FLOWERING ASPECT IN STRAWBERRY BY LIGHT MICROSCOPE AND ELECTRON MICROSCOPY

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ABSTRACT

SEM and Stereomicroscopy were used to examine the flowering aspect in strawberry. The cultivar Torrey from Califonia and the cultivar Toyonoka from Japan were used as the test plants. Three frequencies of liquid leaf fertilizer were applied after cutting back (defoliation) to the Torrey cultivar at the University of Sydney. The effect of temperature on the flowering of the Toyonoka cultivar was studied in the growth chamber at Suranaree University of Technology. There were at least 6 ontogenies of the apices from vegetative to flower by SEM technique, while under the stereomicroscopy only 5 ontogenies were found. SEM gave the most detail while the stereomicroscopy was appropriate for determining flowering in the field.

Introduction

Cultivars of the cultivated strawberry (*Fragaria ananassa* Duch.) are categorized as either 'Junebearring', Everbearing', or 'Day neutral', based on the photoperiodic responses of various development processes, particularly flower bud formation [1],[2]. However, care must be taken when specifying that a cultivar is short-day, long-day, or day neutral, since Junebearers (short-day types) can be classified as Day neutral at low temperatures and Day-neutrals could be classified as Everbearers (long-day types) at high temperature. An examination of the effect of environmental factors e.g. temperature, daylength, nutrition and defoliation, on the separate flowering processes of induction, initiation and development would be beneficial.

Materials and Methods

Scanning electron microscopy (SEM) is a well established technique which has allowed a considerable advancement in studies on flowering processes. A series of experiments using stereomicroscopy and SEM to compare and study flower initiation and development in cultivated strawberry were done in 1989 and in 2001 at the University of Sydney and Suranaree University of Technology. Three frequencies of liquid leaf fertilizer were applied after cutting back (defoliation) to the torrey variety. Twenty plants sampled from each treatment were dissected every fortnight under a wild Heerbrugg M5 stereo-microscope at a magnification of 6 to 50 times, and together with the SEM technique, the flowering processes was studied [3]. The number of induced apices were recorded. At Suranaree University of Technology, the variety Toyonoka was planted in the growth chamber under 20/16°C and 23/18°C (day/night temperature) and 12/12 hr (day/night light). The light intensity used was 10,000 Lux and the RH was 80%. The plants were in the growth chamber for 6 months. Then, the dissecting technique under the stereo-microscopy and SEM were used to investigate the effect of temperature on flowering process of this short day variety.

Result and Discussion

There were at least 6 ontogenesis of the apices from vegetative to flower by SEM technique while under the stereo-microscope only 5 ontogenesis were found. Furthermore, SEM gave the most detail [3]. However, the stereo-microscopy technique was quicker and was more appropriate for determining flower initiation in strawberry plants grown in the field. Each ontogeny of the apices examined by these two techniques are compared in Fig 2 a-f. The number of induced apices at the fourth, sixth and eight week after defoliation is shown in Fig 1. The effect of foliar fertilizer application on the number of induced apices out of 20 as detected by dissection at the fourth, sixth and eighth week defoliation are shown in Table 1. The number of induced apices to flower and the leaf apices seen under the stereo microscopy of variety Toyonoka grown in the growth chamber is shown in Table 2. Both light microscopy and electron microscopy are relevant and appropriate technique for the study of the flowering aspect in strawberry species.

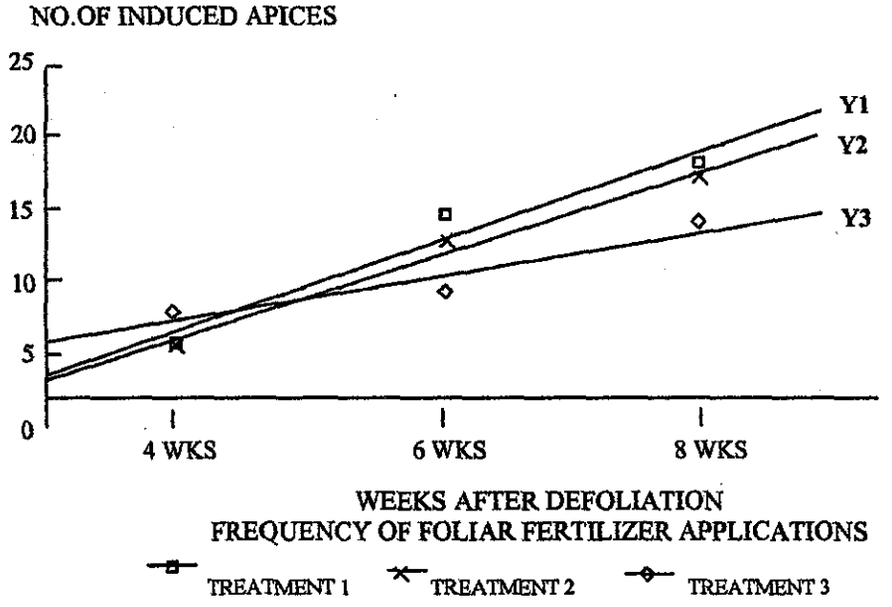

Figure 1 The number of induced apices at the fourth, sixth and eighth week after defoliation.

Regression Equations.

T1	$Y1 = 0.33 + 6.50X$	$R^2 = 95.3\ \%$	$P = .001$
T2	$Y2 = 0.33 + 6.00X$	$R^2 = 99.1\ \%$	$P = .001$
T3	$Y3 = 4.00 + 3.50X$	$R^2 = 94.2\ \%$	$P = .001$

Table 1 The effect of foliar fertilizer application on the number of induced apices out of 20 as detected by dissection at the fourth, sixth and eighth week after defoliation.

Number of foliar fertilizer application	Induced	Not Induced
		4 weeks after defoliation
3 times (T_1)	6	14
2 times (T_2)	6	14
No application (T_3)	8	12
x^2_2, = 0.60, not significant at 5%	level	
Total	20	40
		6 weeks after defoliation
3 times (T_1)	15	5
2 times (T_2)	13	7
No application (T_3)	10	10
x^2_2, = 2.72, not significant at 5%	level	
Total	38	22
		8 weeks after defoliation
3 times (T_1)	19	1
2 times (T_2)	18	2
No application (T_3)	15	5
x^2_2, = 3.75, not significant at 5%	level	
Total	52	8

x^2_2 for total at each sampling time = 36.09, significant $P < 0.001$.

Table 2 The number of induced apices to vegetative, the number of induced apices to flower, the total sample number of apices collecting and the percentage of flower founded in strawberry variety Toyonoka grown at 21/16°C (day/night) and 23/18°C (day/night) temperature.

Temperature	The no. of induced apices to vegetative	The no. of induced apices to flower	The total sample	The percentage to flower
21/16°C (day/night)	3	7	10	70
23/18°C (day/night)	4	6	10	60

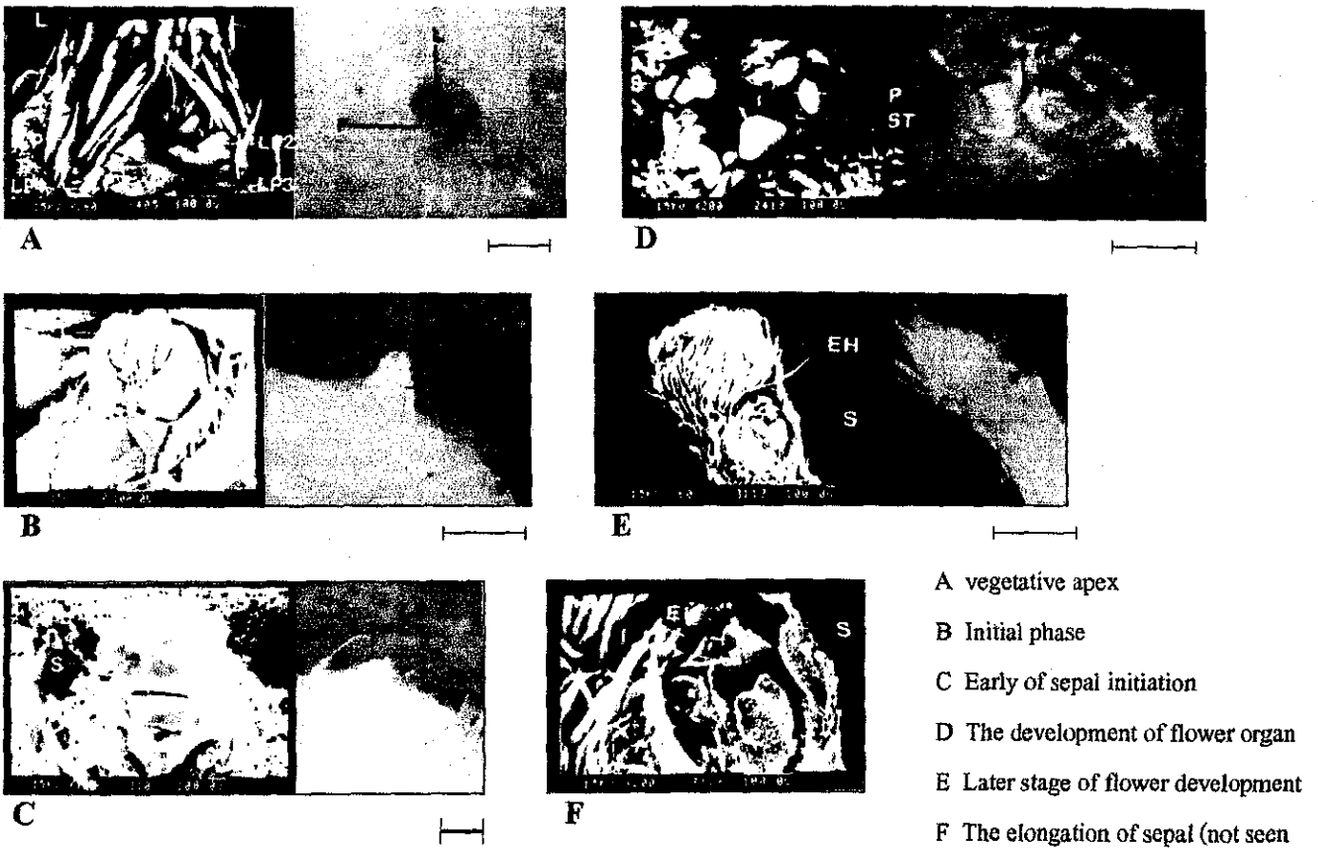

Fig. A- F. The ontogenies of flower development in strawberry observed using the SEM (left) and stereomicroscopy (right) techniques.

Acknowledgement

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References

1. R.S. Bringhurst and V.Voth HortScience 16(3) (1981) 427.
2. C.G. Guttridge, Fragaria x ananassa. In 'CRC Handbook of Flowering' , ed. A.h. Halevy. CRC Press Inc. Boca Raton, Florida, Vol. III (1985) 16-33.
3. Y. Manakasem and P.B. Goodwin, J. Amer. Soc. Hort Sci. 123(4) (1998) 513-517.