Gujarat Journal of Extension Education Vol. 33 : Issue 1 : June 2022 https://doi.org/10.56572/gjoee.2022.33.1.0022

SOIL SURVEY ON THE VERTICAL DISTRIBUTION OF DIFFERENT NEMATODE FEEDING TYPES IN SOILS FROM BRASSICA AND SOLANACEOUS FIELDS IN GWERU PERI –URBAN FARMS OF ZIMBABWE

Tonodzai Rutendo Philomena

House Number 15241 Furanayi Masunda Street, Runyararo West, Masvingo - Zimbabwe
Email:rutendotonho@gmail.com

ABSTRACT

Nematodes are microscopic wormlike organisms and soil is an excellent habitat for them to survive . They have different feeding types that are determined by their mouth parts . Amongst the different feeding types there are , beneficial and plant parasitic nematodes. The research focused on on identifying the different nematode feeding types in the soil . The different feeding types were extracted from soil samples from different soils from different crops at different depths. The soil samples were collected from three t different farms producing solanaceous and brassica crops at three different depths . the experiment was conducted in Randomised Complete Block Design in 2 x 3 factorial replicated three times , with farms as blocking factors . The baerman funnel was used in the extraction of the nematodes , the infiltrate was analysed under a microscope, and nematode were identified using mouth parts . how ever only four feeding types were identified that is the omnivore, bacterivore, fungivore and herbivore. Bacterivores, fungivores and herbivores were abundant in top soil for there is abundant organic matter. Omnivores were abundant in bottom soils , for they are sensitive to soil distubances and nitrogen .There were more beneficial nematodes in the soil samples than plant parasitic, there for that deter mine soil health.

Keywords : *soil; nematode; brassica, solanaceous*

INTRODUCTION

Nematodes are microscopic, whitish to transparent, unsegmented worms, belonging to the phylum nematoda and occupy almost every possible habitat on earth and mostly in in soils (Barbercheck *et al.,* 2015). As soils are an excellent habitat for nematodes, plant parasitic nematodes attracts a special interest to many farmers ,due to their importance in agricultural production (Storey , 2014).Plant-parasitic nematodes are a serious pest which mainly feed on plant roots causing root malformation, leading to wilting hence loss. However nematodes are not only pests, but a diverse group of species that can play important roles in the soil system . It has been discovered that amongst the nematode species there are relatively a few plant parasitic nematodes and more are beneficial also known as the free living nematodes .They play an important role in the soil food web in nutrient mineralization ,decomposition also regulating the behavior of the microbial community ,also used as soil health bio-indicators for they are abundant in different soil (Storey, 2015)

The free living nematodes are divided into five broad trophic groups for easier identification using their mouth parts(Linsell *et al* , 2014),which are the herbivores or plant parasitic, omnivores, bacterivores fungivores and predators .Herbivores or plant parasitic nematodes feed on plant roots (McSorley, 2011). Omnivores feed on more than one type of material , even on other nematodes and will help and limit plant-parasitic nematode densities. Omnivores do better in a stable soil environment (Grabau and Melakeberhan*,* 2016). Fungivores are nematodes which feed on fungi using a stylet to puncture the fungal hyphae and they are also involved in breakdown of recalcitrant materials such as fibrous plant material (McSorley, 2011) . Bacterivores feeds on bacteria only and beneficial for decomposition of organic matter .

The different nematode feeding types in the soil vary between systems and seasons also affected by a variety of factors , including crop and soil management practices . Management practices like tillage, crop rotation, and use of organic matter influence the abundance of nematodes. How ever they are affected by agricultural systems with more physical and chemical disturbances for example fungivores and omnivores are sensitive to soil disturbances (Ugarte, 2014).

However since plant parasitic nematodes(herbivores) co-exist with other free living nematodes, the researcher seeks to identify and compare the vertical distribution and quantity of other nematode feeding types that might exist in brassica and solanaceous crops. This will help farmers to monitor soil health also developing a better and effective intergrated pest management control.

OBJECTIVES

(1) To determine the total population of different nematode feeding types(herbivores, omnivores, bacterivores fungivores and predators) at different soil depths in brassicas and solanaceous crops

(2) To determine different nematode feeding types(herbivores, omnivores, bacterivores fungivores and predators) of nematodes at different soil levels brassica and solanaceous crops

METHODOLOGY

Soil sampling procedures

Soil samples were collected from three different farms in Gweru peri urban areas ,producing brassicas and solanaceous crops .A composite sample for each crop per depth was obtained using azig zag soil sampling pattern with the aid of soil sampling auger.Composite samples were labeled according to the depthss(0-15cm,16-30cm and 31-45 cm), crops (brassica or solanaceous) also farms (farm 1,2 and 3)where they were collected from and placed in cool places for nematodes are affected by high temperatures.

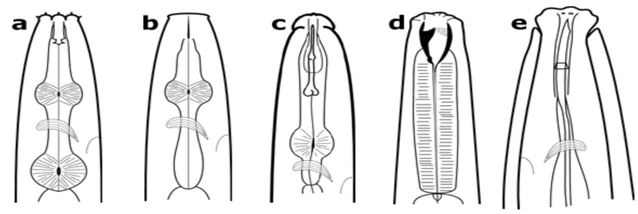
Nematode extraction

Nematode extraction process was carried out Midlands State University under laboratory conditions, using the *Baerman funnel* technique. Composite samples were thoroughly mixed before taking 50gram subsample for nematode extraction. The 50gram sub samples were evenly spread on mutton cloths laid on the funnels of the *Baerman funnel* set ups, half filled with water. The soil samples in the funnels were wrapped with perforated foil papers to reduce evaporation also ventilation of the nematodes. The funnels were left undisturbed under laboratory conditions for 72 hours,however water was added when necessary.

Fig. 1: Baerman funnel technique

NEMATODE IDENTIFICATION

After 72 hours of the extraction process , glass slides with 1 millitre of the nematode suspension solution observed under a microscope at high power. The nematodes were identified according feeding types , using mouth parts illustrated by (Wang et al ,2010) ,(Ugarte and Zaboski , 2014) , (Yeates,1993) and(McSorley,2009). Different nematode feeding types were recorded and shown in fig. 2.



(a) bacterial feeder, (b) fungal feeder, (c) plant feeder, (d) predator, (e) omnivore

Fig. 2 : Different feeding types of Nematode (Source: Zaborski, 2014)

Data collection

Data collection was done after 72 hours of nematode extraction

Population density

Mean nematode population density per depth per crop was determined for each treatment

Different feeding types

Number of different nematode feeding types per day per crop was determined for each treatment.

RESULTS AND DISCUSSION

Nematode total population density at different soil depths in brassicas and solanaceous crops

There was interaction , but there was no significant difference (P>0.005) in the nematode total population density at different soil depths in both brassica and solanaceous crops. however there was statistical difference between brassicas and solanaceous at different soil depths. Brassica in relation to depth had an average of 11.67 (0-15cm), 8.00 (16-30cm) and 8.67 (31-45cm). Solanaceous in relation to depth had an average of 12.67(0-15cm) , 9.00 (16-30cm) and 9.33 (31-45 cm).

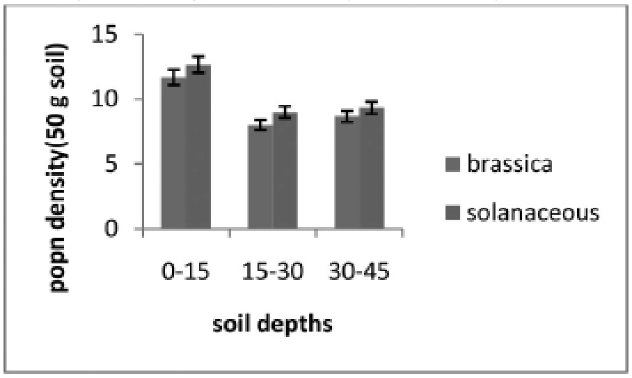


Fig. 3 : Mean nematode total population density

Different feeding types(bacterivore, herbivore, fungivore and omnivore) of nematodes at different soil depths brassica and solanaceous crops

(A) Bacterivore

There was interaction , but there was significant difference (P>0.05) in bacterivore population in in both crops brassica and solanaceous crops and also at different depths.Eventhough there was a statistical difference between bacterivore populations in brassicas 1.642(0-15cm) 1.462(16-30cm) and 2.029 (31-45) cm and in solanaceous crops 1.559 (0-15cm)1.524(16-30cm) and 1.524(31-45cm).

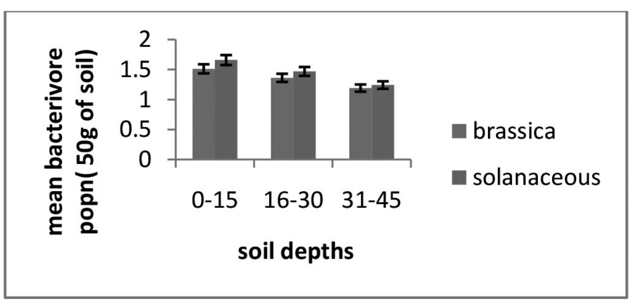


Fig. 4 : Mean bacterivore at different soil depths in brassica and solanaceous

(B) Fungivore

There was an interaction and a significant difference (P< 0.05) in fungivore population in both crops brassica and solanaceous crops and also in different depths. However there was also a statistical difference between fungivore populations in brassicas brassica 0.682(0-15cm) ,0.512(16-30cm) and 0.324(31-45cm) and in solanaceous 0.789(0-15cm), 0.699(16-30cm)and 0.487(31-45 cm)

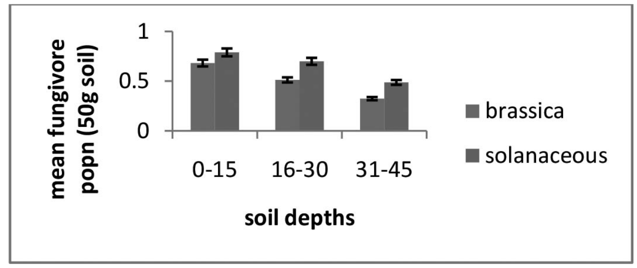


Fig. 5 : Mean fungivore at different soil depths in brassica and solanaceous

(C) Omnivore

There was interaction but there was no significant difference (P>0.05) in omnivore population in depths ,but there was a significant difference (P<0.05) in omnivore population in both crops brassica and solanaceous crops. Eventhough there was a statistical difference between omnivore populations in brassicas in relation to depths there was 0.880(0-15cm), 1.052(16-30cm) and 1.524(31-45cm). In solanaceous there was also a statistical difference in relation to depth 0.707(0-15cm) 0.998(16-30cm) and 1.440(31-45cm).

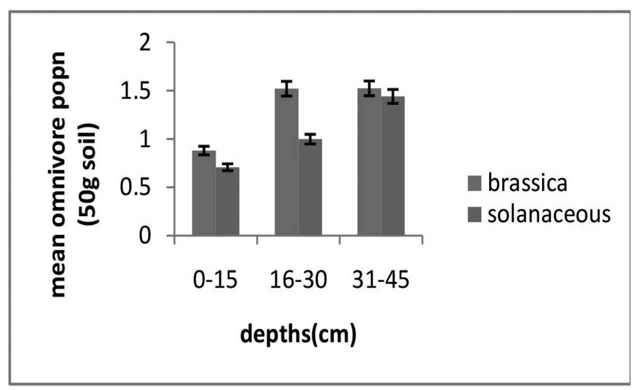


Fig. 6 : Mean omnivore population at different depths , in brassica and solanaceous

(D) Herbivore

There was interaction and a significant difference (P< 0.05) in herbivore population in in both crops brassica and solanaceous crops and also in different depths. There was also a statistical difference between herbivore populations in brassicas 1.871 (0-15cm),1.344 (16-30cm)and 0.880(31-45cm) and solanaceous 2.476 (0-15cm), 1.836 (16-30cm) and 1.871 (31-45 cm.)

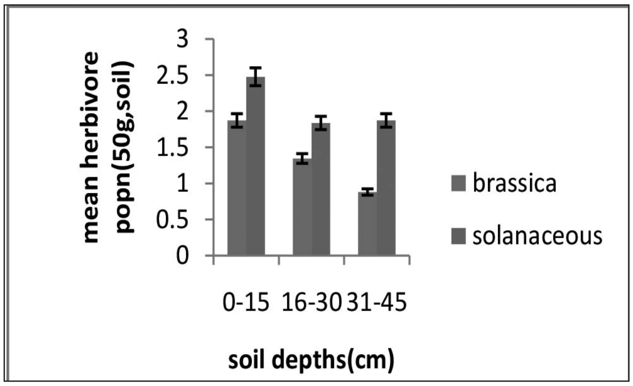


Fig.7 : Mean herbivore population density of different depths in brassica and solanaceous

CONCLUSION

On total nematode population , the top soil layer , which is ranging from 0-15cm was possessing a higher nematode population density as compared to the lower depths . There was a lower nematode population density , in brassica than in solanaceous crops .Omnivore nematode populations were increasing with depth unlike the other nematode populations which were decreasing with depth. Herbivores have got a higher nematode population density , amongst the existing nematode feeding types in the soil. Fungivores have got the least population density amongst the existing nematode feeding types in the soil.However the total population of beneficial nematodes was greater than the plant parasitic nematodes , there more beneficial nematodes than plant parasitic nematodes deter mine soil heathy.

CONFLICT OF INTEREST

The authors of the paper declare no conflict of interest

REFERENCES

Barbercheck M .E, Grewal P.S ,Stuart R. J(2015) Entomopathogenic Nematodes in the Soil Environment: Distributions, Interactions and the Influence of Biotic and Abiotic Factors.Springer International Publishing.: Sustainability in Plant and Crop Protection pp 97-137

Grabau Z, and Melakeberhan H (2016) Plant-parasitic and beneficial nematode distribution in Michigan vegetable soils. http://msue.anr.msu.edu/plant_parasitic_andbeneficial_nematode_distribution (Accessed 23 September 2016)

McSorley, R. (2009) Soil-inhabiting nematodes. http://entnemdept.ufl.edu/Creatures/nematode/soilnematode.htm(Accessed 12 October 2016)

McSorley, R. (2011) Overview of Organic Amendments for Management of Plant-Parasitic Nematodes, with Case Studies from Florida. J Nematol; 43(2): 69–81.

Storey, S. (2015) General information about nematodes. http://www.nemlab.co.za/2015. (accessed 19 0ctober 2016)

Received : May 2022 : Accepted : June 2022