à revoir

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# Preliminary Report on the plant parasitic nematodes in the Republic of the Gambia.

by

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The present report gives an account of the observations carried out by the authors during a short visit (5th till 7th April 1972).

The main reason for this mission was to make a preliminary study of the plant parasitic nematodes in the vegetable crops in the region of Bathurst . The results of the analysis of a few samples from Sapu, sent by Mr BANNISTER are included in the present report.

This, as well as supplementary missions in the future, are carried out on the request of the Gambian Authorities in order to collect the informations necessary for a general survey of nematodes attacking the main crops of the Gambia.

The authors wish to express their gratitude to the Gambian Authorities, particularly to Dr. MARENAH, Director of the Department of Agriculture, for their friendly reception. The assistance, in the field, of Mr T. BANNISTER and Mr. J. GREENHOW whose competence was highly appreciated, has been of great help.

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Studies carried out in different countries of West Africa, and especially Senegal, by nematologists mainly belonging to O.R.S.T.O.M. have shown that the most important problem in vegetable crops is formed by the nematodes belonging to the genus Meloidogyne or "root-knot nematodes". Therefore, our attention has been focussed on these parasites.

Samples, consisting of roots and Soil around have been collected in the different regions visited.

In the laboratory, nematodes present in the soil have been extracted by SEINHORST's elutriation method while eelworms inside the roots were separated by the use of mist-chambers.

## I ROOT-KNOT NEMATODES

These parasites, belonging to the family of the Heteroderidae, are sedentary endoparasites whose life-cycle is a follows : the second stage larvae are moving freely in the soil. They penetrate in roots and fix themselves with their head placed in the central cylinder. Then, their undergo two moults transforming them in the adult stage. If the adult is a male, he leaves the root in order two seek females. As far as the Meloidogyne species are concerned, males are rare and their role in reproduction is doubtful. These species are actually parthenogenetic, meaning that the reproduction takes place without involvment of a male germ cell. If the adult is a female, the animal increases considerably in size during the formation of the eggs. She swells and becomes subsphaerical in shape ;

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# TABLE 1

## Root-knot nematodes (Meloidogyne)

| Plant | Variety | Place | Soil (larvae p. liter) | Roots (larvae p. gram) |
|---|---|---|---|---|
| Tomato 1 | 100 fold | Cape Point | 4.980 | 1.206 |
| 2 | Manalucie | Mile Seven | 300 | 64 |
| 3 | ? | Abuko | 35.500 | 2.963 |
| 4 | Rehovot | Darisalami | 13.800 | 204 |
| 5 | ? | Darisalami | 0 | 113 |
| 6 | local | Gunju | 365.000 | 3.150 |
| 7 | local | Gunju | 22.400 | 1.969 |
| Lettuce 1 | ? | Abuko | 720 | 10 |
| 2 | Great lakes | Darisalami | 2.140 | 591 |
| 3 | ? | Sapu | 1.700 | |
| Sweet pepper 1 | ? | Cape Point | 118.200 | 5.273 |
| 2 | ? | Mile Seven | 41.700 | 566 |
| 3 | ? | Sapu | 16.880 | |
| Eggplant 1 | ? | Cape Point | 12.480 | 628 |
| 2 | Black Beauty | Mile Seven | 1.180 | 1 |
| 3 | ? | Sapu | 29.680 | |
| Bitter tomato 1 | ? | Sapu | 16.960 | |
| 2 | ? | Sapu | 136.800 | |
| French bean | Primeur | Mile Seven | 0 | 6 |
| Melon 1 | Ogen | Cape Point | 0 | 57 |
| 2 | Congo | Cape Point | 120 | 19 |
| 3 | Ogen | Yundum | 1920 | 411 |
| Onion | ? | Gunju | 1.000 | 421 |
| Tobacco | ? | Sapu | 20 | |
| Banana 1 | ? | Yundum | 56.000 | 1.236 |
| 2 | Dwarf | Darisalami | 7.860 | 683 |
| 3 | ? | Cape St Mary | 2.760 | 61 |
| 4 | ? | Sapu | 24.000 | |
| Papaw 1 | local | Yundum | 0 | 1.661 |
| 2 | local | Yundum | 0 | 10 |

(1 = one , 7 = seven)

often, the posterior part of the female bursts out of the plant tissue surrounding the animal. Most eggs are deposited in a gelatinous mass secreted by the female. Under favourable conditions, these eggs hatch in the soil, constituting, in turn, a new population of second stage larvae able to penetrate the roots, thus forming the new generation.

Countings relate only to second stage larvae extracted either from soil or from roots where they existed as unhatched eggs attached to females. Table 1 shows the results obtained on eight vegetables as well as tobacco and two fruit crops :banana and pawpaw, both know to be susceptible to these parasites.

It is concluded that Meloidogyne exists in all the areas visited. In most cases, the populations are important and sometimes even of considerable size, ranging up to 300.000 nematodes per liter of soil or 5.000 per gram of root.

This remark might give the impression that the crops in the visited areas are all subject to particularly strong attacks. As a matter of fact, numerous observations on root systems have been made in all the fields, but samples were only taken from those plants showing symptoms very clearly i.e. with a great number of galls.

As usual, tomato is the plant most frequently and badly attacked. It must be noted, however, that the attacks varied considerably from one point to another in the same field or the same garden. Often, plants situated in a part of a field were the soil was particularly dry only had very few galls. The bad growth shown by these plants was probably due to dryness. In one case (n°5) no larvae were found in the soil though a number was extracted from the roots. It concerned tomatoes planted in an old rice field at Darisalami after a culture of rice. The roots where showing galls and 113 larvae per gram of root have been extracted in the mist chamber.

It is well known that Meloidogyne larvae do not resist to a prolonged submersion, which explains that no larvae were found in the soil. However, the tomato plants were transplanted from a nursery established outside the rice field, on an infested soil. Therefore, symptoms observed on the roots were due to Meloidogyne that had penetrated the roots while the plants were in the nursery. This shows the importance of the period in the nursery with regard to the infection and it is of the greatest importance that nurseries should be freed from nematodes by treatment, with a nematocide for example.

The greatest populations have been found on local varieties of tomato, especially those with small fruits. It is very well possible that, among the varieties grown in the Gambia, some show an interesting degree of resistance to Meloidogyne. Thus, the variety "Mecheast" seemed less attacked in the field. A systematic test of these varieties, in the laboratory, might present a certain interest.

Medium to rather heavy attack have been observed on lettuce, egg plant and melon, plants known for their susceptibility to root-knot. One fact must be mentioned : sometimes even heavy populations have been observed on sweet pepper. However, this plant is not always attacked, it seems that the nature of the parasites present in the soil determine the degree of infestation. Thus, in certain areas of Senegal, sweet pepper is not attacked whereas it is in others. It is evident that virulent pathotypes exist in the Gambia, therefore sweet pepper should be used in crop rotations with caution.

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A medium population has been observed on onion though this plant , in general, is considered resistant in Africa, but here again, it must be noted that numerous root systems of onion have been observed during our trip and that they were almost always free of nematodes. The observation mentioned in table 1 is exceptionnal because the sample just was taken because some symptoms were visible.

The local variety of pawpaw is medium susceptible whereas a plant of the variety "Dwarf Chinese", though standing near an attacked plant of the local variety, was free of nematodes.

Medium to high populations have been found in soil and roots of banana plants.

## II NEMATODES NOT BELONGING TO MELOIDOGYNE

Apart from root-knot nematodes, fifteen other phytoparasitic genera have been found. Table 2 shows their occurence on vegetables, banana plants, pawpaw , citrus and rice.

The genus most frequently encountered is Helicotylenchus. This is no very surprising as many species belong to this genus which as been almost always found in samples from Senegal as well in the Northern part of the country as in the Casamance region. As far as nematode populations found around banana roots are concerned, a special remark must be made. In these cases the species present is H. multicinctus, a nematode well known for its parasitism to banana. Radopholus similis, a despread parasite of this plant, has not been found in the region of Bathurst. It must be stated that banana growing in gardens were examined and that R. similis, existing in almost the whole area where bananas are cultivated, notably in the Casamance, should be present if plantations were established. In fact, this nematode is tranferred with the suckers serving as planting material. Denematisation treatments have not been developped for bananas belonging to the group "Sinensis" (in contrast with the "gros Michel" banana). Nematocide treatments in the field are pratical in numerous African countries like Ivory Coast and the Cameroons. They are efficacious as well as financially very satisfactory. It must be noted that H. multicinctus, on its own, as shown in Israel, may cause serious damage.

The genus Scutellonema is frequently encountered in Senegal in the vicinity of the roots of numerous plants ; it sems to be the same case in the Gambia. The parasitism of the species belonging to this genus seems to be weak towards vegetables and, in spite of their frequent presence, they seem not to cause appreciable losses to these crops.

On the other hand, the repeated presence of the genus Rotylenchulus in the nematode distribution is worth while being considered. In fact, this very polyphagous genus frequently encountered in West Africa, is well known for its parasitism towards many plants. At least in one case, it has been established, in Ghana, that it has caused severe losses to tomato. Very high populations of it have been found around the roots of pawpaw , which is one of the best hosts of the most frequent species : R. reniformis. It is also associated with citrus trees (orange and rough lemon used as root stocks) at the Yundum nursery and at Cape St Mary.

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# TABLE 2

## Nematodes other than root-knot

(S = in soil - R = in roots)

| | Tylenchorhynchus | Helicotylenchus | Scutellonema | Rotylenchulus | Pratylenchus | Hirschmanniella | Trichotylenchus | Heterodera | Criconemoides | Hemicriconemoides | Hemicycliophora | Aphelenchus | Aphelenchoides | Xiphinema | Trichodorus |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tomato 1 | | S | | | | | | | | | | | | S | |
| 2 | | S | S | S | | | | | | | | S | | | |
| 3 | | S | S | S | S | | | | | | | S | | | |
| 4 | | S | S | | S | | | | | | S | | | S | |
| 5 | | | | | | S | S | | | | | | | | |
| 6 | | | S | | S | | | | | | | | | | |
| 7 | | S | S | | S | | | | | | | | | | |
| Lettuce 1 | S | | S | S | | | | | | | | | | | |
| 2 | | S | S | S | | | | | S | | | | | S | |
| Sweet Pepper 1 | | S | S | S | | | | | | | | | | S | |
| 2 | | S | | | | | | | | | | S | | | |
| 3 | | S | | | | | | | | | | | | | |
| Egg plant 1 | | S | | | | | | | | | | | | | |
| 2 | | S | S | SR | | | | | | | | | | S | |
| 3 | | S | S | | S | | | | | | | S | | | |
| Bitter tomato 2 | | S | | | | | | | S | | | | | | |
| French bean | | S | | | | | | | | | | S | | | |
| Melon 1 | | S | S | | S | | | | S | | | | S | S | |
| 2 | | S | S | | S | | | | | | | | | S | |
| 3 | | SR | S | S | | | | | | | | | | | |
| Onion | | | SR | S | S | | | | | | | | | | |
| Banana 1 | | S | | | | | | | | | | | | | |
| 2 | | SR | S | | | | | | S | | | | | | S |
| 3 | | SR | S | | | | | | | | | | | | |
| 4 | | SR | | | | | | | | | | | | | |
| Papaw 1 | | S | S | S | | | | | | | | | | | |
| 2 | | S | S | S | | | | | | | | | | | |
| Citrus 1 | SR | S | SR | | S | | S | | | | | | | S | |
| 2 | | SR | | SR | | | | | | S | | | | S | |
| Rice | | | | | | SR | S | R | | | | | | | |

The genus Pratylenchus is known for its virulence to some plants, as well in Senegal as in other countries of West Africa. However, animals belonging to this genus are endoparasites and no Pratylenchus has been extracted from the roots of a vegetable. Therefore, it is probable that they have been met by chance, these animals being parasites of another plant, probably a wild graminea.

Three parasitic genera have been seen associated with rice Hirschmanniella, Trichotylenchus and Heterodera. They are generally encountered in and around the roots of this crop in Senegal and in the other countries of West Africa where surveys have been carried out on rice. Their specific determination is in progress.

The presence of the other genera around the roots of vegetable crops is of no economic importance.

In brief, apart from Meloidogyne, the only genus to which a certain attention must be paid, on vegetables, is Rotylenchulus.

## III CONCLUSION

As could be expected, the main if not the only nematological problem on vegetables of the region of Bathurst is constituted by Meloidogyne species. Several methods can be used to control these parasites. They all have been reviewed by NETSCHER (1970) in a paper dealing with nematodes of vegetable crops in Senegal.

Soil fumigations with nematocides applied with hand injectors should be suitable, but these treatments are very expensive. On the other hand, they can supply an excellent way of disinfecting nurseries.

Soil dessication obtained by ploughning at the begining of the dry season is fairly effective but it induces an erosion of the soil and a destruction of the organic matter, a subsequent application of organic manure being necessary.

The flooding of the soil, too, destroys almost all the Meloidogyne. Thus, in Senegal, in the periodically flooded "niayes" these parasites have no economic importance. From this point of view, it should be a good practice, where it is possible, to grow tomatoes in the dry season on low lands where paddy has been grow during the wet season, provided that the young plants come from nurseries previously treated against nematodes, or, better, that tomatoes are sown directly in the fields. Unfortunately, it is only possible in a small proportion of the fields where vegetables are grown.

The best way of limiting the losses due to Meloidogyne will consist of crop rotations, in which susceptible plants alternate with resistant ones. Thus, the parasites will not be entirely destroyed, as such a destruction is almost impossible, but the populations of parasites in the soil will decrease to a level sufficiently low to avoid important losses. Unfortunately, these rotations are difficult to establish for almost all Meloidogyne species attack a great number of plants, the host range varying largely between species and even between populations of different localities.

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Among plants which are not or scarcely attacked by Meloidogyne in West Africa, onion, strawberry and groundnut must be cited. Though sweet pepper often shows varying degrees of resistance, this seems not to be the case in the Gambia.

In normally susceptible plants, varieties have been bred which are resistant. But this resistant varieties must be used with caution for, if they are grown continuously on the same soil, there will be a kind of adaptation of the parasites and resistance breaking races will appear (B races). Thus repeated cultures of a resistant variety on the same plot should be avoided. Presently, several resistant varieties of tomato and one of French bean are available.

It is therefore impossible to define a type of crop rotation suitable for every area. It should be recommended to establish simple rotation trials in some localities where vegetable crops are grown to some extent.

This brief prospection reported here represents only the first stage of a more extended operation dealing with the nematodes attacking the main crops of the Gambia.

A second prospection, covering a longer period, will be carried out in September 1972. In a final paper, the general results will be reported. It is possible that, on other plants, more detailed studies should be undertaken. In such a case, possibly, assistance of O.R.S.T.O.M. could be envisaged.