Impact of Environmental Variation on Color Trait Expression and Its Challenge to DUS Testing

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Content

- What- Color Variation in Different Environments
- How— Improving Color Testing Practices

Case 1

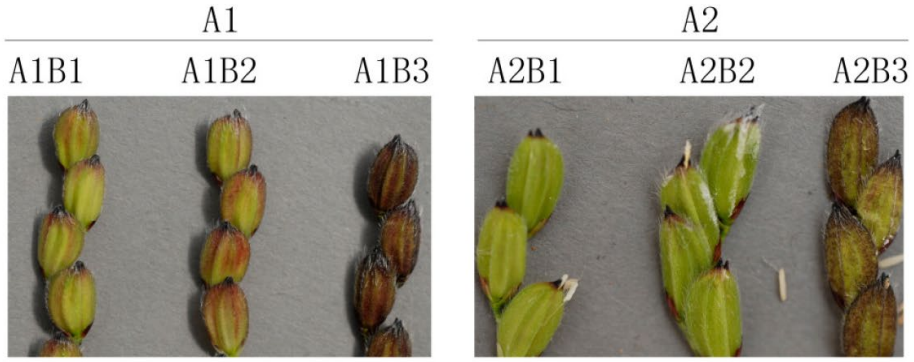


Figure 1: Anthocyanin coloration intensity of lemma (early observation).

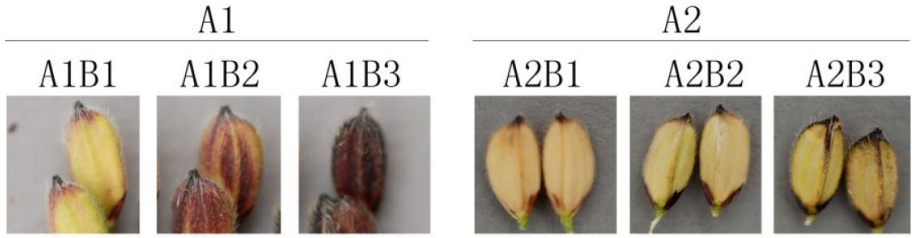


Figure 2: Anthocyanin coloration intensity of lemma (late observation).

	B1	B2	B3
condition	greenhouse	shelter	open field
sunlight	weak	medium	strong
temperature	high	medium	low

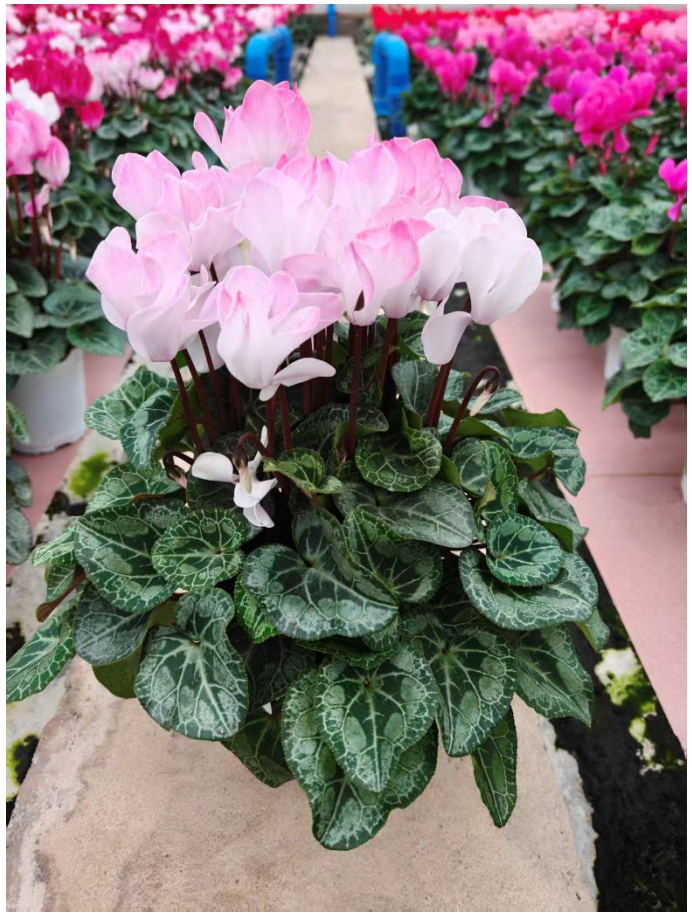
All of data from Liu, *et al.*, 2014

Case 2

Figure 3. Petal coloration of variety of ‘Doppio Pandora-purple’ of *Ranunculus asiaticus* L. (Liu, *et al*., 2022)

Note: A: flower at the stage of florescence; B: upper sides of outer petals; C: lower sides of outer petals; the left one (two) was (were) in the condition of control (8:00-20:00: 18℃; 20:00-8:00: 8℃), while the right one (two) was (were) under the stress of 5℃ decrease (8:00-20:00: 13℃; 20:00-8:00: 3℃) after budding.

Case 3



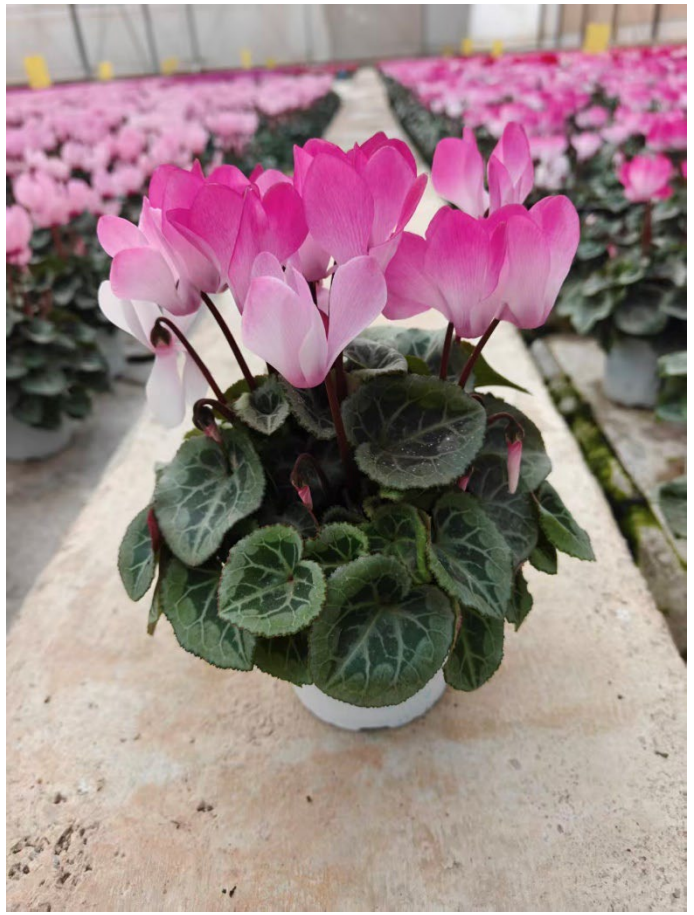


Figure 4. Cyclamen variety 'Mirage' under different environmental conditions (provided by Kunming Binfen Horticulture Co., Ltd.)

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Pigment metabolic pathways vary among different crops.

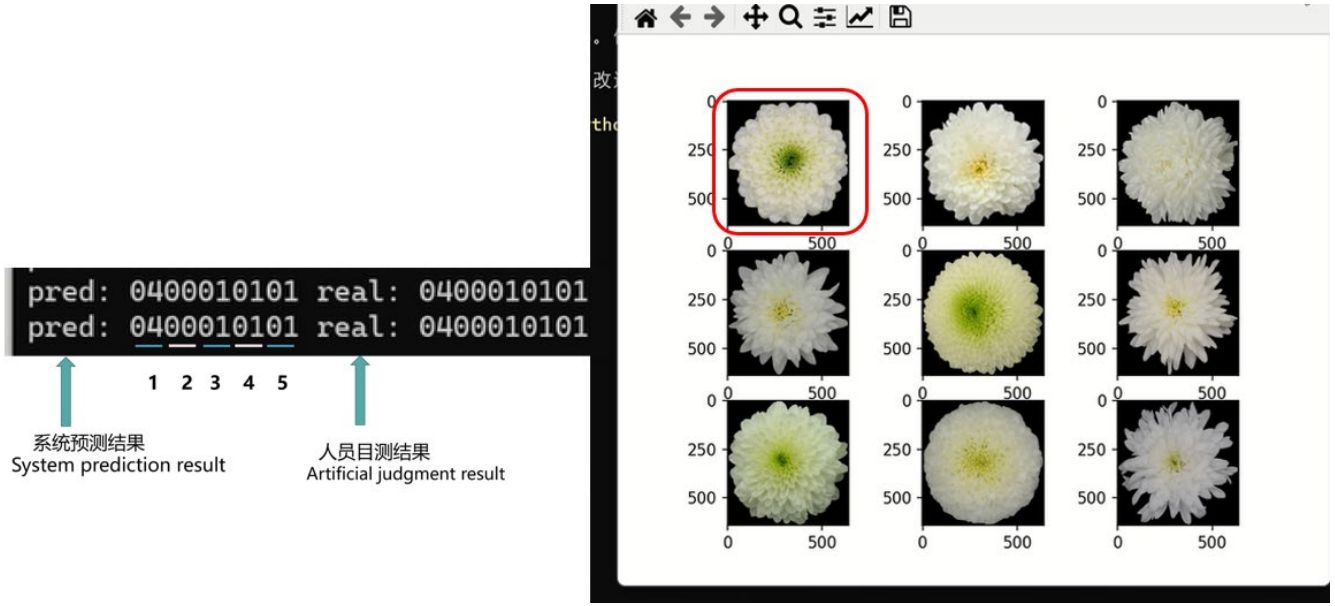
Transcriptional regulatory mechanisms also differ under different environmental conditions

How to perform DUS testing on color-related traits?

Point 1

- **Side-by-side testing mode**
- **Special attention must be paid to light conditions, e.g. shading, angle of light exposure.**

Point 2

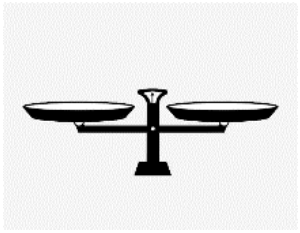


- **When screening similar varieties, attention should be paid to color-related traits.**

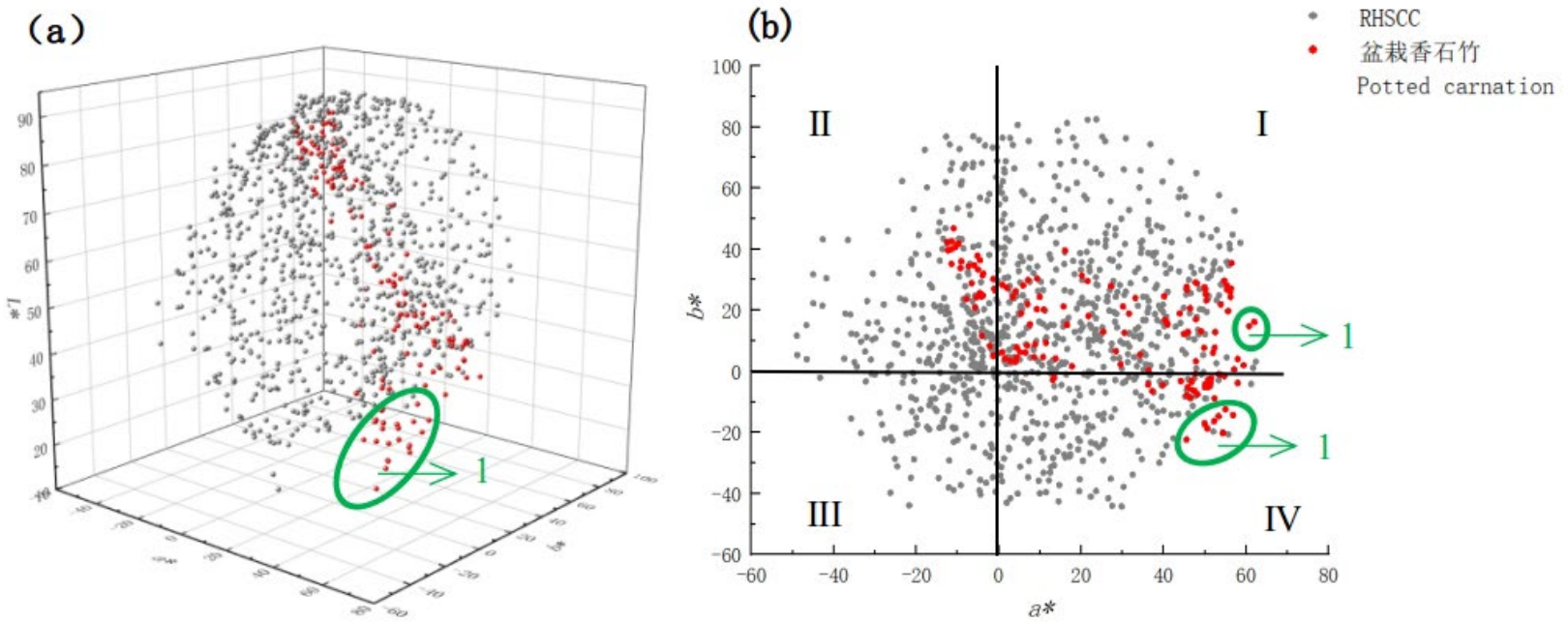
Point 3

- **In PVP disputes, the use of color-related traits should be approached with caution.**

Point 4



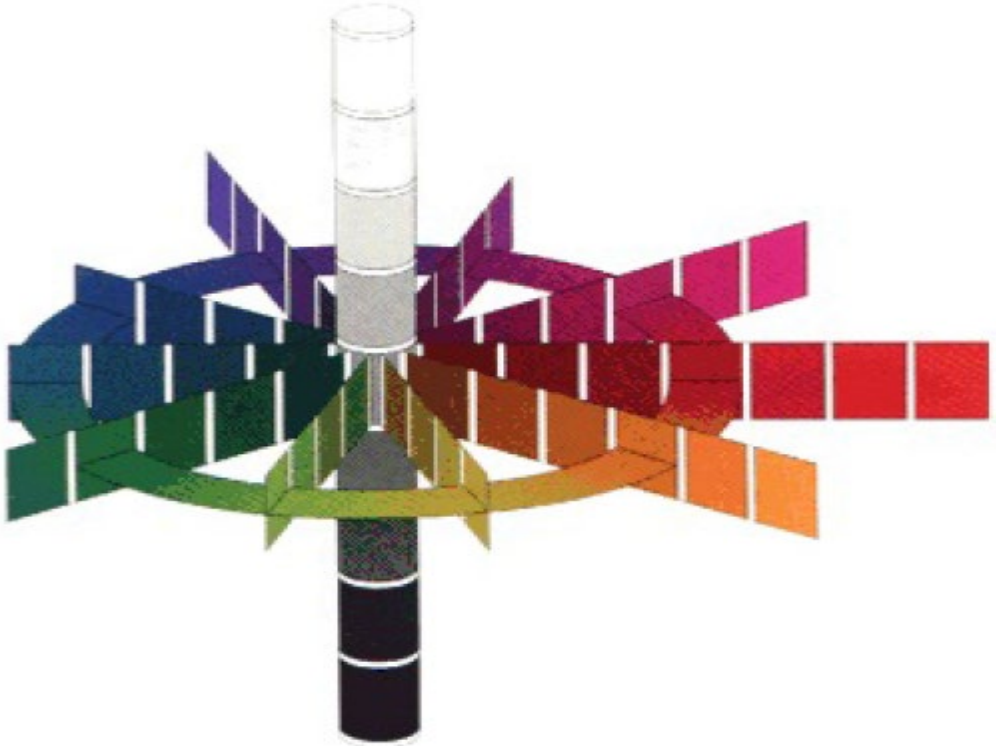
- **Objective and accurate testing methods are very important.**



(a) L^*、a^*和 b^*三维分布图；(b) a^*b^*二维分布图。1 表示 RHSCC 未覆盖花色。

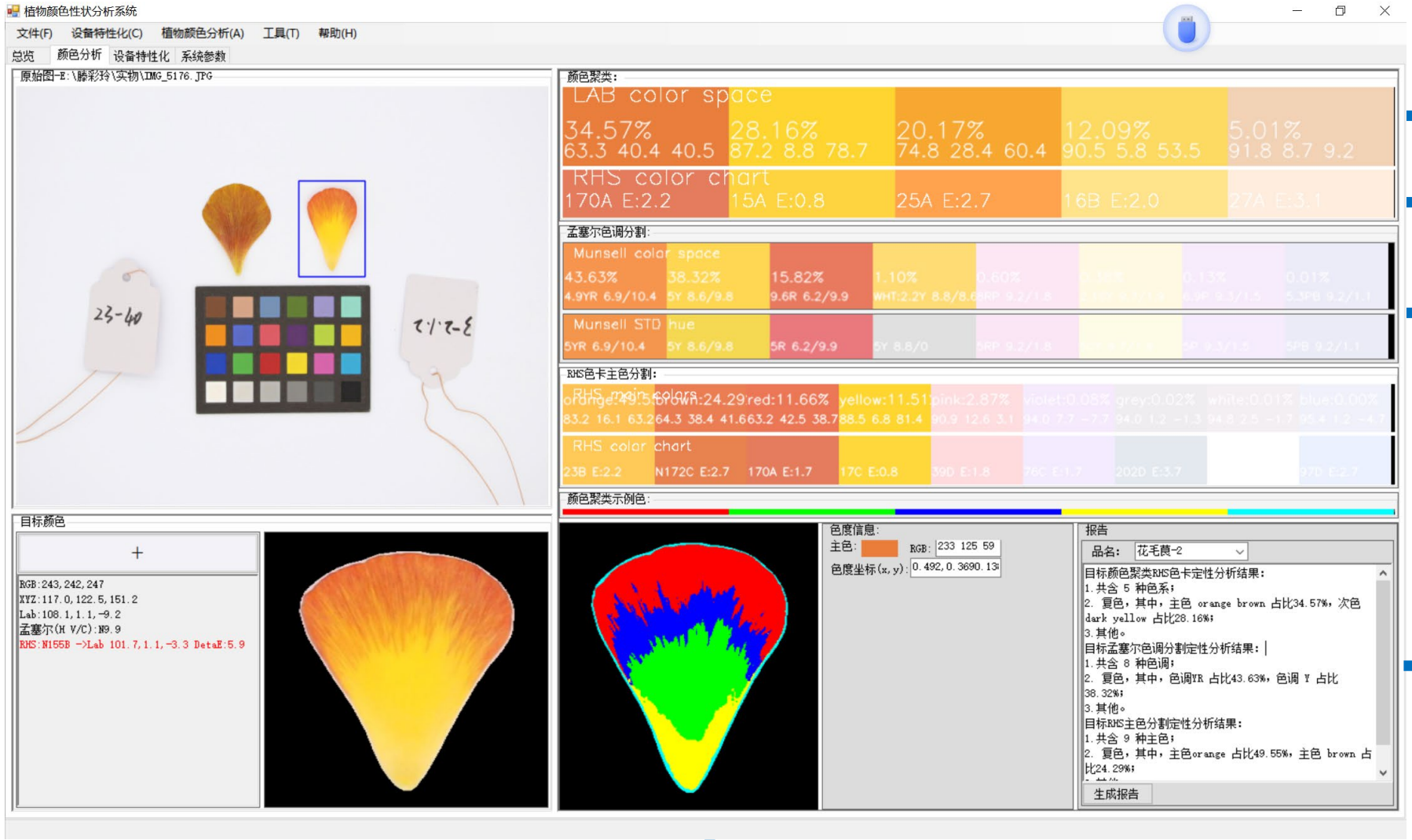
Figure 18. Color space distribution of RHSCC colors and flower colors of 150 potted carnation varieties （Teng, *et al*., 2022）

Figure 19. Examples showing the difficulty in flower color matching using RHSCC（Teng, *et al.* 2022）



Precise quantitative and qualitative analysis on color traits

- On one hand, improve the scientific rigor and accuracy of DUS testing;
- On the other hand, facilitate the localization and mining of molecular markers associated with color traits by integrating environmental data.



quantitative analysis

RHSCC matching / error showing

qualitative analysis

mono- / multi-color determining

background removing

color clustering


Thank you