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Host Status of the Common Weeds of Banana Establishments to Banana Nematodes in Central Uganda

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Abstract: Ninety-one weed species belonging to 27 families were identified from 14 banana plots during a survey study to identify the common weeds of banana establishments in central Uganda. The host status of 13 weed species to the banana nematodes *Radopholus similis*, *Helicotylenchus multicinctus* and *Pratylenchus goodeyi* was studied in a screenhouse experiment. *R.similis* was recovered from only banana roots while *H.multicinctus* was present in soil and/or roots of banana and nine weed species. *H.multicinctus* was the only nematode species recovered from soil around six weed species, at population densities much lower than those recovered from banana. *P.goodeyi* was present in roots of banana and only two weed species, namely, *Digitaria velutina* and *Eleusine indica*, at a very low population density compared to banana. The reproductive ratings show that all the weeds in this study are non-hosts of *R.similis*; *D. velutina* a poor host of both *H.multicinctus* and *P.goodeyi* while *Amaranthus*sp. and *S. nigrum* are poor hosts of *H.multicinctus* and non-hosts of *P.goodeyi*. No nematodes were recovered from *Tagetes minuta*, *Cyperus esculentus*, *Senecio disfolius* and *Digitaria scalarum*, indicating that these four weed species are non-hosts of banana nematodes.

Key words: Banana Nematodes · *Helicotylenchus multicinctus* · *Radopholus similis* · Reproductive Rating · Plant Host · *Pratylenchus goodeyi* · Weeds

INTRODUCTION

Plant parasitic nematodes are widespread and are the most damaging pests of all banana varieties (*Musa* spp.) causing severe crop losses [1-8]. Some 38 species of nematodes belonging to 20 genera have been listed as possible parasites of banana [9]. The most widespread and important banana nematodes are the burrowing nematode, *Radopholus similis* (Cobb) Thorne, the lesion nematodes, *Pratylenchus* spp. and the spiral nematode, *Helicotylenchus multicinctus* (Cobb) Golden.

Races or biotypes of *R.similis* have been recognized; the 'banana race' attacking banana but not citrus and the 'citrus race' which attacks both banana and citrus. These races were designated as sibling species, on the basis of genetic, biochemical, behavioural and minor morphological differences; *R.similis sensu stricto* (banana race) and *R.citrophilus* (citrus race) [10]. However, it was later argued that not enough populations had been studied. Further studies concluded that burrowing nematodes that parasitize citrus are not reproductively isolated from burrowing nematodes that are unable to parasitize citrus [11]. The species have since been synonymised again as *R. similis*. The host range of *R.similis* has been widely studied and reviewed and more than 350 plant species and/or varieties have been documented as hosts [12- 21].

Eight species of the root lesion nematodes, *Pratylenchus* spp., have been reported attacking *Musa* spp. throughout the world, but only two are relatively

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widespread and are recognised as damaging pathogens [6]. The two species are *Pratylenchus coffeae* (Zimmermann) Filipjev & Schuurmans Steckhoven and *Pratylenchus goodeyi* Sher & Allen. *P.goodeyi* has been observed in every banana growing area in East Africa: in Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Uganda [4, 5, 22-24], suggesting that it is indigenous to this area. However, the distribution of *P.goodeyi* seems to be related to altitude [23, 25]. Only a few investigations have been made on hosts of *P. goodeyi* and these show that the nematode has a narrow host range [26-29].

H.multicinctus is probably the most widespread and numerous in all banana plantations and it is often encountered together with *R.similis*. Literature on *H.multicinctus* as a parasite of banana has been reviewed [30]. Although it is possible that biotypes or races of *H.multicinctus* exist, each with a more restricted host range, there have been no reports of such pathotypes and information on the topic is still lacking.

The root-knot nematodes, *Meloidogyne* spp. are world-wide in distribution, attacking many economically important crops, including banana. Root-knot nematodes are obligate sedentary endoparasites of plants. The genus consists of 98 species that parasitize more than 2,000 plant species [31]. In spite of their widespread occurrence and high abundance, root-knot nematodes are not considered important pathogens of banana and plantain. Root-knot nematodes often occur on banana roots together with the other pathogenic nematode species, *R.similis* and *Pratylenchus* spp. However, the damage caused by these other nematode species is more visible and more destructive than the symptoms and other adverse effects caused by *Meloidogyne* spp. Moreover, *R.similis* and, to a lesser extent, *Pratylenchus* spp., tend to outnumber and eventually replace root-knot nematode populations [32].

In Uganda, plant parasitic nematodes, namely, *R.similis, P.goodeyi* and *H.multicinctus*, have been identified among the major factors responsible for the decline in banana production [23, 33, 34]. Banana establishments are normally associated with a wide range of weeds, both broad-leaved and grasses. The potential of these weeds to serve as nematode reservoirs, or cover crops for nematode elimination, is not known because of lack of information on their host status to banana nematodes.The objectives of this study therefore, were to identify weed species associated with banana establishments in Uganda and to establish the host status of the most common ones to the important banana nematodes.

MATERIALS AND METHODS

Occurrence and Abundance of Weed Species: A survey to identify the common weed species in banana plots was conducted in Kayunga district in central Uganda. The study was carried out on 14 farms, all of which were part of an on-farm trial on the management of banana nematodes using break-crops. All weed species present in the survey study banana plot were recorded. Frequency of occurrence of a weed species was recorded as the number of banana plots in which it occurred. Assessment of abundance was by visual appraisal. A weed species was regarded as abundant if it occurred in large numbers wherever it occurred. The term 'common weed' was used to refer to those weeds that occurred in seven or more plots (≥50%) and were abundant.

Determination of Host Status of Weed Species to Banana Nematodes: In a screenhouse experiment, 13 weed species, namely, *Galinsoga parviflora* Cav., *Bidens pilosa* L., *Commelina benghalensis* L., *Ageratum conyzoides* L., *Amaranthus* sp., *Senecio disfolius* Oliv., *Solanum nigrum* L., *Cyperus esculentus* L., *Digitaria scalarum* (Schweinf.) Chiov., *Digitaria velutina* Beauv., *Eleusine indica* (L.) Gaert, *Crassocephalum crepidioides* (Benth.) S. Moore and *Tagetes minuta* L. were evaluated for their host status to banana nematodes. Banana was used as the known host.

Seeds of the broad-leaved weeds, with the exception of *C. benghalensis*, were germinated in shallow plastic basins filled with sterile soil. Propagules of the grasses *D. scalarum*, *D. velutina* and *E .indica* and the sedge species *C. esculentus* and cuttings of *C. benghalensis* were also planted in the shallow basins. Three weeks after planting, the weed seedlings were transplanted into 2*l* plastic buckets filled with sterile soil. Four weed seedlings were planted in each bucket while only one banana plantlet of a local East African Highland cooking cultivar was planted in each bucket. The potted weeds and the control plants were arranged in a randomized complete block design with five replicates in a screenhouse.

Two weeks after transplanting, the weeds were inoculated with a mixed population of banana nematode species obtained from banana roots. The inoculum for each pot was a suspension consisting of *R.similis* females and juveniles; *H.multicinctus* females, males and juveniles; *P.goodeyi* females, males and juveniles; and *Meloidogyne* sp. juveniles in proportions of 123, 1015, 1,212 and 66, respectively. Inoculation was done by introducing the nematode suspensions in depressions made close to the plants, using a syringe. The plants were watered regularly and any foreign weeds that germinated as a result of wind dispersion were removed as soon as they germinated. The short-lived weeds were cut back as soon as they dried and new seedlings planted in the pots without removing the old root systems.

The experiment was terminated five months after inoculation. At termination, a sample of 100 ml of soil and 5g of root was taken for nematode extraction. In case total root weight was less than 5g, all the available root weight was used for nematode extraction and the counts extrapolated to 5g. Extraction of nematodes from soil was by filtration and from roots by maceration and filtration using a modification of the Baermann Funnel technique [35]. The nematodes were collected in 25 ml of suspension by concentration and decanting. Two aliquots of 1 ml each were drawn from each sample for identification and counting of the nematodes, which was done under a stereomicroscope. An average count from the two aliquots was recorded and mean soil and root counts were calculated. The reproductive rating R, defined as the ratio of mean nematode count from the weed species to that of banana, the known host of the nematodes [36] was calculated from mean root counts.

RESULTS

Occurrence and Abundance of Weed Species: Ninety one weed species belonging to 27 families were found associated with banana plots. The frequency of occurrence and abundance of the encountered weed species are shown in Table 1. The weeds *B. pilosa*, *C. benghalensis*, *Euphorbia hirta* L. and *Desmodium* sp. were the most frequent, occurring in all plots. While *B. pilosa* and *C. benghalensis* were abundant, *E. hirta* and *Desmodium* sp. occurred in negligible quantities. Although the weed species *Achyranthes aspera* L., *Conyza floribunda* H.B.K., *Siegesbeckia orientalis* L., *Sonchus oleraceus* L., *Vernonia amygdalina* Del., *Erucastrum arabicum* Fisch. & Mey., *Euphorbia geniculata* Orteg. Syn. *Poinsettia heterophylla* (L.) Klotzsch., *Indigofera errecta* Hochst ex. A. Rich., *Abutilon mauritianum* (G.Don.) Sweet., *Boerhaavia diffusa* L., *Brichiaria lata* C.E. Hubbard, *Panicum maximum* Jacq., *Sorghum arundinaceum* (Desv.) Stapf., *Portulaca oleracea* L., *Solanum incanum* L .occurred in 50% or more of the plots, they were not classified as common because they occurred in negligible quantities.

G. parviflora, B. pilosa, *C .benghalensis, A. conyzoides*, *Amaranthus* sp., *S. disfolius, S. nigrum, C. esculentus, D. scalarum*, *D. velutina* and *E. indica*, were regarded as the most common because they were present in 50% or more of the plots and also occurred in relatively large quantities. *C. crepidioides* was neither very frequent nor abundant. However, it was selected for the screenhouse study because of the cultural belief attached to it. Many farmers do not remove *C. crepidioides* from their banana plots because it is believed to be associated with high banana yields. *T. minuta*, although abundant, was present in only one banana plot. It was nevertheless included in the study because of its potential importance as a botanical with nematicidal effects.

Determination of Host Status of Weed Species to Banana Nematodes: Mean nematode counts from 5g of root and 100 ml of soil from the screenhouse experiment are shown in Table 2. *R.similis* was recovered only from the roots of banana and in very low numbers. *H. multicinctus* was recovered from roots of banana and nine weed species, namely, *D. velutina*, *E. indica*, *Amaranthus* sp., *S. nigrum*, *C. crepidioides*, *C. benghalensis*, *G. parviflora*, *A. conyzoides* and *B .pilosa*. It was also found in soil from banana and six weed species, namely, *E .indica*, *Amaranthus* sp., *S .nigrum*, *C .crepidioides*, *G. parviflora* and *A. conyzoides*. *P. goodeyi* was recovered from roots of banana and the weed species *D. velutina* and *E. indica* and was absent from all soil samples. *Meloidogyne* sp. juveniles were present in the roots of *E. indica*, *Amaranthus* sp., *S. nigrum*, *C .crepidioides* and *C. benghalensis* but were absent from all soil samples. The reproductive rating, calculated from mean root counts, is shown in Table 3.

Table 1: Frequency of occurrence and abundance status of weed species associated with banana plots in Kayunga district.

Family	Weed species	Common Name	Frequency of occurrence	Abundance Status
Acanthaceae	*Asystasia schimperi* T. Anders.	-	5 (35.7%)	NA
	Justicia matammensis(Schweinf.) Oliv.	-	3 (21.4%)	NA
Amaranthaceae	*Achyranthes aspera* L.	Devil's horsewhip	8 (57.1%)	NA
	Amaranthus graecizans L.	Spreading Pigweed	3 (21.4%)	NA
	Amaranthus sp.	Amaranthus	12 (85.7%)	A
	Celosia trigyna L.	Silver spinach	2 (14.3%)	NA
	Psilotrichum elliotti Baker	Elliott's Psilotrichum	1 (7.1%)	NA
Apocynaceae	*Thevetia peruviana* (Pers.) Merr.	Yellow Oleander	1 (7.1%)	NA
Asteraceae	*Ageratum conyzoides* L.	Goat weed	13 (92.9%)	A
	Bidens pilosa L.	Black jack	14 (100%)	A
	Crassocephalum crepidioides (Benth.) S Moore	Redflower ragleaf	9 (64.3%)	NA
	Conyza floribunda H.B.K	-	11 (78.6%)	NA
	Galinsoga parviflora Cav.	Gallant soldier	11 (78.6%)	A
	Senecio disfolius Oliv.	Ragwort	10 (71.4%)	A
	Siegesbeckia orientalis L.	Common St. Paul's wort,	10 (71.4%)	NA
	*Sonchu soleraceu s*L.	Sow thistle	10 (71.4%)	NA
	Tagetes minuta L.	Mexican marigold	1 (7.1%)	A
	Tridax procumbens Linn.	Coat buttons	4 (28.6%)	NA
	Vernonia amygdalina Del.	Bitter leaf	9 (64.3%)	NA
	Vernonia auriculifera Hiern.	-	1 (7.1%)	NA
	Vernonia cinerea (Linn.) Less.	Little ironweed	1 (7.1%)	NA
Cannaceae	*Canna indica* L.	African arrowroot	4 (28.6%)	NA
Chenopodiaceae	*Chenopodium album* L.	Goosefoot, fat-hen,	1 (7.1%)	NA
	Chenopodium procerum Hochet ex. Moq.	-	2 (14.3%)	NA
Commelinaceae	*Commelina benghalensis* L.	Wandering Jew	14 (100%)	A
Convulvulaceae	*Hewittia sublobata* (L.) O. Ktze	-	2 (14.3%)	NA
	Ipomoea hederifolia L.	Scarlet morning glory	1 (7.1%)	NA
	Ipomoea involucrata P. Beauv.	Morning glory	1 (7.1%)	NA
	Ipomoea tenuirostris Steud. ex. Choisy.	-	1 (7.1%)	NA
Crassulaceae	*Kalanchoe* sp.	-	1 (7.1%)	NA
Cruciferae	*Erucastrum arabicum* Fisch. &Mey.	-	9 (64.3%)	NA
Curcubitaceae	*Melothria punctata* (Thum.) Cogn.	-	5 (35.7%)	NA
	Momordica foetida Schumach.	-	11 (78.6%)	NA
Cyperaceae	*Cyperus esculentus* L.	Yellow nutsedge	10 (71.4%)	A
	Kyllinga macrocephala A. Rich.	-	1 (7.1%)	NA
	Mariscus sieberanus Nees	-	4 (28.6%)	NA
Euphorbiaceae	*Euphorbia geniculata* Orteg. Syn.	Spurge weed	13 (92.9%)	NA
	Poinsettia heterophylla (L.) Klotzsch.			
	Euphorbia hirta L.	Asthma weed	14 (100%)	NA
	Euphorbia prostrata Ait.	Prostrate spurge	5 (35.7%)	NA
	Flueggea virosa Baill.	-	1 (7.1%)	NA
	Phyllanthus reticulatus	-	1 (7.1%)	NA
	Ricinus communis L.	Castor bean	3 (21.4%)	NA
Fabaceae	*Acacia hockii* De Wild.	-	1 (7.1%)	NA
	Crotolaria sp.	Rattlepods	7 (50%)	NA
	Desmodium sp.	Tick clover	14 (100%)	NA
	Indigofera circinella Bak. f.	-	1 (7.1%)	NA
	Indigofera errecta Hochst ex. A. Rich.	African Indigo	10 (71.4%)	NA
	Indigofera spicata Forsk	Creeping indigo	1 (7.1%)	NA
	Vigna sp.	Wild cowpea	2 (14.3%)	NA

Table 1: Continued

Family	Weed species	Common Name	Frequency of occurrence	Abundance Status
Labiatae	*Ocimum menthaefolium*	-	5 (35.7%)	NA
	Leonotis nepetifolia (Linn.) Ait. f.	Lion's ear/Lion's tail	2 (14.3%)	NA
	Leucas martinicensis R. Br.	Bobbin weed	4 (28.6%)	NA
Malvaceae	*Abutilon mauritianum* (G.Don.) Sweet.	-	9 (64.3%)	NA
	Sida acuta Burm. f.	Broom weed	1 (7.1%)	NA
	Sida cuneifolia Roxb.	-	1 (7.1%)	NA
	Sida rhombifolia L.	-	6 (42.9%)	NA
Moraceae	*Ficus asperifolia*	-	1 (7.1%)	NA
	Ficus exasperata Vahl.	Sandpaper tree	6 (42.9%)	NA
Nyctaginaceae	*Boerhaavia diffusa* L.	Red spiderling	8 (57.1%)	NA
Ochnaceae	*Cissus* sp.	-	4 (28.6%)	NA
	Cyphostemma adenocaule (Steud. ex A.Rich.) Wild & R.B. Drumm	-	3 (21.4%)	NA
Oxalidaceae	*Oxalis corniculata* L.	Yellow sorrel	3 (21.4%)	NA
	Oxalis latifolia H.B.K.	Purple garden sorrel	5 (35.7%)	NA
Poaceae	*Brichiaria lata* C.E. Hubbard	Signal grass	9 (64.3%)	NA
	Digitaria scalarum (Schweinf.) Chiov.	Couch grass	8 (57.1%)	A
	Digitaria velutina Beauv.	Velvet fingergrass	9 (64.3%)	A
	Eleusine indica (L.) Gaert	Wild fingermillet/ Goosegrass	7 (50%)	A
	Imperata cylindrica (L.) Raeuschel	Sword grass	1 (7.1%)	A
	Panicum maximum Jacq.	Guinea grass/ Buffalo grass	7 (50%)	NA
	Panicum sp.	Panic grass	1 (7.1%)	NA
	Pennisetum purpureum	Elephant grass	2 (14.3%)	NA
	*Rottboellia exaltata*L. f.	Guinea fowl grass/ Itch grass	3 (21.4%)	NA
	Setaria verticillata (L.) Beauv.	Bristly foxtail grass	6 (42.9%)	NA
	Sorghum arundinaceum (Desv.) Stapf.	Wild sorghum	10 (71.4%)	NA
Polygonaceae	*Oxygonum sinuatum* (Meisn.) Dammer	Double thorn	3 (21.4%)	NA
Phytolaccaceae	*Phytolacca dodecandra* L'Herit	African soapberry	3 (21.4%)	NA
Portulacaceae	*Portulaca oleracea* L.	Purselane	7 (50%)	NA
	Portulaca quadrifida L.	Chickenweed	3 (21.4%)	NA
Solanaceae	*Capscum annuum* L.	Sweet pepper/ Green pepper	1 (7.1%)	NA
	Capsicum frutescens L.	Chilli pepper	1 (7.1%)	NA
	Physalis micrantha Link.	-	1 (7.1%)	NA
	Physalis peruviana L.	Cape gooseberry	3 (21.4%)	NA
Solanaceae	*Solanum incanum* L.	Sodom apple	7 (50%)	NA
	Solanum nigrum L.	Black nightshade	12 (85.7%)	A
	Solanum sp.	-	1 (7.1%)	NA
Tiliaceae	*Triumfetta microphylla* K. Schum.	-	2 (14.3%)	NA
	Triumfetta rhomboidea Jacq.	Diamond burbark	2 (14.3%)	NA
Verbenaceae	*Cleodendrum capitatum* (Willd.) Schum and Thonn.	-	1 (7.1%)	NA
	Lantana camara L.	Tick berry/Curse of India	9 (64.3%)	NA
	Priva leptostachya Juss.	-	7 (50%)	NA

Frequency of occurrence of a weed species is the number of banana plots in which it occurred. A = abundant; NA = not abundant; n = 14.

Table 2: Mean nematode counts from roots and soil of banana and weed species.

	Mean nematode count from 5 g of root				Mean nematode count from 100 ml of soil			
Plant species	*R.s*	*H.m*	*P.g*	*Meloid.*	*R.s*	*H.m*	*P.g*	*Meloid.*
Banana	10	305	200	0	0	608	0	0
Amaranthus sp.	0	85	0	5	0	88	0	0
Digitaria velutina	0	36	29	0	0	0	0	0
Solanum nigrum	0	35	0	95	0	148	0	0
Crassocephalum crepidioides	0	22	0	17	0	158	0	0
Commelina benghalensis	0	10	0	40	0	0	0	0
Galinsoga parviflora	0	9	0	0	0	218	0	0
Eleusine indica	0	5	16	5	0	103	0	0
Ageratum conyzoides	0	5	0	0	0	70	0	0
Bidens pilosa	0	5	0	0	0	0	0	0
Tagetes minuta	0	0	0	0	0	0	0	0
Cyperus esculentus	0	0	0	0	0	0	0	0
Senecio disfolius	0	0	0	0	0	0	0	0
Digitaria scalarum	0	0	0	0	0	0	0	0

R.s = Radopholus similis, *H.m = Helicotylenchus multicinctus*, *P.g = Pratylenchus goodeyi*, *Meloid. = Meloidogyne* sp. n = 5

Table 3: Reproductive ratings (R) of banana nematodes on 13 weed species

	Reproductive rating (R)		
Weed species	*R.s*	*H.m*	*P.g*
Digitaria velutina	-	0.12	0.15
Eleusine indica	-	0.02	0.08
Amaranthus sp.	-	0.28	-
Solanum nigrum	-	0.12	-
Crassocephalum crepidioides	-	0.07	-
Commelina benghalensis	-	0.03	-
Galinsoga parviflora	-	0.03	-
Ageratum conyzoides	-	0.02	-
Bidens pilosa	-	0.02	-
Tagetes minuta	-	-	-
Cyperus esculentus	-	-	-
Senecio disfolius	-	-	-
Digitaria scalarum	-	-	-

R is the ratio of mean nematode count from roots of a test crop to that of a known host (banana in this case) of the nematode species.

Host status, after Tedford& Fortnum, [36]: R > 1.0 = good host; R ≤ 1.0 - > 0.5 = moderate host; R ≤ 0.5 - >0.1 = poor host; R ≤ 0.1 = nonhost.

DISCUSSION

Basing on the Tedford & Fortnum scale [36], all the weeds in this study are non-hosts of *R.similis*; *D. velutina* a poor host of both *H.multicinctus* and *P.goodeyi* while *Amaranthus* sp. and *S .nigrum* are poor hosts of *H.multicinctus* and non-hosts of *P.goodeyi*. All the other weed species are non-hosts of both *H.multicinctus* and *P.goodeyi*. The reproductive rating of *Meloidogyne* sp. was not calculated because no *Meloidogyne* was recovered from banana roots although banana is a recorded host of *Meloidogyne* sp. [37, 38]. This observation is in conformity with a report that *Meloidogyne* spp. are less competent in the presence of the other banana nematodes [32]. Banana, therefore, is not the most suitable host to use as a standard for the determination of the host status of other plant species to *Meloidogyne* sp.

No *R.similis* was recovered from any of the weed species. It is possible that this was due to its low population density in the inoculum. However, absence of both *R.similis* and *P.goodeyi* from soil, even from banana, is more likely due to the fact that both nematode species are endoparasites and therefore remain inside roots of the host, especially in the confinement of a pot.

Although observations from this study may not be very conclusive since the nematode population levels in the inoculum were relatively low and the different nematode species were present at different population levels, they did not differ greatly from those made by other researchers. Edwards &Wehunt noted that over 300 plant species and varieties, including weeds, have been reported as hosts for *R.similis* [39], however, most reports do suggest a limited host range of the major banana nematodes. One report states that the banana biotype of *R.similis* seems to be confined to *Musa* spp. and possibly a few other plants such as sugarcane, *Ipomoea batatas* and *Pueraria phaseoloides javanica* [40]. Another report has listed *A .conyzoides* as a susceptible host of *R.similis* [19]. One study on the host range *P.goodeyi* showed that

P. goodeyi was extracted from only five plant species, namely, *Commelina benghalensis, Hyperrhenia rufa, Musa* sp. cv. Nyoya, *Plectranthus barbatus* and *Tripsacum laxam* [26, 41], while another reported that the weed species *A . conyzoides*, *B. pilosa*, *C .benghalensis* and *S .disfolius* were non-hosts of *P.goodeyi* [27, 28]. Although *B. pilosa*, *C. benghalensis*, *C. esculentus*, *D. scalarum* and *S. nigrum* have been listed as susceptible hosts of *P.goodeyi* [19], none of these weeds harboured any *P.goodeyi* in this study.

While *H.multicinctus* has been reported as a parasite with a wide host range [42], other reports mention just a few hosts of the nematode species [19, 43]. *A. conyzoides* has been classified as a susceptible host of *H. multicinctus* [19] and although it did harbour *H.multicinctus* in this study, the reproductive rating was very low and therefore was classified a non-host.

Meloidogyne spp. are not regarded as major pests to banana, however, there are indications that the importance of root-knot nematodes may have been overlooked, especially in areas where *R. similis* is not present. A banana bunch weight reduction of up to 57.1%, due to *M.incognita* infestations has been recorded [3] while asignificant reduction in plant height, pseudostem girth, number of leaves, leaf area, root length and weight in banana cultivar Poovan inoculated with 1000 and 10,000 juveniles of *M.incognita*/kg of soil was reported [44].The low population levels of *Meloidogyne*, observed in this study on *Amaranthus* sp., *S. nigrum*, *C. crepidioides*, *C. benghalensis* and *E. indica* could result in severe banana yield losses if not eliminated.

The weed species in this study were either poor hosts or non-hosts of the major banana nematodes. Both the poor hosts and the non-hosts that harboured some nematodes are potential reservoirs of banana nematodes. Some reports suggest that *R.similis* might survive in soil for longer than 14 months unless special precautions are taken to remove susceptible hosts, including weed species [2, 45]. Weed removal is a recommended management practice. However, special attention should be given to the potential nematode reservoirs that may result in nematode population build-up in bananas plots. It has been reported that the presence of the burrowing nematode was more consistently found within three families, the Euphorbiaceae, Poaceae and Solanaceae [46].

The non-host species that did not harbour any banana nematodes, namely, *B. pilosa*, *C. esculentus*, *D. scalarum* and *T .minuta*, could be used as cover crops to eliminate nematodes from fields intended for banana establishment. Effective control of the root-knot nematode *M. incognita* by selected marigold varieties both in greenhouse experiments and under field conditions was observed during investigations of the potential of *Tagetes* spp. for the control of nematodes [47-49]. It is possible that the other weed species in this category also have nematicidal effects whose potential in nematode management is worth investigating.

It can be concluded from this study that banana establishments are associated with a wide range of weeds including the broad-leaved as well as grasses and sedges. However, only a few of the common weed species are hosts of banana nematodes. Those weed species classified as poor hosts in this study, if not eliminated, could act as reservoirs, contributing to the rapid build-up of field populations of banana nematodes. The weed species that did not harbour any banana nematodes could potentially be used as break-crops to eliminate banana nematodes from fields previously under banana [27, 50]. However, these weed species have very low apparent economic importance and can therefore only be used as cover crops and/or botanicals for the control of banana nematodes.

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