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Among other nematodes, root-knot specimens were collected from wheat roots var. Capeiti, C38290. They were identified as *M. artiellia* Franklin, 1961.

This root-knot nematode was first reported and described from England on cabbage grown in sandy loam in Norfolk. Other hosts noted by Franklin are oats, barley, wheat, kale, lucerne, pea, clover and broad bean.

All stages of the nematode were found. Second stage larvae were collected from soil samples and from egg masses. Males were found partly or completely within root tissue producing small knots of abnormal, dark coloured cells (Fig. 3), and were often seen near or around the partly embedded females. The mature females were flask or pear-shaped with neck tapering to a small head, and smooth, rounded posterior part with terminal vulva and annulated region around the tail. The perineal patterns were similar to those described by Franklin (1961) and Whitehead (1968) for *M. artiellia* (Figs. 1, 2).

Measurements.

5 ♀♀: L = 640 μ (611-675); width = 432 μ (357-458), dorsal oesophageal gland orifice 4.6 μ behind stylet base; vulva = 21 μ (20-22). Stylet = 14.3 μ . 10 eggs = 95 μ (90-99) \times 40 μ (40-40.3).

♂♂: L = 872-1090 μ ; width = 27.25-30.6 μ . a = 32.3-35; b = 11-14.3; c = 80-83; stylet = 21.8-23.2 μ ; spicules 25-27 μ ; dorsal oesophageal gland orifice 5.2 μ behind stylet base.

Many mature females were found only partly embedded in the root and covered completely by the gelatinous sac even before the eggs are laid. (Fig. 4). Wallace (1968) suggests that the egg sac protects the eggs against desiccation. The galls were characteristically small and lateral roots (3-6) had developed around them.

Pathogenicity of the nematodes was not tested. Specific symptoms of parasitism were not observed except the very small galls on the roots and the appearance of lateral roots. The above ground symptoms do not indicate the degree of damage by *M. artiellia* because of the presence of a number of other nematode species and probably fungi. However some reduction in growth is probably due to the presence of this species.

A field test with different chemicals is being established in the above area to determine the responsibility of the species found.

This is the first record of *M. artiellia* on wheat from Greece. It has also been recorded on colza in France, (Ritter, 1962).

FRANKLIN, M. T. (1961). A British root-knot nematode, *Meloidogyne artiellia* n. sp. *J. Helminth. R. T. Leiper Suppl.* 85-92.

RITTER, M. (1962). Répartition géographique et climatique des espèces du genre *Meloidogyne* en France. *Nematologica*, 7, 8 (Abstract).

WALLACE, H. R. (1968). The influence of soil moisture on survival and hatch of *Meloidogyne javanica*. *Nematologica*, 14, 231-242.

WHITEHEAD, A. G. (1968). Taxonomy of *Meloidogyne* (Nematodea: Heteroderidae) with descriptions of four new species. *Trans. zool. Soc. Lond.* 31, 263-401.

K. EVANS¹): Apparatus for measuring nematode movement.

Wallace (1958a) described a method for measuring movement of nematodes in soil at different suction pressures and temperatures. The soil is in polythene tubing, which is cut into sections and the nematodes extracted from the soil in each section by sieving. It is difficult to cut the polythene tubing, and cutting even with the sharpest knife squeezes the soil along the tube. Fig. 1 shows how Wallace's method was modified to overcome this difficulty. The polythene tubing was pre-cut into 1 cm lengths on a lathe with a sharp scalpel to get a true edge. The cut polythene rings were assembled in 8 cm lengths of glass tubing and attached to a sintered glass plate. The assembly was used as Wallace used lengths of polythene tubing (Fig. 1a). After introducing the nematodes, corks were pushed into each end of the glass tube leaving an air space but preventing loss of water by evaporation, which would have increased the suction pressure (Fig. 1b). Soil was replaced by

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sand as the medium for the nematodes and the distance they moved was measured by pushing the polythene rings out of the glass tube one by one into separate glass vials. The nematodes were extracted from the sand in each 1 cm section by shaking with water and decanting them into counting dishes.

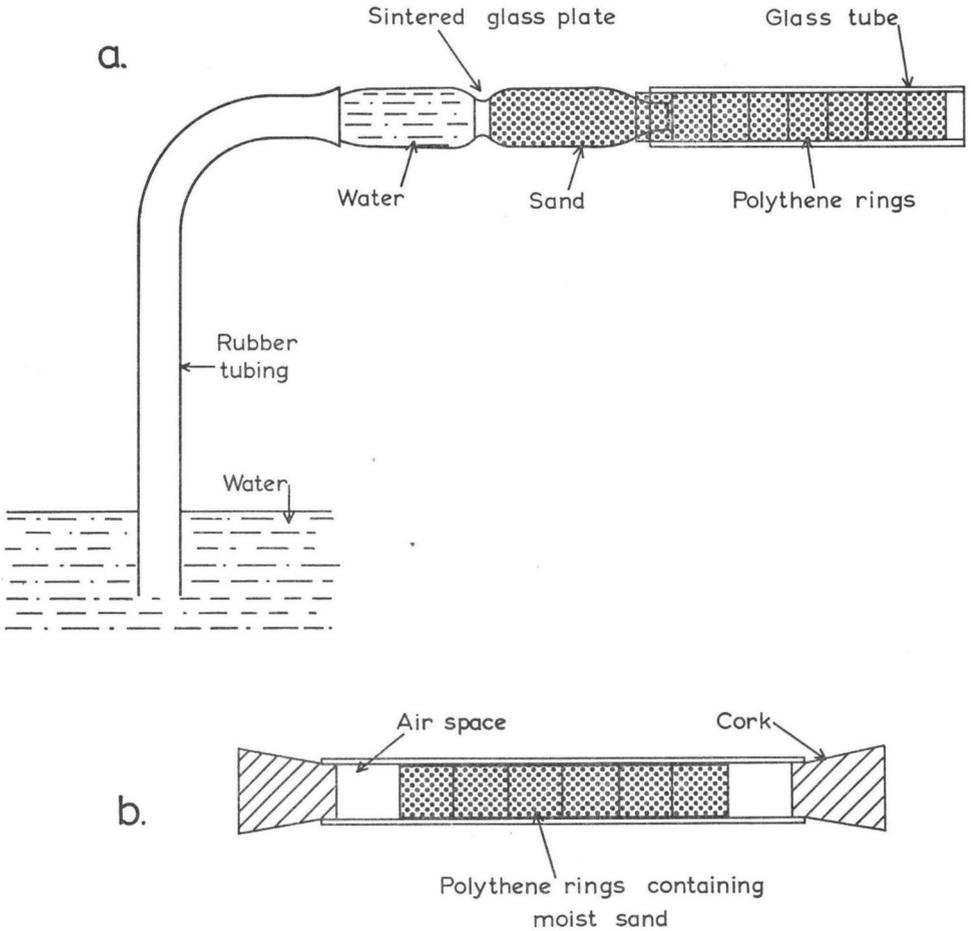


Fig. 1. Modification of Wallace's apparatus for investigating nematode movement.

Studies were made on the influence of several factors on the movement of males of *Heterodera rostochiensis* in sand of particle size 250-750 μ which should be near the optimum for movement assuming that the best size for movement is one third of the nematode's body length (Wallace, 1958b).

Water content of the sand, temperature and the period allowed for movement all affected the average distance males would move along a 6 cm tube. Movement was greatest at water contents closest to the point of inflection of the moisture characteristic curve for the sand, but the males ceased moving after about 48 hours in the tubes. When the temperature was lowered to 5°C there was virtually no movement under any conditions.

The average distance moved by *H. rostochiensis* males rarely exceeded 1 cm, even with the best conditions for movement, but putting white *H. rostochiensis* females in the tubes made them move much farther. Within 72 hours many moved along a 6 cm tube to a group of three females and along a 15 cm tube to a group of ten females. Females kept in water rapidly lost their attractiveness,

and the water then activated males. When added to the tubes, males in them moved much more than otherwise and became evenly distributed along the tubes. *H. rostochiensis* males were not attracted to *H. schachtii* females, and were not activated by extracts from *H. schachtii* females. This not only confirms Green's (1966) conclusion that *H. rostochiensis* females secrete a chemical attractive to their males, but suggests that it is a specific attractant and that it also activates the males, a conclusion shared by Green (pers. comm.).

Adding solutions of inorganic salts to the sand in the tubes usually had no effect on the activity of *H. rostochiensis* males. However, with 0.05% MgSO₄ added to acid-washed and oven-dried sand, males were attracted to the ends of the tubes; this was attributed to the sand adsorbing the chemical and forming concentration gradients. Ibrahim & Hollis (1967) found that *Tylenchorhynchus martini* swarms were attracted on agar plates to sources of AlCl₃ and CdCl₂. However, when the technique of Greet, Green and Poulton (1968) for assaying sex attractants on agar plates was modified to test a range of concentrations of MgSO₄ there was no evidence that *H. rostochiensis* males are attracted to this chemical.

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Nematologica 15 (1969): 434-435. E. J. Brill, Leiden

BOOK REVIEWS

Annual Review of Phytopathology — Edited by James G. HORSFALL and Kenneth F. BAKER. Annual Reviews, Inc., Palo Alto, California, U.S.A. (Vol. 6) 456 pp. \$ 8.50 (U.S.A.), \$ 9.00 (Foreign) per volume.

The sixth volume of this series maintains the very high standards of the previous issues. In fact, I know of no comparable regular publication in plant pathology that gives one as broad and up-to-date an assessment of the discipline than does the Annual Review of Phytopathology.

The paper of most interest to nematologists in the sixth volume is that by H. R. Wallace "The Dynamics of Nematode Movement". But I would also commend the article by P. W. Miles "Insect Secretions in Plants" and that by Ralph Baker "Mechanisms of Biological Control of Soil-Borne Pathogens" to all nematologists. Of course, those readers with a broad interest in plant pathology will find all of the articles to be extremely valuable.

As Wallace notes, the purpose of his review is "to collect and weld together one aspect of nematode behaviour, movement, and in so doing to state a series of hypotheses on how nematodes move under various environmental conditions".

Wallace uses a short introduction to set the scene by defining the importance of movement in the survival of any animal and by showing that undulatory propulsion is the single basic type of locomotion used by almost all nematodes in all major activities.

The sections following the introduction discuss movement relative to a number of distinct activities, viz., within the egg, hatching, in the soil, in water films, and in relation to the host. In a section "Factors Influencing Movement in Soil", Wallace assesses the effects of pore size, soil