Effects of 8-Azaguanine, Thiouracil and Ethionine on Floral Initiation and Vegetative Development in Seedlings of *Pharbitis Nil* Chois.

by Keiji MARUSHIGE* and Yasuko MARUSHIGE*

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In order to investigate biochemical changes involved in flowering, a number of attempts on modifying floral induction by applications of metabolic substrates, inhibitors, plant growth-hormones and others have been made. Recently, a considerable interest has been evoked as to the control of floral initiation by affecting the protein and nucleic acid metabolism¹⁻⁶⁾. In the present experiments, the effects on floral initiation of 8-azaguanine, thiouracil and ethionine which are known to interfere with the synthesis of nucleic acid and protein have been investigated in *Pharbitis* seedlings. The effects of the above chemicals on vegetative development of the plumules have also been examined.

Seedlings of *Pharbitis Nil* Chois., strain Violet, were used. The imbibed seeds were sown in wooden boxes containing sand and germinated at 30° in darkness. After two days, the seedlings were transferred to continuous illumination given by incandescent lamps combined with daylight fluorescent lamps yielding approximately 3000 lux at the plant level. After 32 hours of the illumination at 30° which was enough to make the following dark period effective for floral induction, the seedlings were subjected to a single dark period of 14 hours at 26-28°, and then returned to continuous light at 30°. Just before the inductive dark period, solutions of the chemicals were applied to the upper surface of the cotyledons with a writing brush, and gauzes drenched with the solutions were stuck to the lower surface of the cotyledons. Thus, approximately 0.4 ml of the solutions were applied to a pair of the cotyledons. At the end of such an inductive dark period, the gauzes were removed and the cotyledons were rinsed with tap water.

Two to three weeks after the treatments, plants were carefully dissected for the observation of flower bud initiation under a binocular microscope of low magnification. For the quantitative criteria of flowering response, percentage of flowering plants, percentage of plants with a terminal flower bud, and an average number of flower buds per plant, were used. For determination of the rate of vegetative development, the plumules were clipped from the seedlings 10 days after the treatments, dried in an oven at $100 \pm 5^\circ$ to a constant weight, and weighed on a torsion balance. The results obtained are summarized in Table 1.

As shown in the table, nucleic acid-base analogs, i.e., 8-azaguanine and thiouracil, inhibited photoperiodic initiation of flower primordia, and the inhibition was reversed by simultaneous application of the corresponding metabolites. Floral initiation was stimulated slightly by guanine, and considerably by uracil. In the case of the 8-azaguanine, the differences were slight but consistent in the several replicated experiments. In this kind of experiments, special regards should be paid to whether the chemicals affected flower differentiation specifically or not. 8-azaguanine had an

* Laboratory of Applied Botany, Faculty of Agriculture, Kyoto University, Kyoto, Japan.

Table 1. Effects of 8-azaguanine, thiouracil and ethionine on floral initiation and vegetative development in *Pharbitis* seedlings. The chemicals were applied to the cotyledons during a single inductive dark period of 14 hours.

No. of experiment	Chemicals applied	Floral initiation				Vegetative development
		No. of plants	Per cent of flowering plants	Per cent of plants with terminal flower bud	Average number of flower buds per plant	Dry weight of a plumule on the 10th day after the treatment, in mg*
1**	Control	17	100	18	2.7±0.12	19
	8-azaguanine (5×10^{-4} M)	17	100	0	2.1±0.06	20
	8-azaguanine (5×10^{-4} M) & Guanine (10^{-3} M)	17	100	0	2.4±0.11	18
	Guanine (10^{-3} M)	19	100	21	3.4±0.30	—
2**	Control	18	100	33	3.2±0.20	16
	Thiouracil (10^{-3} M)	18	33	11	0.7±0.32	4.6
	Thiouracil (10^{-3} M) & Uracil (2×10^{-3} M)	19	58	37	2.6±0.63	12
	Uracil (2×10^{-3} M)	20	100	65	4.9±0.33	—
3***	Control	16	100	6	3.2±0.26	21
	Ethionine (5×10^{-4} M)	18	100	72	4.5±0.27	18
	Ethionine (5×10^{-4} M) & Methionine (10^{-3} M)	16	100	0	2.9±0.06	—
	Methionine (10^{-3} M)	19	100	0	3.0±0.19	—
	Ethionine (5×10^{-3} M)	17	0	0	0	3.6
	Ethionine (5×10^{-3} M) & Methionine (10^{-2} M)	16	0	0	0	12
	Methionine (10^{-2} M)	19	42	0	0.9±0.19	19

* Average values of 10 plants.

** Treated on December 11, 1960.

*** Treated on December 19, 1960.

inhibitory effect on floral initiation without any effects on the vegetative development. On the other hand, the inhibition of floral initiation by thiouracil was accompanied with retardation of plumular growth and often with malformation of the leaves. The effects were alleviated by simultaneous application of uracil. Thiouracil at a concentration which exerted no inhibition on the vegetative development, did not inhibit floral initiation.

Ethionine (5×10^{-3} M) inhibited completely floral initiation and also markedly the vegetative development, bringing about weak wrinkling and malformation of the leaves. It was of interest that the vegetative inhibition caused by ethionine was eliminated to some extent by simultaneous application of methionine (10^{-2} M), but the floral inhibition caused by ethionine was not eliminated by methionine. Moreover, 10^{-2} M methionine inhibited flower initiation without any influences on the vegetative development, and other amino acids examined were not so effective as methionine on floral induction. Collins and Salisbury¹⁾ have found that other anti-amino acids than ethionine are ineffective for floral inhibition, and suggested that the synthesis of floral stimulus involves donation of methyl groups. This is likely

discrepant, however, with the present findings. In addition, it was indicated that 5×10^{-4} M ethionine stimulated considerably floral initiation, and this stimulation was completely reversed by simultaneous application of 10^{-3} M methionine, which by itself did not suppress floral induction.

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References

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摘 要

丸重啓二・丸重靖子：アサガオの芽ばえにおける花芽形成ならびに栄養生長に及ぼす
8-アザグアニン，チオウラシル，エチオニンの影響

アサガオの芽ばえを用い，14 時間暗期間を通じて子葉に与えた 8-アザグアニン，チオウラシル，エチオニンが，花芽形成ならびに栄養生長に及ぼす影響を調べた。

1. 8-アザグアニン (5×10^{-4} M) は，栄養生長に対して影響を与えることなく，特異的に花芽形成を阻害する。この阻害は，同時にグアニン (10^{-3} M) を与えることによって軽減される。グアニン (10^{-3} M) 単独では，わずかに花芽形成を促進する。

2. チオウラシル (10^{-3} M) は，花芽形成および栄養生長とともに，著しく阻害するが，これらの阻害は，同時に与えられたウラシル (2×10^{-3} M) によって部分的に軽減される。ウラシル (2×10^{-3} M) 単独では，花芽形成を促進する。

3. 高濃度のエチオニン (5×10^{-3} M) は，花芽形成ならびに栄養生長とともに著しく阻害する。同時に与えられたメチオニン (10^{-2} M) によって，栄養生長の阻害は回復するが，花芽形成阻害はまったく回復しない。低濃度のエチオニン (5×10^{-4} M) は，栄養生長に対する影響なしに，花芽形成を促進する。この促進効果は同時に与えられたメチオニン (10^{-3} M) によって除去される。高濃度のメチオニン (10^{-2} M) は，著しく花芽形成を阻害する。(京都大学農学部応用植物学研究室)