International Journal of Basic Science and Technology
December 2023, Volume 9, Number 3, Pages 246 – 249 **http://www.ijbst.fuotuoke.edu.ng/**
https://doi.org/https://10.5281/zenodo.15318789 **ISSN 2488-8648**

Assessment of Nematodes Associated with *Colocasia esculenta* in Otuoke Ogbia LGA, Bayelsa State

Inala, E.R.
Department of Biology, Federal University Otuoke, Bayelsa State, Nigeria

Article Information

Article # 01014
Received: 24th May 2023
1st Revision:19th June 2023
2nd Revision:26th July 2023
Acceptance:19th Dec. 2023
Available online:
29h December 2023.

Key Words
Colocasia esculenta,
Nematodes, Taro,
Bayelsa State,
Food security

Abstract

Colocasia esculenta (L.) Schott is an important staple cultivated in Bayelsa State, playing a crucial role in food security and livelihoods. The study investigated the diversity of nematodes associated with *C. esculenta* in farmlands in Otuoke, Bayelsa State, Nigeria, to determine their impacts and potential on the growth and yield of this essential agricultural crop. The Baermann funnel technique was utilized for nematode extraction, followed by microscopic identification based on morphology. The results revealed the presence of plant-parasitic nematodes including *Meloidogyne* species., *Belonolaimus longicaudatus* and *Helicotylenchus* species. *Meloidogyne* species and *Belonolaimus longicaudatus* were more widespread and observed in soil and corm samples. *Helicotylenchus sp* was seen associated with soil samples only. These nematode genera negatively affect the growth of *Colocasia esculenta* and could be contributory factors to the declining taro production in Otuoke, and Bayelsa State at large. Infestation is attributed to the practice of monoculture, the use of uncertified taro plantlets and contaminated tools by farmers. The study provides baseline data on the nematodes associated with *C. esculenta* in Bayelsa State.

***Corresponding author: Inala, E.R.**.; inalaer@fuotuoke.edu.ng

Introduction

Colocasia esculenta (L.) Schott commonly known as taro is a staple food crop cultivated in various regions around the world, particularly in tropical and subtropical areas (Owusu-Darko *et al.*, 2014). It is a vital source of carbohydrates and essential nutrients for millions of people, especially in countries such as Nigeria, Ghana, and China, where it is a dietary staple (FAO, 2019). Taro is maintained largely and consistently by small-hold farmers in Nigeria and the productivity has remained low among the local farmers despite the enormous possibilities.

Nematodes are part of the biotic factors influencing plant yields; destroying plant tissues and being vectors of other pathogens (Nicol, *et al.*, 2011; Jones *et al.*, 2013). Globally, plant parasitic nematodes cause serious reductions in yield and quality in most roots and tubers; and have been subjects of various studies (Coyne, 1996; Coyne *et al.*, 2003; Sikora, 2014; IPPC, Secretariat 2021). According to Hodda et al. (2012) yield losses due to nematode damage amount to about 15% of crop production per annum in developing nations. Nematode damage of plants can be 40 – 50% or complete, damage signs/diseases are often confused with other maladies and overlooked by farmers resulting in entire fields infestation; thereby causing considerable yield reductions (Arakaki, 1993; Sikora, 2014; Bridge *et al*., 2022).

Plant parasitic nematodes influencing *Colocasia* yield include sedentary ectoparasites like *Meloidogyne* spp, migratory endoparasites like *Pratylenchus* spp, spiral nematodes like *Helicotylenchus* spp, and stunt nematodes like *Tylenchorhynchus* spp (Coyne *et al*., 2003; Bridge *et al*., 2005). A proper understanding of the nematode communities in taro cultivation systems is essential for the development of targeted control strategies and sustainable management practices. Hence, the study investigated the diversity, prevalence and possible risk factors of nematodes associated with *Colocasia esculenta* in farmlands in Otuoke, Bayelsa State.

Materials and Methods

Study Area

The study was conducted in Otuoke community (4°41′22.417″N 7°17′43.470″E.), Ogbia Local Government Area of Bayelsa State, an area known for its significant cultivation of *Colocasia esculenta*. The vegetation in the area is tropical lowland rainforest. Community folks are predominantly farmers and fishermen.

International Journal of Basic Science and Technology
December 2023, Volume 9, Number 3, Pages 246 – 249 http://www.ijbst.fuotuoke.edu.ng/
https://doi.org/https://10.5281/zenodo.15318789 ISSN 2488-8648

Collection of Samples

Samples were randomly collected from 3 different sites (Table 1). Taro corms and soil samples (depth of 30cm) around corms were collected with a soil auger to maximize the retrieval of nematodes associated with the crop and put in polythene bags for laboratory analysis. Debris, loose roots, and large particles were separated from the soil samples using sieves of appropriate mesh sizes. The samples were homogenized to ensure an even distribution of nematodes

.

Table 1: Sites selected for the study

Site	Location	Co-ordinates
1	Beside Osasuma Complex	4°42′23.418″N
2	Beside Biology Laboratory, Federal University Otuoke	6°19′44.472″E
3	Beside Redeemed Christian Church Otuoke	4.706 50 500°N

Extraction and Identification of Nematodes

Nematodes were extracted from samples using the Baermann funnel technique (Whitehead and Hemming, 1965). The Baermann funnel apparatus was set up with a sieve at the bottom and a collection container. 100g soil sample was put in a beaker and mixed thoroughly with distilled water, the prepared samples were placed in the funnel and the nematodes were concentrated by sieving through a sieve, and allowed to migrate out of the soil through gravity into the collection container. A small sample of the extracted nematodes was placed on a microscopic slide viewed with a compound light microscope at an X10 objective lens for identification.

For the corms, samples were surface sterilized by washing thoroughly under running water to remove any external contaminants. The outer skin of the corm was peeled using a sterilized knife and the corm cut into uniform pieces. 100g of sections were weighed and ground using a blender. The processed sample was placed on the sieve in the Baermann funnel apparatus, ensuring an even distribution of the sample. Nematodes were allowed to migrate and the solution containing the extracted nematodes from the collection container was transferred to a microscopic slide for observation.

Nematodes were identified based on their morphological characteristics such as their body shape, size, stylet structure, oesophagus type, and tail shape using available identification charts/guides. The frequency of occurrence for each species identified was calculated for each site. Data was summarized and presented using percentages and tables. Differences were evaluated by one-way analysis of variance, ANOVA (SPSS Version 23) at a probability significance of 5%.

Results

A total of 32 nematodes from three species of nematodes were detected from the extractions and identified at the genus level. The nematode species identified associating with *Colocasia esculenta* in Otuoke farmlands include *Helicotylenchus* sp, *B. longicaudatus* and *Meloidogyne* sp. *Helicotylenchus* sp was observed only in the soil sample, whereas *B. longicaudatus* and *Meloidogyne* sp in the corm and soil samples collected from the three sites.

Of 32 nematodes extracted and identified, 20 were found in the soil, and the remaining 12 were found in the corm. The percentage distribution of the nematodes is as follows: *Helicotylenchus spp:* 5%, *B. longicaudatus* : 25% and *Meloidogyne* spp: 70% of the total nematodes. The most frequent nematode species is *Meloidogyne sp* with the highest occurrence being in the soil sample (Table 2). There is a significant relationship in the distribution of nematodes identified in soil and corm samples.

Table 2: Nematodes detected from Taro fields in Otuoke

Nematode identified	**Number of Nematodes identified**		**Total**	**Percentage %**
	Soil	Corm		
Helicotylenchus sp	1	0	1	5%
Belonolaimus longicaudatus	5	3	8	25%
Meloidogyne sp	14	9	23	70%
Total	20	12	32	100

Discussion

The nematodes associated with taro in Otuoke were studied for the first time. The study was carried out with a view of identifying and quantifying the various nematodes, and ascertaining if the nematode species

https://doi.org/https://10.5281/zenodo.15318789 ISSN 2488-8648

could be implicated in disease outbreaks and reduction of yield in *Colocasia esculenta* in the study area.

The results showed the presence of the sedentary endoparasitic nematode (*Meloidogyne* sp) and ectoparasitic nematodes (*Helicotylenchus* sp and *B. longicaudatus*). This aligns with previous reports of nematodes associating with *C. esculenta*. *Meloidogyne* sp and *Belonolamus longicaudatus* were observed in all the soil and corm samples collected from the three sites. *Meloidogyne* sp has the highest occurrence in the soil and corm samples collected. *Meloidogyne* spp are cosmopolitan in distribution and have been reported to be associated with *C. esculenta* globally (Coyne *et al*., 2003).

Meloidogyne spp and *B. longicaudatus* are serious pests on taro in different parts of the world reducing growth and yield (Coyne *et al.*, 2003; Hodda *et al*., 2012; Umeokechukwe and Ogbu, 2013; Sikandar, *et al.*, 2020); also *Meloidogyne* spp has been implicated as a cause of secondary infection of taro by providing entry points for fungi and bacteria (Bridge and Gowen, 2006). On the other hand, the sting nematode, *B. longicaudatus* is posited to cause root damage and stunted growth in plants due to restricted uptake of calcium by roots and calcium deficit. It is worth noting that *Helicotylenchus* sp was not found in any of the corm samples studied but in the soil.

The spread, prevalence and severity of nematodes have been attributed to the practice of monoculture by farmers, the use of uncertified taro plantlets and contaminated tools (Coyne *et al.*, 2018). Implementing targeted control and management strategies could prove instrumental in safeguarding the productivity and sustainability of this vital agricultural crop.

Conclusion

Colocasia esculenta is an indispensable staple that provides food and income to the people of Bayelsa State. However, the crop has several limiting factors (including biotic factors like bacteria, fungi, nematodes etc) in its cultivation thereby reducing its production. Consequently, the study investigated the nematodes associated with *C. esculenta*. The results revealed the presence of parasitic nematode species (*Meloidogyne* sp, *Helicotylenchus* sp and *B. longicaudatus*) that have been reported to have adverse effects on the growth and development of *C. esculenta*; and are threats to the overall health and yield of this important crop. The nematodes could be contributory factors to the declining taro production in Otuoke, and Bayelsa State at large.

The study provides baseline information on the nematodes associated with *C. esculenta* in Bayelsa State. The data could be used to understand the prevalence and distribution of different nematode species in the studied environment and Bayelsa State at large, which could be crucial for assessing their impact on the ecosystem and potentially implementing the necessary control measures.

Based on the findings, it is evident that further research is needed to gain insights into the specific impacts of these nematodes on the physiological processes and yield of *Colocasia esculenta*. Also, to mitigate the effect of infestation and improve farmers' income, the certification and use of disease-free plantlets is recommended.

References

Arakaki, M. (1993). Nematode damage and its control in Okinawa. *Japanese Agricultural Research Quarterly*, 27(2), 99-104.

Bridge, J., and Gowen, S. R. (2006). The significance of nematodes in the context of sustainable agriculture. *Annual Review of Phytopathology, 44*, 167-194.

Bridge, J., Coyne, D. L., and Kwoseh, C. K. (2005). Nematode parasites of tropical root and tuber crops (excluding potatoes). In *Plant Parasitic Nematodes in Subtropical and Tropical Agriculture* (pp. 221-258). Wallingford, UK: CABI Publishing.

Bridge, J. and Jatala, P. (1990). Nematode Parasites of Root and Tuber Crops In: (eds) M. Luc, R. A. Sikora and J. Bridge Plant Parasitic Nematodes in Subtropical and Tropical Agriculture CAB International pp 137

Coyne, D. L., Cordata, L., Dalzell, J. J., Claudius-Cole, A. O., Haukeland, S., Luambano, N. and Talwana (2018). Plant-parasitic Nematodes and Food Scurity in Sub-Saharan African *Annual Review of Phytopathology* 56, 381 - 403.

Coyne, D. L., Talwana, H. A. E. and Maslen, N. R. (2003) Plant-Parasitic Nematodes Associated with Root and Tuber in Uganda *African Plant Protection* 9(2), 87 -98

FAO. (2001). Roots and tubers in the global food system: A vision statement to the year 2020. Food and Agriculture Organization of the United Nations. *Nematology*, 43(5), 533-537.

IPPC, Secretariat. (2021). International Standards for Phytosanitary Measures (ISPMs).

Hodda, M, Banks, N. and Singh, S. (2012) Nematode threats in the NAQS region. CSIRO Ecosystem Sciences

https://doi.org/https://10.5281/zenodo.15318789 ISSN 2488-8648

Jones, J. T., Haegeman, A., Danchin, E. G., Gaur, H. S., Helder, J., Jones, M. G. & Perry, R. N. (2013). Top 10 Plant-parasitic Nematodes in Molecular Plant Pathology. *Molecular Plant Pathology*, 14(9), 946-961.

Lamberti, F. (1997). The impact of Nematodes on Agriculture. In: Nematode Pathogenesis of Plants and Other Organisms (pp. 315-328) Springer.

Luc, M.. Sikora, R. A. and J. Bridge, J. (1990) Plant Parasitic Nematodes in Subtropical and Tropical Agriculture CAB International

Nicol, J. M., Turner, S. J., Coyne, D. L., den Nijs, L., & Hockland, S. (2011). Current Nematode Threats to World Agriculture. In: Genomics and Molecular Genetics of Plant Nematode Interactions (pp. 21-43) Springer.

Owusu-Darko, P., Paterson, A., and Omenyo, E. (2014). Cocoyam (corms and cormels)—An underexploited food and feed resource. *Journal of Agricultural Chemistry and Environment, 3*(1), 22-29.

Ravindaran, N. K. K. and Ramesh, K. V. (1991). Nematodes Associated with Tuber Crops in Kerala. PG Thesis Kerala University of Agriculture, Vellayani India. http//:hd.hande.net/123456789/6055

Sikandar, A., Zhang, M. Y., Wang, Y. Y., Zhu, X. F., Liu, X. Y., Fan, H. Y., and Duan, Y. X. (2020). *Meloidogyne incognita* (root-knot nematode) a Risk to Agriculture. *Applied Ecology and Environmental Research, 18*(1).

Sikora, R. A. (2014). Nematode Parasites of Plants. In *Plant Parasitic Nematodes in Subtropical and Tropical Agriculture* (pp. 181-206). CABI Publishing.

Umeokechukwe. E. C. and Ogbu, J. U. (2013) Population Dynamics of Plant Parasitic Nematodes Associated with Cocoyam Cultivars (*Colocasia* and *Xanthosoma* spp) *Acta Agronomica Nigeriana* 13(1/2), 57\-63