Studies on the Flower Bud Differentiation and Development in Ornamental Trees and Shrubs

Ⅷ. On the Time of Flower Bud Differentiation and Development in Wisteria

Kiyoshi KOSUGI, Masato YOKOI, Toshijiro INABA and Ikuko KUSAJIMA

Laboratory of Floriculture and Ornamental Horticulture

Abstract

Studies on the Flower Bud Differentiation and Development in Ornamental Trees and Shrubs. Ⅷ. On the Time of Flower Bud Differentiation and Development in Wisteria. K. KOSUGI, M. YOKOI, T. INABA and I. KUSAJIMA. Faculty of Horticulture, Chiba University, Matsudo, Japan. *Tech. Bul. Fac. Hort. Chiba Univ.*, No. 14 : 13～18, 1966.

Morphological study of flower bud differentiation in Wisteria, two cultivars of *W. brachybotrys Sieb. et Zucc.* and four cultivars of *W. floribunda D. C.*, was made at the Faculty of Horticulture, Chiba University in 1964 and 1965. Flower bud differentiation in the cultivars of *W. brachybotrys* was observed about the end of May, 1964 and the first differentiated floret primordia progressed their development to pistil formation stage (stage Ⅸ) in mid or late June, a half or one month after the flower bud initiation had occurred. In cultivars of *W. floribunda*, the flower buds began to initiate and develop almost the same time or slightly later than those of *W. brachybotrys*.

CHANDLER(1949)studied the pruning time of Wisteria vines in California, U. S. A. He found that flower buds progressed their development to blooming in summer, if the vines were cut back on June 14, 1946, about a month after the flowers had dropped and when new shoots were 16 to 20 inches long. In his study, however, he did not observe the time of flower bud initiation. Up to the present any other reports dealing with the flower bud differentiation in Wisteria have been found in the literature as far as the authors know. Accordingly, the present morphological study of flower bud differentiation in Wisteria was carried out at the Faculty of Horticulture, Chiba University in 1964 and 1965.

Materials and Methods

Cultivars used were as follows : "Blue Capitan" and "White Capitan", belonging to *W. brachybotrys* and "Akebono", "Honbeni", "Kuchibeni" and "Yatsubusa", belonging to *W. floribunda*. Flower bud samples were taken weekly from May 25 to July 27, 1964 from all cultivars and every four days from May 25 to July 14, 1965 from "Akebono" and "Kuchibeni" and stored in 70 % ethanol for later examinations. The stage of floral development of these buds was examined under a stereoscopic microscope by the stripping scale method and photographed.

The effect of mid-June pruning of vines pruned on June 11, 1965 on summer flowering was also tested.

Result

The flower buds of Wisteria are formed on two kinds of shoots, as observed by CHANDLER(1949)and KOSUGI(1966) : the one is a shoot that is terminated by a flower cluster usually having a number of leaves in the axils of which flower buds develop, except the very small buds and the other is a shoot that grow from the buds at the bases of long or short shoots. In

this study the flower buds observed were taken mostly from the former, that is, axial buds on short shoots terminating with flower clusters.

In the present study 9 stages of flower bud development of Wisteria were identified as follows :

Ⅰ. Undifferentiated stage. Vegetative stage, the growing point is still low and small (Fig. 1-A).

Ⅱ. Predifferentiation stage. The growing point is swelling and larger and thicker than the former stage (Fig. 1-B).

Ⅲ. Scale and bract differentiation stage. Scale formation begins at the basal parts of the enlarged growing point and almost simultaneously, bracts appear in the upper portion where the scales are formed thus differentiating in an acropetal succession (Fig.1-C).

Ⅳ. Floret primordium differentiation stage. Formation of individual floret primordia occurs at the basal and upper parts of the domed apex in an acropetal order (Fig. 1-D).

Ⅴ. Bractlet differentiation stage. Shortly after the stage Ⅳ, two bractlets are evident on the sides of each floret primordium (Fig. 1-E and 2-H, I).

Ⅵ. Sepal formation stage. Five sepal protuberances appear at the basal area of each floret primordium (Fig. 1-F and 2-I).

Ⅶ. Petal formation stage. Five petals are formed in the inner parts of each floret primordium (Fig. 2-J, K).

Ⅷ. Stamen formation stage. Stamens begin to form inside the petals (Fig. 2-J, K, L).

Ⅸ. Pistil formation stage. Pistil formation occurs in the center of the floret primordium (Fig. 2-K, L).

The developing stages of flower buds in six cultivars, belonging to two species, are presented in Tables 1 to 3.

As can be seen in these tables, the earliest flower bud differentiation occurs in "Blue Capitan" and "White Capitan" (Table 1). In these cultivars, after floret primordium differentiation (stage Ⅳ, May 25, 1964) the floral buds developed rapidly and reached the stage Ⅸ, pistil formation stage, on June 15 in "Blue Capitan" and on July 6 in "White Capitan".

In "Akebono" cultivar(Table 2), predifferentiation stage and pistil formation stage (stage Ⅸ) were observed on May 15 and July 2, 1965, respectively.

In "Kuchibeni" (Table 2), scale and bract differentiation (Stage Ⅲ) was seen on May 27 and then pistil formation took place on July 2, 1965.

In the case of "Honbeni" (Table 3), stages from Ⅳ to Ⅷ were found to occur on June 22 and floral development reached to stage Ⅸ on June 29, 1964.

In "Yatsubusa" cultivar(Table 3), scale and bract differentiation (stage Ⅲ) was observed on June 8 and bud development reached to stage Ⅸ on July 6, 1964.

On the shoot that was pruned on June 11, 1965, the flower buds developed quickly and began to bloom on July 10, 1965. This observation agrees with the result obtained by Chandler in 1949.

Table 1. Developing stages of flower buds in Wisteria, "Blue Capitan" and "White Capitan" cultivars. Matsudo. 1964.

Date examined	No. of buds examined	Developing stages of the inflorescence and the most advanced florets																
		"Blue Capitan" cultivar									"White Capitan" cultivar							
		Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ	Ⅵ	Ⅶ	Ⅷ	Ⅸ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ	Ⅵ	Ⅶ	Ⅷ	Ⅸ
May 25	5	1			4						4			1					
June 1	5	1		1	2	1					4			1					
8	5	1				4					3		1	1					
15	5									5	5		2	2	1				
22	5									5	3				2				
29	5									5	2							3	
July 6	5									5									5
13	5									5									5
20	5									5									5
27	5									5									5

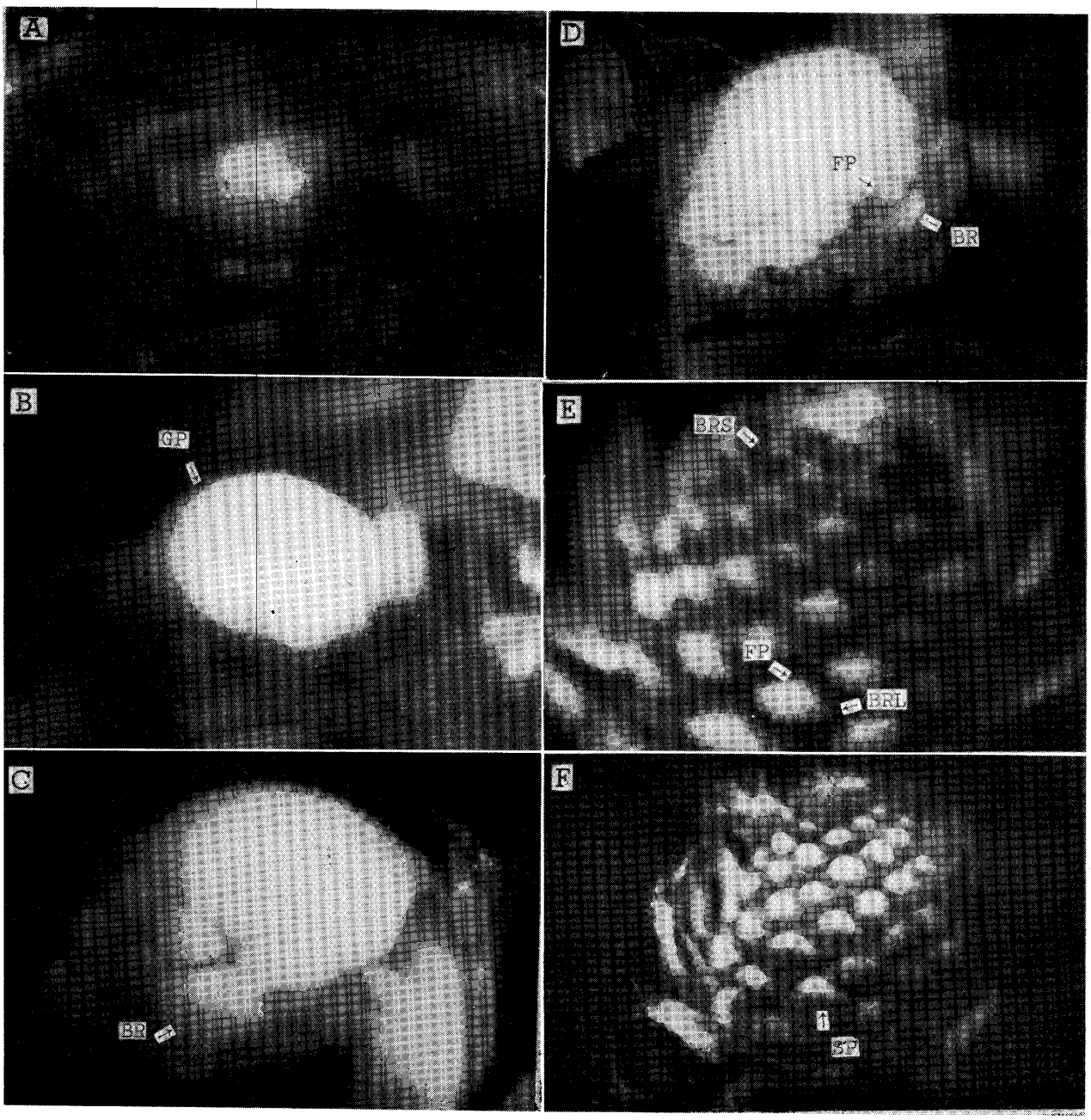

Fig. 1. Developmental stages of inflorescence primordia in Wisteria

(A)Vegetative stage (stage Ⅰ). (B)Predifferentiation stage (stage Ⅱ). Growing point enlarge. (C) Scale and bract differentiation begins (stage Ⅲ). (D) Many floret primordia with bracts are observed (stage Ⅳ). (E) Two bractlets are seen on the right and left side of each floret primordium(stage Ⅴ)when bracts have been removed(black scars). (F) Entire inflorescence at sepal formation stage (stage Ⅵ).

Abbreviations used were : GP : growing point ; BR : bract ; FP : floret primordia ; BRS : bract scars ; BRL bractlets; SP : sepal.

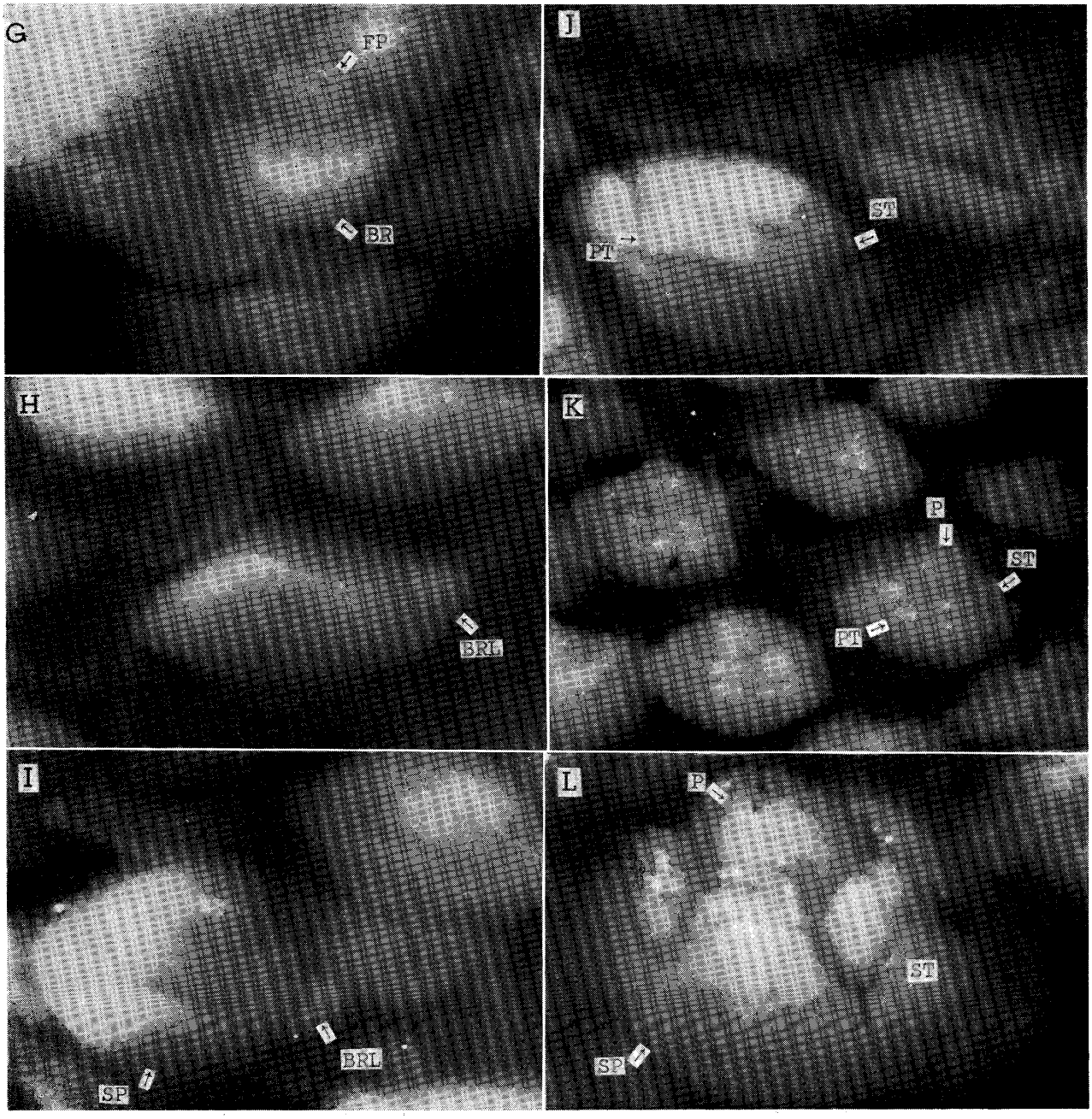

Fig. 2. Magnified views of individual florets in an inflorescence of Wisteria showing various stages of development.

(G) Floret primordia are seen behind bracts (stage Ⅳ). (H) Two bractlets are clearly observed (stage Ⅴ). (I) Enlarged floret primordia with protuberances of sepal (stage Ⅵ). (J) Petals and stamens are beginning to initiate (stage Ⅶ and Ⅷ). (K) Pistil formation stage (stage Ⅸ). (L) A floret primordium is more magnified, showing sepal, stamens and pistil clearly (stage Ⅸ). Petals are hidden by sepal.

Abbreviations used were : ST : stamens ; PT : petals ; P : pistil.

Table 2. Developing stages of flower buds in Wisteria, "Akebono" and "Kuchibeni" cultivars. Matsudo, 1964 and 1965.

Date examined	No. buds examined	Developing stages of the inflorescence and the most advanced florets																
		"Akebono" cultivar									"Kuchibeni" cultivar							
		I	II	III	IV	V	VI	VII	VIII	IX	I	II	III	IV	V	VI	VII	VIII	IX
May 25' 64	10	10									10								
June 1	10	9			1						10								
8	10	9		1							10								
15	10	9				1					10								
22	10			2	3	4	1				6		3	1					
29	10	5		1		2			2						1		1	8	
July 6	10									10					1	1			8
13	10									10							1		9
20	10									10									10
27	10									10									10
May 15' 65	6	4	2								6								
19	6	4	2								6								
23	2, 6	2									6								
27	6	2		4							1	2	3						
31	4, 6	1		2		1							6						
June 4	6, 5			6									5						
8	6			3	3								4	2					
12	6			3	3						1		3	2					
16	6				4	2							3	3					
20	6			2	3	1					1		1	4					
24	6					3	3							2	2	2			
28	6					1	3	2								1		5	
July 2	6						2	1	1	2									6
6	6							1	1	4									6
10	6								1	5									6
14	6								2	4									6

Table 3. Developing stages of flower buds in Wisteria, "Honbeni" and "Yatsubusa" cultivars. Matsudo, 1964.

Date examined	No. buds examined	Developing stages of the inflorescence and the most advanced florets																
		'Honbeni, cultivar									"Yatsubusa" cultivar							
		I	II	III	IV	V	VI	VII	VIII	IX	I	II	III	IV	V	VI	VII	VIII	IX
May 25	10	10									10								
June 1	10	10									10								
8	10	10									5		5						
15	10	10									7		2	1					
22	10				1	2	3	1	3		6				2			2	
29	10	1						1		8	6		1		1	2			
July 6	10	6								4	8		1						1
13	10	2							1	7	4								6
20	10	5				1	1			3	5								5
27	10	1									9								

Conclusion

From the results mentioned above, it can be said that the flower buds of Wisteria begin to initiate from late May to early June and progress their development to pistil formation stage (stage Ⅸ) during the period between mid-June and early July, depending on the cultivars.

When the shoots are cut back in the early stages of floral development, the development of flower buds seems to be stimulated and flowering occurs rapidly in the summer. In this connection, further studies are needed to determine the relationship between the pruning time and summer flowering.

References

1) CHANDLER, W. H.(1949) : Proc. Amer. Soc. Hort. Sci. 54 : 482-484.

2) KOSUGI. K. (1966) : Shinkaki (New Flowers) 48 : 41—45.

摘　　要

花木類の花芽分化に関する研究

Ⅷ.　フジの花芽分化期と花芽の発達について

山フジ（*W. brchybolrys*）系の2品種（紫カピタン，白カピタン）と野田フジ（*W. floribunda*）系の4品種（アケボノ，本紅，口紅，八房）について，1964年と1965年に，千葉大学園芸学部において花芽分化期と花芽の発達状況を調べた．

結果：山フジ系の品種は5月下旬から花穂の分化が始まり，6月中旬～7月上旬には，最初に分化した小花は雌ずい形成期にまで達した．野田フジ系の品種は，これと同じかまたは少し遅れて，花芽の分化発達が行なわれた．

なお，CHANDLER氏にならって，1965年6月11日新梢を剪定したところ，7月10日に開花し始め，氏の実験結果と一致した．