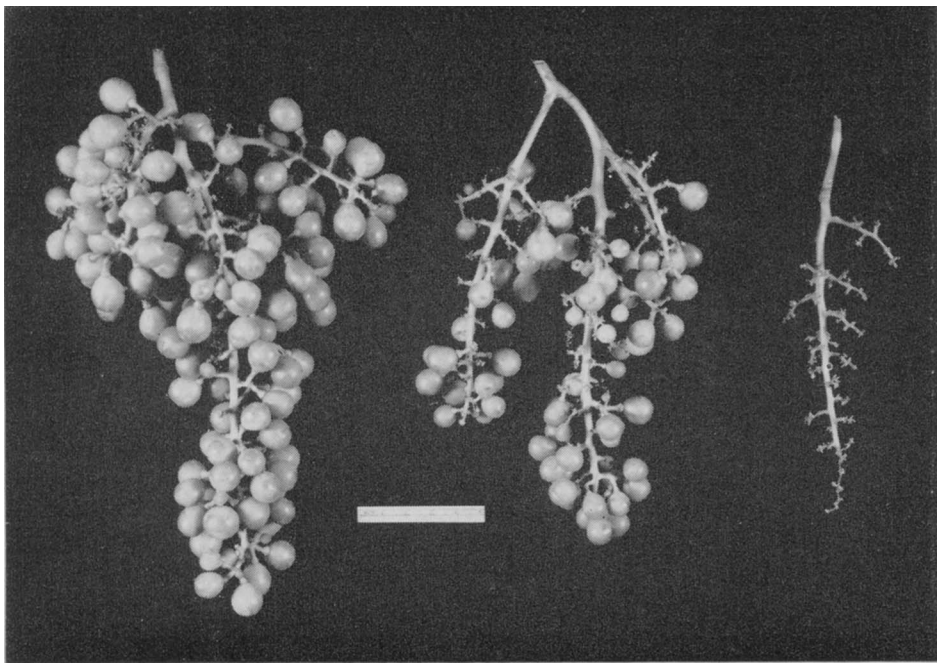
MORPHACTINS INDUCE ABSCISSION IN

R. J. WEAVER · R. M. POOL



Clusters of Muscat of Alexandria 26 days after treatment with the morphactin IT 3456. Left, control; center, 10 ppm; and right, 1000 ppm. Note over half of berries abscissed as a result of compound at 10 ppm, and all berries dropped as a result of 100 ppm.

Two derivatives of fluorene-9-carboxylic acid (termed morphactins because they produce morphological changes and striking suppression of growth in plant species) were tested on seeded Vitis vinifera, Muscat of Alexandria; and seedless Thompson Seedless, and Black Corinth grapes. Berry abscission was induced when the compounds were applied at the fruit-set stage or two weeks later. When morphactins were applied near maturity, no berry drop occurred although the strength of berry attachment was reduced. An auxin (4-CPA) counteracted the morphactin response, indicating that the response may involve auxin metabolism. These chemicals are not registered for use in the U.S. at this time except by researchers on an experimental basis.

THE TWO MORPHACTINS used in the 1967 study, methyl-2-chloro-9-hydroxyfluorene-9-carboxylate (IT 3456) and n-butyl-9-hydroxyfluorene-9-carboxylate (IT 3233), were obtained from E. Merck, AG, Darmstadt, Germany. The compounds were dissolved in ethanol and subsequently diluted with water. Tween-20 at 0.1 per cent was used as a wetting agent in all solutions. Clusters (usually six) from mature vines of *Vitis vinifera* L. were dipped momentarily into solutions of the compounds. Several weeks after treatment, counts were made of the number of berries retained per cluster. In some instances the strength of attachment of mature fruits was determined by placing each cluster into a 13 x 13 x 5 inch box and shaking it vigorously 10 times. A count of the total number of berries reflected berry drop; the percentage of berries retained indicated the strength of berry attachment.

Thompson Seedless

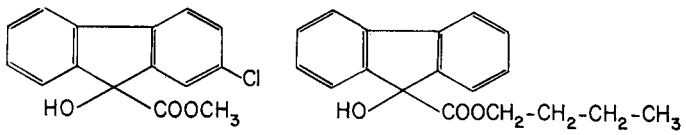
In one experiment, clusters of Thompson Seedless (Sultanina) at the fruit-set stage (June 20) were dipped in IT 3456 at 0, 2, 5, 10 or 50 ppm. With both the 10 and 50-ppm treatments, many berries abscissed within four days of treatment; and after 10 days about 95 per cent of the berries had fallen. An abscission zone had developed at the base of the pedicle, but there was no evidence of toxicity in this or subsequent experiments. All berries or clusters treated with IT 3456 at 5, 10, or 50 ppm had fallen by July 5 (table 1). The same experiment was repeated with IT 3233. Abscission as a result of treatment with 10 ppm was pronounced, although the degree was much less than with IT 3456 (table 1). At 50 ppm there was total drop.

Another group of Thompson Seedless clusters was similarly treated on July 6, when the berries were two weeks past the fruit-set stage. Clusters were dipped in IT 3456 at 0, 0.1, 0.5, 2.0, or 10.0 ppm. By July 12, the compound at 2.0 and 10.0 had caused much abscission. Clusters were collected on August 28, and the data (table 1) showed that much berry fall had occurred although less than in the previous experiment, when clusters were treated at fruit-set stage.

A third group of Thompson Seedless clusters was treated with IT 3456 at 0, 10, 100, or 1000 ppm on August 21, at which time the fruit was approaching maturity and the soluble solids were 12 per cent. Berry counts were made 18 days after treatment, when soluble solids were

BERRY GRAPES

Chemical formulae for two morphactins used in these tests.



IT 3456 IT 3233

about 14 per cent. There were no significant differences among concentrations in the number of berries per cluster (table 1). The percentage of berry fall resulting from the shaking treatment was 32.9, 66.2, 59.8, and 55.9, respectively, at 0, 10, 100, or 1000 ppm. All concentrations of IT 3456 resulted in significantly greater (5 per cent level) berry fall, although there were no significant differences among concentrations. Thus, the compound lowered the strength of attachment of the berry to the cluster.

Black Corinth

Black Corinth clusters (seedless) were treated on June 20 at the fruit-set stage (larger berries, 3 mm in diameter) with IT 3456 or IT 3233 at 0, 2, 5, 10 or 50 ppm. Six days after treatment, about 20 and 60 per cent of the berries, respectively, had fallen from clusters treated with IT 3456 at 2 or 50 ppm. When berry counts were made 21 days after treatment, berry fall was about 80 per cent for IT 3456 at 2 ppm, and about 100 per cent for 50 ppm (table 2). IT 3233 was a much less effective abscission promoter.

The two morphactins were tested on Muscat of Alexandria (seeded) at the fruit-set stage, on June 15. Within four days, all berries had fallen from the clusters treated with IT 3456 at 1000 ppm, and many had fallen from the clusters treated at 10 or 100 ppm. Data at harvest, July 11, revealed that IT 3233 at 100 ppm was less effective than IT 3456 at 100 ppm in inducing abscission (table 2).

An experiment was conducted with Thompson Seedless to determine whether IT 3456 is effective in promoting abscission when placed at the apex of a berry, and to determine whether auxin is an antagonist to this compound, in regard to abscission. Clusters trimmed to 25 berries were treated on June 27, when the berries were past the fruit-set stage (larger berries, 7 mm in diameter), with various concentrations (0 to 50 ppm) of IT 3456 in lanolin, with or without the auxin 4-CPA at 15 ppm. There were four clusters per treatment. Clusters were collected on July 19. No berries had fallen from the control clusters, but only 27 per cent of berries were retained where IT 3456 at 50 ppm, alone, had been applied. IT 3456 at 50 ppm plus 4-CPA at 15 ppm resulted in a significant increase (5 per cent level) in the percentage of berries retained. The fact that applied auxin counteracted the abscission-promoting effect indicates that the morphactin may be influencing grape auxin metabolism.

Preliminary experiments with morphactins at and after late-fruit-set stage on Zinfandel and Carignane, seeded wine grapes, resulted in little or no stimulation of abscission. This may be because these seeded berries produce so much auxin that abscission is prevented.

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TABLE 1. NUMBER OF BERRIES PER CLUSTER OF THOMPSON SEEDLESS SUBSEQUENT TO DIPPING IN MORPHACTINS

Developmental stage	Concentration of morphactin	IT 3456	IT 3233
	ppm	No. of berries*	
Fruit-set	0	416[a]	416[a]
	2	6[b]	444[a]
	5	0[c]	480[a]
	10	0[c]	340[b]
	50	0[c]	0[c]
Post fruit-set	0	433[a]	.....
	0.1	366[a]	.....
	0.5	292[a,b]	.....
	2.0	172[b]	.....
	10.0	194[b]	.....
Berries full size	0	381[a]	.....
	10	337[a]	.....
	100	356[a]	.....
	1000	361[a]	.....

* Within each compound, and stage of fruit development, values with different superscripts differ significantly at the 5% level.

TABLE 2. NUMBER OF BERRIES PER CLUSTER OF BLACK CORINTH AND MUSCAT OF ALEXANDRIA SUBSEQUENT TO DIPPING IN MORPHACTINS AT FRUIT-SET STAGE

	Concentration of morphactin	IT 3456	IT 3233
	ppm	No. of berries*	
Black Corinth	0	483[a]	483[a]
	2	93[b]	337[b]
	5	80[b]	272[c]
	10	38[c]	289[d]
	50	0[d]	8[e]
Muscat of Alexandria	0	111[a]	111[a]
	10	57[b]	54[b]
	100	1[c]	35[c]
	1000	0[d]	0[d]

* Within each variety and compound values with different superscripts differ significantly at the 5% level.

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