Short Communication

INDUCTION OF FLOWERING IN A DUCKWEED — WOLFFIA MICROSCOPICA — BY A NEW KININ, ZEATIN

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Success in induction of flowering, particularly in short-day plants, by chemical means is still a rare phenomenon. Among plants of this class, *Perilla nankinensis* and *Chrysanthemum morifolium* are perhaps the only two examples where flowering has been induced under non-inductive conditions. In *Perilla* cultured shoot apices turned reproductive when kinetin and adenine were included in the medium (Chailakhian, 1961); in *Chrysanthemum* GA applied to plants brought about the same effect (Barbat and Ochesanu, 1964). We report here that zeatin, a new kinin, has a marked effect in initiating flowers in a short-day plant — *Wolffia microscopica* — under long-day conditions. This we believe to be interesting not only from the viewpoint of the role of zeatin in plants in general, but also of the physiology of flowering since few substances of equivalent potency in inducing flowering are yet known. Zeatin, it may be added is chemically known as 6-(4-hydroxy-3-methyl-but-2-enyl) aminopurine, and was recently isolated by Letham (1963) from the immature seeds of *Zea mays*.

The plants of *Wolffia microscopica*, which are about the size of a pinhead, are ideally suited for investigations on flowering (Maheshwari and Chauhan, 1963). They were aseptically cultured on medium containing Hoagland’s major salts and Heller’s micronutrients supplemented with \(5 \times 10^{-6} \text{M EDTA}\) and 1% sucrose. The medium contained the following salts (mg/l): \(\text{KNO}_3\) 506, \(\text{Ca(NO}_3)_2\cdot4\text{H}_2\text{O}\) 1180, \(\text{KH}_2\text{PO}_4\) 136, \(\text{MgSO}_4\cdot7\text{H}_2\text{O}\) 493, \(\text{ZnSO}_4\cdot7\text{H}_2\text{O}\) 1, \(\text{H}_3\text{BO}_3\) 1, \(\text{MnSO}_4\cdot\text{H}_2\text{O}\) 0.1, \(\text{CuSO}_4\cdot5\text{H}_2\text{O}\) 0.03, \(\text{Na}_2\text{MoO}_4\cdot2\text{H}_2\text{O}\) 0.025 and 4 mg of ferric citrate. The pH of the medium was adjusted to 5.5. Plants obtained from a single clone were used for the investigation. The plants were kept at \(25^\circ\text{C} \pm 1^\circ\text{C}\) under a photoperiodic regime consisting of 20 hours of light (550—600 ft-c) and 4 hours of darkness. Under these conditions their number doubles every 24 hours through vegetative multiplication but there is no flowering.

The incorporation of zeatin caused some decrease in the multiplication rate. However, the growth of individual plants was greatly accelerated. An increase in the size of the fronds was apparent even on the fourth
day in the medium containing just 10 μg zeatin per liter. After 6 days the maximal increase of 75% over the control was obtained at 100 μg level (Fig. 1A). The fresh and dry weights of the fronds also increased considerably in media containing 100 μg zeatin per liter (Fig. 1A). The former increased by over 200% and the latter by about 57%. Higher concentrations resulted in a decrease in the size of fronds as well as in their fresh and dry weights.

![Graph A](image1.png)

**Fig. 1A—B.** Effects of zeatin on *Wolffia microscopica*. A. On frond size (determined with the help of a planimeter and camera lucida tracings), and on fresh and dry weights. B. On the percentage of flowering plants. This is evaluated as the number of plants flowering divided by the total number of plants analysed and multiplied by 100. The data pertain to cultures harvested 6 days after inoculation. In each experimental treatment at least a 1000 plants were analyzed.

The more interesting effect of zeatin is, however, the initiation of flowering under long-day conditions. Normally *W. microscopica* behaves as a strict short-day plant when grown *in vitro* in the above medium (unpublished), and a minimum of one photocycle consisting of at least 12 to 14 hours of darkness is required to induce flowering. Under such conditions flowers are discernible 4–5 days after the inductive treatment. While no flowers at all could be detected in plants grown under long-days, addition of 10, 100 and 1000 μg of zeatin per liter of medium resulted in flowering within 6 days. The maximum percentage of flowering plants, i.e. 63%, was obtained in medium containing 100 μg zeatin, while values of 54 and 46% were recorded at 10 and 1000 μg levels respectively (Fig. 1B).

To the best of our knowledge this is the only case where a kinin has induced flowering in a short-day plant — in the intact state — under non-inductive regimes. It may be mentioned that a similar effect has been obtained with kinetin in two cold requiring long-day plants, *Cichorium intybus* and *Arabidopsis thaliana*, though it was less effective.