The nematodes are a very common and widespread group of animals. Most of them are free-living (i.e., are not parasites), and these are to be found in soil, and in fresh and salt water, in large numbers. They may also turn up in the most unlikely places such as vinegar, or in book-binder’s paste that has turned sour. Although these free-living nematodes are so common, few people ever see them because they are usually less than 1/20” long, and usually very thin and transparent. A microscope is needed to examine them.

Another group of nematodes is parasitic in animals and in man; most of these are quite large and can be seen with the naked eye: the “round-worms” of dogs and cats and pigs, and the pin-worms of children, are examples.

A third group of nematodes is responsible for damaging plants, either as true internal parasites (living within the plant tissues) or as external parasites, sucking the plant sap from the outside. More than 70 different species of internal plant-parasites are known at present and almost as many external parasites. Most of the latter live in the soil around the roots, which they attack, but a few are found above ground in the developing leaf-buds. Of the true internal plant parasites, some species live in the roots, others in the stems, or in the leaves or flowers.

Most of the plant parasites are too small, thin and transparent to be seen without a microscope so, if you see worm-like animals wriggling about in plant tissues, you can be fairly certain they are not nematodes: they are more likely to be insect larvae.

Usually, any one species of nematode will attack only a few different kinds of plants, and that gives us our best method of control: by rotation of crops.

Nematode diseases, in animals as well as in plants, are mainly a product of civilization. Under wild, natural conditions a rough balance is achieved — a kind of “live and let live” arrangement. The parasites are there, in small numbers, but they rarely cause disease. Thus the semi-wild sheep that roam the Welsh mountains have a few nematode parasites, but no nematode disease. The sheep have a free range over a vast area so that the ground never becomes badly contaminated with nematode eggs. But, herd these sheep together in large numbers on confined pastures, and in a few years young lambs are dying of nematode diseases. The reason is that herding together in a confined space leads to an enormous multiplication of the parasites, to a level never found in nature. The sheep can stand a certain number without harm; above that number symptoms of disease appear, and finally the parasite gets the upper hand.

It is rather similar with plants. Although they do not range around,

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THE GOLDEN NEMATODE IN BRITAIN

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they are found under wild conditions scattered about, singly or in clusters, with other kinds of plants in between. Even if one cluster gets attacked by nematodes, and even destroyed, the nematodes have a difficult task in finding other plants of the same species nearby. But if you bring together a lot of plants of the same species in one field, and keep growing them there year after year, conditions are ideal for the multiplication of nematodes (and other pests and diseases). Of course, if the particular species of nematode which attacks that plant is not present, you may “get away with it” for a long time. But the chances are that, sooner or later, the parasite will be accidently introduced and then, sooner or later, disease is almost certain to follow.

This happened to the potato crop in the British Isles. Potatoes have been grown there for hundreds of years. But when the human population jumped from 9 million in 1800 to 33 million in 1900, potatoes began to be grown intensively. Specialist potato farmers appeared, growing nothing but potatoes, year after year, on the same land. They had their troubles. Blight would sometimes ruin the crop. But, on the whole, they got away with it. Then, early in this century, a new parasite appeared (from God knows where): the “golden nematode.” It was first found in Scotland in 1913 and in England in 1917, but by that time it must have been already widespread, and in sufficient numbers to cause disease. It now infests more than half our potato land in all the principal potato growing areas.

In the same year, 1913, it was found in Germany and shortly after in Denmark and Sweden. Since then it has been found in all countries round the Baltic Sea, and in recent years has invaded Holland, Belgium, France, and Austria. Outside Europe it has been found in Long Island, and (last year) in South America.

Long Island is not far away. The Federal Quarantine Service is making a valiant attempt to keep it from spreading to the mainland. But, sooner or later it may cross the Sound. It may have crossed already, for it might be present in a soil for several years before there is a reasonable chance of detecting it. You may, therefore, be interested to know something about it.

The Golden Nematode is a species of *Heterodera*, and all the Heteroderas are highly specialized as internal parasites of the underground parts of plants. The larvae and the adult males are thin, transparent, and worm-like, like most other nematodes, but the females are quite untypical. Instead of laying their eggs, they retain them inside the body, which swells up to a spherical shape with a neck sticking out, like a child’s balloon. The young stages live wholly within the root, feeding on the plant tissues, but the swollen part of the female bursts through to the outside in some 4 or 5 weeks after infection. At this stage the females are transparent but, in a few weeks, they turn a golden yellow and then brown. This is an outward sign of an inward chemical change, for the outer skin becomes tanned to a leather-like substance. At this stage the female worm dies and drops away from the root into the soil: a dead, leather bag packed with living eggs. These brown, dead females are the so-called “cysts.” They measure about 1/50 inch across and are just visible to the naked eye under favorable conditions: the golden yellow stage attached to the roots is the most clearly visible.