Leading out from these four, the positions of other atoms in the nucleus could be traced in four five-membered rings A B C D. There was one unusual and unexpected feature which was at first difficult to accept. This was the direct linking of two of the 5-membered rings (A and D) without an intermediate bridging atom, with a methyl group attached directly to one of the tertiary carbon atoms.

Most of the tremendous numerical calculations required during the evaluation of the triple Fourier series of several thousand terms at tens of thousands of points were done on the electronic computer SWAC by Trueblood at the University of California.

The figure shows the chemical formula. Using the Bijvoet method these workers have also established the absolute configuration of this molecule.

PLANT DISEASE IN RELATION TO NUTRITION

1. Effect of Nitrogen, Potassium and Phosphorus on the Leaf Blight of Hollyhock

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THE host nutrition has been considered an important factor in modifying the host response to parasitic infection. The level of nutrition and the nature of nutritive elements available to the plant generally influence the development of its various organs which consequently determines in a large measure the degree of its resistance or susceptibility to pathogens, its histological and morphological structure or properties. The disease disposition by the nutrition, however, varies according to the pathogen and the host. Studies with macro-nutrients have been considerable from this view-point. It is the general opinion that nitrogen increases the susceptibility of plant to infection while potassium and phosphorus tend to decrease it. A series of investigations have been undertaken to study the effect of macro- and micro-nutrients on some of the common diseases of the crop plants and the ornamentals. This paper presents the results of investigations on the influence of nitrogen, potassium, phosphorus and the Knop's solution on the leaf blight of hollyhock (*Althœa rosea* Cav.), which is caused by *Alternaria tenuis* Nees. The disease is also being recorded for the first time.

The symptomatology reveals that the older leaves at the base are heavily affected and the young ones escape infection till late in the season. There is usually no infection on the stem but the flowers at the axil of the more heavily infected leaves may be attacked. The disease initiates as small, isolated pale-brown spots at the tip and margin of the leaves, which develop irregularly as circular or narrow well-defined areas; some of them coalescing and extending centrally downwards reaching up to the petiole. Later the infected regions exhibit pronounced curls, cracks and folds which dry up and become brittle, often producing irregular holes in the leaf lamina due to the disorganisation of the tissue (Fig. 1).

The pathogenicity tests have shown that the fungus gains entry through the stomata or the weak and injured regions on the lower surface of the leaves and not through the upper surface, even if injured.

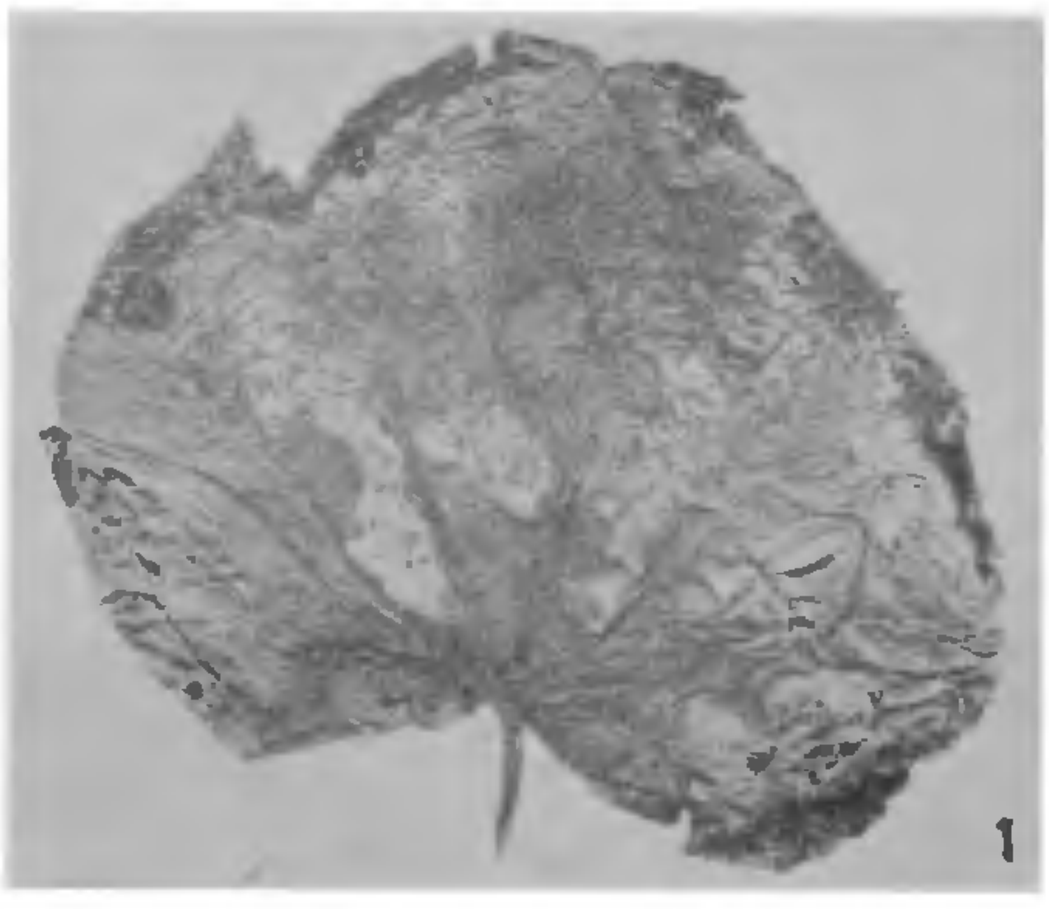

FIG. 1. A naturally infected leaf of hollyhock.

FIG. 2. An experimentally infected leaf of the same.

For the study of the influence of the macronutrients on the host susceptibility, hollyhock plants were raised in pots filled with ordinary unmanured garden soil, which was dressed with definite quantity of sodium nitrate for nitrogen (0·36% and 0·18%), disodium hydrogen phosphate for phosphorus (0·18% and 0·09%) and potassium sulphate for potassium (0·36% and 0·18%) prior to seed sowing. Nearly uniform conditions of growth were maintained for the plants except the varying concentration of the nutrient in the soil. The nitrogen-fed plants had leaves with broad and expanded lamina, were fast growing and more than double the size of those growing in the phosphorus-fed soils, which were the shortest and with comparatively small leaves. The plants growing in the 6" pots measured as: nitrogen 8–12", potassium 5½–7½" and phosphorus 3–5½" in height.

To study the influence of the Knop's solution on the susceptibility of hollyhock plants to chlorosis, spotting and the blight. The general symptoms as developed in all these experimentally inoculated plants resembled those occurring in nature (Fig. 2) and the fungus employed for inoculation was reisolated from these. The results have been presented in Figs. 3 and 4.

It is evident from Fig. 3 that the plants grown in nitrogen-dressed soil show the incidence of the disease in nearly half the time than those in the potassium or phosphorus. The higher the percentage of nitrogen in the soil, the more the plants are susceptible to blight while in the case of phosphorus-fed plants, the higher concentration seems to make them more resistant. The status of potassium in this regard is intermediate, although the data indicate that the lower strength favours the disease appearance.

The increase in the solute concentration of Knop's does increase the susceptibility of hollyhock plants up to the 2 normal stage, in which the plants exhibit a general and complete

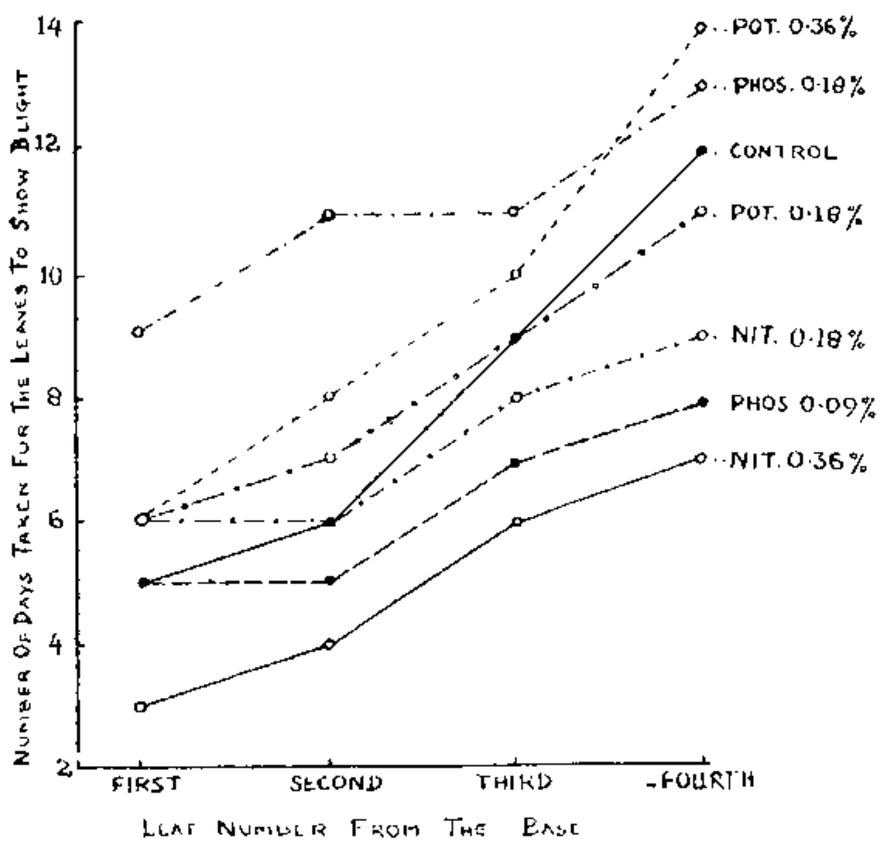

FIG. 3. Showing the pathogenicity of *A. tenuis* on hollyhock plants raised in ordinary soil dressed with the macronutrients.

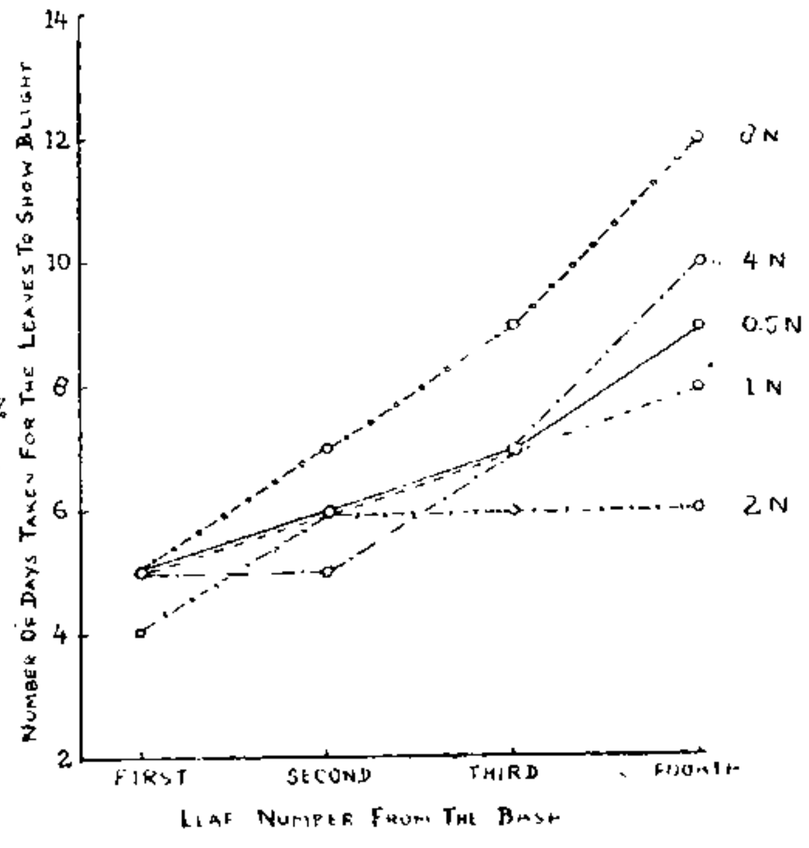

FIG. 4. Showing the pathogenicity of *A. tenuis* on hollyhock plants raised in ordinary washed sand dressed with various concentrations of Knop's solution.

A. tenuis, seeds were sown in glass jars filled with water washed sand. After forty-eight hours of the seed sowing the cultures were periodically supplied with Knop's solution of concentrations of 0·5 N, N, 2 N, 4 N, 8 N and 16 N. The plants supplied with 16 N solution did not survive beyond the cotyledonary stage, while those growing in the normal and 2 normal strengths were more succulent and green than the others.

The six to eight-leaved plants, in both these sets of experiment, were inoculated by the usual 'spore suspension spray' method on the lower surface of the leaves. The development of the infection was recorded in three stages, *viz.*, the blighting of all the leaves within 4-6 days after the inoculation (Fig. 4). This corresponds very much to the results obtained for the plants dressed with nitrogen. In higher strengths, however, the infection is not as severe and general. Leaves of plants growing in 4 normal had average number of spots mainly developed centrally while in the case of 8 normal plants the number of spots was fewer but comparatively big and marginal. In both these cases the apical leaves remained unaffected even after twelve days of the inoculation.

The author is thankful to Prof. S. N. Das-Gupta for his interest and valuable suggestions during the course of study.