SHORT COMMUNICATION

INDUCTION OF FEMALE ORGANS IN STAMINATE GRAPE BY 6-SUBSTITUTED ADENINE DERIVATIVES

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The cytokinin, 6-benzylamino-9-(2-tetrahydropyranyl)-purine (BTP) can induce hermaphroditic flowers in staminate plants of *Vitis vinifera* (Negi and Olmo 1966) and *V. thunbergii* (Iizuka 1967) and makes possible the selfing of such plants. The present study was conducted to discover other chemicals which affect sex expression in *Vitis* spp. The cytokinins, 6-benzyladenine (BA) and 6-benzyladenosine (BAS), chosen from a group of 6-substituted adenine derivatives synthesized by one of the authors (T. H.) were tested along with BTP, gibberellic acid (GA), 3-indoleacetic acid (IAA), and spermine tetrahydrochloride. BA, GA, and IAA were applied in a 2-percent alcohol solution at 1,000 ppm; BAS was applied in a 5-percent propylene glycol solution at 1,000 ppm; BTP in a 5-percent isopropanol solution at 1,000 ppm and spermine in an aqueous solution at 1,000 ppm. Airol-OP at 0.1 percent was added to the solutions as a wetting agent. Blanks without the test chemicals were run in each assay with essentially no effect in respect to sex conversion.

Species tested included *Vitis coignetiae* Pulliat, *V. thunbergii* var. *typica* Makino, *V. linsecomii* Buckley, *V. aestivalis* Michaux, *V. vulpina* L. and *V. labrusca* L. Each species shows segregation for "male" and "female" individuals under natural

Fig. 1. Modification of flowers in
V. thunbergii.

A: Untreated flowers in "male" vines. B: Hermaphroditic flowers induced with 6-benzyladenine in "male" vines. C: Untreated flowers in "female" vines.

Table 1. Effect of 6-benzyladenine on female organ induction of staminate *V. thunbergii*

Sex of vine	Application date in days before anthesis	% Flowers with female organs	% Pollen stainability	Fruit set %
Male	14	0	98	—
	19	100	97	20
	24	100	98	35
	28	100	93	18
Female	—	100	97*	60

* Stainable with acetocarmine, but non germinative.

populations. At intervals from 14 to 37 days before anthesis, flower clusters from "male" vines of each species and "female" vines from *V. coignetiae* and *V. thunbergii* were dipped in the above solutions. Two individuals of each species and three flower clusters, each on a different shoot, were treated with adjacent clusters on the same shoots as controls. Flower development was compared at anthesis, and fruit setting was observed 70 days after anthesis. Both BA and BAS as well as BTP promoted the formation of female organs in "male" plants. The clusters treated 18-35 days before anthesis produced typical hermaphroditic flowers showing pistils with mucus on stigmas, upright stamens with functional pollen grains, and normal fruit set (Fig. 1, Table 1). The clusters treated 14-17 days before anthesis were affected slightly having only a portion of the stigma or poorly developed pistils and no fruit development, or unaffected without any formation of pistils. Clusters from the "male" vine treated with GA, IAA and spermine showed no alteration of sex expression but GA elongated clusters, IAA and spermine reduced flower size. Cytokinin treatment of "female" vines failed to transform sex expression except for pistil enlargement and slight anther deformity.

One genetic explanation of sex determination in *Vitis* assumes that functional dioeciousness is controlled by two closely linked genes, *So* and *Sp*. *So* is a dominant gene which suppresses ovule development and *Sp* is a dominant gene which promotes normal pollen development (Oberle 1938). According to this hypothesis, "female" individuals are of the genotypes *so sp/so sp*, and "male" individuals *so sp/So Sp*. Each of the three cytokinins apparently bypasses the genetic regulatory mechanisms of *So* as a suppressor of ovule development. These results lead us to believe that the morphogenesis of female organs in *Vitis* is regulated by a key substance, such as endogenous cytokinin, possibly a 6- or 1-substituted adenine derivative during a specific stage of flower development.

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LITERATURE CITED

- Iizuka, M., 1967 Sex conversion in male *Vitis*, monoecious *Castanea* and *Diospyros*. Japan. J. Breed. **17**, Suppl. 2: 117-118 (in Japanese).
 Negi, S. S., and H. P. Olmo, 1966 Sex conversion in male *Vitis vinifera* L. by a kinin. Science **152**: 1624-1625.
 Oberle, G. D., 1938 A genetic study of variations in floral morphology and function in cultivated forms of *Vitis*. N. Y. State Agri. Expt. Sta. Bulle. **250**: 1-63.