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Identification of Dominant Geo-Helminths in High Area of Anthropogenic Activities in Mubi North Local Govetment Area of Adamawa State

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ABSTRACT
Several factors responsible for the survival of geohelminths parasite such as temperature, soil quality, pH and rainfall as well as organic matter etc. geo-helminthes such as tape warm, rounds, earths and hook worms etc. are parasites that thrives well in environment with poor sanitation. The samples used were obtained in dumpsite, farmland and virgin land during training and dry season. The samples were identification for geohelminths and physicochemical properties were analyzed. Results obtained shows that *Ascaris lumbricoides (*AL), *Trichuris trichura* (TT), *Strongyloides stercoralis (*SS) *and Ancyclostoma duodenale were present during raining seasons with a mean score value of* AL (1.00 – 14.67), TT (0.00 – 5.00), SS (0.00 – 6.67) and AD (0.00 – 11.67). The results of physicochemical properties of soil samples analyzed in raining and dry seasons in dumpsite, farmland and virgin land across Mubi North during raining season revealed that there were significant difference at (P< 0.05 %) level among the samples in terms of temperature, pH, E.C and O.M across the three locations where 9 samples were analyzed with mean value ranged from temperature, (35.10 – 35.90 ^{o}C) in dumpsite, (35.10 – 36.10 ^{o}C) in farmland and (35.10 – 36.80 ^{o}C) respectively. The E.C ranged from the highest mean value to the lowest in sample (358 – 678) in dumpsite as compared with other location which ranged from (71 – 334) compared with the farmland during raining season with an average mean value of (4.95 – 6.50) obtained in dumpsite, (3.75 – 5.05), virgin land and (7.60 – 8.50) in farmland which indicates that the organic matter depends on the nature of the land and its soil fertility rate. The physicochemical properties of the soil changes with change in seasons and geographical location.

Keywords: Soil, Geohelminths, Parasites, Physiochemical, Raining and Dry Season

INTRODUCTION

Environmental factors tend to influence the survival and prevalence of geo-helminthes, such as; temperature, Rainfall, Soil quality etc. (Tchakounte *et al* 2018). Geo-helminthes are depends on the environment for their life cycle when exist outside the host. Geo-helminthes such as; hookworms, roundworms, earthworms and tape warms etc, found in the soil are affected by climate change (WHO, 2006). Increase in temperature leads to faster larvae development and decrease infectivity rates (Bethony *et al.,* 2006; Oyun *et al.,* 2025). Increased rainfall could prevent helminthes eggs/larvae desiccation by providing adequate moisture which enhance their survival and rate of prevalence in the southeast (Nwoke, 2013).

Geo-helminthes, also known as soil-transmitted helminthes (STHs), are parasitic worms that thrive well in environments where sanitation is poor and human or animal fecal matter contaminates the soil (Ishaya *et al.,* 2007). Common species such as *Ascaris lumbricoides, Trichuris trichiura*, and hookworms (*Ancylostoma duodenale, Necator americanus*) are endemic in many parts of Nigeria, where they contribute significantly to public health burdens, especially among children and rural populations (Ojha *et al.,* 2014). In recent studies, *Ascaris lumbricoides* infects over 1 billion people, over the years and 770 million people by *Trichuris trichura,* 800 million people are infected by *Necator americanus* and *Ancyclostoma duodenale*), among all this soil helminthes species, 5 nematodes in particular stand out because of their wide spread, prevalence and distribution which is the cause of the millions of infection in humans. These nematodes include; Roundworms (*A. lumbricoides*), Whipworms (*T. trichura*), Hookworms (*N. americanus* and *A. duodenale*) (Nock e*t al.,* 2007).

The eggs of soil transmitted geo-helminthes are prevalent in environment where sanitation practices are poor. People living in dirty environment are prone to infections caused by those soil helminthes. Those infections occur when people come in contact with soil infected with helminthes eggs and larvae.

These worms survive in the gastro-intestinal tract of their host for years (Traversa, 2012). These helminthes living in intestinal tract of their host caused morbidity and disability than death. These morbidities include; malnutrition in children, anemia, low weight gain, severe intestinal absorption and or disorder etc. (Ojha *et al* 2014).

The rise in soil transmitted helminthes infection remains a great challenge in the world especially in the tropics. Environmental variability plays a vital role in shaping geo-helminthes survival and transmission as the eggs and larvae depend on soil and climatic factor for their survival. Communities where sanitation is poor and the people come in contact with geohelminths' egg through farming activities or consuming contaminated fruits and vegetables leads to increase in soil transmitted helminthes diseases (Ojha *et al.,* 2014; Traversa, 2012).

In Adamawa state, particularly Mubi and its surrounding environment, people practice open defecation, they use animal feces as fertilizers, and poor dumping of refuse practices contributes highly to prevalence of geohelminths. The change in climatic factors influencing geohelminths egg/larvae survival in Mubi LG of Adamawa state is not given much importance as it is one of the driving factors contributing to the occurrence of geo-helminthes. This study takes into consideration the identification of dominant geo-helminthes found in the area where anthropogenic activities is high in Mubi North LG and their relationship between the environmental changes and the prevalence of geo-helminthes eggs/larvae.

MATERIALS AND METHODS

Materials

The materials used in this article comprises of field and laboratory materials. Which are; hand trowel, sterilized sample bottles, hand gloves, meter rule, soil thermometer, and spatula used in he filed. While the laboratory materials used includes; petri dish, sieve, analytical soil pH meter, soil electric conductivity meter, dissecting microscope etc.

Study Area

The study were conducted in Mubi North Local Government, Area of Adamawa State. The study covers a land area of 25 km² (2500 Hectares). Mubi North is a local Government of Adamawa state, Nigeria with Coordinates 10°16'N Latitudes and 13°16'E longitudes. The seasonal change ranges from raining season to dry season and its temperature range from 15.6 - 38.3 °C. The raining season in Mubi North is oppressive starting from the month of May being the cloudiest, and most of the days rainy. Its rainy season lasts from the month of May to October.

Sampling Sites

The sampling sites of this study covers 3 locations. These locations include; Dumpsites, Farmlands, and Virgin lands, in Mubi North Local Government, Area of Adamawa State.

Sample Technique

The geohelminths and the soil sample were obtained by collecting 500 g of soil in each location from the dumpsite, farmland and virgin land using a hand trowel at a depth of 3 - 5 cm between 08:00 - 11:00 am where geo-helminthes egg activity is more prevalent. The samples were stored in a well labeled and sterile sampling bottles. The samples were transported in a cooling flask to the laboratory for further analysis as described by (Tchakounté *et al.,* 2018). The samples were collected in August and September for the rainy season, while dry season samples were collected in October and November respectively.

Extraction and Identification of Geohelminths Ova and Larvae

The extraction of the soil-transmitted helminthes ova and their larvae were carried out using the Baermann' culture technique (Traversa, 2012). This technique were first developed by Barker et al (1985) while the helminthes ova were isolated using the floatation technique as described by Nock *et al* (2007). The larvae and ova were observed under a dissecting microscope with 10x, 40x and 100x objective lenses observing the standard morphological keys features used in their identification (WHO, 2001, 2006; Ojha *et al.,* 2014).

Determination of Soil Physicochemical Parameters

The physicochemical properties analyzed includes; temperature, pH, electrical conductivity and soil organic matter respectively following a method described by (Idris *et al.,* 2025).

Temperature

The soil temperature were obtained from the study area were analyzed on-site during collection using analytical soil thermometer, where the thermometer were inserted at a depth of 3 - 5 cm into the soil sample for 1-2 minutes for accuracy and the readings were taken and recorded in triplicates as described by (Oyun *et al.,* 2021*;* Idris *et al.,* 2025).

pH

The soil pH value of the soil sample were using a standard digital pH meter, where 5 g of the soil was weighed and transferred into a beaker, 50 mL of water were added to form a solution. The soil solution was stirred carefully for proper dispersion and the pH electrodes were placed inside the solution for 2-3 minutes and the reading were taken and recorded. This procedure were repeated three times for accuracy as described by (Ukabiala, 2021).

Electrical Conductivity

The soil electrical conductivity were determined using conductivity meter by weighing accurately 5 g of soil sample into a 250 mL beaker, and the 50 mL distilled water were added to a make a solution, then stirred carefully to ensure proper solution ((Oyun *et al.,* 2021*;* Idris *et al.,* 2025). The electrical conductivity meter were inserted into the solution for 2-3 minutes before the reading was taken and this were repeated in triplicate for accuracy (Aminu, 2024).

Soil Organic Matter

Constitute of soil organic matter in the study area were analyzed using a method described by (Traversa, 2012). Where the soil sample were dried, grounded to fine particles then sieved using 2 µm mesh sieve (Fikresilasie, 2015). Three gram (3 g) of the previously sieved soil sample was weighed out into 250 mL conical flask and 10 mL of 0.2 M $K_2Cr_2O_7$ were added to the soil mixture in the flask then swirled continuously to obtained homogeneity. Twenty mill (20 mL) of concentrated H_2SO_4 were rapidly added and allowed to rest for 30 minutes, then 200 mL distilled water were also added followed by 10 mL of 85 % H_2PO_4 and 1 mL of diphenylamine as indicator. The solution were titrated using 0.5 M $(NH_4)_2\ Fe(SO_4)_2.6H_2O$ until a bright green color were obtained. A blank titration (without soil) were carried out following the steps above and the total organic matter were calculated as follows:

Organic Carbon % in soil =

$$\text{TOM} = (X - Y)\ X + \frac{(X - Y)XNX0.003)}{Weight\ of\ soil\ (w)} x\ 100$$

Organic Carbon % in soil × 1.724

Where:

X- Volume of $(NH_4)_2Fe\ (SO_4)_2.6H_2O$ used in sample titration

Y- Volume of $(NH_4)_2Fe\ (SO_4)_2.6H_2O$ used in blank titration

Statistical Analysis

All the data obtained in triplicates were imputed into Microsoft excel office 16 version and further analyzed statistically for mean standard deviation using SPSS software version 21 as described by (Fikresilasie, 2015).

RESULTS AND DISCUSSION

Prevalence of Geohelminths in 3 Locations in Mubi North

Table 1 showed the result of geohelminths in Mubi north during raining season where dumpsite, farm land and virgin land were sampled across 3 locations with nine (9) samples each for the presence of *Ascaris lumbricoides (*AL), *Trichuris trichura* (TT), *Strongyloides stercoralis (*SS) *and Ancyclostoma duodenale (*AD) respectively. The results revealed that AL were predominantly found in dumpsite followed by farm land while the virgin land had the least (14.6, 10.00 and 6.00) in location A, meanwhile, location I, B and C had the least *Ascaris lumbricoides (2.67 - 0.00) respectively. The Trichuris trichura (TT) evaluated in dumpsite, farm land and virgin across nine (9) locations in Mubi north local government showed that the dumpsite and virgin land had a very minimal concentration of Trichuris trichura ranged from 0.00 – 3.33) in dumpsite, (0.00-8.33) in farm land and (0.00-2.33) in virgin land respectively.*

The results in Table 1 above showed that during the raining season in Mubi north, *Ascaris lumbricoides* was found to be significantly high at dumpsite with a mean value of (14.67± 0.57) followed by farmland with mean value of (13.67 ± 5.50) and virgin land with mean value of (7.33 ± 2.30). This showed that *Ascaris lumbricoides* is predominantly found in dumpsites than farmlands and virgin lands. The Strongyloides stercoralis helminthes sampled in Mubi north during raining season from dumpsite, farmland and virgin were analyzed and the results obtained indicate that there was a high presence of (SS) which raged from (0.00 – 10.33) in dumpsite, (0.0-5.67) in farmland and (0.00-5.00) in virgin respectively. This showed that the more fertile dumpsite is the major carrier of the geo-helminthes. While, farm land and the virgin land showed low concentration. While. The Ancyclostoma duodenale showed a slight decrease among the samples across the 3 locations which revealed that dumpsite had a mean value of (0.00-11.67), 0.00-10.33) in farmland and 2.00-7.00) with p-Value of (0.00, 0.61 and 0.02). Similarly, table 2. Showed the results of geo-helminthes samples obtained during dry season in same location showed that the presence of geo-helminthes significantly reduced due to lack of adequate moisture content where the AL had an average mean value ranged from (4.67-10.67) in sample B to sample F in dumpsite, followed by (1.11-5.33) in sample C-H in the farmland to the least mean value of (0.00-3.33) in sample A – E) analyzed from the virgin land. The results of TT showed that Virgin land had the highest mean value ranged from (0.00-8.33), followed by farmland samples with a mean value of (0.00-7.00) and the samples analyzed in the dumpsite (0.00-6.67) had the lowest. The SS ranged from (0.0-6.67) in dumpsite, (0.00-6.00) in farmland and (0.00-5.00) in virgin land across the 9 samples analyzed in 3 locations. While the number of AD across the 3 sampling locations revealed that dumpsite had a mean value of 2.00-7.00), farmland ranged from (2.00-7.00) and virgin land (0.00-3.33) with a significant decreases which revealed that the more contaminated soil contained certain number of geo-helminthes while the farm land also contained a specific geo-helminthes. This result presented in table 1 and 2 analyzed from 3 locations in dumpsite, farmland and virgin land samples obtained in Mubi north local government area showed a distinct difference in the presence of geo-helminthes in raining and dry season which implies that during raining season the number of geo-helminthes were significantly high compared with the dry season.

Physicochemical Properties of Soil Analyzed in Mubi North

The results of physicochemical properties of soil analyzed in Mubi north during raining season and dry seasons are presented in table 3 and 4. The result obtained from soil sampled in dumpsite, farmland and virgin land across Mubi north during raining season revealed that there were no significant difference at (P> 0.05 %) level among the samples analyzed in terms of their temperature, pH, and organic matter across all the three locations where 9 samples were taken which ranged from temperature, (35.10 – 35.90 ^{o}C) in dumpsite, (35.10 – 36.10 ^{o}C) in farmland and (35.10 – 36.80 ^{o}C) respectively.

The pH value analyzed in soil samples across the study area showed that there was no significant difference at (P>0.5 %) level of probability in dumpsite, farmland and virgin land with an average mean value of (8.15 – 8.80) in dumpsite, (8.90 – 9.35) in farmland and the (8.80 – 9.60) which are all alkaline as analyzed during raining season. While, the electric conductivity and organic matter showed a significant difference among the samples and across the study area at (P<0.05 %) level of probability, were the E.C ranged from the highest mean value to the lowest in sample (358 – 678) in dumpsite with significant difference among the samples where sample E had the lowest E.C and the sample C had the highest. The results obtained in farmland were slightly slower than the dumpsite which ranged from (167 – 516) with the lowest in sample G to the highest mean value in sample F which implies that the E.C varies significantly according to location and season respectively. Meanwhile, the results of E.C obtained in virgin land had a very low E.C compared with other location which ranged from (71 – 334) in sample to F with a significant difference among the samples at (P<0.0 %) level of significance. (Table 1 and 2) organic matter analyzed in soil samples in the three location showed that there was significant difference (P<0.05 %) among the samples where the virgin land and dumpsite had a minimal organic matter compared with the farmland during raining season with an average mean value of (4.95 – 6.50) obtained in dumpsite, (3.75 – 5.05) in virgin land and (7.60 – 8.50) in farmland which indicates that the organic matter depends on the nature of the land and its fertility rate. Similarly, the results obtained from the location during dry season showed a similar results in Temperature, pH, as presented in table 4, while the E.C, and O.M showed that significant decrease in their mean value as compared with table 3 which indicates that the physicochemical properties of the spoil soil changes with change in seasons and well as geographical location.

Table 1: Geo-Helminthes in Mubi North during Raining Season

Location/	DUMPSITE				FARMLAND				VIRGIN LAND			
Code	AL	TT	SS	AD	AL	TT	SS	AD	AL	TT	SS	AD
A	14.67±0.57	2.00±0.64	5.00±2.00	11.67±5.03	10.00±4.00	8.33±3.05	4.00±1.73	10.33±3.51	6.00±2.64	0.00±0.00	2.33±0.57	5.67±1.52
B	9.33±0.57	0.00±0.00	10.33±3.21	8.00±2.00	9.33±1.08	7.00±1.55	2.67±1.51	8.33±2.51	4.33±1.51	0.00±0.00	1.33±0.15	7.00±2.00
C	4.67±0.57	1.67±0.52	6.67±2.04	10.00±3.01	0.00±0.00	1.00±0.00	0.00±0.00	6.33±1.15	0.00±0.00	0.00±0.00	0.00±0.00	5.00±0.00
D	14.67±0.57	3.33±1.52	0.00±0.00	6.00±2.05	9.00±1.54	4.00±1.51	0.00±0.00	4.33±2.08	0.00±0.00	1.33±0.15	0.00±0.00	4.00±1.00
E	11.00±1.00	3.67±1.05	5.00±1.03	10.00±2.64	6.33±1.16	0.00±0.00	0.00±0.00	8.33±2.51	7.33±2.30	0.00±0.00	0.00±0.00	5.33±1.52
F	9.00±1.00	0.00±0.00	5.33±1.52	11.33±4.76	8.00±2.00	6.00±2.72	5.67±2.08	8.67±2.42	5.00±1.00	1.00±0.00	5.00±2.00	6.67±2.16
G	11.00±1.00	0.00±0.00	0.00±0.00	8.00±2.60	13.67±5.50	11.33±5.77	3.67±1.08	7.00±2.46	6.67±1.52	2.33±1.52	3.33±1.52	5.00±1.73
H	1.00±1.00	5.00±0.00	10.00±3.04	0.00±0.00	9.67±4.72	6.67±2.72	1.67±0.57	0.00±0.00	1.33±0.52	0.00±0.00	1.00±0.00	2.00±0.00
I	2.67±0.57	0.00±0.00	4.33±1.51	0.00±0.00	8.33±2.88	7.00±1.73	3.33±1.05	0.00±0.00	3.00±1.00	0.00±0.00	3.00±1.15	3.33±1.52
p-value	4.29	0.00	0.00	0.00	0.15	0.01	0.00	8.61	3.50	0.00	0.00	0.02

The values are mean standard deviation (mean±SD) of triplicate measurements.
KEY: Locations: = AL= *Ascaris lumbricoides* TT =*Trichuris trichura* SS = *Strongyloides stercoralis* AD= *Ancyclostoma duodenale* Sample Code: A -I stands for number of samples analyzed each in triplicate measures.

Table 2: Geo-Helminthes in Mubi North during Mubi Dry Season

Location/	DUMPSITE				FARMLAND				VIRGIN LAND			
Code	AL.	TT	SS	AD	AL	TT	SS	AD	AL	TT	SS	AD
A	6.00±1.73	3.00±0.00	6.67±0.51	3.00±0.00	2.67±0.51	2.00±0.00	0.00±0.00	3.00±0.00	3.33±0.57	4.33±0.57	5.00±1.35	0.00±0.00
B	4.67±0.51	2.67±1.51	5.67±0.08	3.67±0.15	1.33±0.15	2.33±0.57	0.00±0.00	3.67±0.15	4.33±1.15	4.67±1.15	1.67±0.52	2.67±1.15
C	7.00±0.00	0.00±0.00	6.33±0.04	2.00±0.00	3.33±0.15	4.67±0.51	6.33±0.30	2.00±0.00	0.00±0.00	7.67±3.21	0.00±0.00	0.00±0.00
D	7.67±0.51	4.67±1.08	6.67±0.88	5.33±0.15	1.33±0.52	5.00±0.00	4.00±0.00	5.33±0.15	5.00±1.73	5.00±0.64	0.00±0.00	0.00±0.00
E	3.67±0.57	5.00±0.00	2.33±0.57	7.00±0.46	4.00±0.73	6.00±0.00	5.33±0.88	7.00±0.46	7.00±0.64	8.33±0.05	0.00±0.00	3.33±0.57
F	10.67±0.08	0.00±0.00	4.00±0.46	3.33±0.15	4.67±0.52	0.00±0.00	0.00±0.00	3.33±0.15	0.00±0.00	3.33±1.52	0.00±0.00	1.33±0.57
G	5.97±1.15	5.67±1.15	0.00±0.00	2.67±0.15	7.00±0.64	4.00±0.00	6.00±0.60	2.67±0.15	6.67±0.85	0.00±0.00	0.00±0.00	0.00±0.00
H	8.67±0.51	5.67±0.05	0.00±0.00	5.67±0.15	5.33±0.04	7.00±0.35	6.00±1.00	5.67±0.15	4.66±0.05	6.33±0.08	0.00±0.00	0.00±0.00
I	6.00±1.00	6.67±0.05	7.33±0.11	4.00±0.73	3.33±0.52	5.67±0.52	5.00±0.60	4.00±0.73	4.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
p-Value	1.49	0.00	0.02	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.01	1.55

The values are mean standard deviation (mean±SD) of triplicate measurements.
KEY: Locations: = AL= *Ascaris lumbricoides* TT =*Trichuris trichura* SS = *Strongyloides stercoralis* AD= *Ancyclostoma duodenale* Sample Code: A -I stands for number of samples analyzed each in triplicate measures.

Table 3: Physicochemical Properties of the Soil in Mubi North during Raining Season

Location /	DUMPSITE				FARMLAND				VIRGIN LAND			
parameters	Temp.	pH	E.C	O.M	Temp.	pH	E.C	O.M	Temp.	pH	E.C	O.M
A	35.20±0.35	8.80±0.21	541±1.41	6.40±0.14	35.90±0.14	9.25±0.21	338±2.82	7.60±0.28	36.8±0.21	9.40±0.28	710±4.24	5.05±0.21
B	35.80±0.21	8.70±0.14	607±1.41	6.50±0.14	35.90±0.42	8.90±0.14	336±2.82	7.85±0.21	36.8±0.21	8.85±0.21	730±4.24	5.00±0.42
C	35.20±0.35	8.50±0.14	678±2.82	5.90±0.14	35.30±0.49	9.30±0.28	346±2.82	7.60±0.14	36.6±0.21	8.80±0.28	780±2.82	4.75±0.35
D	35.30±0.14	8.90±0.14	824±2.82	6.00±0.14	35.20±0.35	8.90±0.14	500±2.82	8.25±0.35	35.9±0.35	9.05±0.21	319±1.41	4.25±0.35
E	35.90±0.14	8.90±0.14	358±2.82	5.90±0.14	35.70±0.35	8.95±0.35	506±2.82	8.05±0.21	35.2±0.35	8.90±0.14	334±2.82	4.10±0.28
F	35.80±0.28	8.60±0.14	360±2.82	6.30±0.14	36.10±0.56	9.10±0.56	516±2.82	8.35±0.21	36.7±0.14	9.30±0.28	336±2.82	4.15±0.49
G	35.10±0.21	8.40±0.28	364±2.82	5.40±0.42	36.30±0.42	9.35±0.21	167±4.24	8.65±0.21	36.1±0.14	9.60±0.14	317±1.41	3.75±0.35
H	35.10±0.07	8.60±0.14	405±7.07	4.95±0.07	36.20±0.35	9.15±0.35	272±2.82	8.20±0.28	35.8±0.28	8.80±0.28	327±4.24	4.80±0.28
I	35.20±0.28	8.15±0.21	400±2.82	5.10±0.14	35.30±0.49	9.15±0.35	172±2.82	8.50±0.28	35.2±0.35	8.80±0.28	332±2.82	4.25±0.35
p-value	0.02	0.04	1.85	0.00	0.00	0.27	4.80	0.00	2.37	0.07	7.24	2.29

The values are mean standard deviation (mean±SD) of triplicate measurements.
KEY: Temp. =temperature, pH = negative logarithm of hydrogen iron, EC = electric conductivity and O.M = Sample Code: A -I stands for number of samples analyzed each in triplicate measures.

Table 4: Physicochemical Properties of the Soil in Mubi North during Raining dry season

Location /	DUMPSITE				FARMLAND				VIRGIN LAND			
parameter	Temp.	pH	E.C	O.M	Temp.	pH	E.C	O.M	Temp.	pH	E.C	O.M
A	35.80±0.21	8.90±0.14	200±2.82	4.60±0.28	36.3±0.35	8.85±0.21	682±2.82	3.25±0.35	35.2±0.12	9.45±0.21	277±4.24	1.25±0.35
B	35.20±0.35	9.20±0.14	198±2.82	4.45±0.21	35.7±0.35	8.80±0.28	342±2.82	2.25±0.35	35.2±0.12	9.00±0.14	284±2.82	1.50±0.28
C	35.70±0.35	9.05±0.21	380±2.82	5.25±0.35	34.5±0.70	8.75±0.35	212±2.82	4.15±0.35	35.8±0.04	9.00±0.28	352±2.82	1.40±0.28
D	36.50±0.07	8.90±0.14	383±4.24	6.20±0.28	35.3±0.35	8.75±0.35	134±2.82	4.25±0.35	35.8±0.04	9.25±0.35	197±4.24	1.25±0.35
E	35.20±0.35	8.90±0.28	337±1.41	8.85±0.21	35.3±0.35	9.00±0.42	200±2.82	4.40±0.28	35.8±0.04	9.05±0.49	253±4.24	1.25±0.35
F	35.20±0.35	8.30±0.42	207±4.24	2.85±0.21	35.9±0.14	9.30±0.28	344±2.82	4.40±0.42	35.1±0.02	9.00±0.28	388±2.82	1.75±0.35
G	35.90±0.14	8.25±0.35	555±4.24	2.45±0.21	35.3±0.35	9.05±0.21	462±2.82	3.15±0.35	35.1±0.04	8,85±0.63	206±2.82	1.50±0.35
H	35.90±0.14	8.95±0.21	557±4.24	3.75±0.35	35.8±0.21	8.85±0.21	204±5.65	4.45±0.21	36.8±0.08	8.85±0.21	168±2.82	1.45±0.21
I	35.8±0.21	9.15±0.35	305±7.07	4.40±0.14	35.7±0.35	7.50±0.28	204±2.82	3.75±0.35	35.5±0.50	8.85±0.21	215±4.24	1.40±0.42
p-value	0.01	0.02	6.05	2.64	0.05	0.00	1.71	0.00	0.02	0.22	2.64	0.00

The values are mean standard deviation (mean±SD) of triplicate measurements. KEY: Temp. =temperature, pH = negative logarithm of hydrogen iron, EC =electric conductivity and O.M =. Sample Code: A -I stands for number of samples analyzed each in triplicate measures.

Discussion

The soil Geo-helminthes samples obtained and analyzed from three locations in Mubi North Local Government Area in dry and raining season indicates that there is a high prevalence of soil transmitted (geohelminths) infections compared with different prevalence rates of soil obtained from dumpsite site, farmland and virgin land respectively. The samples analyzed are among some of the common soil infections worldwide, where helminthes tends to contaminates soil such as; dumpsite were found more contaminated with geo-helminthes which agreed with the findings reported by (Fikresiasie, 2015) predominantly in the raining season as presented on Table 1 and 2. This study is in line with a similar findings conducted on the geohelminths eggs and their prevalence in soli as reported by (Blaszkowska *et al.,* 2013) indicate the rate at which helminthes predominate soil, exposed by dumped material, improves the soil fertility and also enhance the organic matter (Blaszkowska *et al.,* 2013).

The results showed that geo-helminthes activities tend to infect soil properties and are most prevalent in dumpsite than virgin land simply because their presence in the wet environment favors their activities (Bojar and Kapeu, 2012), while the rate of their dropped significantly during dry season as a result of low soil moisture content. the presence of moist climates in tropical and many stray or uncontrolled human activities and refuse dumping site as compared with the farmland and virgin land, where there was no human activities or excessive waste having potential to cause high geo-helminthes contaminate in the environment as relates with the study conducted by (Assefa *et al.,* 2013) on faece, dumping an high industrial activity enhance the prevalence of geo-helminths in their study area due to lack of good environmental soil control and maintenance. According to Assefa *et al.,* (2013), repeated exposures to soil parasite such as; *Ascaris lumbricoides, Trichuris trichura, Strongyloides stercoralis, Ancyclostoma duodenale* from nine (9 samples) across the study area in Mubi north local government showed a different level of prevalence of these geohelminths parasite which degrade the soil and also cause human diseases (Idris *et al.,* 2025).

The results of this study on prevalence of geohelminths analyzed indicates that the result obtained were lower than the result obtained by (Fikresilasie, 2015), which were carried out on soil contamination with geohelminths parasite in Sasiga district of East Wollega Zone Northwest Ethiopia and Chukwuma *et al.,* (2009) reported similar findings on the prevalence geohelminths parasites species in selected eastern part of Nigerian. The findings comprised environment of Nigeria which is higher than the current study conducted in Mubi north. But the result obtained were relatively lower than previous studies reported in Abattoir, Primary Schools, Private Houses and Market places for the load of soil-transmitted helminthes (Tavalla *et al.,* 2000; Marchioro *et al.,* 2013).

The nine different soil samples obtained in each study area during the two seasons in Mubi North such as; dumpsite, farmland and virgin land as presented in table 1 and 2 for raining and dry season revealed that the prevalence of geohelminths were predominantly present in raining season and much higher in the dumpsite compared with farmland and virgin land which implies that the soil quality is low in the dumpsite and the dry season present lower geohelminths activities during dry season (Tchakounté *e al.,* 2018; Marchioro *et al.,* 2013) in location where public activities are considered high. Different prevalence's of soil transmitted parasite' were recorded in dumpsite and majorly during raining season. The results indicates that, highest number of different species of soil transmitted parasite' were recorded in area of high human activities and waste. This might be due to the high land utilization that attracts different species of Helminths such as; *Ascaris lumbricoides, Trichuris trichura, Strongyloides stercoralis and Ancyclostoma duodenale* those have potential to contaminate the soil fertility or improve the nitrogen fixation process.

The result of the soil samples screened from virgin land shows to contained less helminths contaminates in which only few species of parasites were observed. However, statistical analysis showed a significant difference among the samples analyzed in the three study area ($P< 0.05$) were virgin land had the lowest of all in both raining and dry season respectively.

The observed eggs of these parasites were *Toxocara canis, Ascaris lumbricoides, Hook worm, Echinococcus multilocuris, Trichuris vulvus, Strongyloides stercoli* and mixed (Hook worm, *Trichuris vulvus, A. lumbricoides* are the most identified species in dumpsite (Bowman *e al.,* 2011). Among the species of parasites observed during this study, *A. lumbricoides* was slightly the leading geo-helminths parasite in the study areas. However, there is no statistical difference between the species of parasites and locations ($P>0.05$) in dry season for virgin land.

The physicochemical properties of soils samples obtained from tropical region of Mubi North typically showed that there is a clear seasonal variations due to differences in rainfall, temperature, leaching, and biological activity on the soil as presented in Table 3 and 4. The soil samples were analyzed for temperature, pH, electrical conductivity (EC) and organic matter (O.M) respectively. The soil Temperature analyzed revealed that there was no significant difference in the soil temperature in dry season and raining season despite the amount of direct solar radiation during dry season which is slightly lower in rainy season due to formation of cloud cover and relative humidity or high air moisture. The reported soil temperatures ranged between 35.10 - 35.90 °C in both the 2 seasons which implies that, the temperature were not affected by seasonal variation. Meanwhile, according to (Marchioro *et al.,* 2013), higher temperatures tends to accelerate organic matter decomposition in the soil with reduced moisture availability or water content.

The results of the soil pH were significant among the samples but varied from the study area as well as the seasonal variation between the rainy and dry seasons, according to the result in table 3 and 4, the pH value is the amount of acidity or alkalinity of the soil which were not affected by the geohelminths. According to different scholars, many studies across Nigeria on soils tend to be slightly acidic during the rainy season and closer to neutral in the dry season which disagreed with the results obtained in this study, this variation could be attributed due to analytical methods, error or properties of the soil studied. According to (Bojar and Kaapeu, 2012), an increased rainfall tends to promotes leaching of basic cations (Ca^{2+}, Mg^{2+}, K^{+}), thereby lowering the pH (acidic conditions). Meanwhile, in dry season, reduced leaching and accumulation of bases may slightly increase pH values ranging from (4.3–6.2) acidic while, low pH value were observed in wet conditions. Similarly, near-neutral pH (~6.7) has been recorded in dry season particularly in northern Nigeria.

The electrical conductivity (EC) of the soil samples analyzed in dumpsite, farmland and virgin lands in Mubi north reflects the level of soluble salts concentration in the soil. As indicated on the table 3 and 4, there is no consistency in the EC value of the soil sampled in dumpsite, farmland and the virgin land were the concentration depends on the sampling site in each

study area. According to (Idris *e al.,* 2025) the dry season tends to evaporate off certain concentration of salts from the soil there by increased in amount compared with the wet season which caused the salts to dilutes and leached out casing unsteady rate in the soil. This pattern aligns with findings that contaminants and dissolved ions become more concentrated during dry periods. The elevated EC value in dry season may be attributed due to high salinity risks that affects plant growth (Rudohradska *et al.,* 2011).

Similarly, the organic matter content revealed high concentration in raining season with reduced mean value on dry season. This changes may be due to an increase in plant litters, biological and decomposable dumpsite material decomposition in moist conditions thereby enhanced microbial activity during raining season. According to (Oyun *e al.,* 2025), reports that OM values exceeding 3 % and reaching up to 6.23 % were mostly found in raining season unlike dry season which lacks high moisture content to sustained the organic matter activities as reported in wet seasons by (Ukabiala, 2021). Whereas, higher organic matter improves soil fertility, structure, and water retention during the rainy season (Nock *et al.,* 2013).

CONCLUSION

The assessment of geohelminths and the physicochemical properties of soils samples analyzed in Mubi North local government area (dumpsite, farm land and virgin land sites) exhibits a clear seasonal dynamics and effects on the soil and its quality. In raining season, there were high prevalence of geohelminths across the study area with highest in the dumpsite, followed by farmland which could be attributed due to high moisture content, organic matter, microbial and or geohelminths (parasite) activities which tends to increase the leaching and acidity of the soil. While, there were slight difference in the dry season due to reduced rainfall, high temperature, an increase in salinity (EC), and often stable slightly higher pH value. These variations in geohelminths and physicochemical quality of the soil samples provides an insight on the importance of season-specific soil management practices, which are; liming acidic soils during rainy season, provides road map for irrigation farming as well as mulching during dry season. This study also provides information on the soil quality in Mubi North Local Government Area on soil properties with significant seasonal variability, affects soil quality and agricultural productivity. Therefore, it can be concluded that, raining season enhances biological activity and nutrient cycling in soil while dry season tends to promotes salt accumulation and reduced moisture availability.

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