The morphological character used by Franklin[3] to separate species of *Heterodera* was, originally, the form of the male copulatory spicules, and *H. schachtii*, the species with bidentate spicules, was found to have a wide range of host plants. Recently, however, *H. schachtii* has been subdivided into several species, with, so far, no strictly morphological characters to distinguish them. The separation of these new species is based on measurements of the length of cysts, males, larvæ and eggs, certain habits and the host ranges.

Measurements of length and breadth, even when statistically significant, are of doubtful validity as specific characters since they take no account of variation that results from changes of food and environment, and are useless for the determination of individuals and for the separation of the component parts of field populations. Differences in the frequency with which eggs and males are found in the jelly protruded from the vulva are not sharply defined; besides, in the extraction of cysts from the soil the jelly is generally detached from the parent cysts. The inclusion of the host-range in the description of species is also open to grave objection because it precludes by definition any advance in the knowledge of their feeding habits.

The difficulty of distinguishing between *H. schachtii* and *H. cruciferæ* on cruciferous plants is further complicated by the fact that no study of the host-range of *H. schachtii* from Cruciferæ appears to have been made. *Heterodera schachtii* from *Beta vulgaris* is known to feed readily on a number of plants; but I have found no record of the host-range of *H. schachtii* after it has been established for some generations on Cruciferæ. It cannot be taken for granted that it will remain unchanged after such a radical alteration in the environment.

For the present, then, the field-worker is without good morphological or biological characters on which to distinguish the two species of *Heterodera* described from Cruciferæ. Investigations are now started at Wye College which, it is hoped, will provide some information on the behaviour of *H. schachtii* on cruciferous plants and perhaps enable it to be separated from other species on the same hosts.

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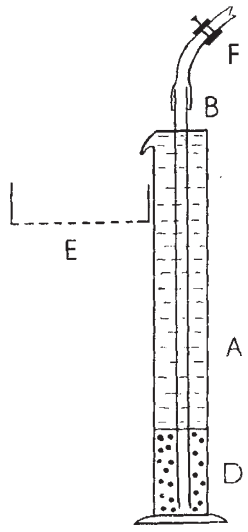
Feb. 26.

[1] Franklin, M. J., *J. Helminth.*, **21**, 71 (1945).
[2] Jones, F. G. W., *Ann. App. Biol.*, **37**, 407 (1950).
[3] Franklin, M. J., *J. Helminth.*, **18**, 193 (1940).

A Rapid Method for Estimating the Density of White Cysts of *Heterodera rostochiensis* on Potato Roots

Although there is little doubt that the best method of detecting and estimating infestations of *Heterodera rostochiensis* is by examining samples of air-dried soil, it is sometimes necessary to obtain an estimate of the density of white cysts present on growing roots. Chitwood and Feldmesser[1] describe a technique for this purpose using a 'nematode index', which is the number of white cysts which can be counted on a root in one minute. Although such a technique is interesting, we feel that when critical experiments are in progress it is unwise to confound true experimental effects with such personal factors as the varying rate at which different observers count. Moreover, it is important to be able to estimate the accuracy of any given technique so that the results can be analysed and significance-levels determined. The following method which we have used for obtaining a quantitative measure of numbers of cysts present on roots may, therefore, be of interest.



Representative plants, selected at random, are carefully lifted and each root with its adherent soil is transferred to a jar of 4 per cent formalin without delay. The roots can be stored in this until it is convenient to examine them, when they can be thoroughly brushed in a 'Petri'-dish of water to free the white cysts. The 'brushings' and remainder of the soil mass are now washed through a 25-mesh sieve and collected on a 100-mesh sieve. A brush with a moderately stiff bristle, for example, a soft tooth-brush, is recommended as the most suitable for removing the cysts with a minimum of damage. The roots are weighed before being discarded. The washings are transferred to a 100-ml. measuring cylinder and elutriated with a steady stream of water, as shown in the accompanying diagram; *A* is a 1,000-ml. measuring cylinder, the spout of which has been elongated after softening by heat to the shape shown; tube *B*, connected to a constant-head apparatus, extends to the bottom of the cylinder which contains the washings, *D*. The flow of water through *B* carries up the white cysts and other lighter soil particles over the lip into the 100-mesh sieve *E*. The rate of flow is adjusted by the screw clip *F*, so as to be just insufficient to bring over sand and other heavy soil particles. Five minutes elutriation per sample is sufficient. The elutriate obtained is washed, and then stirred with a saturated magnesium or zinc sulphate solution in a 100-ml. measuring cylinder. The white cysts float up from the debris and are poured into a second cylinder. Water is now added to make up to a known volume, and the mixture is agitated; separate 1-ml. samples are withdrawn for counts of the cysts. By simple computation the total number of cysts present on the whole root and also the density per gm. of root can be estimated.

Series totals of white-cyst counts from replicate plants within different treatments can be computed, and subjected to an analysis of variance. The technique can thus yield results of known accuracy, which are amenable to statistical analysis.

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Nov. 24.

[1] Chitwood, B. G., and Feldmesser, J., *Proc. Helminth. Soc. Wash.*, **15** (2), 43 (1948).