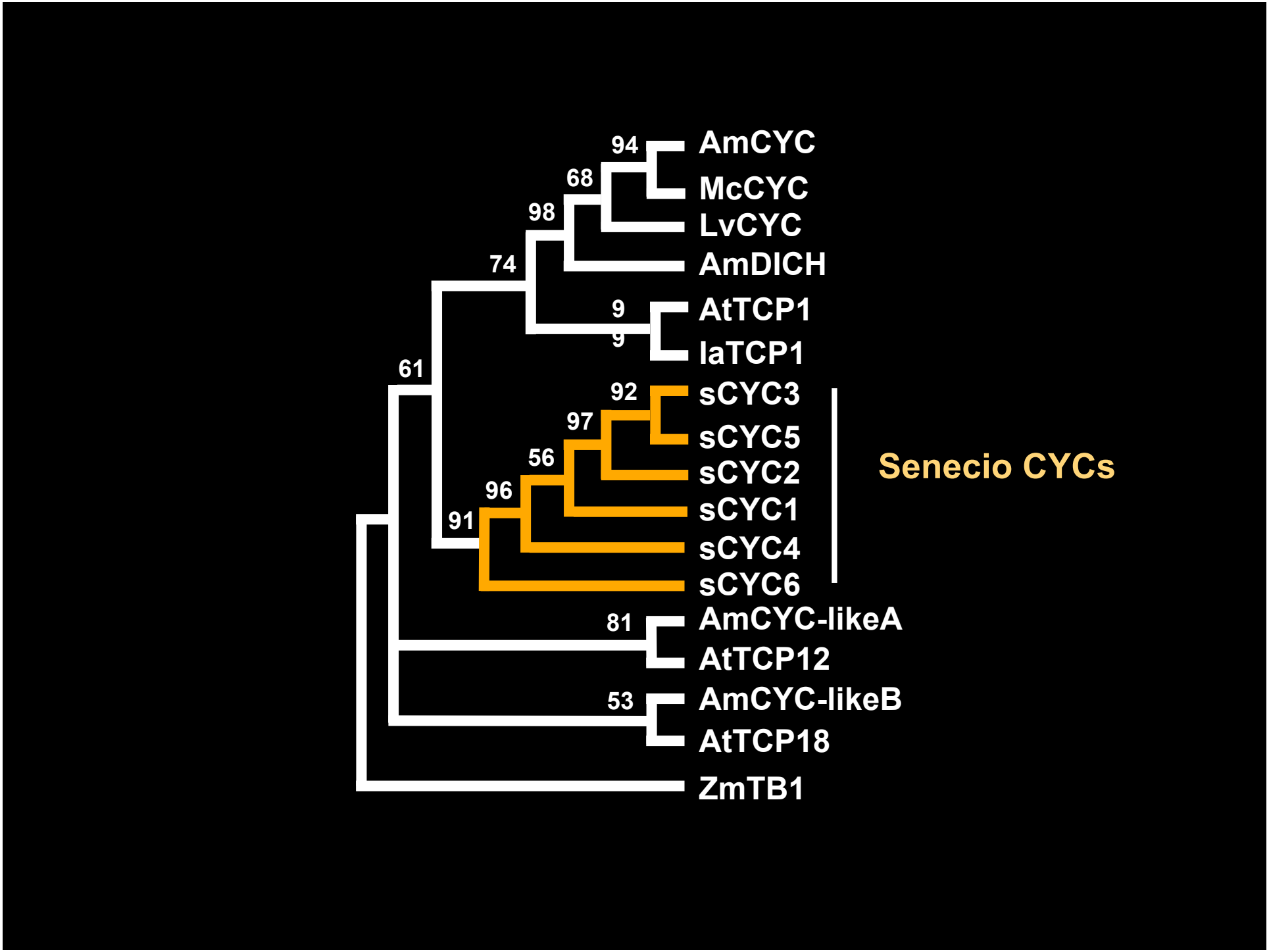
What is the *RAY* locus?

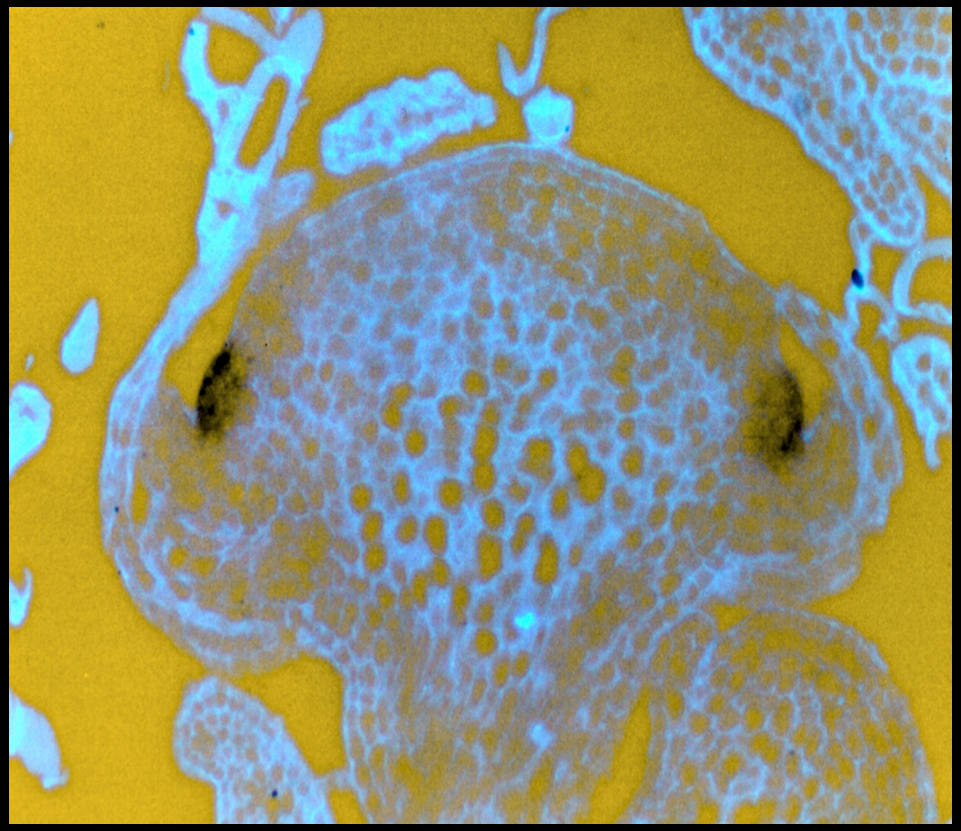

WT
cyc;dich
CYC ?
ray floret
disc floret

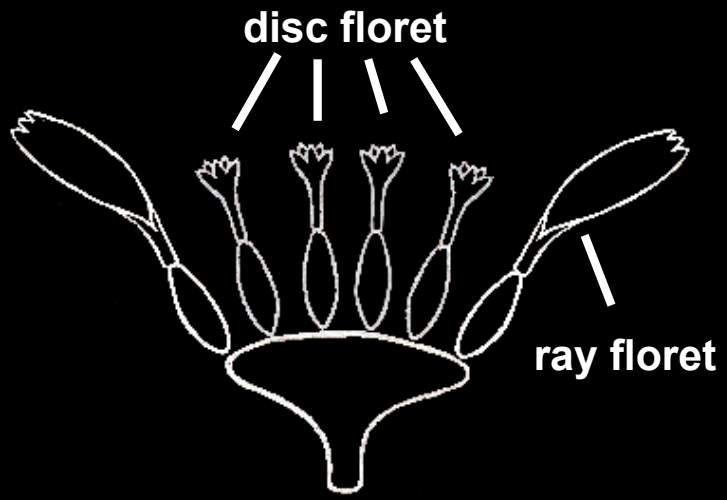
6 *CYC-like* genes in *Senecio vulgaris*

sCYC1 *sCYC2* *sCYC3*

sCYC4 *sCYC5* *sCYC6*


94
68
98
74
9
9
61
92
97
56
96
91
81
53
AmCYC
McCYC
LvCYC
AmDICH
AtTCP1
laTCP1
sCYC3
sCYC5
sCYC2
sCYC1
sCYC4
sCYC6
Senecio CYCs
AmCYC-likeA
AtTCP12
AmCYC-likeB
AtTCP18
ZmTB1

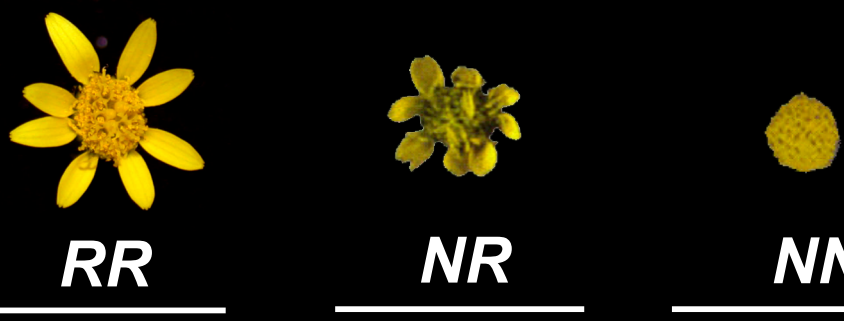




sCYC1 **and** ***sCYC2***

Mapping *sCYC1* and *sCYC2*

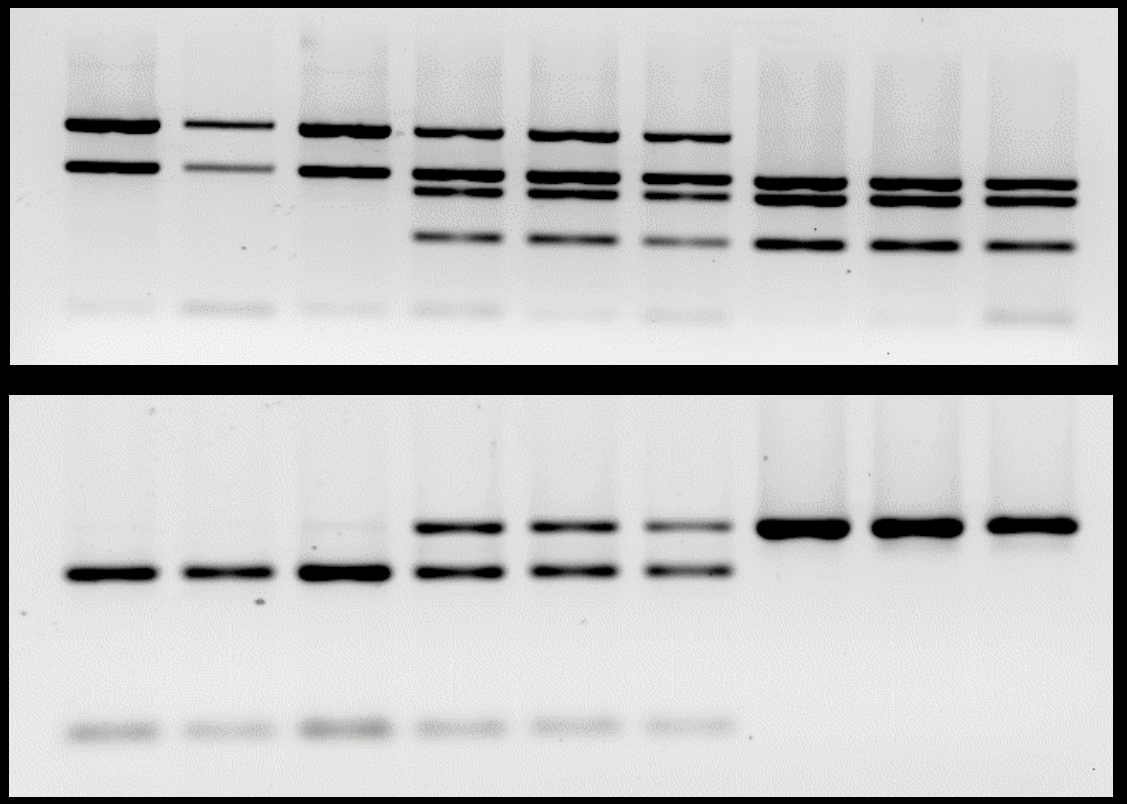
Polymorphism associated with flower forms



RR *NR* *NN*

sCYC1

sCYC2



taqI

sCYC1 RR

sCYC1 NN

taqI taqI

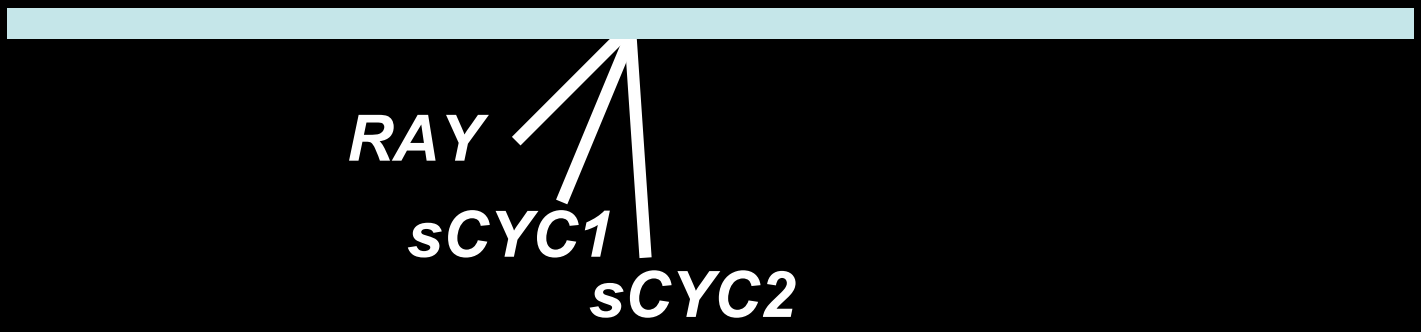
EcoRI

sCYC2 RR

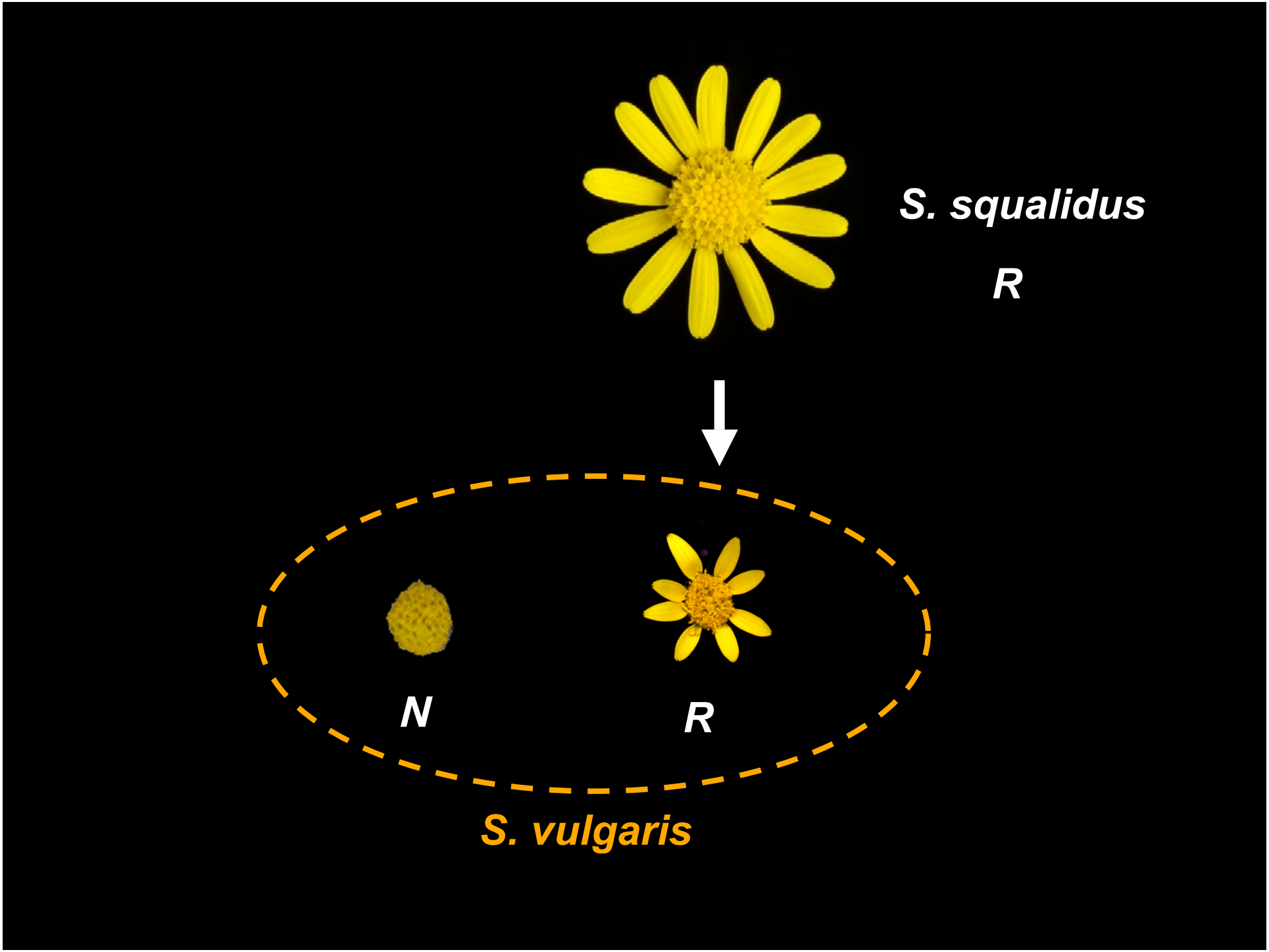
sCYC2 NN

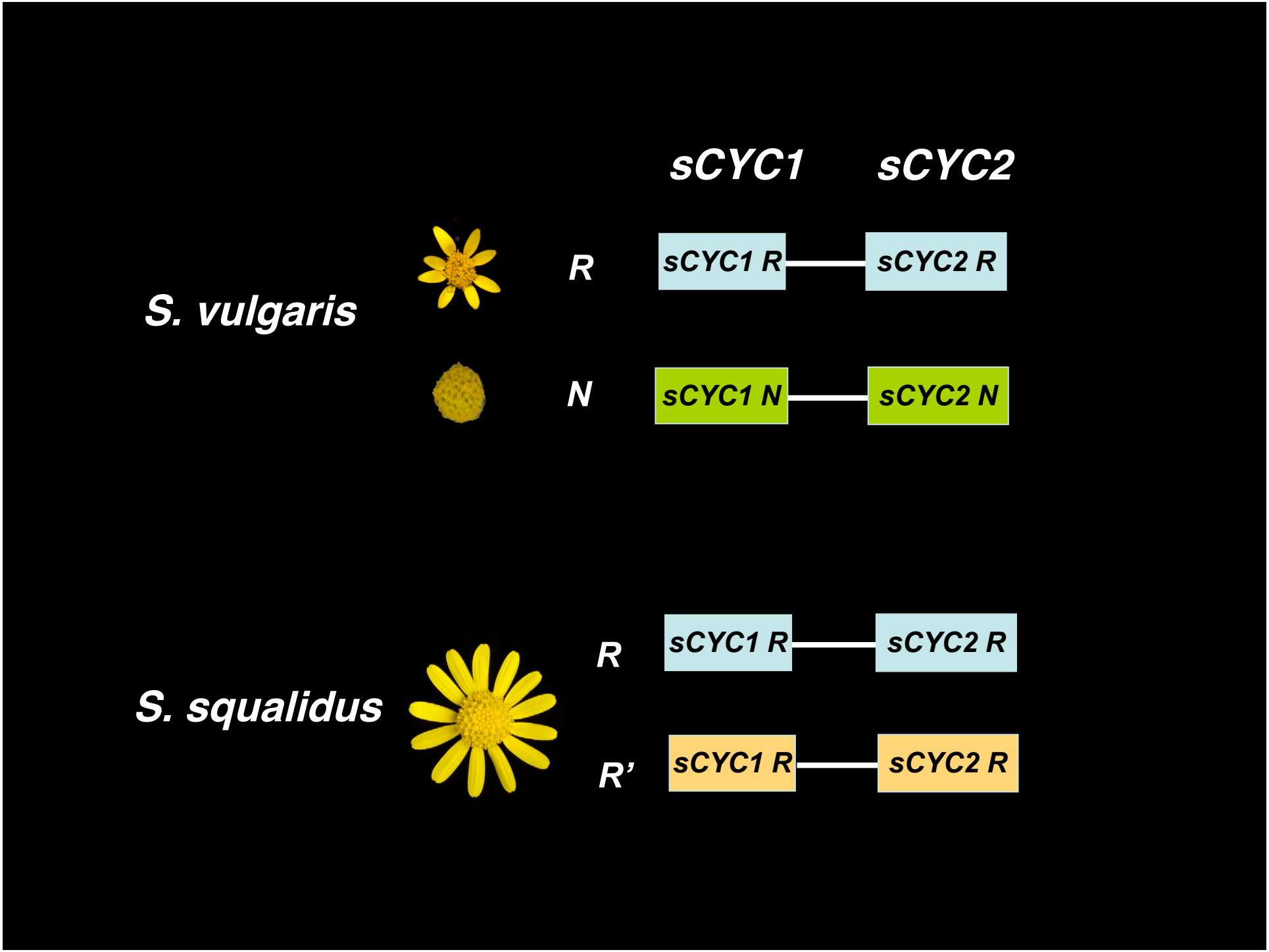
~2,500 F2 plants of *RR* X *NN*

NO genetic recombination between *RAY* locus and *sCYC1/sCYC2*



sCYC1 or *sCYC2* = *RAY locus*?


S. squalidus
R
N
R
S. vulgaris


sCYC1
sCYC2
S. vulgaris
R
sCYC1 R
sCYC2 R
N
sCYC1 N
sCYC2 N
S. squalidus
R
sCYC1 R
sCYC2 R
R'
sCYC1 R
sCYC2 R

How tight is the association between flower head phenotypes and genetic polymorphisms?

Senecio accessions

radiate

R

sCYC1 R — *sCYC2 R*

discoid

N

sCYC1 N — *sCYC2 N*

100% association between flower head phenotypes and genetic polymorphisms.

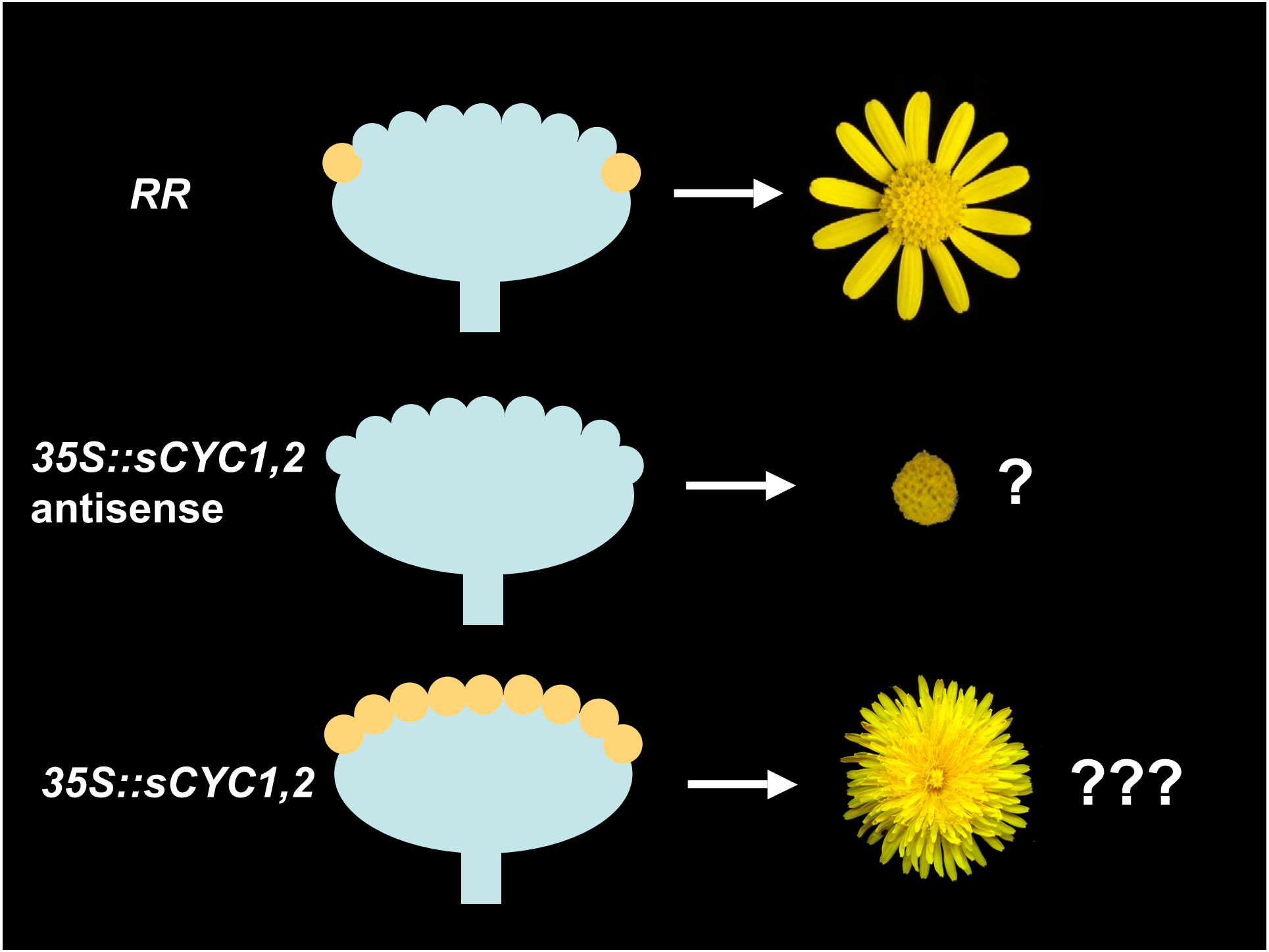
sCYC1-sCYC2 = *RAY* locus*?*

Expression data

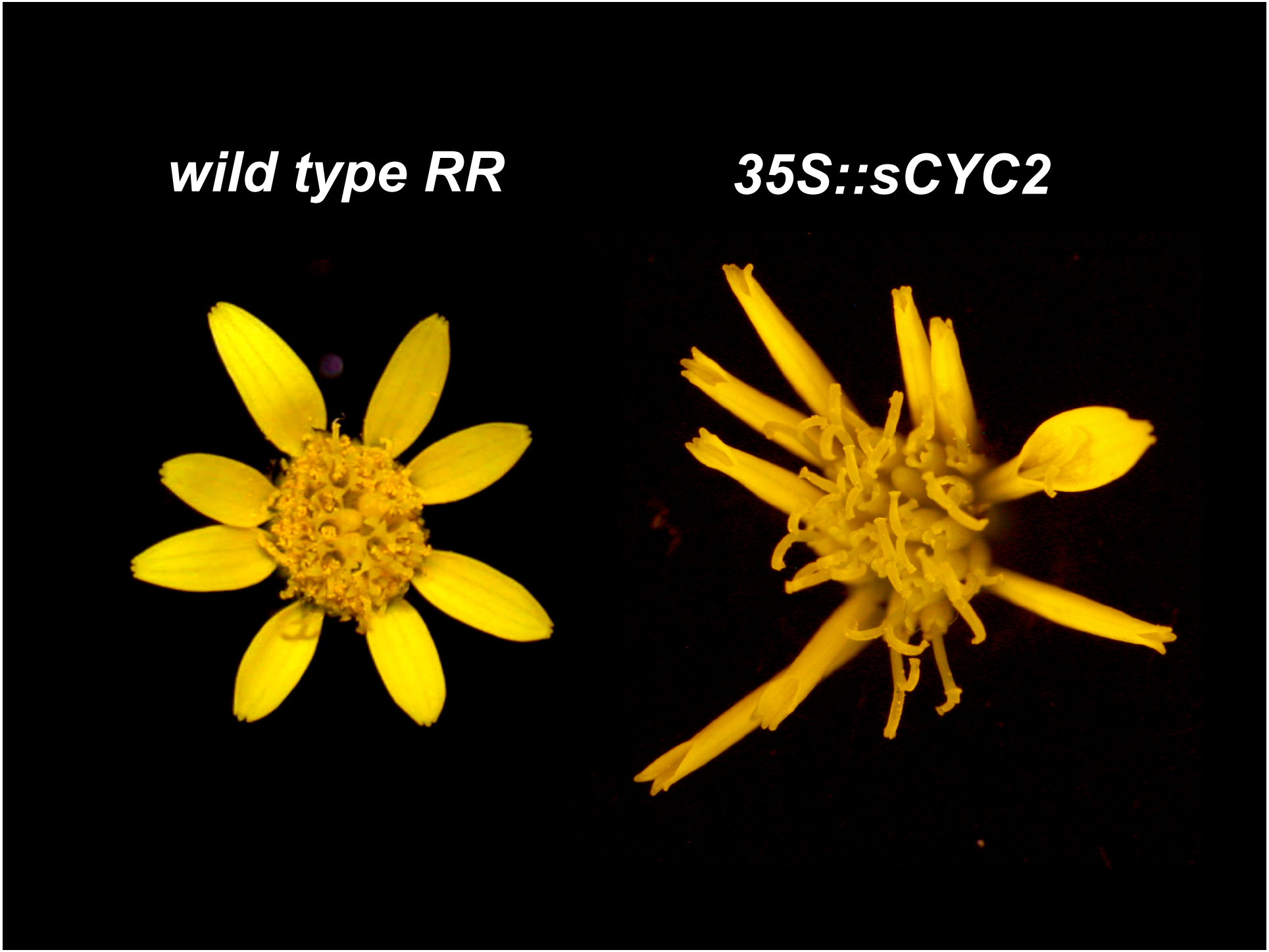
Mapping data

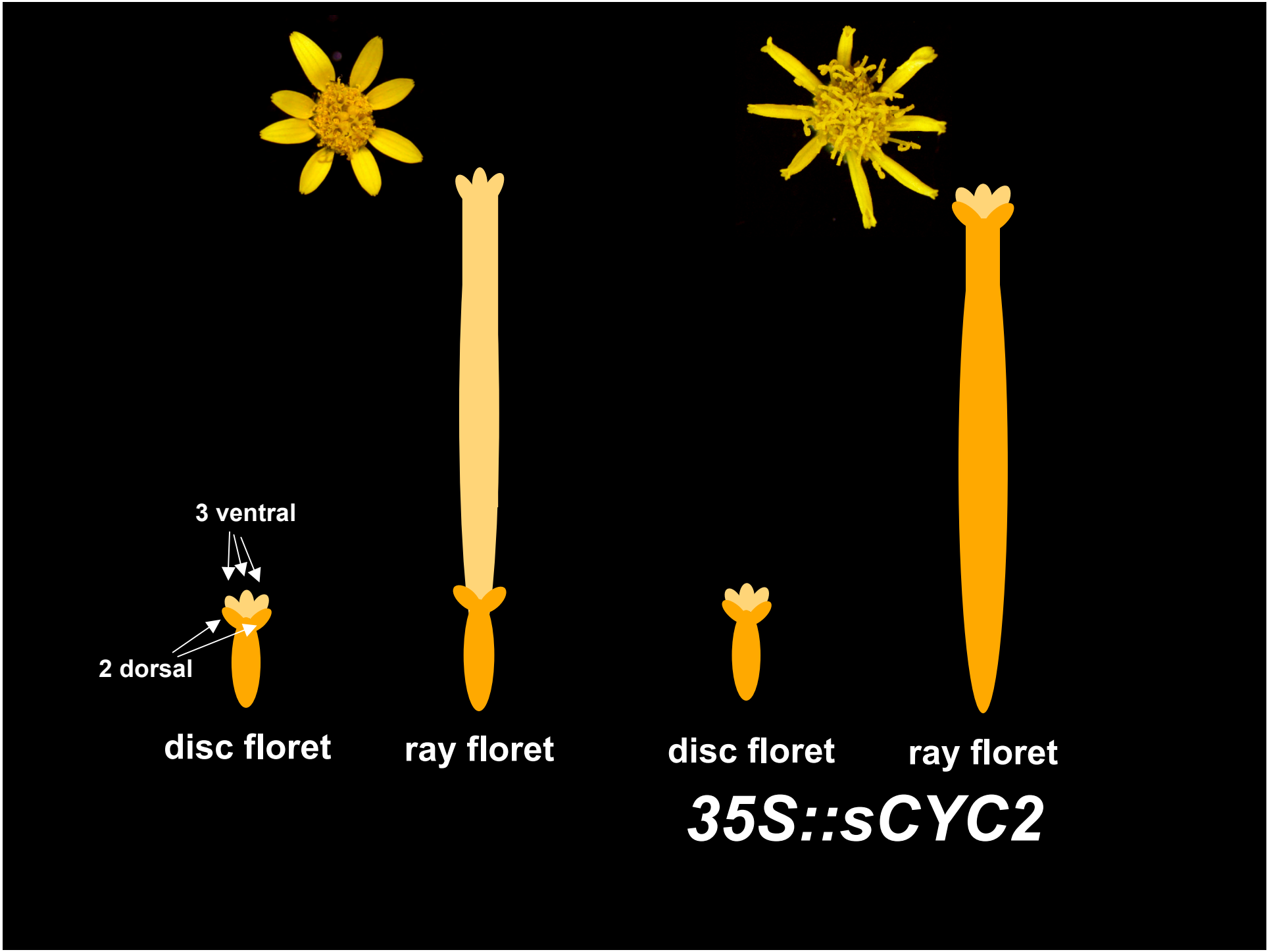
Natural populations-Genotyping

Making transgenic *Senecio*


RR
35S::sCYC1,2
antisense
?
35S::sCYC1,2
???

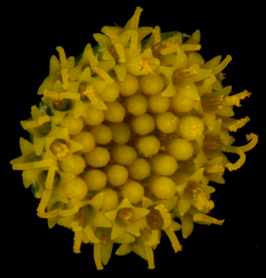
35S::sCYC2 Senecio !!!


wild type RR
35S::sCYC2


3 ventral
2 dorsal
disc floret
ray floret
disc floret
ray floret
35S::sCYC2

wild type RR

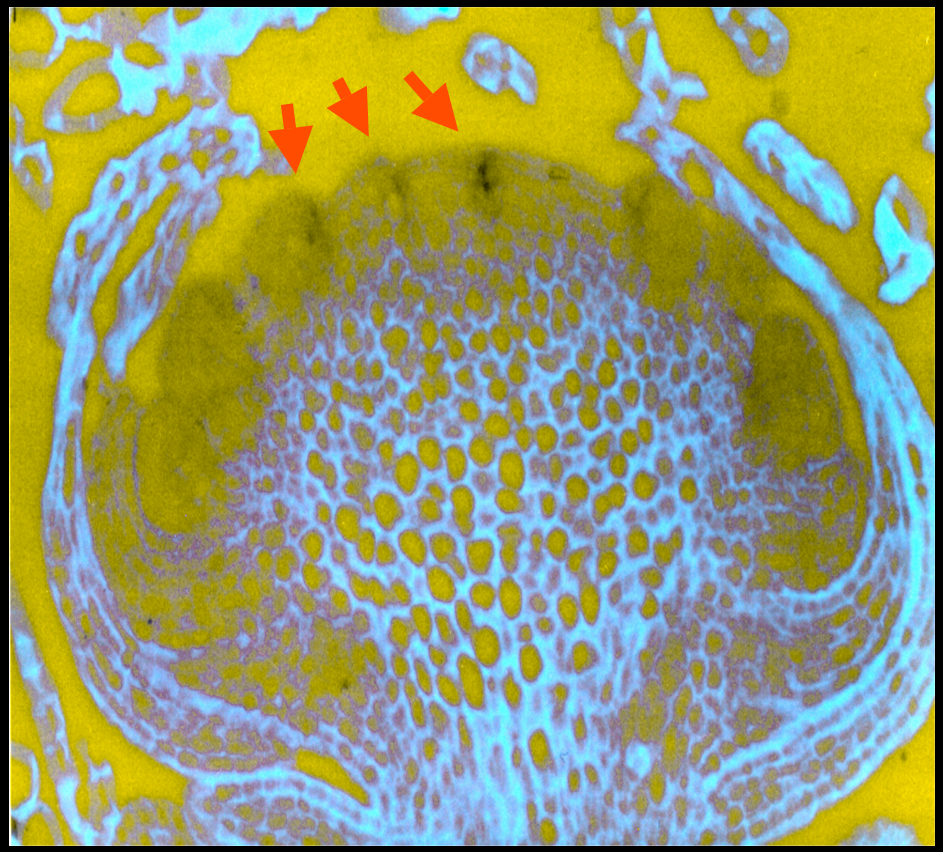
35S::sCYC 1



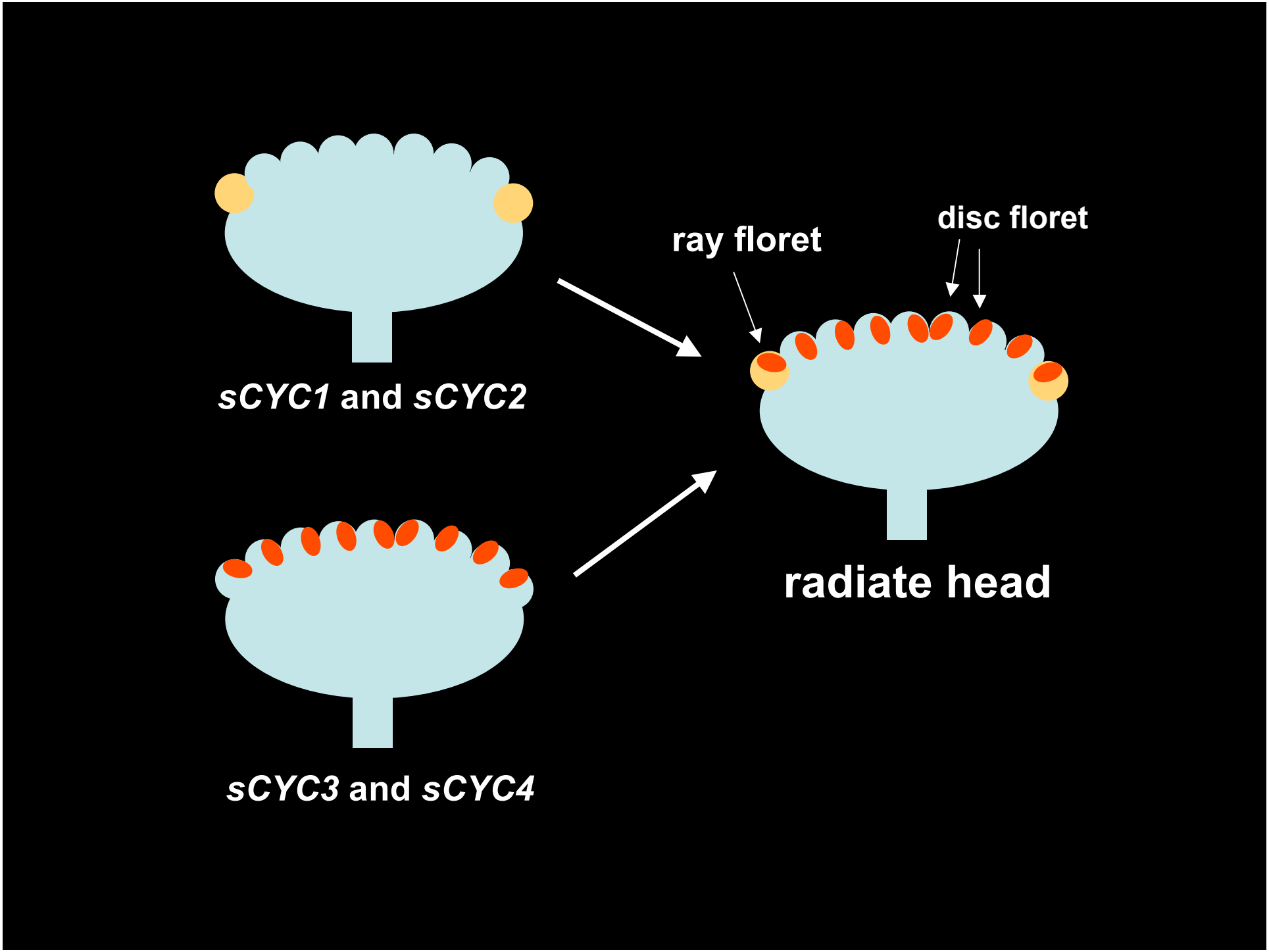
1. *sCYC1*and *sCYC2* determines the ray floret identity and are responsible for petal outgrowth/inhibtion.

2. *sCYC1* (*sCYC2*) alone is not enough to change disc florets to ray florets.

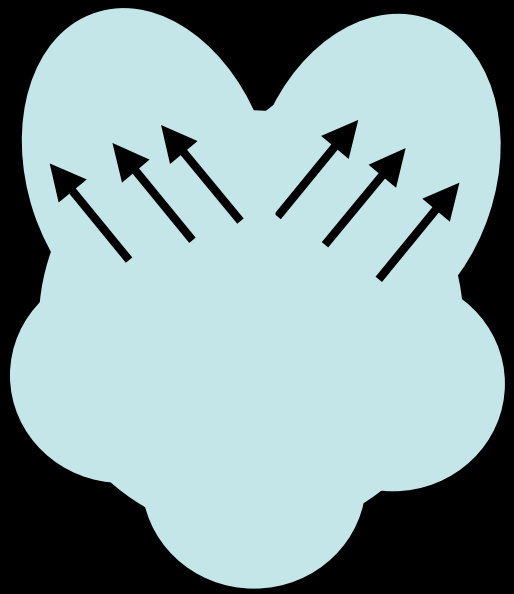
3. Another genetic factor(s) provides the dorsal-ventral cue to establish petal growth in ray florets.



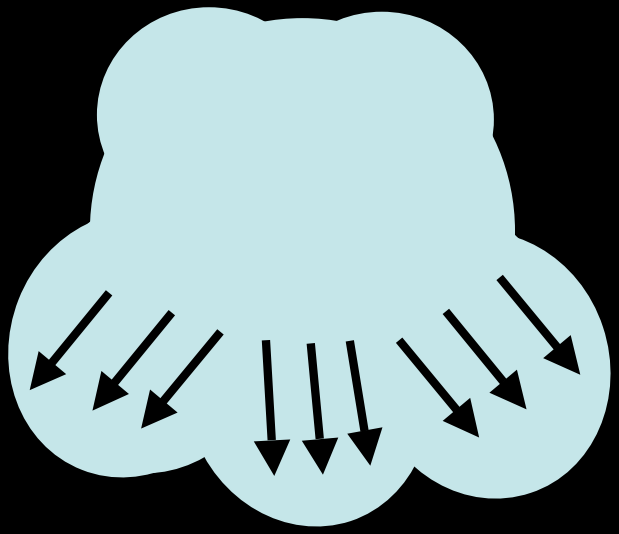
sCYC3* and *sCYC4

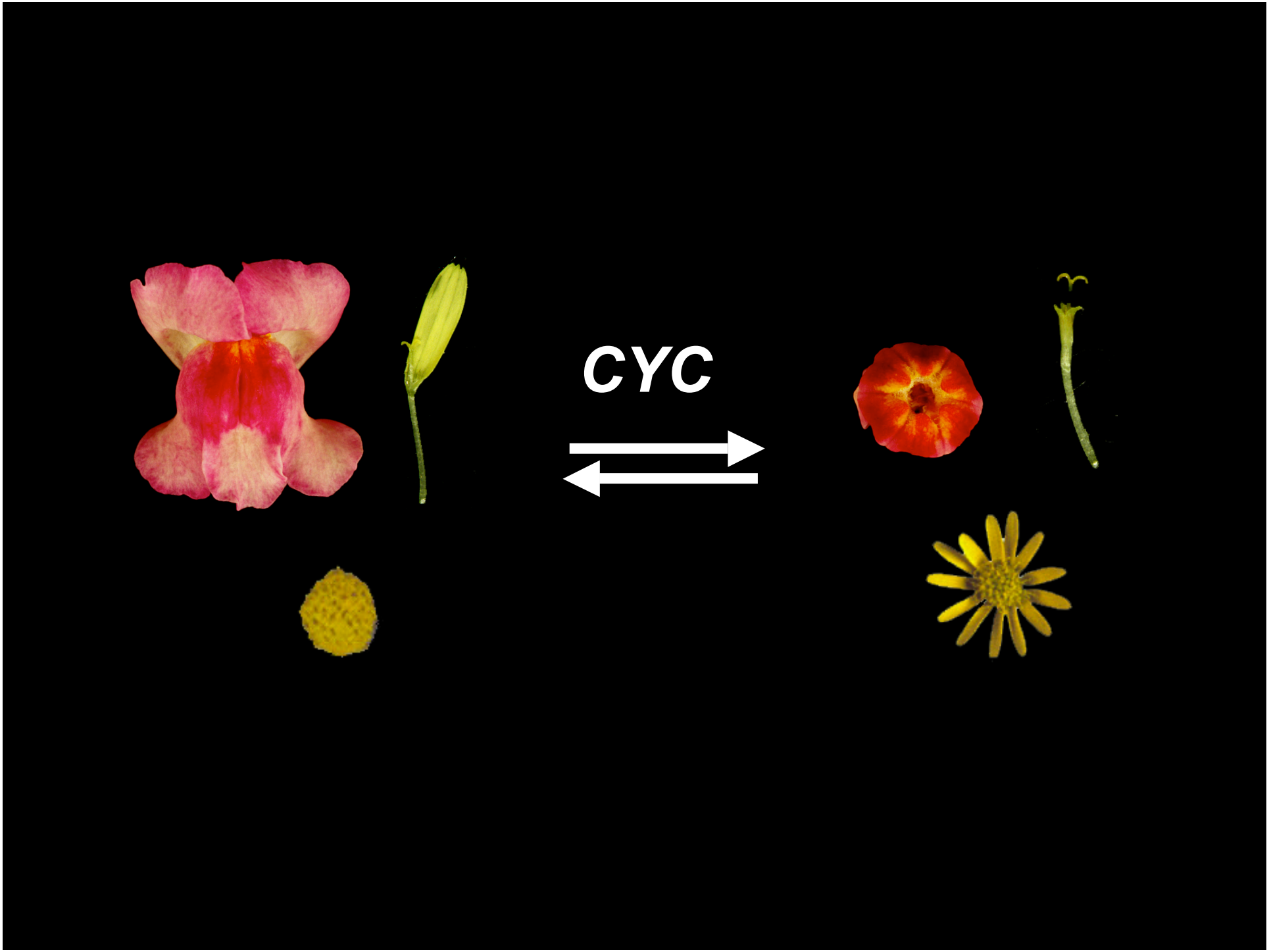

ray floret
disc floret
sCYC1 and sCYC2
sCYC3 and sCYC4
radiate head

Antirrhinum

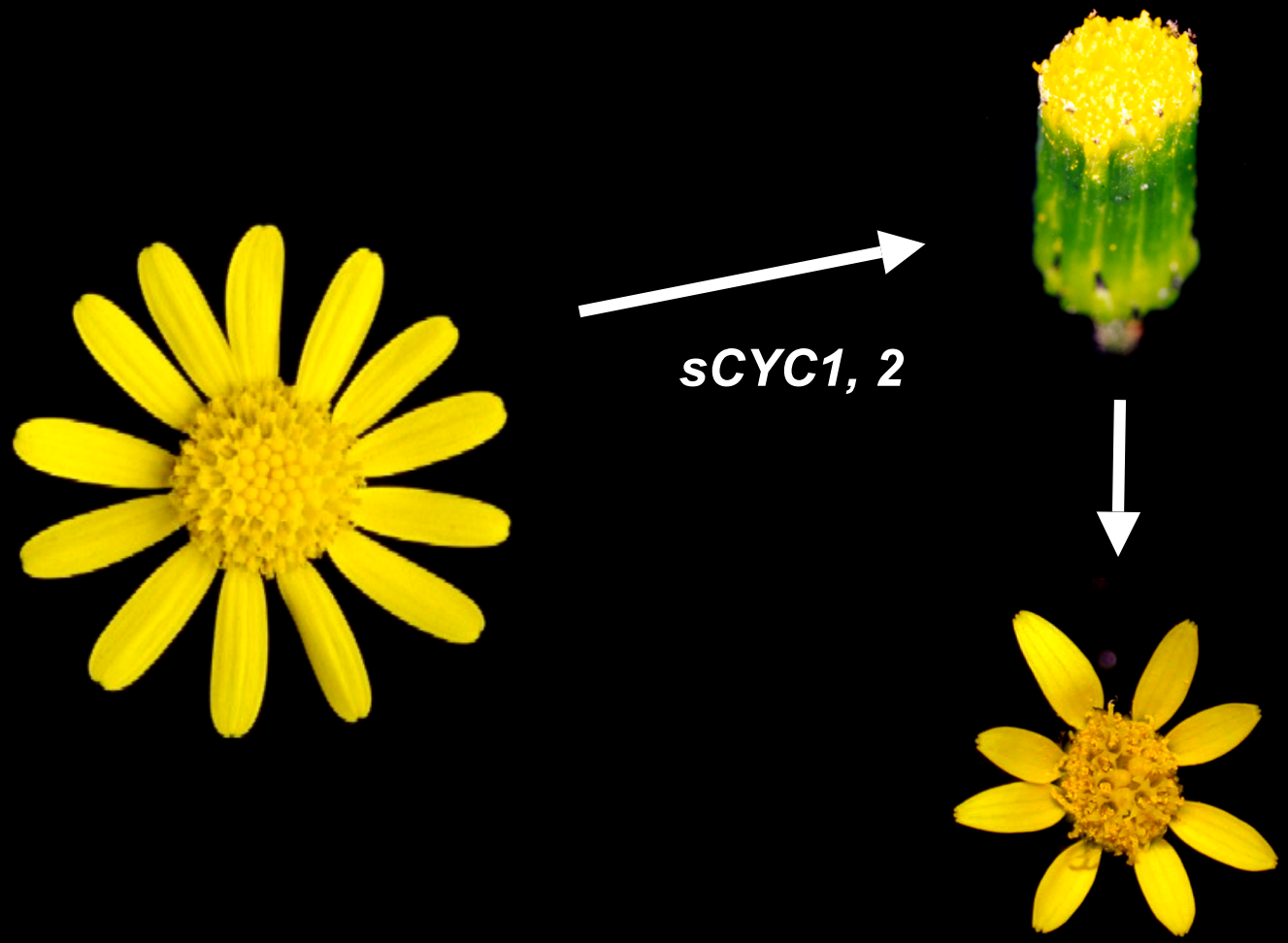


Senecio
ray floret




CYC

This is the first example showing that a trait can be transferred between species by transferring a key regulator



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