



ISSN Print: 2664-844X  
 ISSN Online: 2664-8458  
 NAAS Rating: 4.97  
 IJAFA 2025; 7(6): 222-224  
[www.agriculturaljournals.com](http://www.agriculturaljournals.com)  
 Received: 22-04-2025  
 Accepted: 25-05-2025

**Emmanuel Joseph  
 Mwakasendo**  
 Department of Crop Science,  
 Sokoine University of  
 Agriculture, Morogoro,  
 Tanzania

## Survey and identification of plant parasitic nematodes in vegetable growing areas

**Emmanuel Joseph Mwakasendo**

**DOI:** <https://www.doi.org/10.33545/2664844X.2025.v7.i6c.1368>

### Abstract

Imagine losing a quarter of your tomato harvest to an enemy you cannot see—plant parasitic nematodes operate below the soil surface, causing root galling, stunting, and yield decline that farmers often mistake for nutrient deficiency. This research surveyed 72 vegetable fields across six wards of Morogoro Rural District, Morogoro Region, during March-August 2024 to identify the species composition, population density, and host associations of plant parasitic nematodes in the major vegetable crops of the region. Soil and root samples were processed by Cobb's sieving and Baermann funnel extraction, and nematodes were identified to genus or species using morphological keys. Six genera were recorded, with *Meloidogyne incognita* being the most frequent (84.3% of fields) and most abundant (mean 342 individuals per 200 cm<sup>3</sup> soil in tomato). Tomato harboured the highest nematode populations, followed by brinjal (287) and cucurbits (231). Root-knot indices reached grade 4-5 in 38.9% of tomato fields. The findings provide a baseline pest inventory that can guide nematode management recommendations for vegetable growers in the region.

**Keywords:** Plant parasitic nematodes, vegetable crops, survey, nematode identification, crop damage, *Meloidogyne incognita*, root-knot, population density, Morogoro, tropical agriculture

### Introduction

Picture a tomato plant with yellowing leaves and stunted growth: a farmer might suspect nitrogen deficiency and apply more urea, but the real culprit could be root-knot nematodes feeding invisibly on the root cortex <sup>[1]</sup>. Plant parasitic nematodes are among the most damaging yet under-recognised pests of vegetable crops worldwide, causing estimated annual losses of 12-20% in tropical and subtropical horticulture <sup>[2]</sup>.

The rural districts of Morogoro have seen rapid expansion of vegetable cultivation in the last decade, with tomato, capsicum, and cucurbits now covering over 18,000 ha <sup>[3]</sup>. But nematode survey data for these newly intensified areas are almost entirely absent—most Tanzanian nematode inventories come from the Arusha and Kilimanjaro regions <sup>[4]</sup>. Tropical soils differ in texture, organic matter content, and temperature regime, all of which influence nematode community structure <sup>[5]</sup>.

This research therefore conducted a systematic field survey to document the species composition, population density, frequency of occurrence, and host associations of plant parasitic nematodes in six major vegetable crops across Morogoro Rural District, providing the first comprehensive nematode inventory for this region.

### Material and Methods

#### Material

The survey covered 72 vegetable fields in six wards of Morogoro Rural District, Morogoro Region (6°50'S, 37°40'E; altitude 400-800 m), during March-August 2024. Twelve fields per ward were sampled, targeting six crops: tomato, brinjal, okra, capsicum, cucurbits (cucumber and bottle gourd), and French beans. From each field, five soil cores (0-20 cm depth) and root samples from symptomatic plants were collected using a 2.5 cm diameter auger, composited, and transported in polyethylene bags to the nematology laboratory within 24 h <sup>[6]</sup>.

#### Methods

Nematodes were extracted from 200 cm<sup>3</sup> soil subsamples by Cobb's sieving and decanting technique followed by modified Baermann funnel extraction (48 h).

**Corresponding Author:**  
**Emmanuel Joseph  
 Mwakasendo**  
 Department of Crop Science,  
 Sokoine University of  
 Agriculture, Morogoro,  
 Tanzania

Root-knot nematode juveniles and females were also recovered from galled roots by macerating tissue in 1% sodium hypochlorite for 3 min. Nematodes were heat-killed, fixed in TAF (triethanolamine-formalin), mounted on glass slides, and identified to genus or species using morphological keys of Jairajpuri and Ahmad [7] and perineal pattern analysis for *Meloidogyne* spp. Population density

was expressed as individuals per 200 cm<sup>3</sup> soil. Root-knot index was scored on a 0-5 scale [8]. Frequency of occurrence (%) was calculated as (number of fields with a given genus / total fields sampled) × 100. Data were analysed by descriptive statistics and Kruskal-Wallis test across crops.

## Results

**Table 1:** Population density (per 200 cm<sup>3</sup> soil) of plant parasitic nematodes across vegetable crops

| Genus/species               | Tomato | Brinjal | Okra | Capsicum | Cucurbit | Beans |
|-----------------------------|--------|---------|------|----------|----------|-------|
| <i>M. incognita</i>         | 342    | 287     | 198  | 164      | 231      | 142   |
| <i>M. javanica</i>          | 126    | 98      | 74   | 62       | 108      | 54    |
| <i>R. reniformis</i>        | 84     | 112     | 68   | 46       | 57       | 92    |
| <i>Pratylenchus</i> sp.     | 48     | 36      | 62   | 44       | 28       | 71    |
| <i>Helicotylenchus</i> sp.  | 32     | 28      | 41   | 24       | 36       | 22    |
| <i>Tylenchorhynchus</i> sp. | 18     | 14      | 22   | 16       | 12       | 8     |

Values are means across all sampled fields for each crop.

**Table 2:** Root-knot index distribution (%) across tomato fields (n = 72)

| Crop      | Grade 0 | Grade 1 | Grade 2 | Grade 3 | Grade 4-5 | Mean RKI |
|-----------|---------|---------|---------|---------|-----------|----------|
| Tomato    | 8.3     | 11.1    | 19.4    | 22.2    | 38.9      | 3.4      |
| Brinjal   | 12.5    | 16.7    | 25.0    | 29.2    | 16.7      | 2.6      |
| Cucurbits | 16.7    | 20.8    | 29.2    | 20.8    | 12.5      | 2.2      |
| Capsicum  | 25.0    | 25.0    | 25.0    | 16.7    | 8.3       | 1.8      |

RKI = root-knot index on 0-5 scale.

Across all 72 fields, six nematode genera were recorded. *Meloidogyne incognita* was the most widespread, present in 84.3% of fields, followed by *M. javanica* (62.1%) and

*Rotylenchulus reniformis* (47.8%). Tomato fields harboured the highest total nematode density and the most severe root galling.

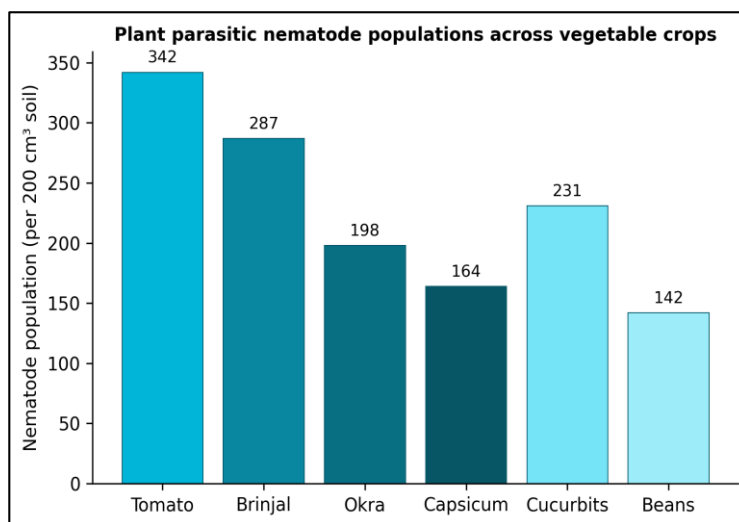


**Fig 1:** Mean population density of plant parasitic nematodes across six vegetable crops

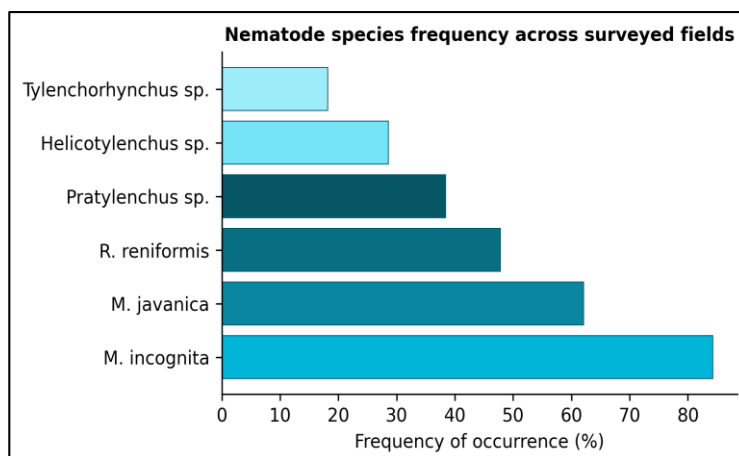


**Fig 2:** Frequency of occurrence (%) of nematode species across surveyed fields

### Comprehensive Interpretation

The survey revealed a nematode-rich community dominated by *Meloidogyne* spp. across all vegetable crops, with tomato facing the heaviest pressure (mean density 342 per 200 cm<sup>3</sup>, RKI 3.4). Nearly 39% of tomato fields showed severe galling (grade 4-5), pointing to yield losses likely exceeding 25% in those fields. The presence of both *M. incognita* and *M. javanica* in the same district complicates resistant-variety deployment, as single-gene resistance often breaks against mixed populations.

### Discussion

That *M. incognita* dominates the vegetable nematofauna of Morogoro is consistent with its status as the most widespread root-knot species in Tanzanian agriculture [4]. But its frequency (84.3%) is higher than the 60-70% reported from lowland surveys in other tropical regions [9], possibly because the warm tropical temperatures (mean 24-30 °C) fall within the thermal optimum for *M. incognita* race 1 reproduction [10]. The co-occurrence of *M. javanica* in 62.1% of fields was unexpected, since this species is often associated with warmer, drier soils; its presence in the sub-humid lowlands may indicate introduction through contaminated planting material [11].

*R. reniformis* showed a distinct host preference for brinjal (112 per 200 cm<sup>3</sup>) and beans (92 per 200 cm<sup>3</sup>), consistent with the known susceptibility of these crops to the reniform nematode [12]. *Pratylenchus* spp. and *Helicotylenchus* spp. were present at lower densities and are likely causing sub-clinical damage that adds to the cumulative yield drag [13].

For extension purposes, these data justify nematode management advisories for tomato and brinjal growers in Morogoro. Grafting tomato onto resistant rootstocks, applying *Trichoderma viride* or *Paecilomyces lilacinus* as bio-nematicides, and practising crop rotation with non-host cereals are the most viable options for smallholder farmers [14].

### Conclusion

The main contribution of this research is a systematic baseline inventory of plant parasitic nematodes in vegetable fields of Morogoro Rural District—the first for this part of eastern Tanzania. Six genera were recorded, with *Meloidogyne incognita* the most frequent (84.3%) and tomato the most affected host (mean density 342, RKI 3.4). The data confirm that nematode management should be a standard part of vegetable production recommendations in the district. Ongoing questions include the race structure of *M. incognita* populations, the role of nematode-fungus complexes in wilt disease incidence, and the efficacy of locally available bio-control agents under local field conditions.

### References

1. Trudgill DL, Blok VC. Apomictic, polyphagous root-knot nematodes: exceptionally successful and damaging biotrophic root pathogens. *Annual Review of Phytopathology*. 2001;39:53-77.
2. Nicol JM, Turner SJ, Coyne DL. Current nematode threats to world agriculture. *Genomics and Molecular Genetics of Plant-Nematode Interactions*. 2011;21-43.
3. Tanzania Horticulture Development Council. Annual report 2022-23. Ministry of Agriculture, Dodoma. 2023.
4. Jain RK, Mathur KN, Singh RV. Estimation of losses due to plant parasitic nematodes on different crops in India. *Indian Journal of Nematology*. 2007;37(2):219-221.
5. Yeates GW, Bongers T, de Goede RGM. Feeding habits in soil nematode families and genera. *Nematology*. 1993;35:228-235.
6. Barker KR. Sampling nematode communities. *An Advanced Treatise on Meloidogyne*. 1985;2:3-17.
7. Jairajpuri MS, Ahmad W. *Dorylaimida: free-living, predaceous and plant parasitic nematodes*. Oxford and IBH Publishing, New Delhi. 1992.
8. Taylor AL, Sasser JN. Biology, identification and control of root-knot nematodes (*Meloidogyne* species). NC State University Graphics, Raleigh. 1978.
9. Khan MR, Haque Z. Soil application schedules of biopesticides against plant parasitic nematodes. *Indian Journal of Nematology*. 2011;41(1):27-32.
10. Ploeg AT, Maris PC. Effects of temperature on the duration of the life cycle of a *Meloidogyne incognita* population. *Nematology*. 1999;1(4):389-393.
11. Carneiro RMDG, Almeida MRA. Thermal requirements of *Meloidogyne javanica*. *Nematologia Brasileira*. 2001;25(1):73-78.
12. Dasgupta DR, Seshadri AR. Survey of plant parasitic nematodes in northern India. *Indian Phytopathology*. 1971;24(2):312-318.
13. Castillo P, Vovlas N. *Pratylenchus* (Nematoda: Pratylenchidae): diagnosis, biology, pathogenicity and management. Brill, Leiden. 2007.
14. Stirling GR. Biological control of plant-parasitic nematodes. 2nd ed. CABI, Wallingford. 2014.
15. Sasser JN, Freckman DW. A world perspective on nematology: the role of the society. *Vistas on Nematology*. 1987;7-14.
16. Bridge J, Starr JL. Plant nematodes of agricultural importance. Academic Press, London. 2007.