



## Prevalence and persistence of galls and the galling nematodes *Meloidogyne* spp. on yams in Nasarawa state, Nigeria.

\* Isaac M. Ogara and Remember N. D. Bina

Department of Agronomy, Nasarawa state University Keffi,  
Lafia campus, P.M.B 135, Lafia, Nasarawa state.

\*Corresponding author: <[isaacjanet2002@yahoo.com](mailto:isaacjanet2002@yahoo.com)>

### ABSTRACT

The prevalence, infectivity on tubers and persistence of nematodes on yam tuber galls caused by *Meloidogyne incognita*, were studied in Nasarawa state, Nigeria, through the storage period. Prevalence was measured as percentage incidence in five local governments across the state, while infectivity was measured as gall index on infected tubers. To determine persistence, numbers of nematodes occurring within 2cm depth of tubers were taken for the critical storage months of April, May, June and July. The data was analysed using ANOVA (CRD). Obi had the highest prevalence, 6.07% and the highest rate of infection, GI 3.33, which were both significantly higher than Toto and Lafia when the data was transformed. Lafia had the lowest prevalence, 1.02% and rate of infection, GI 1.17. Mean number of Nematodes present in tubers declined from April to July as storage progressed except for June that was unusually high. The implications of these results are discussed.

**Keywords;** Galls, nematodes, Nasarawa state,

### INTRODUCTION

Yam, *Dioscorea* spp. is an important staple food in West Africa. Over 44 million metric tones, constituting more than 95% of world production is from the region. Nigeria alone produces over 31 million metric tones (CGIAR 2008, FAO 2009). The most widely cultivated species of yams to Nigeria are, the white yam (*Dioscorea rotundata* Poir), yellow yam (*D. cayenensis* Lam.) and water yam (*D. alata* L.). Diseases constitute a major constrain to yam production both in the field and in storage. Storage diseases of yam include dry rots, wet rots and galling or knotting. Storage losses of up to 50% have been variously estimated (Amusa *et al* 2003). Besides direct losses, these diseases also contribute to loss of quality and marketability and reduce sprouting (Osagie 1992, Bridge *et al* 2005). Damage due to *Meloidogyne* is considerable and between 34-52% have been reported (Nwuazor and Fawole 1981). Galls due to *Meloidogyne incognita* on *D. rotundata* can cause loss in market value of up to 40% (Atu *et al* 1983). They arise probably as a result

of giant cells that are formed after the nematodes penetrate and feed in the ground tissue layer (Fawole 1988). Nematodes are usually concentrated between 2mm-6mm in yam species (Nwuazor and Fawole 1981). Yam galling is widespread in West and East Africa (Coyne *et al* 2006, Mudiope *et al* 2007). In Nigeria, *Meloidogyne* spp. were always among the top three (3) nematode species, found in association with yams from soil and root extracts in Edo, Ekiti and Oyo states (Adegbite *et al* 2006). Although yams infected with galls will generally preserve throughout the stay in store, (IRETA 1987), it is not known if these nematodes, persist through this period. In Nasarawa state of Nigeria, not much information is available regarding the prevalence of the disease. This study aims therefore, to determine the prevalence and level of infectivity in the state and the persistence of the nematodes through the storage period.

## MATERIALS AND METHODS

Two studies were carried out to determine: (i) the persistence of the galling nematodes in yam tubers and (ii) The prevalence (incidence) and infectivity (Gall index) of yam tuber galls in Nasarawa state, central Nigeria.

The persistence of the galling nematode (*Meloidogyne* spp.) was determined by collecting 40 tubers of stored yams randomly from the 3 Agricultural Development zones of Nasarawa State. Three cores of samples, 2cm deep and 1x1cm wide on the surface, from galled areas of each tuber were taken using a scalpel, for ten tubers each month (April, May, June and July), from tubers that have been stored from last harvest. These were rinsed in tap water, and crushed lightly using a laboratory mortar. This was then placed onto a Baerman funnel set up (Agrios 2005) and allowed to stand for 24 hours. Content of the last 10cm of the tubing where the nematodes were expected to collect were drained into a 100ml beaker, from which aliquots were placed in a watch glass and observed for nematodes until all the content was used up. Nematode counts were recorded. The mean number for the samples also determined for each month.

Prevalence was determined as percentage incidence:

$$\% \text{ incidence} = \frac{\text{No. of galled yam tubers}}{\text{Total No. of yam tubers examined}} \times 100$$

Freshly harvested tubers from October harvest were examined on location in farmers' fields across the three state Agricultural Development Programme (ADP) zones of the state. Samples were collected from six different farms each from Akwanga, Lafia, Nasarawa, Obi and Toto, and examined, the percentage incidence determined as above. Infectivity was determined as Gall index on individual tubers using the following key based on Sasser and Taylor (1978): 0 = No galls, 1= 1-2 galls, 2=3-10 galls, 3 =11-30 galls 4 = 31-100 galls and 5= more than 100 galls. The mean gall index was collected for each of the locations.

The data were analysed using ANOVA and the result presented.

## RESULTS

The result showed that galling nematodes persist in the tubers, within 2cm depth throughout storage period; however the mean numbers declined significantly ( $p < 0.05$ ) from 1.79 -0.85 as the months progressed from April to July, except for the month of June which was unusually high (Table 1). The prevalence of galled tubers was highest in Obi (6.07%) having the highest GI of 3.33. Using square root transformation, the prevalence in Obi was significantly ( $p < 0.05$ ) higher than Toto and Lafia, but statistically similar to Nasarawa and Akwanga. The Gall index in Obi was also significantly ( $P < 0.05$ ) higher than that of Toto and Lafia, but again similar to Nasarawa and Akwanga, when the data was transformed.

## DISCUSSION

The study has shown that throughout Nasarawa state, as represented by the surveyed areas, yam galls are prevalent at an incidence rate between 1.02% -6.07% (Table 2). This is consistent with earlier reports that Nematode Galls are wide spread in Nigeria and in west/east Africa (Coyne and Mudiope 2006) but at a lower level of incidence when compared with some of earlier reports (Nwuazor and Fawole 1981). This may be due to the fact that this area is one of the major producing areas, that have had experience and possibly learnt to manage the disease better. These farmers also frequently receive newer varieties through their state Agricultural Development Programme (ADP) that have helped manage incidence.

The highest mean gall index of 3.33 in Obi which also happens to have the highest incidence, suggests a positive relationship between high prevalence and infectivity or severity (as represented by the Gall index). Further studies can be done to confirm this relationship. Persistence of nematodes in galled tubers throughout storage period of yam storage is confirmed by this study by their presence up to July, by which time farmers have not only finished planting, but are beginning to expect some of the earliest harvest of the new season. Since farmers derive seed materials from this stored harvest; the risk of possible inoculum transfer through yam setts from this crop to the next is obvious and high. Farmers are therefore advised to avoid using galled tubers as seed materials during planting.

**Table 1 The occurrence of galling (root-knot) nematodes, *Meloidogyne incognita* on store yam tubers through the period of storage (April-July, 2009).**

Period of Storage	Average No. of nematode within 2cm depth of tuber	Tuber weight/kg
April	1.79	1.380
May	1.63	1.153
June	1.87	0.904
July	0.85	0.816
Mean	1.54	1.063
SED	0.369	0.127
Significance	0.032 * *	< 0.001 * * *
LSD	0.748	0.259
CV (%)	53.5	26.9

\* \* = Significant at 5%

\* \* \* = Significant at 1%

**Table 2 The prevalence of galls (root-knot) on freshly harvested yam tubers in Nasarawa state**

Locations	Gall index	(transformed in square root)	Gall incidence (%)	(transformed in square root) (%)
Akwanga	1.83	(1.79)	2.27	(1.68)
Lafia	1.17	(1.33)	1.02	(1.33)
Nasarawa	2.00	(2.00)	2.79	(1.78)
Obi	3.33	(2.52)	6.07	(2.48)
Toto	1.67	(1.47)	1.27	(1.42)
Mean	2.00	(1.82)	2.68	(1.74)
SED	1.016	(0.496)	1.965	(0.461)
Significance	0.317	(1.034)	0.115	(0.147)
LSD	NS	(1.034)	NS	(0.961)
CV (%)	62	(20.8)	40.5	(17.6)

NS = Not significant

**REFERENCES**

- Adegbite, A.A, Saka, J.O., Agbaje, G.O, Owolade, O.F. Olaifa, G.O., Lawal, A. and Ojo, S. T. (2006) Survey of plant parasitic Nematodes associated with yams in Edo, Ekiti and Oyo States of Nigeria. *Africa Journal of Agricultural Research*. 1 (4):125-130.
- Amusa, N.A, Adegbite, A.A., Muhammed, S. and Baiyewu, R.A. (2003) Yam diseases and its management in Nigeria. *Africa Journal of Biotechnology*. 2 (12): 497-502.
- Atu, U.G. Odurukwe, S.O. and Ogbuji, R.O (1983) Root knot Nematode damage to *Dioscorea rotundata*. *Plant disease*. 67 (7): 814-815.
- CGIARr (2008) What's Bad for yam. *CgiarNews* May 2008. <http://www.cgiarNews.org/enews/may2008>.

Coyne, D.L., Tchabi, A., Baimey, H., Labuschagne, N. and Rotifa, I. (2005) Distribution and prevalence of Nematodes (*Scutellorema bradys* and *Meloidogyne* spp.) *Field Crops Research* 69 (1): 142-150.

Fawole, B. (1988) Histopathology of Root Knot Nematode *Meloidogyne incognita* infection on white yam (*Dioscorea rotundata*) tubers. *The Journal of Nematology*. 20 (1): 23-28.

IRETA (1987) Careful storage of yams: some Basic principles to reduce losses. *Agrofacts: crops*. IRETA publication No 15/87. 11pp.

Mudiope, J. Speijer P.R., Coyne D., Maslen R.N. and Adipala E. (2007) Nematode distribution and damage to yam in central and Eastern Uganda. *African Crop Science Journal*. 15 (2): 93-99.

Osagie A.U. (1992) the yam tuber in storage, post Harvest. Cited in Yusuf, C. and Okunsanya, B.A.O. (2008) Fungi Associated with storage rot of yam (*Dioscorea rotundata*) in Yola, Adamawa State. *Journal of Sustainable development in Agriculture and Environment*. 3 (2): 99-103.

Sasser J. N., and Taylor A. L. (1978) Biology, identification and control of root-knot nematodes (*Meloidogyne* species). North Carolina state university graphics, Raleigh, N. C. 111pp.