International Journal of Food, Agriculture and Veterinary Sciences ISSN: 2277-209X (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jfav.htm
2015 Vol. 5 (3) September-December, pp. 23-29/Agaba and Fawole
Research Article

SCREENING OF SOME PEPPER CULTIVARS FOR RESISTANCE TO *MELOIDOGYNE INCOGNITA* (CHITWOOD)

***Agaba T.A.[1] and Fawole B.[2]**
[1]Department of Agricultural Education, College of Education, Oju, P.M.B 2035, Otukpo, Benue State, Nigeria
[2]Department of Crop Protection and Environmental Biology, Faculty of Agriculture and Forestry, University of Ibadan, Ibadan, Oyo State, Nigeria
**Author for Correspondence*

ABSTRACT
Pepper (*Capsicum* spp.) is an important fruit vegetable but its production is being constrained by the root-knot nematode, *Meloidogyne incognita*. This nematode causes dramatic yield losses and various control measures are used. With the hazardous effects from chemical control that led to the withdrawal of nematicides. Alternative measures like plant host resistance among others are emphasized. There is the scarcity of resistant pepper cultivars to *M. incognita* in Nigeria and worldwide. This study was undertaken in the Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan, Oyo State, Nigeria to identify host suitability of some pepper cultivars to *Meloidogyne incognita*. Fifteen pepper cultivars; 12 from Ahmadu Bello University Zaria, Nigeria, two from the National Horticultural Research Institute (NIHORT), Ibadan, and one from Amens Agro store, Mokola, Ibadan were used. The standardized method in which combined Galling index (GI) and Reproductive Factor (RF) values was used to indicate resistance or susceptibility of the cultivars. Four pepper cultivars (KNT 204, Tugantashi, Bird's Eye, Bor-kono-Tsidif) (26.6%) were rated resistant, while five cultivars (GHA, Prof-fintashi, NHV1F, Ex-Sam-St, California Wonder) (33.3%) were rated susceptible. In this study, susceptible cultivars were more in number than the resistant ones.

***Keywords*:** *Capsicum, Galling Index, Meloidogyne Incognita, Reproductive Factor, Standardized Method*

INTRODUCTION
Pepper *(Capsicum* spp.) is one of many fruit vegetables grown worldwide (Fayemi, 1999). Pepper fruits are used in sauces, soups, stews and generally as flavouring agent. Pepper is suitable for diets of the obese, useful for control of stomach and colon cancers, low in sodium, cholesterol free (Chigoziri and Ekefan, 2013). The root-knot nematode, *Meloidogyne incognita* is a major constraint to successful pepper production in all pepper producing countries; it causes severe damage that leads to dramatic yield losses (Sikora and Fernandez, 2005; Yap, 2013). Olabiyi and Oyedunmade, (2008) reported 100% reduction in yield of pepper caused by *M. incognita*. Nematode management or control is an important factor in vegetable production (Sikora and Fernandez, 2005). The various management control measures include chemical, physical, biological, cultural, and plant resistance. The root-knot nematodes due to their high reproductive potential and wide host ranges are notoriously difficult to manage and require about 99% control in order to prevent the subsequent build up of damaging populations (Chaudhary and Kaul, 2013). The use of resistant cultivars is considered one of the most effective and environmental-friendly alternatives, increases and stabilizes the yield, blends with cultural control (Olowe, 2007; Moon *et al.,* 2010). A resistant plant restricts or prevents the nematode's reproduction by activating defense mechanisms which may limit penetration of second-stage juveniles, repels them or activates physiological and molecular processes that inhibit formation of feeding site, and prevents or delays second-stage juvenile development and or reproduction of the adult female (Rodrigo *et al.,* 2013).
There is the problem of availability of resistant pepper cultivars worldwide (Narasimhamurthy *et al.,* 2013: Yap, 2013), thus this study was undertaken to identify the host status of some pepper cultivars available in Nigeria. This might help in improving the susceptible cultivars available, Costa *et al.,* (2009)

reported that a gene flow can be maintained between the improved *Capsicum* spp. and their wild, domesticated and semi-domesticated relatives which are carriers of genes of agronomic interest (resistance to pests and diseases etc).

MATERIALS AND METHODS

Fifteen pepper cultivars were screened; 12 were collected from the Department of Crop Protection, Ahmadu Bello University, Zaria. Nigeria (GHA, Prof-fintashi, Isadu, M'daku, Ex- Sam- St, Ex-Sam-Jun06, Tugantashi, Bird's Eyes, Bor-Kono-Tsidif, KNT 204, Ex-Kunukunu and N-M-Iddi); NHV1A and NHV1F from the National Horticultural Research Institute, (NIHORT) Ibadan. California Wonder was bought from Amens Agro store in Mokola, Ibadan.

The experiment was set up on the Roof-Top Garden of the Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan, Nigeria in 2009. The method used for screening for resistance was the Standardized method based on Gall Index (GI), as a measure of root damage and Reproductive Factor (RF) (Sasser *et al.,* 1984). A nursery was raised in plastic pots that contained heat-sterilized soil. One seedling each of the cultivars was transplanted at four weeks old into five-litre plastic pots, which contained heat-sterilized soil. A week after the establishment of the seedlings, each pot was inoculated with 5,000 eggs of *Meloidogyne incognita* extracted with the sodium hypochlorite method (Hussey and Barker, 1973), when the aqueous nematode suspension of nematode eggs was poured into four holes, 2-4 cm around the base of the plant. This was done in a Completely Randomized Design and replicated four times. The plants were watered daily, weeds were hand pulled when necessary, and after a period of 60 days, the plants were up-rooted, carefully washed under slow running water, examined with a hand lens and rated for rated for galling on a 0-5 scale (Taylor and Sasser, 1978). The final nematode population was estimated by adding the number of the extracted second-stage juveniles by Pie-pan method (Whitehead and Hemming, 1965) from 200 ml soil to the number of eggs extracted from 10 g of roots per cultivar with the sodium hypochlorite method (Hussey and Barker, 1973). Host efficiency was determined by the calculation of RF, RF = Pf/Pi, where Pf = final nematode population and Pi = initial inoculum level and using RF combination with it with GI (Almeida and Santos, 2002; Nwauzor and Fawole, 1992). The resulting data was used to indicate resistance or susceptibility of the various pepper cultivars. The pepper cultivars were rated resistant, susceptible or tolerant as follows: (GI $\leq$, RF $\leq$ 1) = resistant, (GI $\geq$ 2, RF > 1) = susceptible, (GI $\leq$ 2, RF > 1) = tolerant, (GI > 2, RF $\leq$ 1) = hyper susceptible, according to Olowe (2007). A second screening experiment with the same cultivars and treatments was carried out.

RESULTS AND DISCUSSION

Results

Using the combination of the values of Reproductive Factor (RF) and Galling Index (GI), the screened pepper cultivars were rated resistant (RF$\leq$ 1; GI$\leq$ 2), susceptible (RF $\geq$1;GI > 2) or tolerant (RF > 1; GI$\leq$ 2) to *Meloidogyne incognita* in the two trials (Tables 1 and 2). In the first trial (Table 1) the pepper cultivars rated resistant were NHV1A, KNT 204, Bird's Eye, N-M- Iddi, Tugantashi and Bor-kono-Tsidif. In the second trial (Table 2), Ex-Kunkunu, Isadu, KNT 204, Bird's Eye, Tugantashi and Bor-kono-Tsidif were rated resistant. The resistant cultivars were not significantly different in RF and GI among themselves, but significantly different in RF aand GI from the susceptible cultivars. The cultivars rated susceptible to *M. incognita* in the trial (Table 1) were GHA, Prof-fintashi, NHV1F, M'daku, Ex-Kunkunu, Ex-Sam-St and California Wonder. In the second trial (Table 2), the cultivars rated susceptible were GHA, Prof-fintashi, Ex-Sam-St, Ex-Sam-jun06, California Wonder and N-M-Iddi. In the first trial (Table 1) Isadu and Ex-Samjun06 were rated tolerant, also in second trial (Table 2) M'daku and NHV1A were rated tolerant.

The combination of consistent results from the two trials showed that the resistant cultivars were KNT 204, Tugantashi, Bird's Eye and Bor-kono-Tsidif, while the susceptible cultivars were California Wonder, Ex-Sam-St, NHV1F, Prof-fintashi and GHA.

Table 1: Host status of fifteen cultivars of pepper to *Meloidogyne incognita* sixty days after inoculation* Screening experiments for resistance to *M. incognita*. First trial

Cultivar	Root population (E)	Soil population (J2/5kgsoil)	Final population (E+J2)	RF	GI	Host status
G.H.A.	42604.0±22402.1(4.6)	100.0±0.0(2.0)	42704.0±22402.1(4.6)	8.5±0.2(0.9)	2.7±0.1(0.5)	Susceptible
Prof-fintashi	33999.0±20341.5(4.5)	50.0±0.0(1.7)	34049.0±21223.1(4.5)	6.8±0.3(0.8)	2.2±0.1(0.5)	Susceptible
Ex-kunkunu	22596.0±12436.2(4.3)	327.0±28.6(2.5)	22924.0±18241.2(4.3)	4.5±0.4(0.7)	2.7±0.2(0.5)	Susceptible
NHVIF	18616.0±14423.6(4.2)	475.0±75.6(2.6)	19099.0±14472.6(4.2)	3.8±0.2(0.6)	1.5±0.0(0.3)	Susceptible
M'daku	15590.0±14232.4(4.1)	100.0±0.0(2.0)	15690.0±12246.1(4.1)	3.1±0.2(0.6)	3.0±0.0(0.6)	Susceptible
Isadu	13044.0±11001.2(4.1)	100.0±0.0(2.0)	13144.0±11001.2(4.1)	2.6±0.1(0.5)	2.0±0.1(0.4)	Tolerant
Ex-Sam-St	8783.0±1759.1(3.9)	25.0±25.0(1.4)	8808.0±1809.4(3.9)	1.7±1.0(0.4)	2.2±0.1(0.5)	Susceptible
Ex-Sam-Jun06	8624.0±2866.2(3.9)	200.0±100.0(2.3)	8824.0±1678.2(3.9)	1.7±0.9(0.4)	2.0±0.0(0.4)	Tolerant
California wonder	6099.0±4561.8(3.7)	1800.0±1250.0(3.2)	7899.0±1436.4(3.8)	1.5±0.4(0.4)	3.0±0.0(0.6)	Susceptible
NHVIA	4769.0±1466.3(3.6)	100.0±0.0(2.0)	4869.0±2816.5(3.6)	0.9±0.9(0.2)	1.7±0.2(0.4)	Resistant
KNT204	3512.0±1436.7(3.5)	150.0±50.0(2.1)	3662.0±1424.6(3.5)	0.7±0.4(0.2)	1.2±0.1(0.3)	Resistant
Bird's Eye	3260.0±1202.1(3.5)	50.0±0.0(1.7)	3310.0±2213.4(3.5)	0.6±0.2(0.2)	2.0±0.0(0.4)	Resistant
N.M. Iddi	2941.0±1109.2(3.4)	0.0±0.0(0.0)	2941.0±1109.2(3.4)	0.5±0.3(0.2)	1.2±0.1(0.3)	Resistant
Tugantashi	1618.0±968.4(3.2)	100.0±0.0(2.0)	1718.0±1100.2(3.2)	0.3±0.1(0.1)	1.2±0.1(0.3)	Resistant
Bor-Kono-Tsidif	1140.0±842.4(3.0)	96.0±96.0(1.9)	1165.0±1165.0(3.0)	0.2±0.1(0.08)	1.0±0.0(0.3)	Resistant
LSD 0.05	38396(4.5)	359.0(2.5)	384.9(2.5)	7.6(0.9)	1.0(0.3)	

**Data are means of four replicates, RF = Reproductive Factor, GI = Gall index. P_1 = 5000 M. incognita eggs*

Table 2: Host status of fifteen cultivars of pepper to *Meloidogyne incognita* sixty days after inoculation* Screening expriments for resistance to *M. incognita*. Second trial

Cultivar	Root population (E)	Soil population (J2/5kgsoil)	Final population (E+J2)	RF	GI	Host status
G.H.A.	5361.0±1506.3(3.7)	15000.0±10002.6(4.1)	20361.0±19804.5(4.3)	4.0±0.2(0.7)	2.5±0.5(0.5)	Susceptible
Prof-fintashi	5060.0±1500.0(3.7)	15000.0±10002.6(4.1)	11165.0±10100.4(4.0)	2.6±0.4(0.5)	2.5±0.1(0.5)	Susceptible
Ex-kunkunu	1636.0±849.2(3.2)	6250.0±1468.8(3.7)	7886.0±1764.1(3.7)	1.5±0.1(0.3)	1.7±0.9(0.3)	Resistant
NHVIF	5178.0±1443.2(3.7)	2500.0±1250.0(3.3)	7678.0±1512.2(3.7)	1.5±0.1(0.3)	3.0±0.2(0.6)	Susceptible
M'daku	1208.0±1001.3(3.0)	5000.0±1560.0(3.7)	6208±1382.6(3.7)	1.2±1.1(0.3)	1.7±0.1(0.4)	Tolerant
Isadu	639.0±0.0(2.8)	5000.0±2500.0(3.7)	5639.0±1200.4(3.7)	1.1±0.1(0.3)	0.7±0.1(0.2)	Resistant
Ex-Sam-St	5011.0±1440.3(3.7)	2500.0±1250.0(3.3)	7511.0±2456.8(3.8)	1.5±0.1(0.3)	2.5±0.0(0.5)	Susceptible
Ex-Sam-Jun06	5109.0±1341.1(3.7)	2500.0±1250.0(3.3)	7609.0±2010.2(3.8)	1.2±0.2(0.3)	2.5±0.0(0.5)	Susceptible
California wonder	6580.0±1682.3(3.8)	1250.0±1442.3(3.0)	7830.0±1750.4(3.8)	1.5±0.1(0.3)	3.2±0.2(0.6)	Susceptible
NHVIA	2607.0±1603.8(3.4)	2500.0±1250.0(3.3)	5107±2500.0(3.7)	1.0±0.0(0.3)	1.0±0.0(0.3)	Tolerant
KNT204	222.0±0.0(2.3)	2500.0±1250.0(3.3)	2722.0±1250.0(3.4)	0.5±0.0(0.1)	0.5±0.0(0.1)	Resistant
Bird's Eye	2277.0±1250.0(3.3)	200.0±0.0(2.3)	2477.0±1250.0(3.3)	0.4±0.1(0.1)	1.2±0.1(0.3)	Resistant
N.M. Iddi	6195.0±1600.6(3.7)	12500.0±12500.0(4.0)	18695.0±14268.0(4.2)	3.7±0.1(0.6)	2.5±0.1(0.5)	Susceptible
Tugantashi	2477.0±498.2(3.3)	1250.0±1250.0(3.0)	3727.0±1102.6(3.5)	0.7±0.2(0.2)	1.0±0.0(0.3)	Resistant
Bor-Kono-Tsidif	960±96.0(1.9)	2500.0±1250.0(3.3)	2596.0±1240.1(3.4)	0.5±0.1(0.2)	0.7±0.1(0.2)	Resistant
LSD 0.05	2056.1(3.3)	6478.8(3.8)	7369.1(3.8)	1.4(0.3)	1.0(0.3)	

**Data are means of four replicates, RF = Reproductive Factor, GI = Gall index. P_1 = 5000 M. incognita eggs.*

Discussion

Host suitability or efficiency is evaluated by root galling and nematode reproduction (Molinari and Abd-Elgawad, 2007: Udo *et al.,* 2008). The suggestion to include yield factor in the screening for resistance (Ibiam *et al.,* 2014) was not considered in the study. The fifteen pepper cultivars screened for resistance to *M. incognita* were rated resistant (26.6%) or susceptible (33.3%) which showed that there were fewer number of resistant cultivars and more susceptible ones in the study. This was similar to reports by Fery and Thies (1997) and Thies and Fery (2000). In a screening, three lines (NSKY-SE, NSKY-LP and Attaragu) (25.0%) of 12 indigenous pepper lines tested in Nigeria were resistant to *M. incognita* race 1 (Udo *et al.,* 2005).

Moon *et al.,* (2010) reported that 33 lines (84.6%) were susceptible, six lines (15.3%) were resistant and two lines (5.1%) were highly resistant to *M. incognita*. Yap (2013) reported the non-availability of resistant pepper cultivars to *M. incognita*. In screening of five pepper cultivars, none showed resistant reaction (Narasimhamurthy *et al.,* 2013). The findings of this study and other reports indicate that there is the scarcity of resistant pepper cultivars or germplasm. Most common pepper varieties are susceptible to the southern root-knot nematode, *Meloidogyne incognita* (Oka *et al.,* 2004). When resistance is scarce within the crop species, related species may be an alternative source of resistance (Soriano *et al.,* 1999). The genus *Capsicum* has five domesticated, 10 semi-domesticated and 20 wild taxa (Costa *et al.,* 2009), the very few sources of the identified resistant cultivars might be used as breeding materials for improving pepper for resistance to *M. incognita*. The identification and use of resistant or tolerant varieties can be a viable means of minimizing loss caused by root-knot nematodes (Gharabadiyan *et al.,* 2012). The genetic component of host management involves the identification and utilization of selected sources of resistance (in the breeding programs for development of nematode resistant cultivars) (Hussain *et al.,* 2014). Host plant resistance is one of the most efficient methods to control root-knot nematode (*Meloidogyne* spp.), protects the genetic yield potential of the crop (Wang *et al.,* 2009). Resistant varieties prevent root-knot nematode reproduction and reduce root-knot nematode populations significantly (Anwar and Mckenry, 2010).

Conclusion

In this study, the resistant cultivars identified were KNT 204, Tugantashi, Bird's Eye and Bor-kono-Tsidif and susceptible cultivars were California Wonder, Ex-Sam-St, NHV1F, Prof-fintashi and GHA. The cultivars California Wonder, NHV1F had been rated susceptible to *M. incognita* and NHV1A rated tolerant (Fery and Thies, 1997; Nwanguma *et al.,* 2011). This study showed that susceptible cultivars were more than the resistant cultivars in the sample of the cultivars screened. Screening for resistance to root-knot nematodes would identify potential sources for resistance and to carry out effective management options for root-knot disease.

ACKNOWLEDGEMENT

I appreciate the contributions of Prof. Fawole, B during my PhD study, my family and my employer, Benue State Government through College of Education, Oju.

REFERENCES

Almeida AMSF and Santos MSNdeA (2002). Resistance and host response of selected plants to *Meloidogyne megadora. Journal of Nematology* **32**(2) 140-147.

Anwar SA and Mckenry MV (2010). Incidence and reproduction of *Meloidogyne incognita* on vegetable crop genotypes. *Pakistan Journal of Zoology* **42**(2) 135-141.

Chaudhary KK and Kaul RK (2013). Efficacy of *Pasteuria penetrans* and various oil seed cakes in the management of *Meloidogyne incognita* in Chilli pepper (*Capscium annuum* L.). *Journal of Agricultural Science Technology* **69** 617-626.

Chigoziri E and Ekefan EJ (2013). Seed-borne fungi of Chilli pepper (*Capsicum frutescens*) from pepper producing areas of Benue State, Nigeria. *Agriculture and Biology Journal of North America* **4**(4) 370-374.

Costa LV, Lopes R, Lopes MTG, de Figueiredo AF, Barros WS and Alves SRM (2009). Gross compatibility of hot pepper and cultivated sweet pepper. *Crop Breeding and Applied Biotechnology* **9** 37-44.

Fayemi PO (1999). *Nigerian Vegetables* (Heinemann Edu. Books (Nigeria Plc). Ibadan. Nigeria) 156-268.

Fery RL and Thies JA (1997). Evaluation of *Capsicum chinense* Jacq cultigens for resistance to southern root-knot nematode. *Horticulture Science* **32** 923-926.

Gharabadiyan F, Jamali S, Ahmadiyan AY and Eskandari A (2012). Source of resistance to root-knot nematode (*Meloidogyne javanica*) in tomato cultivars. *Journal of Agricultural Technology* **8**(6) 2011-2021.

Hussain MA, Mukhtar T and Kayani MZ (2014). Characterization of susceptibility and resistance responses to root-knot nematode (*Meloidogyne incognita*) infection in okra germplasm. *Pakistan Journal of Agricultural Science* **51**(2) 309-314.

Hussey RS and Barker KR (1973). A comparison of methods of collecting inocula of *Meloidogyne* spp. *Plant Disease Reporter* **57** 1025-1028.

Ibiam BUN, Ononoju CC, Onyenobi FI, Okorocha AD and Ikwunagu EA (2014). Evaluation of soybean (*Glycine max*) L., Merrill) varieties for resistance to root-knot nematode (*Meloidogyne* spp.) under field conditions. *Asian Journal of Plant Science and Research* **4**(4) 48-53.

Molinari S and Abd-Elgawad MM (2007). Catalase inhibition as a biochemical marker of resistance to root-knot nematodes in tomato. *Nematologia Mediterranea* **33** 237-242.

Moon HS, Khan Z, Son S and Kim YH (2010). Biological and structural mechanisms of disease development and resistance in chilli pepper infected with the root-knot nematode. *Plant Pathology Journal* **26**(2) 149-153.

Narasimhamurthy TN, Bommalinga S, Prahalada GD and Reddy BMR (2013). Screening of bell pepper cultivars against root-knot nematode, *Meloidogyne incognita* (Kofoid and White) Chitwood). *International Journal Life Sciences Biotechnology and Pharma Research* **2**(1) 225-228.

Nwanguma EL, Olabiyi TL, Idowu-Agida OO and Olufolafi AO (2011). Efficacy of soil organic amendments in the control of *Meloidogyne incognita* and on some growth and yield parameters of pepper (*Capsicum frutescens*) in southwestern Nigeria. *European Journal of Applied Sciences* **3**(4) 140-145.

Nwauzor EC and Fawole B (1992). The development and life cycle of *Meloidogyne incognita* race 2 on *Dioscorea rotundata* var Okorocha. In: *The Biology and Control of Nematode Pests of Food Crops in Africa*, 1st edition, edited Fawole B, Egunjobi OA, Adesiyan SO, Babatola JO and Idowu AA (African Society of Nematologists, Hiswill InfoResources Management Limited, Ibadan, Nigeria) **1** 127-133.

Oka Y, Offenbach R and Pivonia S (2004). Pepper rootstock graft compactibility and response to *Meloidogyne javanica* and *M. incognita. Journal of Nematology* **36**(2) 137-141.

Olabiyi TL and Oyedunmade EEA (2008). Performance comparison of carbofuran and bio- nematicidal potentials of the extracts from rattle weed and nitta plants on root-knot nematode pest of pepper. *Research Journal of Agronomy* **2**(2) 48 - 51.

Olowe T (2007). Reaction of cowpea genotypes to the root-knot nematode, *Meloidogyne incognita*. *Nematologia Mediterranea* **35** 177- 182.

Rodrigo SRV, Oliveira RDL, Ferreira PS, Ferreira AO and Rodrigues FA (2013). Defense responses to *Meloidogyne exigua* in resistant coffee cultivar and non-host. *Tropical Plant Pathology* **38**(2) 114 -121.

Sasser JN, Carter CC and Hartman KM (1984). *Standardization of host suitability studies and reporting of resistance to root-knot nematodes*. A co-operative publication of the North Carolina State University, Department of Plant Pathology and USAID. 7.

Sikora RA and Fernandez E (2005). Nematode parasites of vegetables. In: *Plant-Parasitic Nematodes in Subtropical and Tropical Agriculture*, 2nd edition, edited by Luc M, Sikora RA and Bridge J (CAB International) 319-392.

Soriano IR, Schmit V, Brar DS, Prot J and Reversat G (1999). Resistance to rice root-knot nematode *Meloidogyne graminicola* identified in *Oryza longistaminata* and *O. glaberrima. Nematology* **1**(4) 395 - 398.

Taylor AL and Sasser JN (1978). *Biology, Identification and Control of Root -Knot Nematodes Meloidogyne* spp. North Carolina University, USAID. 56-86.

Thies JA and Fery RL (2000). Heat suitability of resistance to *Meloidogyne incognita* on Scotch Bonnet peppers (*Capsicum chinense* Jacq.). *Journal of Nematology* **32**(4) 356-361.

Udo IA, Uguru MI and Ogbuji RO (2005). Pathogenicity of *Meloidogyneincognita* race 1 on Nigerian pepper (*Capsicum* spp.) lines. *Global Journal of Agricultural Sciences* **4**(1) 23-27.

Udo IA,Uguru MI, Ogbuji RO and Ukeh DA (2008). Sources of resistance and tolerance to root-knot nematode (*Meloidogyne javanica*) in cultivated and wild tomato species. *Plant Pathology Journal* **7**(1) 40-44.

Wang LH, Gu XH, Hua MY, Mao SL, Zhang ZH, Peng DL, Yun XF and Zhang BX (**2009).** A SCAR marker linked to root-knot nematodes (*Meloidogyne* spp.) in pepper (*Capsicum annuum* L.). *Scientia Horticulturae* **112**(2) 318-322.

Whitehead AC and Hemming JR (1965). A comparison of some quantitative methods of extracting small vermiform nematodes from soil. *Annals of Applied Biology* **55** 25-28.

Yap CA (2013). Screening for nematicidal activities of *Bacillus* species against root-knot nematodes (*Meloidogyne incognita). American Journal of Experimental Agriculture* **3**(4) 794-805.