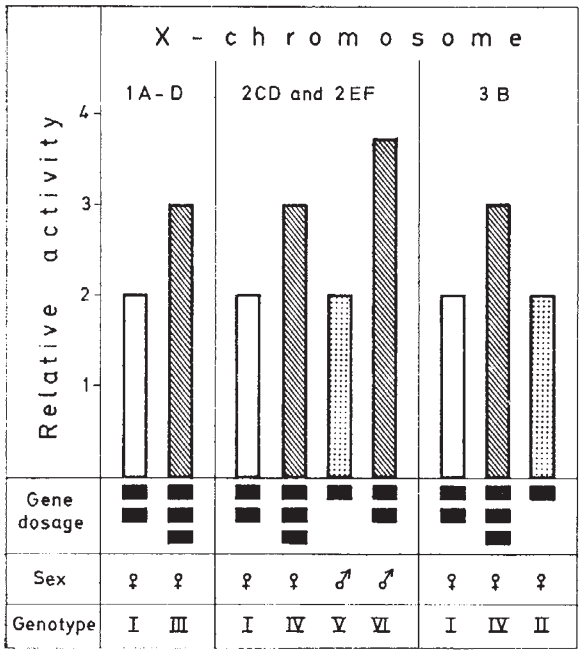

Fig. 1. Dosage effect and dosage compensation for RNA synthesis in small puffed sections of chromosome *X* determined autoradiographically. The identity of the relative activity in normal females and males is based on Mukherjee's data and my own unpublished data. Open columns represent normal activity; hatched columns, dosage effect; stippled columns, dosage compensation. For genotypes see Table 1.

to a 50 per cent increase in RNA synthesis—in a male to a 100 per cent increase. The findings of a greater increase in RNA synthesis in males than females can be explained by this hypothesis, but the behaviour of puff 3*B* in $Df(1)w^{258-11},y/+$ females cannot. Its dosage compensation cannot even be explained on the basis of a simple feedback mechanism. With such a mechanism, in the 3*B* duplication (as in *y w bb*; $Dp(1;3)w^{vco}$ females), RNA synthesis should be inhibited beyond the normal level.

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Antagonism between the Effects of Kinetin and Extracellular Metabolites of the Pathogen in Apple Scab Disease

THE elucidation of metabolic relations between plants and their pathogens must precede a reasoned approach to control before and after infection. Disturbances of protein synthesis, respiration and transpiration have been widely reported in host plants after infection, but the direct manipulation of plant hormone systems in disease has been neglected, as has the study of metabolic control exerted by the pathogen.

Although cytokinins, gibberellins and auxins have been implicated in plant disease[1-3], the effects of application of plant hormones or their analogues to an intact fungal disease system do not seem to have been assessed. Total cytokinin activity increased and solute mobilization patterns were altered in bean leaves infected with rust[1], while the application of kinetin strongly affected solute transport in healthy oat and bean leaves[1,4].

Pigmented products isolated from culture filtrates of *Venturia inaequalis* have specific effects on solute transport in apple leaves and on the course of the scab disease[5]. Similarities between the actions of kinetin and the fungal products on solute transport encouraged us to compare the separate and combined effects of kinetin and fraction 4 of the pigment complex on the disease system.

Young leaves of MM.109 apple rootstock shoots were inoculated with *V. inaequalis* (clone E1), and kinetin at the rate of 0·3 ml. per shoot (60 mg/l.) was applied as a spray 2 and 3 days later. Fraction 4 was applied in a similar fashion (5 mg/ml.) 2 days after inoculation. In the combined treatment, a mixed solution of kinetin and fraction 4 was applied after 2 days and kinetin alone after 3 days, in the same respective concentrations. No direct chemical or physical interaction was observed between them. The severity of disease was recorded 4 weeks after inoculation by counting the numbers of visible lesions on the six leaves uppermost at the time of inoculation; the numbers of these leaves which had no visible lesions were also recorded.

Table 1. EFFECTS OF KINETIN AND FRACTION 4 ON THE SCAB DISEASE RESPONSE

Experiment No.	Treatment	No. of lesions per 100 leaves	Percentage of recorded leaves with no visible lesions
4/02	Control	272	31
	Kinetin	552	14
	Fraction 4	394	23
6/01	Control	283	49
	Kinetin	335	40
	Fraction 4	402	41
	Kinetin + fraction 4	289	44

Experiment 6/01 indicates that kinetin alone increased the numbers of recorded lesions and decreased the numbers of leaves with no visible lesions. Application of fraction 4 alone produced similar effects. But a combination of the two treatments indicates that they are mutually exclusive, the result being very similar to the untreated control in both numbers of lesions and numbers of leaves with no visible lesions.

Experiment 4/02 was started 14 days before 6/01. More mature plants receiving 50 per cent less daylight were used in the former and the quantitative effects of the single treatments differed considerably, although both were stimulatory in each experiment. The greater response observed is attributed chiefly to the lower light intensity which is known to have fundamental effects on plant hormone systems. The observations we have described are typical of a series made during the past 2 years. The probability of the results of the separate treatments occurring at random was less than 1 in 100.

Thus kinetin and fraction 4 have similar effects on the course of the disease, but the mutual antagonism expressed when they are applied in combination indicates that their modes of action are different. It can be inferred that each treatment acts on the same metabolic system which is closely involved with the susceptibility of the host to the pathogen.

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