the well-known fact that seed vernalization occurs only in germinating seeds supports this view.

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Effect of Temperature on Hatching in the Cereal Root Eelworm

Unlike most other species of *Heterodera*, the larvæ of the cereal root eelworm (*Heterodera avenae* Wollenweber, 1924) do not hatch in response to diffusates of the host plant root[1]. The mechanism controlling hatching in this species has never been demonstrated, although it has been known for many years that in the field larvæ invade the roots of the host plant in the greatest numbers in spring and early summer[2]. Experiments carried out at the Welsh Plant Breeding Station during the summer and winter of 1961/62 indicate that, in the laboratory, hatching of the cereal root eelworm occurs in response to a rise in temperature after a period of low temperature.

In the first experiment cysts obtained from soil in July were stored in tap-water at 5° C. and at room temperature (12°–22° C.) for 90 days. At the end of that period both lots of cysts were set up to hatch in tap-water at 21° C. and over 14 days hatching was strongest among those which had been stored at 5° C. (Table 1).

Table 1. Mean Daily Hatch per 100 Cysts at 21° C.

After 90 days at room temperature	After 90 days at 5° C.
10·9	72·3

In a second experiment, cysts obtained from soil in October were set up to hatch in tap-water at 5° C. and at 21° C. Over 62 days there was no difference between the hatching under the two treatments; for the cysts at 5° C., the mean hatch was 9·4 per 100 cysts per day, while for the cysts at 21° C. the mean hatch was 8·8. However, when the cysts hatching at 5° C. were transferred to 21° C. the hatch during the next four days was 510 larvæ per 100 cysts, which was almost as great as the hatch for the whole of the previous 62 days. During this 4-day period only 2·8 larvæ per 100 cysts emerged from those cysts which were continued at 21° C. throughout.

These results appear to show that hatching occurs as a result of a rise in temperature after a period at low temperature; results of experiments still in progress agree with this view. It has been found, for example, that plants grown in infested soil which previously had been stored out of doors during the winter bore large numbers of mature cereal root eelworm females, while plants grown in the same soil which had been stored at 21° C. over winter bore almost none. It is possible, however, that the viability of the larvæ had been affected by storage at the higher temperature and this point is being investigated.

Clearly, and for the first time, larvæ of the cereal root eelworm have been shown to hatch in response to an external influence. The results appear to show that a period at low temperature is essential for the subsequent spring hatch of the cereal root eelworm, and that this occurs in response to a rise in temperature. In the field, cysts would not meet the abrupt rise in temperature to which they were subjected in these experiments, nor is it likely that they would ever be subjected to a temperature of 21° C., except perhaps for short periods in the surface layers of the soil. It is possible, however, that a smaller rise in temperature may induce hatching; this question is under investigation.

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Endogone Spores in Cultivated Soils

Using nematological methods of wet sieving and decanting with agricultural soils in Illinois, Gerdemann[1,2] extracted two types of large one-celled spores which gave endotrophic mycorrhiza of the phycomycetous type in inoculated plants. The larger of these spores, 183–812μ diam., produced arbuscules but not vesicles in infected roots. Clusters of echinulate one-celled spores were formed on external hyphæ[1]. A smaller spore, 133–288μ diam., induced typical vesicular-arbuscular infections and, in addition, produced on hyphæ surrounding the roots an *Endogone* sporocarpic stage and chlamydospores[2]. The chlamydospores were identical with those extracted from field soil and the sporocarps were similar to those produced by the unnamed mycorrhizal species of *Endogone* described by Mosse[3].

Using the same technique in the examination of cultivated soils from the Dundee area, numerous large one-celled spores have been observed. They range in size from 130 to 400μ diam., and also vary in shape, which may be spherical to irregular, or oblong. These spores are considered to be either chlamydospores or zygospores of species of *Endogone*. When extracted from soil they occur singly (Fig. 1) and do not appear to have been formed in sporocarps. Samples containing an abundance of spores have also been examined for the presence of sporocarps, but only a few small specimens have been found.

The spores can be divided into 6 distinct types which are recognized by differences in average size, in wall thickness and in the morphology of the hyphal attachment. In addition, each spore type has a characteristic colour which may be various shades of yellow or brown, and black. In some soils only one

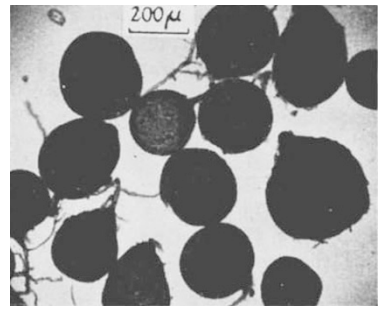

Fig. 1. Miscellaneous collection of spores extracted from soil of a wheat field