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Parasitic Nematodes of Cashew Plants in Nurseries in Western Burkina Faso

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Cashew production is a very important source of income for thousands of people in Burkina Faso and employs more than 45,000 households from production to marketing. The cashew tree is subject to many phytosanitary problems that can cause huge yield losses. An inventory of parasitic nematodes associated with cashew trees in nurseries in a farming environment was carried out for the first time. Cashew production is a very important source of income for thousands of people in Burkina Faso and employs more than 45,000 households from production to marketing. The cashew tree is subject to many phytosanitary problems that can cause yield losses. An inventory of parasitic nematodes associated with cashew plants in nurseries in a farming environment was carried out. The inventory revealed that ten (10) genera of nematodes are associated with the cashew plants in the nursery and the most frequent present in the soil are represented by *Helicotylenchus dihystera* (78.43%), *Tylenchus* sp. (62.75%), *Pratylenchus brachyurus* (39.22), *Scutellonema cavenessi* (33.33%) and T*ylenchorhynchus* sp. (19.61%). The most abundant

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nematodes were represented by *Helicotylenchus dihystera* and *Tylenchus* sp. with 336 and 53 nematodes/soil dm^3 respectively. Five genera of nematodes are associated with the roots of cashew plants in nurseries, the most frequent of which are represented by *Tylenchus* sp. and *Pratylenchus brachyurus* at levels of 62.75 and 52.94% respectively. Population densities of root-extracted nematodes were low with a maximum of 2 nematodes/g of roots.

Keywords: Cashew plant; nursery; parasitic nematode; Burkina Faso.

1. INTRODUCTION

The cashew sector in West Africa has been experiencing an ever-growing interest over the last decade, justified by the attractive prices of raw nuts and almonds at the international level. Over the past ten years, West Africa has become the world's leading cashew-producing region. Indeed, the cashew tree is a species recognized for its economic importance in this part of Africa and mainly in Burkina Faso, in the same way as cotton. Fruit crops occupy a prominent place in Burkina Faso's agriculture and make it possible to meet part of the food needs and improve cash incomes. Among these fruit crops, cashew production plays an important role in the national economy. Indeed, the cashew sector has experienced a dynamism in recent years with the creation of a Burkinabe Cashew Council (CBA) which aims to improve producers' access to quality plants (Tarpaga, et al., 2020). The cashew nut sector is not performing well with an estimated production of 85,000 tons in a production area of 250,000 ha for a yield of 354 kg/ha, i.e. less than kg/tree (Ricau, 2019). In order to support the cashew sector, national research has been committed for the past ten years to the selection of highly productive plant material of very good quality nuts. For a large-scale distribution of cashew nuts, the main route chosen for the reproduction of productive trees remains grafting in nurseries. This route requires the production of rootstocks on rigid schedules, the failure to follow which causes enormous damage to the plant breeding program. The most common constraints are the non- or low germination of nuts after sowing, the slow growth and poor development (deformation of organs) of rootstocks after germination, and the mortality of growing plants. The cashew tree, like most fruit crops, is attacked by a large number of nematodes. Research on this crop is scarce in Burkina Faso and current work aims to assess nematological problems. Research carried out around the world has shown that the cashew tree is strongly attacked by parasitic nematodes to varying degrees depending on the climate. The objective of this research work is to identify the main nematodes associated with cashew trees in nurseries in western Burkina Faso in terms of frequency and abundance; The collection will take into account visual observations of the plants in the nursery and the taking of plant samples for the extraction and characterization of the different genera of nematodes observed.

2. MATERIALS ET METHODS

2.1 Materials

The inventory was carried out in the main cashew production areas in nurseries and focused on the popularized varieties from elite plants provided by the INERA breeding program to the various farmers (Photo 1).

Photo 1. Cashew plants nursery in a farming environment

Photo 2. Healthy root (left) and infested root with *Meloidogyne javanica* and *M. javanica* + *Pratylenchus brachyurus*

2.2 Sampling Method and Site Selection

Sampling was carried out in the main growing areas of the cashew plants nursery located in western Burkina Faso, in the localities of Niangoloko, Banfora, Guena, Kourinion and Orodara. The number of pots is chosen according to the size of the nursery. Each plant in a pot is considered as a sample. The plants of the nursery cashew were mostly 138 days old. A total of 52 samples were taken from 1er to 4th march 2018 during the wet season in the main production areas of the cashew tree in western Burkina Faso.

2.3 Extraction of Samples in the Laboratory

Soil nematodes are extracted by the Seinhorst elutriator method (1962). The soil sample of volume 250 cubic centimeter which is washed under the action of a stream of water through a sieve of one millimeter mesh finally to remove large particles. The resulting suspension is recovered in a 2 liters Erlenmeyer flask by means of a funnel placed under the strainer and subjected to an upward flow of water with a flow rate of 70 millimeters per minute for 20 minutes. This current holds the nematodes while the heavy particles descend to the bottom of the column. The excess is collected in a bucket and the contents of the Erlenmeyer are transferred to the same bucket for the screening phase consists of passing the contents through four superimposed sieves of 50 micrometers of mesh each. The passages are facilitated by water jets and the filtrate obtained during each of the four passages is collected in a single plastic glass. Finally, the passive filtration phase allows to separate the nematodes from the impurities on the basis of their mobility by pouring the content on Kleenex paper containing a small mesh sieve placed in a petri dish for 48 hours.

Root nematodes are removed from a nebulization chamber by the Seinhorst sprinkler method (1950). The roots are maintained continuously for a period of 14 days under a mist produced by a sprinkler. The moisture of the roots causes their decomposition, hence the release of nematodes. After 14 days, nematodes retained in the container are recovered by active filtration method for 48 hours.

This phase allows to count the nematodes present in the extractions. It is carried out using a counting plate and a binocular magnifying glass. Soil population is expressed in nematodes per decimeter-cube (N/dm^3) and root populations in nematodes per gram of fresh roots (N/g).

2.4. Data Analysis

The datas were analyzed using the statistical software XLSTAT 2016. An analysis of variance using the ANOVA software was performed and the comparison of the means was made with the Newman-Keuls test at the 5% threshold.

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1 Frequency and abundance of parasitic nematode populations associated with cashew trees

About ten genera of nematodes have been observed on cashew plants in nurseries in western Burkina Faso on the prospected sites (Table 1).

Nematodes observed in soil: The most frequent and abundant nematodes are represented by *Helicotylenchus dihystera* as they were observed in 78.43% of the samples for levels between 0 and 3,480 nematodes/dm^3 of soil; The average density observed is 336 nematodes/dm^3 of soil. *Tylenchus* sp. is observed at frequencies of 62.75% for population densities of 53 nematodes/dm^3 of soil. Pratylenchus and Scutellonema are present at frequencies of 39.22 and 33.33% respectively for population densities of 29 and 18 nematodes/dm^3 of soil. *Tylenchorhynchus* sp. is observed at a frequency of 19.61% for densities of 12 nematodes/dm3 of soil. *Xiphinema* sp. and *Hoplolaimus pararobustus* are observed at a frequency of 9.8% for population densities of 5 and 4 nematodes/dm^3 of soil, respectively. *Rotylenchulus reniformis* is observed at a frequency of 7.84% with a population density of 3 nematodes/dm*3* of soil. Low frequencies are observed for *Criconemella onoensis* and *Meloidogyne javanica* as they were observed in 1.96% of the samples. The population levels are very low and 2 and 1 nematodes/dm^3 of soil respectively.

Table 1. Frequency and abundance of the main parasitic nematodes associated with cashew plants in nurseries in western Burkina Faso

Nematodes species (soil nematodes)	Frequency %	Abundance			
		Minimum	Maximum	Everage	Error std
		(Number of nematodes/dm^3 of soil)			
Helicotylenchus dihystera	78.43	0	3480	336	85.0
Tylenchus sp.	62.75	0	300	53	10.2
Pratylenchus brachyurus	39.22	0	160	29	6.5
Scutellonema cavenessi	33.33	0	120	18	4.3
Tylenchorhynchus sp.	19.61	0	140	12	4.0
Xiphinema sp.	9.80	0	100	5	2.4
Hoplolaimus pararobustus	9.80	0	60	4	1.9
Rotylenchulus reniformis	7.84	0	80	3	1.8
Criconemella onoensis	1.96	0	100	2	1.9
Meloidogyne javanica	1.96	0	40	1	1.8

Table 2. Frequency and abundance of the main parasitic nematodes associated with cashew plants in western Burkina Faso

Nematodes species (Root nematodes)	Frequency %	Abundance			
		Minimum	Maximum	Average	Error std
		(Number of nematodes/g of roots)			
Tylenchus sp.	62.75	0	34	2	0.8
Pratylenchus brachyurus	52.94	0	27	2	0.7
Rotylenchulus reniformis	19.61	0	4	1	0.1
Scutellonema cavenessi	15.69	0	3	1	0.1
Meloidogyne javanica	3.92	0	2	1	0.0

Nematodes extracted from the roots: Five (5) genera of nematodes are associated with the roots of cashew plants in nurseries (Table 2). Common nematodes are represented by *Tylenchus* sp. and *Pratylenchus brachyurus* at levels of 62.75 and 52.94%, respectively. Population densities are low with 2 nematodes/g of roots. *Rotylenchulus reniformis, Scutellonema cavenessi* and *Meloidogyne javanica* are observed at frequencies of 19.61, 15.69 and 3.92% respectively for population densities of 1 nematode/g of roots.

3.1.2 Population densities of nematodes associated with cashew nurseries by site

For soil nematodes: The population densities of nematodes observed on cashew plants in nurseries are given in Table 3. The most abundant nematodes on cashew nurseries are represented by *Helicotylenchus dihystera, Pratylenchus brachyurus* and *Scutellonema cavenessi*. The highest population densities are observed at the Kourinion site with a total population of 1,260 nematodes/dm^3 of soil ($P<0.05$). Significant differences ($P<0.05$) are observed for *H. dihystera* and *S. cavenessi* for the Kourinion site with other sites. On the other hand, the site of Guena is more infested for *Pratylenchus brachyurus* with 107 nematodes/dm^3 of soil ($P<0.05$). Population densities are comparable for the nematodes *M. javanica, Xiphinema* sp., *Tylenchus* sp., *Criconemella onoensis, Scutellonema cavenessi, Tylenchorhynchus* sp., *Hoplolaimus pararobustus* and *Rotylenchulus reniformis* ($P<0.05$).

For root nematodes: Root populations are represented by the genus *P. brachyurus* and the species *R. reniformis* at relatively different population levels. The Guena site is more infested with 8 nematodes/g of roots compared to the other sites ($P<0.05$).

Table 3. Population densities of parasitic nematodes to cashew trees in nurseries in western Burkina Faso

Locality	Nematodes/dm³ of soil											Nematodes/g root		
	Melo	***Praty***	***Scut***	***Heli***	***Xiph***	***Tychus***	***Crico***	***Tycho***	***Hoplo***	***Roty***	**Total**	***Praty***	***Roty***	**Total**
Bandougou	0	17a	27b	367a	3	47	47	0	3	0	470a	4a	1	5
Banfora	0	15a	4a	43a	1	81	0	12	0	9	171a	1a	1	2
Guena	7	107b	13a	293a	10	47	0	0	0	0	483a	8b	0	8
Kourinion	0	38a	48a	1092b	8	37	8	0	17	0	1260b	1a	0	1
Niangoloko	0	5a	3a	117a	3	40	0	35	0	2	215a	1a	0	1
Probabilité	NS	*	*	*	NS	NS	NS	NS	NS	NS	*	*	NS	NS

*The means followed by the same letter do not differ significantly according to the Newman-Keuls test at the * : 5% threshold.*
Legend: Nbre Ech.: Number of samples; Melo: Meloidogyne; Praty: Pratylenchus; Scut: Scutellonema; Heli: Helicotylenchus Xiph: Xiphinema; Tychus: Tylenchus; Crico: Criconemoides; Tycho: Tylenchorhynchus; Hoplo: Hoplolaimus; Roty: Rotylenchulus

3.2 Discussion

3.2.1 Populations of parasitic nematodes associated with cashew trees in nurseries

Our research work on parasitic nematodes associated with cashew plants in nurseries has revealed the predominance of *Helicotylenchus dihystera* and *Tylenchus* sp. at high frequencies (more than 60%) and at high population levels, mainly for *Helicotylenchus dihystera.* The other genera are represented by *Pratylenchus brachyurus, Scutellonema cavenessi, Tylenchorhynchus* sp., *Xiphinema* sp., *Hoplolaimus pararobustus, Rotylenchulus reniformis, Criconemella onoensis,* and *Meloidogyne javanica*. Our work is in line with that of several authors, including (Agu, 2007) who identified 5 genera and 12 species of parasitic nematodes associated with cashew trees in Nigeria, the most important of which were represented by *Xiphinema* (with 3 species), *Scutellonema* (2 species), *Criconemella* (4 species), *Rotylenchulus reniformis* and *Trophorus imperalis*. Poor growth has been observed on cashew seedlings in nurseries caused by *Xiphinema ifacolum* in Liberia (Lamberti, et al., 1992) cited by (Luc, et al., 2005).

Studies in West Africa and Brazil have shown immunity or high resistance of cashew nuts to *Meloidogyne* root-knot nematodes (Netscher, 1981) and (Da Ponte & Saraiva, 1973) cited by (Luc, et al., 2005), which may explain the low populations of *Meloidogyne* observed on cashew nurseries in western Burkina Faso. In a literature review on parasitic nematodes associated with cashew trees in Brazil, (Freire, et al., 2002) noted the presence of several nematodes on cashew trees in Brazil of which the most important were represented by *Criconemoides, Scutellonema, Xiphinema*. (Pradhan, et al., 2020) identified five (5) species of parasitic nematodes associated with cashew trees in Bhubaneswar, India, represented *Aphelenchus avenae, Hoplolaimus indicus, Rotylenchulus reniformis, Tylenchorhynchus mashhoodi.*

3.2.2 Densities of parasitic nematodes associated with cashew trees in nurseries

The study also revealed that cashew nurseries are infested with parasitic nematodes at high population levels for nematodes belonging to the genera *Helicotylenchus dihystera, Pratylenchus brachyurus* and *Scutellonema cavenessi*. (Tarpaga, et al., 2020) focused on the major cashew production areas, mainly in the Cascades region (Banfora and Niangoloko) and the Hauts-Bassins (Bandougou, Guena, Kourinion) recognized as areas of ancient introduction. The importance of the nematode population densities on the sites of Kourinion (for *H. dihystera*, *P. brachyurus* and *S. cavenessi*) and Guena (for *Pratylenchus* sp.) shows the importance of promoting good nursery production practices, particularly in soil sterilization (Seinhorst, 1962, Seinhorst, 1950).

4. CONCLUSION

The study of parasitic nematodes associated with cashew plants in nurseries in western Burkina Faso is original and has revealed high population levels of nematodes belonging to the genera *Helicotylenchus dihystera, Pratylenchus brachyurus* and *Xiphinema* sp. likely to cause damage to plants. The other groups of nematodes are represented by the genera *Tylenchorhynchus, Xiphinema* sp., *Hoplolaimus pararobustus, Rotylenchulus reniformis, Criconemella onoensis* and *Meloidogyne javanica.* Plants already infested in the nursery constitute a starting inoculum during transplantation and can spread the parasitic nematodes in disease-free areas. As recommendations, we propose that soils used for nurseries should be sterilized beforehand in order to have plants free of parasitic nematodes during transplanting.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Agu, J. M. (2007). Survey and effects of plant parasitic root nematodes of cashew (*Anacardium occidentale*) in southeastern Nigeria. *Journal of American Science, 3*(2).

Da Ponte, J. J., & Saraiva, L. M. (1973). Immunity of the cashew nut, *Anacardium*

occidentale L., to nematodes of the genus *Meloidogyne* Goeldi, 1887. *Ciencia Agronomia, Fortaleza, 3*, 35–36.

Freire, F. C. O., Cardoso, J. E., dos Santos, A. A., & Viana, F. M. P. (2002). Diseases of cashew nut plants (*Anacardium occidentale* L.) in Brazil. *Crop Protection, 21*, 489–494.

Lamberti, F., Boiboi, J. B., Ciancio, A., Tuopay, D. K., Jimehez, E. A., & Elia, F. (1992). Plant parasitic nematodes associated with tree crops in Liberia. *Nematologia Mediterranea, 20*, 79–85. Nematode parasites of subtropical and tropical fruit tree crops. Available from https://www.researchgate.net/publication/281397687_Nematode_parasites_of_subtropical_and_tropical_fruit_tree_crops

Luc, M., Sikora, R. A., & Bridge, J. (2005). *Plant parasitic nematodes in subtropical and tropical agriculture* (2nd ed.). CAB International.

Netscher, C. (1981). Trees resistant to *Meloidogyne* spp.: Use as a windbreaker in Senegal. *Tropical Agronomy, 36*(2), 175-177.

Pradhan, P., Kumar Patra, M., & Kumar Sahoo, N. (2020). Association of nematodes with fruit crops in Bhubaneswar, India. *International Journal of Current Microbiology and Applied Sciences, 9*(5). https://doi.org/10.20546/ijcmas.2020.905.219

Ricau, P. (2019). *The West African cashew sector in 2018: General trends and country profiles* (p. 30). Nitidae.

Seinhorst, J. W. (1950). De betekenis van de toestand van de grond voor het optreden van aantasting door het stengelaahje (*Ditylenchus dipsaci* (Ktthn) Filipjev). *Tijdschrift over Plantenziekten, 56*, 289-349.

Seinhorst, J. W. (1962). Modifications of the elutriation method for extracting nematodes from soil. *Nematologica, 8*, 117-128. https://doi.org/10.1163/00282562-8-1-120

Tarpaga, W. V., Bourgou, L., Guira, M., & Rouamba, A. (2020). Agromorphological characterization of cashew nuts (*Anacardium occidentale* L.) in selection for high yield and superior raw nut quality in Burkina Faso. *International Journal of Biological and Chemical Sciences, 14*(9), 3188-3199. https://doi.org/10.4314/ijbcs.v14i9.5

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