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Survey on the plant parasitic nematodes associated with various crops in the Republic of the Gambia.

by

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This report follows a first one appeared in June 1972 (Luc & Merny) dealing with parasitic nematodes of vegetable crops in the region of Banjul.

The mission reported here has been carried out by the authors from the 1st to the 6th of october 1972 and is part of an agreement between the Government of the Gambia and the O.R.S.T.O.M. The purpose of this mission was to carry out a rapid prospection of parasitic nematodes on rice and other food crops, especially graminea and cotton.

The following samples have been taken :

n° 1 Paddy - Darisalami
n° 2 " - Mankamankunda
n° 3 " - Saruja
n° 4 " - Sakarikunda, Georgetown ferry, southern shore
n° 5 " - Georgetown ferry, northern shore (prisonner's field)
n° 6 " - Wassu
n° 7 " - Niani Maru Bakadaje.
n° 8 " - Niani Maru Jeilan
n° 9 " - Bansang (southern shore)
n°10 " - Kudang
n°11 " - Jarreng
n°12 " - Donkunku
n°13 " - Pakali Ba (chinese fields)
n° 14 " - road from Pakali Ba to Japenni
n°15 " - Sibanor
n°16 Maize - Crop rotation trial - Mixed Farming Center Jambanjelly
n°17 " - Pirang (Mixed Farming Center).
n°18 Sorghum Mankamankunda.
n°19 " - Jaromeh
n°20 " - Niani Maru Jeilan
n°21 " - Yonah
n°22 " - Sare N'Gai (Mixed Farming Center)
n°23 " - Donkunku (Mixed Farming Center)
n°24 Millet - Kuntaur (Mixed Farming Center)
n°25 " - Kudang
n°26 " - Genoi
n°27 Cotton - Dioulangel
n°28 " - Mankamankunda (Mixed Farming Center)
n°29 " - Kulari
n°30 " - Kulari

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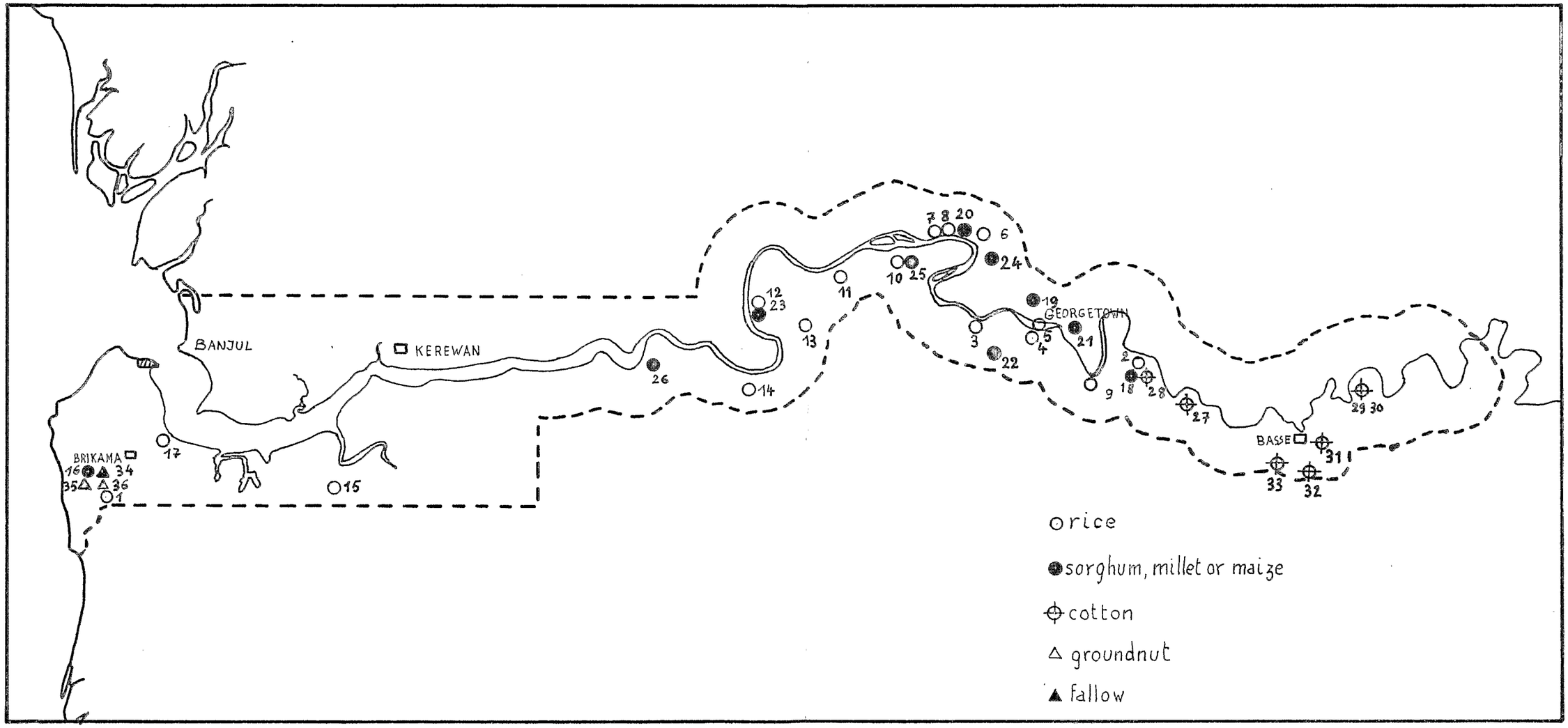
BANJUL
KEREWAN
BRIKAMA
GEORGETOWN
BASSE
7 8 20
6
24
10 25
12
23
11
19
13
3
5
4
21
22
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9
18
28
27
29 30
31
33
32
26
14
17
15
16
34
35
36
1
orice
sorghum, millet or maize
cotton
groundnut
fallow

B6166

n° 31	Cotton	- Jiruba Kunda
n° 32	"	- Sabi
n° 33	"	- Dembakunda
n° 34	Groundnut	- Crop rotation trial. Mixed Farming Center Jambanjelly
n° 35	"	- same place
n° 36	Fallow	- " "
n° 37	Yam	- Kunkujan.

The geographical position of the different points where samples were taken is indicated on the map, figure 1.

The following nomenclature has been adopted to describe the different degrees of importance of the populations found in the soil and the roots.

	Soil (per dm^3)	Roots (per gram)
Very low	$\leq$ 50	$\leq$ 5
Low	51 - 200	6 - 20
Fair	201 - 1000	21 - 100
High	1001 - 5000	101 - 500
Very High	> 5000	> 500

I SPECIES OBSERVED

The list mentioned here has been established from a rather small number of samples and cannot give a complete picture of the nematode forms present but will give an idea of the most common nematodes present in the regions that were visited.

ORDER : TYLENCHIDA

Super-family : TYLENCHOIDEA

Family : Dolichodoridae

Genus : Tylenchorhynchus Cobb, 1913.

- Tylenchorhynchus n. sp. This species has been discovered in Senegal in millet and sorghum soils. The nematode is widespread in this Country where it often has been found in fields of upland rice, cotton, groundnut and maize. In the Gambia, fair to very high populations are present in numerous fields of cotton, sorghum and millet. This species has never been found in flooded paddy fields.

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- T. mashoodi Siddiqi & Basir, 1959 (syn : T. elegans, Siddiqi 1961). This species that has been found in Ivory Coast in flooded paddy fields (Merny, 1970) and in Senegal on rice and on sorghum has only been found once in the Gambia in a flooded paddy field in fair numbers.

- T. spp. In a few fields, nematodes belonging to this genus have been found in small to very small numbers in the vicinity of roots of rice, groundnut, maize and cotton. As no adult animals have been found, it has not been possible to identify them.

- Genus Uliginotylenchus Siddiqi, 1971. Two species of this genus, very close to the genus Tylenchorhynchus have been found in certain paddy fields in the Gambia. These species have also been found in paddy fields in Ivory Coast and Senegal.

U. rhopalocercus (Seinhorst, 1963) Siddiqi, 1971. This species is common in rice fields in Ivory Coast, it has also been found in three paddy fields in the Gambia in low to fair populations A parasitic relationship with rice seems very probable.

U. palustris (Merny & Germani, 1968) Siddiqi, 1971 found in two paddy fields in the Gambia, also seems to be a specific African species, because it has been discovered in paddy fields in Ivory Coast and also found in several paddy fields of the Casamance.

Family : Belonolaimidae

- Genus Telotylenchus Siddiqi, 1960.

Though this genus is widespread in Senegal where one species : T. ventralis Loof, 1963 has been found in millet and sorghum fields, it seems rather rare in the Gambia. It has been found however twice, associated with sorghum in important populations, once to millet and once to cotton.

A high population of another species has been found once in the Gambia, associated with sorghum. Most probably, T. paaloofi Tikyani & Khera, 1970, is concerned in this case, though the stylet is clearly shorter than the one described in the original population (17 - 18 µ against 19 - 21 µ).

Genus Trichotylenchus Whitehead 1959

- T. falciformis Whitehead, 1959. Originally discovered in the vicinity of roots of gramineae in Tanzania, has also been found near

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roots of sugar-cane in the Congo (Luc, Merny & Netscher, 1964) on rice in Zaïre (Coomans & De Grisse, 1963) and on sorghum and millet in Senegal.

In the Gambia, it is sometimes associated with rice, groundnut and with maize but most frequently and in rather important numbers with millet and sorghum. Though it seems to concentrate in rather high numbers around certain gramineae, thus suggesting a certain parasitism, it has not been possible to show any pathogenicity towards any plant up to now.

Family : Pratylenchidae

Genus ; Pratylenchus Filipjev, 1936

This genus widespread in Africa, where it sometimes causes important damage to certain crops . Three species have been found in the Gambia :

P. brachyurus (Godfrey, 1929) Filipjev & Schuurmans-Stekhoven, 1941. This species, omnipresent and polyphagous is associated with numerous crops in Ivory Coast, Central African Republic and Congo (Luc, Merny & Netscher, 1964). It causes decreases in yield on cassava(de Guiran, 1965) in Togo and Caveness (1967) mentions its presence in Nigeria in a wide range of crops. Though relatively rare in Senegal, it is clearly more frequent in the Gambia where it has been found associated with groundnut, maize and cotton, in rather important populations and in soil of a field under fallow.

Pratylenchus n. sp. This species, presently being described has been discovered in the Casamance where it causes important yield reduction on certain gramineous food crops, notably maize. It is the most frequently encountered species in Senegal and this also is true for the Gambia where it has been found in high to very high populations and associated with maize, cotton, sorghum and millet.

P. zeae Graham, 1951. This species is an important parasite of rice in Louisiana (Atkins, Fielding & Hollis, 1957). Though it is rarely met in Africa, it is found occasionally, however, in certain countries geographically separated by long distances. The authors have found this parasite on rice and maize in the Casamance, on rice in Ivory Coast (Merny, 1970) and on sugar cane in the Congo (Luc, Merny & Netscher, 1964).

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In the Gambia, P. zeae has been found in only one field and high populations of this nematode, mixed with P. brachyurus have been extracted from roots of maize.

Pratylenchus spp. In four fields, animals belonging to this genus have been found in low to fair populations in groundnut, sorghum and millet. Because of the absence of adults, it has not been possible to make any determination.

Genus Hirschmanniella Luc & Goodey, 1963.

Two serious parasites of rice in West Africa, H. oryzae (V. Breda de Haan, 1902) Luc & Goodey, 1963 and H. spinicaudata (Schuurmans-Stekhoven, 1944) Luc & Goodey, 1963, belong to this genus. The geographical distribution of these two species in West Africa is such that, if one excludes North Cameroon with its obvious continental climate, H. spinicaudata is mainly found in the forest or semi-forest areas (Ivory Coast, Casamance) whereas H. oryzae is predominant in countries with a dry climate (Upper-Volta, Mali, North Senegal).

In Senegal, these two species are present in the North, as well as in Casamance, though H. oryzae predominates in the North, whereas the second one is more frequent in the Casamance.

Though the two species are present in the paddy fields of the Gambia, H. oryzae has been found in eleven of the fifteen fields sampled, in almost always high to very high populations, whereas H. spinicaudata was only present in six fields, in small numbers and always mixed with the former species. This shows, as one could expect, that the Gambia is a transitory area between the North Senegal and the Casamance as far as the repartition of Hirschmanniella species is concerned.

Family : Hoplolaimidae

Genus : Hoplolaimus Daday, 1905. This genus has been observed only once in the Gambia in the soil of a groundnut field. Only one male has been observed, that probably belongs to the species H. pararobustus (Schuurmans-Stekhoven & Teunissen, 1938) Sher, 1963.

Genus Scutellonema Andrassy, 1956. As far as we know, this genus is only represented in Senegal by one species : S. cavenessi Sher, 1963. In the Gambia, this species is also predominant. Omnipresent, in populations generally high to very high, it has been found

associated with millet, sorghum, cotton groundnut and maize.

Another species has been found in the Gambia : S. bradys (Steiner & Lehew, 1933) Andrassy, 1958 ; in this case, a very high population was found in a tuber of yam.

Genus Peltamigratus Sher, 1963

The only species observed in the Gambia : P. nigeriensis Sher, 1963, has been found only once as a mean population around roots of millet. This species is occasionally found in Senegal, in the vicinity of roots of upland rice and millet.

Genus Helicotylenchus Steiner, 1945.

This genus, that has been found in high to very high populations in all the fields of millet, sorghum, groundnut, maize and cotton and more rarely and less abundantly in paddy fields, is represented by only one species that belongs to a group where the distinction between species is very difficult. Though ressembling by certain characters H. pseudorobustus (Steiner, 1914) Golden 1956, we classify this species, at least preliminary, as H. dihystera (Cobb, 1893) Sher, 1961. The high populations observed strongly suggest that a parasitic relation exists between this species and the plants around which it has been observed.

Family : Heteroderidae

Genus : Heterodera A. Schmidt, 1871.

This genus includes several species causing great damage to important crops in temperate regions, for example : H. rostochiensis on potato and H. schachtii on sugar beet. Though rarely present in the tropics, the genus Heterodera includes two African species : H. oryzae Luc & Berdon 1961, known on flooded rice in Ivory Coast, and H. sacchari Luc & Merny, 1963, also frequent in the same country on flooded rice and that also has been found on sugar-cane in the Congo (Luc & Merny, 1963) and in Nigeria (Jerath, 1968).

Though these two species have been successfully inoculated on other cultivated or wild gramineae, they only have been observed in nature on rice and sugar cane. In the Gambia, it is for the first time that Heterodera has been found associated with sorghum (in two cases) and with millet (in one case). Larvae belonging to the second stage (the only stage that is mobile in this genus) have also been observed in the soil of a field under fallow. Though this genus is relatively frequently met in the Casamance on rice, it is rarely present in the

Gambia on the same crop. In one field only, a few larvae have been observed.

The identification of the species is long and difficult. However, it seems that in this case, we are not dealing with H. oryzae but with another species closely resembling or identical to H. sacchari.

The Heterodera found in the Gambia are reared in the laboratory and a study on their morphology, their biometry, their cytology and their host range is on its way.

Genus : Meloidogyne Goeldi, 1887.

Only a few second stage larvae belonging to this genus have been observed in the soil in the vicinity of roots of millet. It seems that this genus, whose importance in vegetable crops in the Gambia has been noted in the preceding report (Luc & Merny, 1972) is only rarely associated to other crops in this country.

Super-family : CRICONEMATOIDEA

Family : Criconematidae

Genus : Criconemoides Taylor, 1936

Criconemoides have been found in most tropical soils around roots of very different crops. They are rarely found in important populations.

In the Gambia, the genus is relatively rare. A few Criconemoides have been found however, around roots of sorghum, cotton and groundnut. In all cases where specific determination could be made, C. curvatus Raski, 1952, a species that is widespread in West Africa, as been found.

Genus : Hemicriconemoides Chitwood & Birchfield, 1957.

A single species of this genus has been observed in the Gambia. The species concerned, H. cocophilus (Loos, 1949) Chitwood & Birchfield, 1957, was rarely encountered and in low to very low populations.

Family : Hemicycliophoridae

A few individuals, belonging to the genus Hemicycliophora De Man, 1921, have been found in the vicinity of roots of cotton and in a rotation trial, around roots of maize and groundnut. It has not been possible to make an identification of these animals.

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Family : Paratylenchidae

Animals belonging to the genus Paratylenchus Micoletzki, 1922 have been found in two paddy fields, Unfortunately, the populations that were extracted from the soil did not contain any adult and therefore, no specific determination has been possible. It is possible taht the species concerned belong to the genus Cacopaurus. In this genus the larvae closely ressemble that of Paratylenchus, the female remaining attacked to the root and being never found in the soil.

ORDER : DORYLAIMIDA

Super-family : DORYLAIMOIDEA

Family : Longidoridae

Genus : Xiphinema Cobb, 1913

Numerous species belonging to this genus have been described in West Africa. The genus is widespread in the soils of the Gambia though, generally, in small populations and containing few adults. In three cases, it has been possible to make determinations.

Xiphinema n. sp. that was discovered in paddy fields in Ivory Coast where it is frequently found, has been encountered is a paddy field in the Gambia. Its description is on its way.

X. cf. bakeri was associated with sorghum and has been found in fair population. This species is also present in the Casamance where it has been found around millet and upland rice.

X. attorodorum Luc, 1961. An important population of this species has been found around cotton roots.

Super-family : DIPHTHEROPHOROIDEA

Family : Trichodoridae

Genus : Trichodorus Cobb, 1913.

Though this genus is fairly frequent in the Gambia, it has only been found in relatively low populations. No specific determination has been possible.

II THE HOSTS AND THE NEMATODES ASSOCIATED TO THEM

RICE

The observations made on fifteen paddy fields have been resumed in table 1. It is evident that the principal parasite of rice in the Gambia is Hirschmanniella oryzae. This species was present in soil and roots of eleven of the fifteen samples taken. The populations

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Table 1 - Rice

SAMPLES	Tylenchorhynchus mashoodi	Tylenchorhynchus sp.	Uliginotylenchus rhopalocercus	Uliginotylenchus palustris	Hirschmanniella oryzae		Hirschmanniella spinicaudata		Scutellonema cavenessi	Helicotylenchus dihystera	Heterodera sp.	Hemicriconemoides sp.	Paratylenchus sp.	Xiphinema n. sp.	Xiphinema sp.
	S	S	S	S	S	R	S	R	S	S	S	S	S	S	S
1					H	F	VL						F		
2															
3					H	H	VL		VL						
4					H	F									
5			L	L	H	L									
6					H	F									
7					H	F	VL								VL
8					VH	H									
9		VL	F		H	F			VL	VL					
10					F	L	VL								
11										VL					
12											VL				
13				H	F	H				H			VL		
14			F												
15	F				L	L	VL			VL		L	H	L	

observed in the soil are high in seven cases and very high in one. In the roots, the populations seem to be less important but this might be explained by the fact that, though being endoparasitic, the animals have the possibility to migrate into the soil. It has been observed (Merny, 1970) that up to the flowering, the populations of the closely related species H. spinicaudata stay almost completely inside the roots, but that from this moment until maturation, the parasite left the roots to form an exophytic population that became more and more important. The importance of the populations extracted either from the soil or the roots depends, therefore, on the age of the hosts and on the moment that the sample is taken.

In five paddy fields, a few isolated individuals of H. spinicaudata have been found. Though the parasitism of this species is known and its pathogenicity has been shown, it is evident that in the Gambia, this species has a completely secondary role.

Another fact that must be noted is the rare appearance of parasites belonging to the genus Heterodera. In fact, this genus has only been found, as a few second stage larvae in a single paddy field whereas it is relatively frequently met in paddy fields of the Casamance. An extension of this genus might be expected as parasites belonging to it have been found around roots of other gramineous crops and it is well possible that they also could be parasites of rice.

It has been observed in Ivory Coast that this genus, which was not known until 1961, when it was discovered in a paddy field, has extended itself during the ten years that followed. Therefore, one should be aware of an eventual extension of this parasite in the Gambia.

Three other parasites have been found, each once, and in rather important numbers :

Helicotylenchus cf. dihystera, also known from paddy fields in the Ivory Coast, it is particularly widespread in Senegal sometimes in high and very high populations and associated to a number of crops. Its parasitism towards rice seems doubtful.

Uliginotylenchus palustris. This parasite has been discovered for the first time in a paddy field of the Ivory Coast and has been found again in the Casamance, associated with the same crop. This nematode, that seems to parasitize rice, is relatively seldom met and its pathogenicity is not known.

Paratylenchus sp. It is possible that Paratylenchus aquaticus Merny, 1966 is concerned, but the populations found, though sometimes important, did not contain any adults and a specific determination the-

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refore has not been made.

The other species found in the paddy fields are, at the same time, rare and scarce ; their presence must be considered as fortuitious.

OTHER GRAMINEOUS CROPS

Eleven samples have been examined. Two were taken on maize, six on sorghum and three on millet. Examination of table 2 shows that the nematological populations associated with these three plants are the same.

It is evident that the most frequent and abondant species are Scutellonema cavenessi and Helicotylenchus cf. dihystera, both belonging to the family of the Hoplolaimidae. The first one has been found in all but one of the samples in almost always high populations, sometimes even very high. The second one has been found in all the samples and was always still more abundant. So it seems possible that we are dealing with the two main parasites of gramineous crops, not only in the Gambia but also in Senegal because they have also been found frequently and abundantly in the last country. Unfortunately, their pathogenicity is not known and long and careful studies are necessary to know if they really represent a danger for food crops.

On the contrary, tha danger represented by three species of the genus Pratylenchus : P. brachyurus, P. zeae and Pratylenchus n. sp. is not doubtful.

Pratylenchus n. sp. originally discovered in the Casamance is present in six samples and is found on the three crops studied. It is often observed in very high populations as well in the soil as in the roots. Its pathogenicity is well known and, in the Casamance, important decreases in yields caused by this species have been observed. Trying to calculate the pathogenicity of this parasite, one of the authors (R.F.) has concluded that it certainly is the most dangerous parasite of gramineous crops in this region.

P. zeae and P. brachyurus have only been found in one case and, in this case, a maize crop was concerned that was grown in a rotation experiment between two crops of goundnut. As P. brachyrus is a parasite of groundnut as well as maize, this crop rotation must have favorised its rapid multiplication.

Tylenchorhynchus n. sp. is sometimes found in important populations in the vicinity of roots of sorghum and notably millet. Therefore, it could be possible that its parasitism towards these crops is not negligible, but in this case again, were are facing a new

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Table 2 _ Gramineae

	SAMPLES	Tylenchorhynchus n. sp.	Tylenchorhynchus sp.	Telotylenchus ventralis	Telotylenchus cf. paaloofi	Trichotylenchus falciformis	Trichotylenchus sp.	Pratylenchus brachyurus		Pratylenchus n. sp.		Pratylenchus zeae		Pratylenchus sp.		Scutellonema cavenessi	Peltamigratus nigeriensis	Helicotylenchus dihystera	Heterodera sp.		Meloidogyne sp.	Criconemoides curvatus	Criconemoides sp.	Hemicycliophora sp.	Xiphinema cf. bakeri	Xiphinema sp.	Trichodorus sp.
		S	S	S	S	S	S	S	R	S	R	S	R	S	R	S	S	S	S	R	S	S	S	S	S	S	S
maize	16		VL					H[X]	H[X]			H[X]	H[X]			H		F						VL		VL	VL
	17					L				VH	VH					H		H								L	VL
sorghum	18	F								H	H					H		H				L			F		
	19				VH									VL		L		VH									VL	
	20			H						VH	H					H		H	H	H			L			VL	
	21	H				L				H	F					VH		VH									
	22			H		F								L	F	H		VH				H					
	23	H				F				L	L					VH		H	H	VH						L	VL
millet	24	VH														H		H									
	25	H				H				VH	H						F	H	H	H							F
	26	H		L			L							L	VL	H		H			L					VL	

× Mixture of Pratylenchus brachyurus and P. zeae

parasite whose pathogenicity is not known.

Finally, an important fact should be noted that constitutes a pecularity for the gramineous crops of the Gambia : the presence of one or more species of Heterodera associated with sorghum and millet. Up to now, the two known species of this genus in West Africa have only been found on rice and sugar cane and, sometimes on wild gramineae and cyperaceae. In the Gambia, however, Heterodera have been observed in three cases in the field parasitizing sorghum and millet. Inoculations carried out in the laboratory have confirmed this parasitism. It is not yet possible to have an exact idea of the decrease in yield, caused by this parasite but the damage caused by certain Heterodera on crops of the temperate regions always makes the presence of this parasites alarming and, parallel to studies of pathogenicity carried out in the laboratory, it should be desirable that a more detailed survey focussing on the presence of Heterodera in the Gambia should take place and that their possible extension should be watched.

COTTON

Seven samples have been examined (table 3). It is striking to find that the nematological fauna of cotton is about the same as that of gramineous crops, with the only difference that the species of secondary importance are less numerous.

Helicotylenchus cf. dihystera and Scutellonema cavenessi are almost always present and generally in high to very high populations. Therefore, it seems probable that these two species are parasites of cotton. Nevertheless, as in the case of gramineous crops, studies should be carried out to determine their pathogenicity.

Pratylenchus n. sp, that also has been found on cotton in Eastern Senegal, has been found three times in the Gambia. This species was present in the soil in high populations but the numbers of individuals extracted from the roots were small to very small. It could be possible that cotton is not a good host and that the high populations observed in the soil are originated on another adventitious plant.

Pratylenchus brachyurus has been found once, in soil, in fair number. This parasite has not been found in roots of cotton. Therefore, it seems that this crop is not parasitized by this species and that, again, the populations observed in the soil were associated to an adventitious plant.

.../...

Table 3 _ Cotton

SAMPLES	Tylenchorhynchus n. sp.	Tylenchorhynchus sp.	Telotylenchus ventralis	Pratylenchus n. sp.		Pratylenchus brachyurus		Scutellonema cavenessi	Helicotylenchus dihystera	Criconemoides curvatus	Criconemoides sp.	Hemicriconemoides cocophilus	Hemicycliophora sp.	Xiphinema attorodorum	Xiphinema sp.
	S	S	S	S	R	S	R	S	S	S	S	S	S	S	S
27	F							H	H						
28			L	H	L			H	H	VL					
29	H			H	L			VH	VH			VL			
30								VH	VH		L				L
31		L		H	VL			H	H		VL				L
32		VL				F			VH		L		VL	H	
33	H							F	H				VL		F

Finally, the parasitism of Tylenchorhynchus n. sp. and Xiphinema attorodorum that have been found in important numbers might be possible.

The total absence of the genus Meloidogyne on cotton must be noted. Apart from the damage that these parasites could cause they are known to favorise the appearance of wilt due to Fusarium. This has been found in the U.S.A. and Meloidogyne is an important parasite of cotton in several countries in Africa, notably in the Central African Republic (Luc, Merny & Netscher, 1964). At Kulari, spots of wilted cotton have been found in the absence of Meloidogyne, but specialists of the I.R.C.T. state that these symptoms are not caused by Fusarium wilt.

ROTATION GROUNDNUT-MAIZE-FALLOW

At the Mixed Farming Center of Jambanjelly samples have been taken from plots of a rotation experiment where the sequence of the crops was as follows : fallow-groundnut-maize-groundnut.

It is evident that this rotation will not affect the principal parasites : Scutellonema cavenessi, Helicotylenchus dihystera and Pratylenchus brachyurus are all polyphagous and able to live at the expense of groundnut as well as maize. This is confirmed by the examination of table 4. The degree of infestation in the different plots is about the same. An exception must be made for Pratylenchus brachyurus. The Pratylenchus present in the plot of groundnut following maize was so low that it was not possible to make any determination with certitude. This is probably a fortuitous fact due to the very low abundance of this parasite in this plot at the beginning of the experiment.

No definite conclusions may be drawn from this experiment unless a rotation has been completed on every plot.

The same kind of observations are on their way in the Casamance on different types of rotations.

Y A M

This crop, almost inexisting in Senegal is also very rare in the Gambia. At Kunkujan, a tuber of cush-cush yam (Dioscorea trifida L.) was heavily attacked by Scutellonema bradys, a dangerous parasite of yam and known throughout West Africa where this plant is grown.

.../...

Table 4 _ crop rotation trial Jambanjelly

SAMPLES	Tylenchorhynchus n. sp.	Tylenchorhynchus sp.	Trichotylenchus falciformis	Pratylenchus brachyurus		Pratylenchus sp.		Scutellonema cavenessi	Helicotylenchus dihystera	Hoplolaimidae sp.	Criconemoides sp.	Hemicycliophora sp.	Xiphinema sp.	Trichodorus sp.
	S	S	S	S	R	S	R	S	S	S	S	S	S	S
34	VL			L				H	F	F				
35		VL	VL	L	F			H	L		VL	VL	VL	VL
16		VL		F[x]	H[x]			H	F			VL	VL	VL
36		VL				VL	VL	H	H			L	VL	VL

[x] mixed with P. zeæ

The samples are in the same order as the succession of the crops on the field.

34 fallow
35 groundnut
16 maize
36 groundnut

III CONCLUSION

If, one does not consider the species not frequently met or those found in small numbers the following species liable to cause economical problems remain :

Hirschmanniella oryzae that is the only important parasite of rice and, considering the studies carried out in the Ivory Coast on the closely related species H. spinicaudata (Merny, 1970), it is probable that, in case of heavy attacks, yield decrease will occur.

Pratylenchus n. sp. that seems to be the principal parasite of gramineous crops and of cotton. In certain cases, however, P. brachyurus and P. zeae, whose pathogenicity is known, are found. Moreover, P. brachyurus has been found on groundnut and it is known that this nematode is an important parasite of this crop. Therefore, it is possible, that in certain fields, where this organism is present in important numbers, it is causing yield reduction.

Finally, Helicotylenchus cf. dihystera and Scutellonema cavenessi are abundantly present in all the crops studied, with the exception of rice. Therefore, these nematodes seem to be liable to be active parasites and probably pathogenic towards numerous plants.

The other species found are probably only incidentally met in the fields visited ; they could eventualy parasitize adventitious plants and even, occasionally, cultivated crops.

The control of these parasites demands a rather refined agricultural technique and extensive studies will be necessary to establish these techniques.

The use of nematocides is too costly and eventual increasing yields will, in most cases, not justify the expense.

Crop rotation, is generally the most elegant and less costly method to prevent nematode populations to attain a level dangerous to the crops.

The rotation consisting of growing vegetables, in intercampagne, between successive rice crops may be useful to prevent the build up of Meloidogyne on vegetables but this period is too short to cause a decrease of Hirschmanniella oryzae to an acceptable level. However, this type of rotation could become interesting, if the period of vegetable growing could be extended to two or three years. In this case,

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all measures should be taken, of course, to avoid a build up of Meloidogyne during these years (treatment of nurseries, rotation of resistant and susceptible varieties). Anyhow, before adopting such a rotation, it should be necessary to carry out several experiments to know the longevity of the parasite in the field and the maximum level of populations of Hirschmanniella that could be stood by rice without apparent damage.

The control of Pratylenchus n. sp. by crop rotation is particularly difficult because this parasite attacks most crops (groundnut, cotton and gramineous crops).

No doubt it will be necessary to make use of resistant varieties in the control of this species. Therefore, an extensive study should be undertaken to find these varieties.

The problems encountered in the Gambia are about the same as those in Senegal, where studies are undertaken to determine the host range and the pathogenicity of the differerent parasites as well as the influence of several types of crop rotation on the nematode populations.

Once the results studies will be obtained, they will be communicated to the Direction of Agriculture of the Gambia. If, however, the Authorities of the Gambia wish to carry out certain research themselves, the Laboratory of Nematology of O.R.S.T.O.M. in Dakar will always be at their disposal to help them in their work.

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References cited

ATKINS, J.G., FIELDING, M.J. & HOLLIS, J.P. (1957). Preliminary studies on root parasitic nematodes of rice in Texas and Louisiana F.A.O. Pl. Protec. Bull. 5, 53 - 56.

CAVENESS, F.E. (1967) Nematology studies 1960-1965. End of tour progress report on the Nematology Project. Lagos : Ministry of Agriculture & Natural Resources, Western Region Nigeria & U.S.A. Agency for International Development, revised ed. VI + 135 pp.

COOMANS, A. & DE GRISSE, A. (1963). Observations on Trichotylenchus falciformis Whitehead, 1959. Nematologica 9, 320 - 326.

GUIRAN, G. de (1965) Nematodes associés au manioc dans le Sud du Togo. C.R. Trav. Congr. Protect. Cult. trop. Marseille, 677 - 680.

JERATH, M.L. (1968). Heterodera sacchari a cyst nematode pest of sugar cane new to Nigeria. Pl. Dis. Reptr. 52, 237 - 239.

LUC, M. & MERNY, G. (1963) Heterodera sacchari n. sp. (Nematoda : Tylenchoidea) parasite de la canne à sucre au Congo-Brazzaville. Nematologica 9, 31 - 37.

LUC, M. & MERNY, G. (1972). Preliminary report on the plant parasitic nematodes in the Republic of the Gambia. Rapport ORSTOM ronéo 5 pp. 2 tab.

LUC, M. & MERNY, G. & NETSCHER, C. (1964). Enquête sur les nématodes parasites des cultures de la République Centrafricaine et du Congo-Brazzaville. Agron. trop. Nogent 19, 723 - 746.

MERNY, G. (1970). Les nématodes phytoparasites des rizières inondées de Côte d'Ivoire. Thèse Doct. Etat. Abidjan 167 pp.