Flukes can be kept alive for 60 hours at 36° C. in the following solution: NaCl 150 mM., KCl 10 mM., $CaCl_2$ 1 mM., borax 6 mM., glucose 30 mM., *p*H 8·6. Survival times can be further increased by using fructose instead of glucose, and by the addition of 1/5,000 trypan blue[5], but the medium as stated is simpler and cheaper, and thus more suitable for large-scale work. A survival time of 60 hours, although disappointing, is a considerable advance upon previous records, and is adequate for preliminary tests of the effects of anthelmintics *in vitro*. Certain of these tests have been carried out, and it has been shown that carbon tetrachloride, probably the most effective anthelmintic *in vivo*, is innocuous *in vitro*.

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Control of Red Spider Mites

SINCE the discovery in 1936 of its insecticidal properties, 2 : 4 dinitro-6-cyclohexylphenol[1] has been widely used in the United States for the control of tetranychid mites. Successful control has been obtained of *Paratetranychus citri* (McG.)[2,3] and of *Tetranychus telarius* (L.) on citrus, cotton[4] and hops[5]; on all these crops damage by red spider is of considerable economic importance, and this substance is the only synthetic compound which has been successfully applied to control on a large scale. It is of interest that 4 : 4′ dichloro-diphenyl-βββ-trichloroethane (D.D.T.) is of no use as an acaricide. Later work has established that the phytocidal effect of dinitro-*ortho*-cyclohexylphenol can be diminished by use of its dicyclohexylamine salt without impairing its properties as an insecticide or acaricide.

Experiments recently carried out in the field from this laboratory have established that control of *T. telarius* can be obtained on hops and on greenhouse tomatoes in Great Britain.

The experiments on hops were carried out in Kent in September. Two proprietary dusts and one dust using kaolin as filler were used; all three dusts contained 1 per cent of 2 : 4 dinitro-6-cyclohexylphenol as the dicyclohexylamine salt, and ½ lb. was applied to each plant. Both were also applied as aqueous suspensions, and the compatibilities with cuprous oxide and copper oxychloride, and of the salt with nicotine were tested.

Treatment	Mites counted	% killed
Dusts		
Proprietary dust *A* } Dicyclohexylamine salt cont.	2100	94·8
,, ,, *B* } 1% 2 : 4 dinitro-6-cyclohexylphenol	1630	94·3
Dicyclohexylamine salt with dinitrocyclohexylphenol with kaolin	1600	82·3
Flowers of sulphur	1780	26·6
Aqueous Suspensions		
0·05% dinitrocyclohexylphenol	2920	98·4
0·025% ,,	4500	97·0
0·025% ,,	1100	96·6
0·025% ,,	685	97·2
0·025% dinitrocyclohexylphenol + 0·5% proprietary cuprous oxide	1600	91·1
0·025% ,, + 0·5% copper oxychloride	1950	95·2
0·025% dicyclohexylamine salt with dinitrocyclohexylphenol	1140	97·9
0·025% ,, ,, +0·037% nicotine	780	93·3
1% Lime sulphur	2130	65·5
Control untreated	1605	9·8

0·025 per cent of the salt as a suspension gave a 96 per cent kill against 65 per cent with a standard lime sulphur used widely by the growers. With the dusts, a 94–95 per cent kill was obtained against 27 per cent with flowers of sulphur.

The mortality was only slightly reduced by the addition of cuprous oxide, copper oxychloride and nicotine.

It was further found that 60–70 per cent of the eggs were killed by application of 0·025 per cent suspensions of the dinitro compound and of its mixture with the dicyclohexylamine salt.

Experiments to compare the use of dinitrocyclohexylphenol and of its mixture with the dicyclohexylamine salt and the ammonium salt of 2 : 4 dinitro-*ortho*-cresol in killing *T. telarius* on greenhouse tomatoes in October, showed up markedly the superior properties of the dicyclohexylamine salt under conditions where plants are liable to be easily damaged. It was found that on tomatoes, satisfactory cover of the foliage could not be obtained without the addition of a wetting agent.

Treatment	Mites counted	% kill	Damage to plants
0·03% dinitrocyclohexylphenyl	109	77·1	Very slight
0·006% ,,	194	87·6	Slight
0·012% ,,	795	88·0	Some severe damage
0·025% ,,	—	—	Plants killed
0·006% ,, with the dicyclohexylamine salt	561	66·3	Slight
0·012% ,, ,, ,,	725	90·1	Slight
0·025% ,, ,, ,,	524	91·0	Slight
0·018% dinitro-*ortho*-cresol	—	—	Plants killed
0·036% ,, ,, ,,	—	20	Plants killed

Ammonium dinitro-*ortho*-cresylate killed the plants completely at dosages too small to be lethal to the red spider mite. 0·025 per cent of dinitrocyclohexylphenol as the salt gave a 91 per cent kill and caused insignificant damage, while the same concentration of the free phenol killed the plants.

Preliminary experiments with *Oligonychus ulmi* Koch on damsons have given similar promising results.

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Control of White Rot in Onions

WHITE rot in onions and other *Allium* species has been recorded in many countries and has increased in severity in England during recent years. The disease is caused by the fungus *Sclerotium cepivorum* Berk., which survives for several years as sclerotia in the soil, and is therefore difficult to control by cultural methods. Ogilvie and Hickman[1] obtained satisfactory control by broadcast applications of a proprietary fungicide containing hydroxymercury-chlorophenol; but this treatment did not come into general use, possibly on account of the high cost. Apart from this, no direct control method has been recommended.

In trials made during 1943 and 1944, mercurous chloride (calomel) showed promise as a means of controlling white rot in spring-sown onions, var. James' Keeping. The best results were obtained by the application of 4 per cent calomel dust to the seed drill at the time of sowing. The drills were opened, the dust was applied and roughly mixed with the soil. The seed was then sown and the drill closed. One pound of 4 per cent calomel dust to 50 yd. of drill appeared sufficient for salad onions raised from March sowings, but 1 lb. per 25 yd. gave better results on bulb onions grown from seed.

Full details of these trials will be published elsewhere, and in view of the prospect of controlling this obstinate disease by an economical direct method, the work is being continued and extended in 1945.

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'Bolters' in Potatoes

Carson and Howard in their recent letter[1] consider the possibility that the 'bolter' sport which occurs in many varieties of potatoes is due to chromosome abnormality—excess or deficiency. Their examination of root tips, however, forces them to conclude that there is no chromosome difference between 'bolter' and normal.

Experience has shown that critical study of small chromosomes can only be made at meiosis, using a technique which does not allow contraction[2]. Again the possibility of chromosome loss in roots which need not occur in the germ track must not be overlooked[3,4].

From material supplied by Dr. McIntosh, Edinburgh, and Mrs. McDermott, Sutton Bonington, I have examined normal and aberrant types among the varieties Gladstone, Doon Star and Majestic. While there are no gross chromosomal changes, a small fragment was observed at meiosis in the 'bolter' types but in none of the corresponding normal or, for that matter, 'wilding' types. The accompanying illustration shows this fragment in a 'bolter' form of Gladstone. It is too small to determine whether it is euchromatic or heterochromatic.

It seems likely therefore, although not yet certain, that the mutation is due to the production of this fragment which, of course, will be similar in its effects to the mutation of a group of genes such as Carson and Howard infer from their breeding results. The observation of the fragment, if it is responsible, will, however, facilitate the study of the mutation.

Photograph showing extra fragment (smallest fragment, in centre) at meiosis in a 'bolter' form of Gladstone. Acetocarmine squash, Thomas method[2]. × 2000.

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Effect of Controls on Stability

During the War the introduction of governmental controls has led to many matters being dealt with by an order *fixing* some quantity, price or other variable where a *laissez-faire* system would have allowed them to find their own levels. As examples we have rates of foreign exchange, wages and prices. Not only has this fixing occurred in many instances during the War, but a further extension of control or planning in peace will probably lead to even more variables being fixed in this way.

It is the purpose of this communication to point out the danger that in any dynamic system the fixing of one variable may render the rest unstable; and it will be shown that there is one type of variable particularly likely to lead to this result. (In a social or economic system the change to an unstable state would be shown by the subsequent growth of various peculiar and undesirable 'vicious circles'.)

The theory may be shown in the following way: a dynamic system in general, of n variables, has equations of form

$$\frac{dx_i}{dt} = f_i(x_1, \ldots, x_n) \quad (i = 1, \ldots, n).$$

Near a point of equilibrium (at which the fluxions are zero) the equations may, without serious loss of generality, be considered linear:

$$\frac{dx_i}{dt} = a_{i1}x_1 + a_{i2}x_2 + \ldots + a_{in}x_n \quad (i = 1, \ldots, n).$$

For a system to be stable at the equilibrial point, it is necessary and sufficient that the real parts of the roots of the equation

$$\begin{vmatrix} a_{11} - \lambda & a_{12} & \ldots & a_{1n} \\ a_{21} & a_{22} - \lambda & \ldots & a_{2n} \\ \ldots & \ldots & \ldots & \ldots \\ a_{n1} & a_{n2} & \ldots & a_{nn} - \lambda \end{vmatrix} = 0$$

are all negative. (Since we are discussing an actual system, the quantities a_{ij} will all be real.) Further, since we are discussing an equilibrial point which has existed for some time under free conditions, we may suppose it stable.

Now suppose we fix x_n. The stability of the remainder will depend on the real parts of the roots of the equation

$$\begin{vmatrix} a_{11} - \lambda & a_{12} & \ldots & a_{1,n-1} \\ a_{21} & a_{22} - \lambda & \ldots & a_{2,n-1} \\ \ldots & \ldots & \ldots & \ldots \\ a_{n-1,1} & a_{n-2,2} & \ldots & a_{n-1,n-1} - \lambda \end{vmatrix} = 0.$$