

Flower Anthocyanins of Herbaceous Peony

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シャクヤクの花のアントシアニン

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Abstract Flower anthocyanins in Japanese and Western herbaceous peony cultivars, *Paeonia lactiflora*, *P. officinalis* cultivars, *P. tenuifolia*, *P. obovata*, *P. japonica* and Manchurian herbaceous peony were identified. Six kinds of anthocyanins were detected; cyanidin 3, 5-diglucoside, cyanidin 3-glucoside, peonidin 3, 5-diglucoside, peonidin 3-glucoside, pelargonidin 3, 5-diglucoside and pelargonidin 3-glucoside. Dark red or purplish red flowers contained 4 to 5 anthocyanins and their anthocyanin contents were greater than those of light color flowers. Six kinds of anthocyanins detected in herbaceous peony were identical with those detected in tree peony.

Introduction

In herbaceous peony, many horticultural cultivars were born from *P. officinalis* (native of Europe) between the periods from 15th and 18th century¹⁾. In 19th century, *P. lactiflora* (native of China) was introduced to Europe and many Western cultivars with various flower colors were born from this species. In Japan, hundreds of cultivars were born from *P. lactiflora*, especially in Kanagawa Agricultural Experimental Station²⁾.

In spite of these active breeding history, no study on flower anthocyanins has been conducted so far. The objective of the present study is to clarify components of flower anthocyanins in *P. lactiflora* and *P. officinalis* cultivars, and some other peony species.

Materials and Methods

Japanese *P. lactiflora* cultivars ('Takinoyosooi', 'Kashokunoten', 'Harunoyosooi' and 'Hyouten'), Western *P. lactiflora* cultivars ('Sarah Bernhardt', 'Bunker Hill', 'Karl Rosenfield', 'Marcial Pilant'), wild *P. lactiflora*, *P. officinalis* cultivars ('Alba Plena', 'Rubra Plena', 'Rosea Plena', 'Rosea Superba', 'Mutabilis Plena'), *P. tenuifolia*, *P. obovata*, *P. japonica* and Manchurian herbaceous peony were studied.

For determination of anthocyanin components and its amount, 1g (f. w.) of petals was immersed in 5 ml of 1% methanolic HCl for overnight and the methanol was evaporated to a small amount (ca., 5 μ l) at a temperature below 30°C. The extracted anthocyanins were spotted on a thin layer chromatogram plate (Merk Art 5716, cellulose type) and developed in two directions, using two solvent systems; n-butanol : acetic acid : water (6 : 1 : 2, v/v/v) and acetic acid : HCl : water (15 : 3 :

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82, v/v/v) for the first and second, respectively³⁾. Each spot separated was identified based on the Rf values of the previous paper⁴⁾.

Results and Discussion

Six kinds of anthocyanins were detected from the flowers examined in the present study; cyanidin 3, 5-diglucoside (Cy3G5G), cyanidin 3-glucoside (Cy3G), peonidin 3, 5-diglucoside (Pn3G5G), peonidin 3-glucoside (Pn3G), pelargonidin 3, 5-diglucoside (Pg3G5G) and pelargonidin 3-glucoside (Pg3G) (Fig. 1). In general, more diglucosides were found than monoglucosides (Table 1). Deep red or purplish red cultivars contained various kinds of anthocyanins and their amounts were greater, compared to pink cultivars. No anthocyanins were detected in pale yellow green 'Hyouten' and '*P. japonica*'. Western *P. lactiflora* cultivars except 'Sarah Bernhardt' contained greater amount of anthocyanins than Japanese *P. lactiflora* cultivars. In *P. officinalis* cultivars, 'Rubra plena' contained 5 kinds of anthocyanins and their amounts were the greatest among all the cultivars examined. *P. obovata* (native of China), *P. japonica* and Manchurian herbaceous peony contained no or a small amount of anthocyanins.

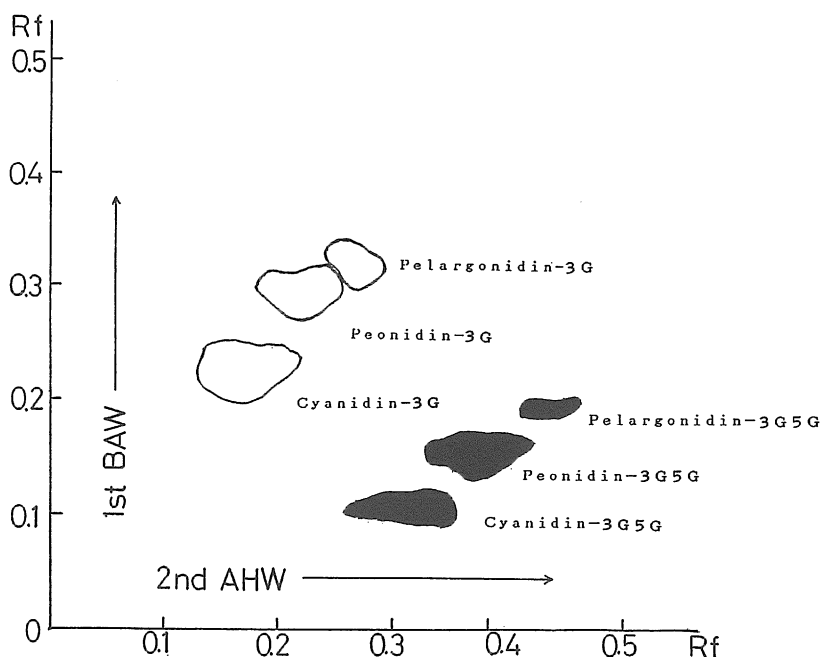


Fig. 1. Six anthocyanins of herbaceous peony flowers separated on a thin layer chromatogram (1st solvent BAW, n-butanol: acetic acid: water=6:1:2 and 2nd solvent AHW, acetic acid: HCl: water=15:3:82).

In tree peony, many cultivars with deep red or purple flowers contained 6 kinds of anthocyanins⁴⁾, whereas in herbaceous peony, only 'Rubra Plena' contained a maximum of 5 anthocyanins. Therefore, a lack of Pg3G might be a characteristics of flower anthocyanins in herbaceous peony, although more cultivars must be checked.

Table 1. Flower anthocyanins of various herbaceous peonies.

Cultivars or species	Petal colors ^z	Color ^z code No.	Relative amount of 6 anthocyanins ^y					
			Cyanidin		Peonidin		Pelargonidin	
			DG ^x	MG ^x	DG	MG	DG	MG
[<i>P. lactiflora</i> group]								
'Takinoyosooi'	Pale purplish pink	9502	—	—	(t)	—	—	—
'Kasyokunoten'	Strong purplish pink	9205	±	—	++	—	±	—
'Satsuki'	Bright red purple (outer) ^w	9506	+	—	++	—	—	—
	Strong purplish pink (inner) ^w	9504						
'Harunoyosooi'	Strong purplish pink (outer)	9205	±	—	+	—	—	—
	Pale purplish pink (inner)							
'Hyouten'	Pale yellow green	3102	—	—	—	—	—	—
'Sarah Bernhardt'	Purplish pink	9203	(t)	—	±	—	—	(t)
'Bunker Hill'	Bright red purple	9506	+	—	++	±	+	—
'Karl Rosenfield'	Vivid purplish red	9707	++	—	+++	++	+	—
'Marcial Peilant'	Vivid red purple	9208	++	—	+++	—	—	—
Wild lactiflora	Deep purplish pink	9213	++	—	++	—	(t)	—
[<i>P. officinalis</i> group]								
'Alba Plena'	Soft yellow green	3310	—	—	(t)	—	—	—
'Rubra Plena'	Deep red	0108	+++	++	+++	++	++	—
'Rosea Plena'	Vivid purplish red	9707	++	—	++	±	—	—
'Rosea Superba'	Purplish pink	9203	±	—	+	—	—	—
'Mutabilis Plena'	Pale purplish pink	9502	±	—	+	—	—	—
<i>P. tenuifolia</i>	Vivid purplish red	9707	++	++	+++	++	—	—
<i>P. obovata</i>	Purplish pink	9503	±	—	+	(t)	—	—
<i>P. japonica</i>	Pale yellow green	3102	—	—	—	—	—	—
Manchurian herbaceous peony	Pale greenish yellow	2903	(t)	—	±	—	—	—

Z Referred to Japan Color Standard for Horticultural Plants.

Y +++ : heavy, ++ : much, + : intermediate, ± : slight, (t) : trace.

X DG : 3, 5-diglucoside, MG : 3-glucoside.

W Outer : outer petal, Inner : inner petal.

In conclusion, herbaceous peony essentially contains the same kinds of anthocyanins as tree peony, and their kinds were 5 at most in one cultivar. A combination of these anthocyanins determines various flower color in herbaceous peony.

References

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摘 要

洋シャクヤク、和シャクヤク品種、*Paeonia lactiflora*, *P. officinalis*, *P. tenuifolia*, *P. obovata*, *P. japonica* およびマンシュウシャクヤクのアントシアニン組成が調べられた。その結果、6種類のアントシアニンが見いだされた(シアニジン3, 5-ジグルコシド, シアニジン3-グルコシド, ペオニジン3, 5-ジグルコシド, ペオニジン3-グルコシド, ペラルゴニジン3, 5-グルコシドおよびペラルゴニジン3-グルコシド)。

もっとも多い品種で5種類のアントシアニンが見いだされた。ペラルゴニジン3-グルコシドは1品種でのみ見いだされた。暗赤色ないし紫赤色の花は4ないし5種類のアントシアニンを含んでおり、それらの含量は薄い色の花より多かった。シャクヤクで見いだされた6種類のアントシアニンはボタンで見いだされたものと本質的に同一組成であった。