make its appearance." This conclusion, however, was discredited by Angel,[1] who found that infection could be secured at temperatures as high as 31 degrees C., and he concludes, "It is, therefore, useless to attempt to control the disease by temperature modification only, as the plants are susceptible even at those temperatures that are much higher than the optimal for growth."

In our experimental approach to this problem it was recognized that at least three phases of the disease might be affected by temperature: (1) The production of conidia, (2) spore germination and infection, (3) subsequent development of the fungus in the host tissues.

In studying the influence of temperature on sporulation it was first established that this occurs in the early morning, and that this was not associated with light, since leaves held in complete darkness also sporulated about the same time. The conidiophores begin to grow out through the stomata on the under leaf surface just before dawn, and mature conidia can be gathered between 5 and 6 A. M. Sporulation, however, was not observed when the minimum temperature remained above 70° F., regardless of the maximum temperature, and in controlled temperature experiments good sporulation was only secured with temperatures ranging from 50 to 65° F., with a well defined optimum around 60–62° F. Furthermore, the temperature of the day previous was found to have an effect, and abundant sporulation was not secured with maximum day temperatures of 85° F. and above. Destructive outbreaks of the disease were invariably associated with periods of abundant sporulation.

Our studies of spore germination and infection yielded results comparable to those reported by Angel and indicated that infection was possible over a range of temperatures from 35 to 88° F.

Studies of disease development subsequent to infection, however, also yielded results of interest. With day temperatures rising above 85° F. and dropping to 70° or above at night, the fungus invaded only a small leaf area and quickly caused round, white lesions up to ¼ inch in diameter. These lesions made no further development and plants of fair size usually suffered no injury of consequence from such infections. However, when the day temperature did not go above 80° F. and the night temperature dropped to around 60° F., the fungus, following penetration, continued to spread through the leaf tissues, but without any destruction of tissues until about a week after inoculation. Then sporulation would occur over large portions of the leaf area, to be followed by the death of these parts. High temperatures consequently, while they do not inhibit infection, do prevent disease spread by preventing sporulation and also check the development of the fungus in the tissues of the host. The inhibiting effect of high temperatures has frequently been observed in the field, and periods of 5 or 6 days of hot weather have often so effectively checked the disease that it failed to renew its activity during a subsequent period of favorable weather conditions.

Proof of the practical efficiency of high temperature in controlling mildew has been obtained by the authors both in plant bed and greenhouse tests. In these experiments minimum temperatures of 70° F. or above were usually maintained, while high temperatures during the day were favored by the use of glass sash in place of cloth.

The temperature results have also solved the problem of how to keep the fungus in culture through the summer months, since it is an obligate parasite and can not be found in the field after warm weather begins. Plants growing in a chamber so constructed as to maintain a maximum and minimum of 80° and 60° F., however, have continued to provide all stages of the disease throughout the summer.

In conclusion it is to be pointed out that despite the effective disease control secured in our plant bed experiments this year it is not to be assumed that such satisfactory results would be secured under all conditions. The mildew, as it has occurred in this country during the past three years, has rarely caused severe damage until the latter part of the plant bed period, frequently at a time when the plants are almost large enough to set out. It is under these conditions that temperature regulation has proven most effective. On the other hand, our experiments indicate that small seedlings, if exposed to mildew attack, would not be so effectively protected, a fact that appears to be associated with the extreme susceptibility of the very young plants. Also our experiments have been conducted with flue-cured varieties, and there is one variety, White Burley, that is more susceptible to the mildew disease. It is probable that this increased susceptibility will make control of the disease more difficult with Burley.

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[1] Australian Council for Scientific and Industrial Research, Bul. 65, 1932.

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