

THE ACTIVITY OF SOME SYNTHETIC CYTOKININS IN BREAKING THERMODYNAMIC OF LETTUCE (*LACTUCA SATIVA* L.)

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SUMMARY

The following synthetic cytokinins: 6-furfurylamino-purine (kinetin), 6-(3-methyl-2-butenyl-amino)purine (isopentenyladenine) and their 1-deaza-, 8-aza-1-deaza-, 3-deaza-, and 8-aza-3-deaza-analogs were investigated for biological activity in breaking thermodynamic in lettuce seed (*Lactuca sativa* L. cv. meikoningin, Asteraceae). In dose-response experiments 6-(3-methyl-2-butenylamino)-1-deazapurine appeared to be the most active substance tested. This chemical stimulated germination at lower concentrations and to a greater extent than the others. All the isopentenyl derivatives were more active than the corresponding furfuryl analogs. In general, the results are similar to those obtained with a callus growth test, which supports the view that the results definitely indicate cytokinin activity.

1. INTRODUCTION

A number of kinetin-like compounds, synthesized at the Organic Chemistry Laboratory of Utrecht University, have previously been investigated for their cytokinin activity with a callus culture test (KROON 1973; ROGOZIŃSKA et al. 1973; KROON et al. 1974). This test, based on the growth stimulation of tobacco callus tissue, is commonly used for cytokinin activity determinations (e.g. SKOOG et al. 1967; ROGOZIŃSKA et al. 1973). The use of a second test, based on one of the other physiological effects of cytokinins (MILLER 1963), however, is recommended as bioassays in general may have different specificities.

The present work reports the results of a test on breaking thermodynamic comparable to the tests described by MILLER (1963) and by SKINNER (1957).

2. MATERIALS AND METHODS

Test solutions were made in dimethylsulfoxide (DMSO) and diluted with water to the correct cytokinin concentration. The final DMSO concentration in the test solutions was maintained below the inhibitory concentration for lettuce germination (LEMMENS, unpublished) at 0.06%.

For each test 200 achenes of lettuce (*Lactuca sativa* L. cv. meikoningin) from one lot were used. They were soaked in darkness at 35°C in 100 ml test solution

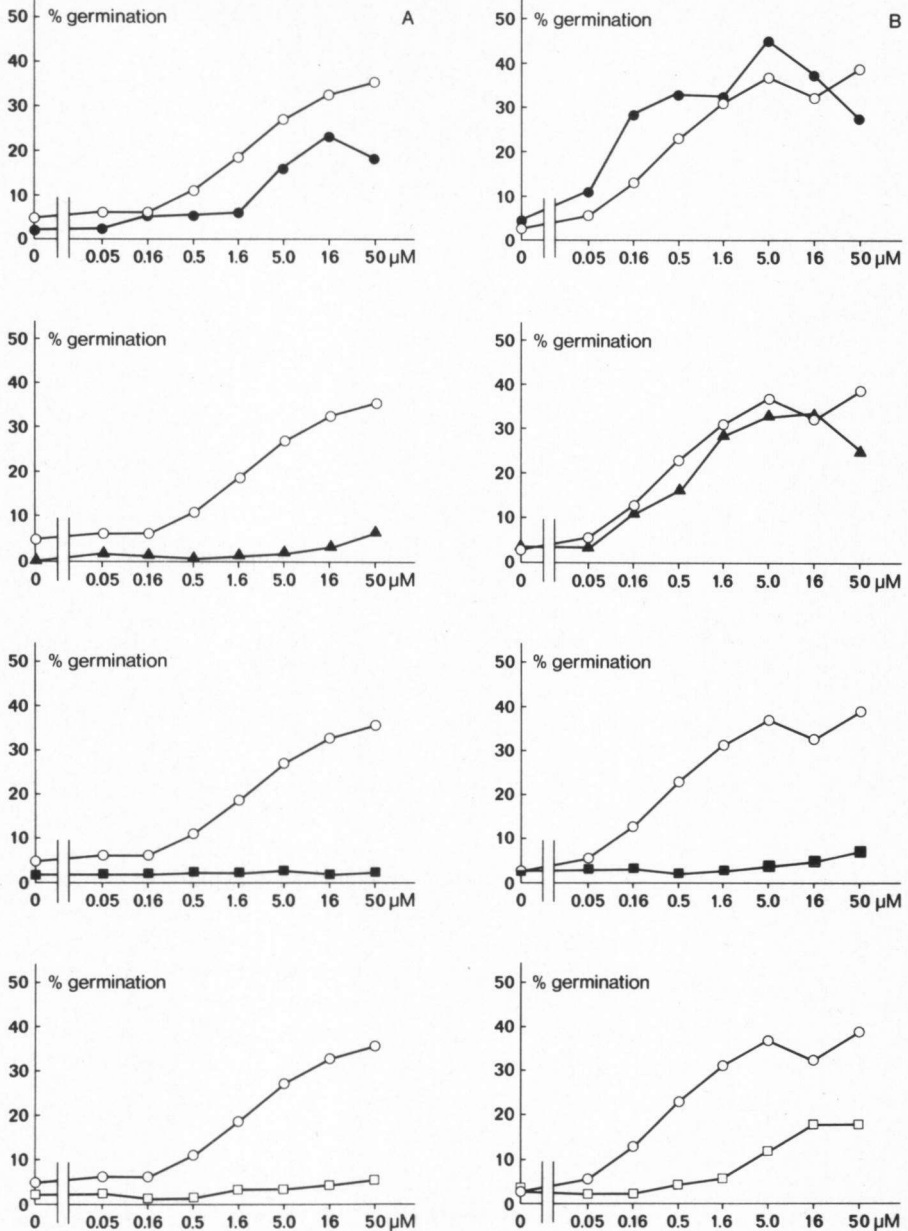


Fig. 1. Germination percentages of thermodormant lettuce seed in the presence of different concentrations of 6-furfurylaminopurine and analogs (A) and of 6-(3-methyl-2-butenylamino)purine and analogs (B). Parent compounds: \circ —, 1-deazapurines: \bullet —, 8-aza-1-deazapurines: \blacktriangle —, 3-deazapurines: \blacksquare —, and 8-aza-3-deazapurines: \square —. The graph of the parent compound is given in quadruplicate. For test conditions see text.

for 5 hrs. The soaked achenes were spread out on filter paper in a 9 cm ϕ petri-dish. 5 ml test solution was added and the petri-dish was placed for 67 hrs in light of about 30 W/m² from HPL bulbs. The appearance of the root tip was used as the criterion for germination. Each test was carried out in quadruplicate. The cytokinins tested – 6-furfurylamino-purine, and 6-(3-methyl-2-butenyl-amino)purine and their 1-deaza-, and 8-aza-1-deaza-, and 3-deaza-, and 8-aza-3-deaza-analogs – were obtained from the Organic Chemistry Laboratory of Utrecht University.

3. RESULTS AND DISCUSSION

The percentage of germination obtained in the different tests is given in *fig. 1*. From this figure it appears that the investigated cytokinins with a 6-(3-methyl-2-butenylamino) group (*fig. 2*) have a higher activity than their corresponding 6-furfurylamino derivatives. The activity of the 1-deaza analogs (except 6-furfurylamino-8-aza-1-deazapurine) is relatively high, the activity of the corresponding 3-deaza analogs low. The replacement of the 8 carbon atom by a nitrogen atom causes lower activity in the 1-deaza compounds but higher activity in the 3-deaza analogs. The activity of 6-furfurylamino-8-aza-1-deazapurine is even lower than that of 6-(3-methyl-2-butenylamino)-8-aza-3-deazapurine. The highest cytokinin activity in our test was obtained with 6-(3-methyl-2-butenylamino)-1-deazapurine.

It is not possible to give relative activity values as the shapes of the different dose-response curves are not identical. Both optimum concentration, and maximum response, and some other parameters can be used under certain circumstances to characterize the activity, but their numerical values can be misleading.

The results of the lettuce germination tests appear to be quite similar to those of the tobacco callus growth test. As more than one (cytokinin stimulated)

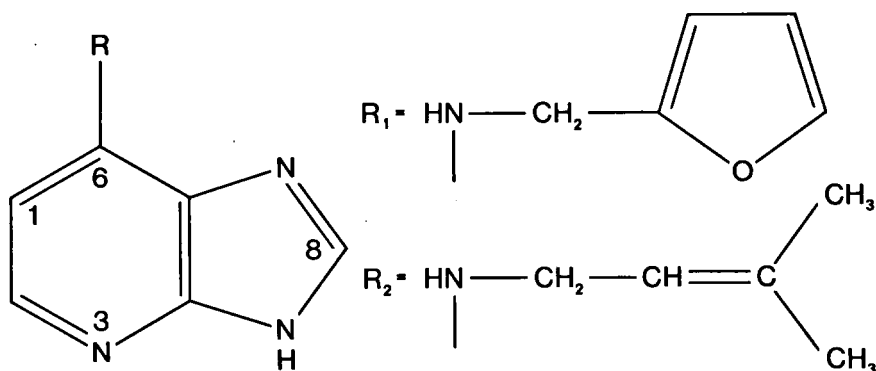


Fig. 2. Structure of some of the synthetic cytokinins tested. R = R₁: 6-furfurylamino-1-deazapurine. R = R₂: 6-(3-methyl-2-butenylamino)-1-deazapurine.

physiological process is involved this strongly supports the view that the substances tested show cytokinin activity.

ACKNOWLEDGEMENT

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