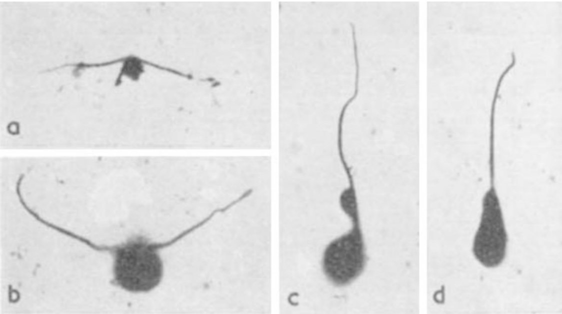

Fig. 2. Gametes and zygotes of *Prasiola stipitata* Suhr. *a*, Male gamete ; *b*, female gamete ; *c*, gametic fusion ; *d*, motile zygote. All photographed after staining by Kirkpatrick's method. × 1,250

The gametes and zygote in Fig. 2 have been fixed in fumes of osmic acid and have been stained by Kirkpatrick's method as modified by Manton[6].

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[1] Yabe, Y., *Sci. Rep. Tokyo Bunrika Daigaku*, **1**, 39 (1932).
[2] Fujiyama, T., *Bot. Mag. Tokyo*, **62** (729–730), 25 (1949).
[3] Fujiyama, T., *J. Fac. Fish. and Anim. Husb., Hiroshima Univ.*, **1**, 15 (1955).
[4] Fritsch, F. E., Rapports et communications parvenus avant le Congrès à la section 17 (p. 83), VIII Cong. Int. Bot., Paris (1954).
[5] Smith, G. N., "Cryptogamic Botany" (New York, 1955).
[6] Manton, I., Greenwood, A. D., and Flint, E. A., *J. Exp. Bot.*, **3**, 204 (1952).

Flowering of *Xanthium* under Long-Day Conditions

EFFORTS to induce flowering in the short-day plant *Xanthium pensylvanicum* under long-day conditions have consistently failed up to now. From numerous reports it has been concluded that for flower induction a short photoperiod must be followed by a long night. The role of the short photoperiod seems to be the photosynthetic production of energy substrates, since it can be substituted for it by sugar treatment[1]. An uninterrupted long dark period of 9 hr. or more is considered to be necessary to build up a minimum amount of 'flower stimulus'. However, in *Perilla*, also a short-day plant, the long-night requirement was alleviated by exposing the plants to a low light-intensity during the day[2]. Furthermore, a low-temperature treatment during part of the long photoperiod was found to promote flowering (Wellensiek, private correspondence). Thus it appeared worth while to study the effect of low light-intensity and of low temperature during a long photoperiod on the flowering response in *Xanthium*.

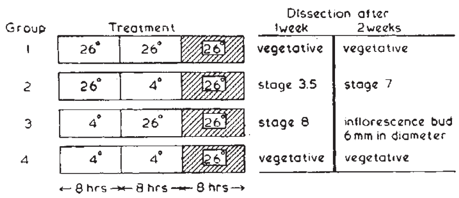

Fig. 1. The influence of different temperatures during the long photoperiod on the flowering response in *Xanthium*

Experiments on the influence of a low light-intensity during a 16-hr. photoperiod on flowering were completely negative. No flowering occurred. *Xanthium* requires a high light-intensity period for its flower induction. In addition, a low light-intensity during the short photoperiod (8 hr.) delayed flowering considerably. From dissection of the terminal buds, it was concluded that this delay was not due to postponed induction but to a slower development of the flower primordia. This again supports the idea that in *Xanthium*, in contrast to *Perilla*, flowering is only possible when a relatively large amount of energy is available. Given this amount of energy, the question remains whether a long-night period is obligatory for flowering or not.

It is known that small amounts of light or a low temperature during the dark period render this period in short-day plants ineffective. A low temperature during the short light-period does not affect flowering very much. But what is the effect of light at low temperature, provided that enough light at high temperature has been given to meet the high light-intensity requirement of *Xanthium* ? Does this light prevent flowering, or does it act, in a physiological sense, as darkness ?

To investigate this effect, the following experiments were set up in the Earhart Laboratory at Pasadena, California. Plants grown under long-day conditions (light-intensity ± 1,000 f.c.) until they had three or four mature leaves were exposed to a 16-hr. photoperiod, half of which was at 26° C. and half at 4° C. ; the dark period (8 hr.) was given at 26° C. In one group the low temperature was given just before the dark period, and in the other just after the dark period (see Fig. 1). The treatment lasted four days, after which the plants were put under normal long-day conditions. Each treatment included twenty plants, half of which were dissected at one week and the other half two weeks after treatment. A suitable measure of rate of growth of inflorescence bud was found to be that developed by Salisbury[3].

The results (see Fig. 1) indicate that : (1) flower initiation under long-day conditions is possible ; (2) flower initiation is, qualitatively, not dependent on the time of the low-temperature treatment during the light period ; (3) the flowering response is much larger when the low-temperature period precedes the high-temperature period.

In another experiment the same treatments were given, but for two days only. The plants responded in the same way, although less markedly. After two weeks, the terminal buds of group 2 were just starting to become generative (stage 1.8), whereas those of group 3 had already reached stage 6. The controls were completely vegetative.

It is evident from these experiments that for flowering there is no absolute requirement for a 9-hr. dark period in *Xanthium*. More work has still to be done to elucidate the relation between light at low temperature and darkness.

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[1] Liverman, J. L., and Bonner, J., *Bot. Gaz.*, **115**, 121 (1953).
[2] Zeeuw, D. de, *Proc. Kon. Ned. Akad. Wetensch. Amsterdam*. C. **56**, 418 (1953).
[3] Salisbury, F. B., *Plant Physiol.*, **30** (4), 327 (1955).