Inheritance of Leaf Shape in Coleus

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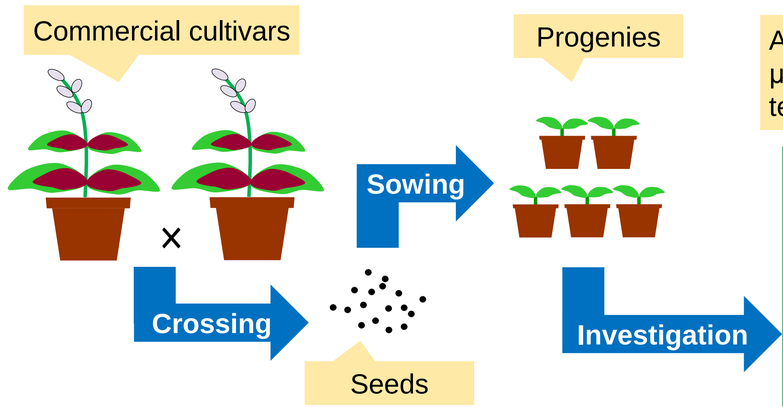
Abstract

Coleus [*Solenostemon scutellariodes* (L.) Codd.], with various leaf forms and shapes, can be used extensively for outdoor landscaping and decoration. Crosses between commercial cultivars were conducted to understand leaf shape inheritance of Coleus. Progeny from selfing or crossing cultivars with normal leaf width were all normal width, except that progeny from selfing 'Cardinal' and 'Defiance' resulted in a 3:1 ratio (normal: narrow). These results indicated that leaf width characteristic was controlled by a single locus, while normal width (*W*) is dominant to narrow width (*w*). Progeny from crossing between shallow-lobed cultivars all had shallow-lobed leaves, while crossing between deep-lobed cultivars resulted in a 3:1 or 1: 0 ratio (deep-lobe: shallow-lobe). Progeny from crossing between deep-lobed and shallow-lobed leaf cultivars segregated in a 1:1 ratio (deep-lobe: shallow-lobe). These suggested that leaf margin trait was controlled by a single locus, while deep-lobe (*L*) is dominant to shallow-lobe (*l*). Cultivars with crinkled surface were crossed, and progeny fit a 3:1 ratio (crinkled: smooth). Crossing between smooth leaf cultivars produced all smooth-leaved seedlings. Progeny from crossing between crinkled and smooth cultivars all had crinkled leaves. These suggested that leaf surface trait was governed by a single locus. Crinkled surface (*C*) is dominant to smooth surface (*c*). Crossing between regular-vein cultivars, between anastomosis cultivars, and between anastomosis and regular-vein cultivars fit a 0:1, 3:1 and 1:0 ratio (anastomosis: regular-vein) respectively in progeny. This indicated that leaf vein trait was governed by a single locus, and anastomosis vein (*G*) is dominant to regular vein (*g*).

Introduction

Coleus [*Solenostemon scutellariodes* (L.) Codd.] is used extensively in landscaping and as potted plant in tropical and subtropical areas. The ornamental value of Coleus is determined primarily by leaf characteristics. Many cultivars of Coleus are available in a board range of leaf shapes. The objective of this study was to understand the mode of inheritance of leaf width, lobe, surface and vein, and to infer the genotype of important Coleus cultivars for leaf shape.

Materials and Methods



Average day light irradiance: 1370 μmol·m^{-2}·s^{-1} *PPF*, and day night temperature: 23/20 ℃

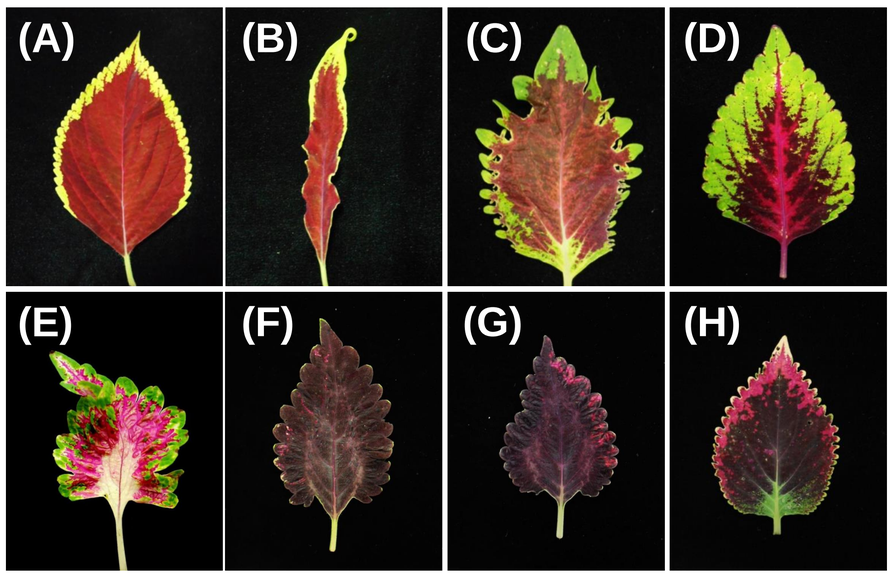


Fig. 1. Typical leaf shape characters in coleus progeny. Normal width (A), narrow width (B), deep lobed (C), shallow lobed (D), crinkled surface (E), smooth surface (F), irregular vein (G), and regular vein (H)

Results

Leaf Width

Table 1. Coleus progeny leaf width segregation ratios (normal: narrow) for cultivar crosses. *W*_ = normal width; *ww* = narrow width

Crosses (proposed genotype)	Leaf width			Expected ratio	χ^2	Probability
	Normal	Narrow	Total			
Cardinal (*Ww*) ⊗	34	12	46	3: 1	0.290	0.865
Defiance (*Ww*) ⊗	23	6	29	3: 1	0.287	0.592
Fiesta (*WW*) ⊗	27	0	27	1: 0	0	1
Wizard Jade (*WW*) × Fiesta (*WW*)	14	0	14	1: 0	0	1
New Hurricane (*WW*) × Green Cloud (*WW*)	17	0	17	1: 0	0	1
Norris (*WW*) × Cardinal (*WW*)	27	0	27	1: 0	0	1
Norris (*WW*) × Carefree (*WW*)	9	0	9	1: 0	0	1
Norris (*WW*) × Wizard Jade (*WW*)	16	0	16	1: 0	0	1
Norris (*WW*) × The Line (*WW*)	6	0	6	1: 0	0	1
Wizard Jade (*WW*) × Fiesta (*WW*)	14	0	14	1: 0	0	1

- Crosses between normal width cultivars ⇨ segregation ratio = 1: 0 (normal: narrow width)
- 'Cardinal' and 'Defiance' selfing ⇨ segregation ratio = 3: 1 (normal: narrow width)

➔ Normal width (Fig. 1 A) is dominant to narrow width (Fig. 1 B). 'Cardinal' and 'Defiance' is heterozygous, while other cultivars are homozygous

Leaf Margin

Table 2. Coleus progeny leaf margin segregation ratios (deep: shallow) for cultivar crosses. *L*_ = deep lobed; *ll* = shallow lobed

Crosses (proposed genotype)	Leaf margin			Expected ratio	χ^2	Probability
	Deep	Shallow	Total			
Defiance (*ll*) ⊗	0	29	29	0: 1	0	1
Fiesta (*ll*) ⊗	0	27	27	0: 1	0	1
Wizard Jade (*ll*) × Fiesta (*ll*)	0	14	14	0: 1	0	1
New Hurricane (*Ll*) × Green Cloud (*Ll*)	13	4	17	3: 1	0.020	0.889
Norris (*Ll*) × Cardinal (*ll*)	13	14	27	1: 1	0.037	0.847
Norris (*Ll*) × Carefree (*LL*)	6	3	9	3: 1	-	-
Norris (*Ll*) × Wizard Jade (*ll*)	5	11	16	1: 1	2.25	0.134
Norris (*Ll*) × The Line (*ll*)	3	3	6	1: 1	-	-
Wizard Jade (*ll*) × Fiesta (*ll*)	0	14	14	0: 1	0	1

- Crosses between shallow lobed cultivars ⇨ segregation ratio = 0: 1 (deep: shallow lobed)
- Crosses between deep lobed cultivars ⇨ segregation ratio = 3: 1 or 1:0 (deep: shallow lobed)
- Crosses between deep and shallow lobed cultivars ⇨ segregation ratio = 1: 1 (deep: shallow lobed)

➔Deep lobed (Fig. 1 C) is dominant to shallow lobed (Fig. 1 D)

Leaf Surface

Table 3. Coleus progeny leaf surface segregation ratios (crinkled: smooth) for cultivar crosses. *C*_ = crinkled; *cc* = smooth

Crosses (proposed genotype)	Leaf surface			Expected ratio	χ^2	Probability
	Crinkled	Smooth	Total			
Defiance (*cc*) ⊗	0	29	29	0: 1	0	1
Fiesta (*cc*) ⊗	0	27	27	0: 1	0	1
Wizard Jade (*cc*) × Fiesta (*cc*)	0	14	14	0: 1	0	1
New Hurricane (*Cc*) × Green Cloud (*Cc*)	12	5	17	3: 1	0.176	0.674
Norris (*cc*) × Cardinal (*cc*)	0	27	27	0: 1	0	1
Norris (*cc*) × Carefree (*CC*)	9	0	9	1: 0	0	1
Norris (*cc*) × Wizard Jade (*cc*)	0	16	16	0: 1	0	1
Norris (*cc*) × The Line (*cc*)	0	6	6	0: 1	0	1
Wizard Jade (*cc*) × Fiesta (*cc*)	0	14	14	0: 1	0	1

- Crosses between smooth surface cultivars ⇨ segregation ratio = 0: 1 (crinkled: smooth surface)
- Crosses between crinkled surface cultivars ⇨ segregation ratio = 3: 1 (crinkled: smooth surface)
- Crosses between crinkled and smooth surface cultivars ⇨ segregation ratio = 1: 0 (crinkled: smooth surface)

➔Crinkled surface (Fig. 1 E) is dominant to smooth surface (Fig. 1 F)

Leaf Vein

Table 4. Coleus progeny leaf vein segregation ratios (irregular: regular) for cultivar crosses. *G*_ = irregular; *gg* = regular

Crosses (proposed genotype)	Leaf vein			Expected ratio	χ^2	Probability
	Irregular	Regular	Total			
Defiance (*gg*) ⊗	0	29	29	0: 1	0	1
Fiesta (*gg*) ⊗	0	27	27	0: 1	0	1
Wizard Jade (*gg*) × Fiesta (*gg*)	0	14	14	0: 1	0	1
New Hurricane (*Gg*) × Green Cloud (*Gg*)	13	4	17	3: 1	0.020	0.889
Norris (*gg*) × Cardinal (*gg*)	0	27	27	0: 1	0	1
Norris (*gg*) × Carefree (*GG*)	9	0	9	1: 0	0	1
Norris (*gg*) × Wizard Jade (*gg*)	0	16	16	0: 1	0	1
Norris (*gg*) × The Line (*gg*)	0	6	6	0: 1	0	1
Wizard Jade (*gg*) × Fiesta (*gg*)	0	14	14	0: 1	0	1

- Crosses between regular vein cultivars ⇨ segregation ratio = 0: 1 (irregular: regular vein)
- Crosses between irregular vein cultivars ⇨ segregation ratio = 3: 1 (irregular: regular vein)
- Crosses between irregular and regular vein cultivars ⇨ segregation ratio = 1: 0 (irregular: regular vein)

➔Irregular vein (Fig. 1 G) is dominant to regular vein (Fig. 1 H)

Conclusions

- Leaf width is governed by a single locus, and normal width (*W*) is dominant to narrow width (*w*).
- Leaf surface is governed by a single locus, and crinkled surface (*C*) is dominant to smooth surface (*c*).
- Leaf lobe is governed by a single locus, and deep lobed (*L*) is dominant to shallow lobed (*l*).
- Leaf vein is governed by a single locus, and irregular vein (G) is dominant to regular vein (g).