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Response of Certian Vegetable Genotypes to the Root Knot Nematode, *Meloidogyne incognita*

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ABSTRACT

Resistance evaluation of 60 vegetable cultivars and hybrids of Eggplant, Pepper, Tomato, Cantaloupe, Cucumber and Squash were tested against Root-knot nematodes (RKN) *Meloidogyne incognita*. Among Eggplant genotypes, Arosy1 recorded the lowest reproduction rate (15.1) while the highest population was possessed by kaser abiad (41.1). Pepper genotypes, in general, were less susceptible to RKN compared with Eggplants and Tomatoes, the reproduction rate varied between 3.5 (Romey) to 8.9 (P77). All Tomato genotypes were highly susceptible to RKN infection, Super strain B was the most susceptible cultivar because the nematode success to multiply 38.3 times, the lowest reproduction rate (13.3) registered by 820 and Castel rock (11.6 & 11.8 respectively). Similarly, all cucurbitaceous plants found to be susceptible to RKN infection. Among Cantaloupe genotypes, Alhana possessed the highest reproduction rate (15.8), while Galia 3 recorded the lowest reproduction (7.2). Within Cucumber genotypes, the minimum reproduction rate (6.2) was observed on Almanar, but the maximum population was possessed by Aliaa (13.8). Squash genotypes viz. Sama recorded the lowest reproduction rate (4.8) and the greatest population (10.1) was possessed by Dahab. Plant growth in most cases negatively reacted with nematode infection and the differences between infected and healthy plant was unobvious in many cases. To recommend the less susceptible genotypes as a tool for managing nematode strategy, further experiments are needed in the field for using these selected genotypes, also insertion these genotypes in breeding program for improving their characters specially resistance to nematode.

Keywords: Host reaction, vegetable genotypes, Meloidogyne incognita

INTRODUCTION

Plant parasitic nematodes (PPN) are the major pests that threat the sustainable agriculture in the cultivated areas of the light soils in the wormer parts (as in Egypt) of the world. at such areas, susceptible crops and suitable environmental conditions together raise the reproduction of nematodes to reach densities exceeding the economic threshold and may become a limiting factor in the production of certain crops.

The root-knot nematodes, *Meloidogyne* spp. are considered among the top five major plant pathogens and the first among the ten most important genera of PPN in the world. This devastating nematode causes tremendous losses in agricultural production (Jiskani *et al*., 2008, Ibrahim *et al*., 2010; Hussain *et al*., 2011 and El-Sherif *et al*., 2012). The disease caused by these insidious nematodes (root-knot disease) is often the only, or one of the few, nematode diseases of crops known to farmers owing to its severe symptoms (Hassan, 2005). Vegetable crops especially those belong to Solanaceae and Cucurbitaceae are the most favorable hosts to root- gall nematodes. Cultivation of susceptible cultivars of these crops results in great losses in the growing as well as the following crops because of the high rates of reproduction and population build-up. Such higher rates of nematode build-up and progression of population size may result in the breakdown of resistance and/or tolerance to nematode infections under certain conditions.

Resistance is one of several tools for use in an integrated approach for root knot nematode management. Consequently, nematologists always seek vegetable germplasms resistant to phytoparasitic nematodes and evaluate the economic thresholds and tolerance limits of the local cultivated as well as the newly imported cultivars and hybrids. Several attempts to evaluate and or discover new resistance or tolerant vegetable genotypes were accomplished (Khan *et al*., 2000; Nono-Womidin *et al*., 2002; Ozarslandan and Elekcioglu, 2003; Gopinatha *et al*. , 2005; Al-Yahia, 2006; Moosavi *et al*. , 2006; Abd-Elgawad *et al*. , 2007; Adam *et al*. , 2008; Shalaby *et al*. ,2012; El-Ansary and Mostafa, 2013; Mukhtar *et al*., 2013; Ibrahim *et al*., 2014; Sujatha *et al*., 2017 and Sundharaiya *et al*., 2018). The objectives of this study are aimed to: Screening for some vegetable cultivars and hybrids against the *Meloidogyne incognita* and studying the impact of nematode infection on growth parameters of each vegetable genetic resource.

MATERIALS AND METHODS

1. Stock culture of Root-knot nematode

Pure culture of root-gall nematode, *Meloidogyne incognita* originally obtained from infected tomato roots was established. Single egg mass from previously identified females were used to inoculate three weeks old of healthy tomato cv. Super strain B grown in 15 cm pots filled with sterilized soil (3:1 v/v sand: clay). After six weeks form inoculation plants were uprooted and investigated for forming egg masses then further inoculation for many eggplant and tomato seedlings was carried out. The culture was kept on clean benches in greenhouse of plant protection department, Desert Research Center and continuous culture was cared for further inoculation.

2. Test plants

A Pot culture experiment was conducted to evaluate the relative susceptibility of 60 vegetable genotypes to the RKN, *M. incognita*, These vegetables were belonging to family of Cucurbitaceae and Solanaceae and included 8 of Cantaloupe (*Cucumis melo*), 6 of Cucumber (*Cucumis sativus*), 8 of Eggplant (*Solanum melongenea*), 9 of Pepper (*capsicum annum*), 4 of Squash, (*Cucrbita pepeo*), 25 of Tomato (*Lycopersicon esculentum*).

3. Screening tests

Healthy seedlings of sixty vegetable genotypes, including commonly cultivated vegetables cultivars and hybrids, were evaluated against RKN. 3 week old of tested vegetable plants were singly transplanted in 15 cm diameter clay pots filled with disinfesting sandy clay soil (3:1v/v). Two weeks later, seedlings were inoculated with approximately 2500 newly hatched juveniles of *M. incognita* per plant by pipetting the nematode suspension above the root system after removing the surface layer of soil. Inoculum of RKN was obtained from available pure stock culture. Four replicates of each vegetable species were used and equal number of uninoculated (control) served as check. All pots were arranged in randomized design and treated the same until the end of the experimental time. All pots were arranged on a greenhouse bench at 30 ± 5°C receiving the same fertilization and watered as needed. Forty five days after nematode inoculation, all plants were uprooted and the root system of each plant was washed to remove soil particles by tap water. Plant growth parameters viz. root fresh weight, root and shoot length, shoot fresh and dry weight (after drying the plants in a hot air oven at 60°C for 72 hours). Nematode parameters were determined as described subsequently in details.

To categorize the tested vegetable plants as susceptible or resistance to RKN we used two scales; the first was root gall index ranges which determined according to (Hadisoeganda and Sasser, 1982) as follow: 0-1.0= highly resistant (HR); 1.1-3.0= very resistant (VR); 3.1-3.5= moderately resistant (MR); 3.6-4.0= slightly resistant (SR) and 4.1-5.0= susceptible (S) (this scale are related to root gall index of Taylor and Sasser (1978) in which values were estimated according to the following scale: (0 = 0 galls; 1= 1-2 galls; 2= 3-10 galls; 3= 11-30 galls; 4= 31-100 galls and 5 =>100 galls). The second scale was depending on the rate of build-up (Pf/Pi): ≥ 3= highly susceptible (HS), 2-3 = S, 1-2= MS, 0.5-1.0= MR, 0.3-0.5= resistant (R) and ≤0.3= HR

4. Nematode assay.

A- Soil population:

Upon harvest, each pot was soaked in a plastic bucket filled with water until the root system could be easily separated. Each root system was gently dried using soft clean tissue paper, weighed and stored in 5% formaldehyde in plastic jars. The soil suspension was quite stirred, then poured through a series of 60, 200 and 325 mesh sieve. Hawksley counting slide was used to calculate the number of juveniles in one milliliter (repeated three times) of the suspension and then referred to the whole volume of soil suspension contains second stage juveniles of RKN.

B- Root population

Roots were stained in lacto phenol acid fuchsin (Franklin and Goodey, 1959). The stained roots were added to one liter of distilled water, stirred and heated to boiling for about one minute. The root was then immersed in the stain for one minute, then removed and soaked in tab water to get rid of the excess stain. Developmental stages, mature females and egg-masses were counted under a stereomicroscope using two fine dissecting needles.

C- Number of eggs per egg-mass (fecundity)

Ten egg-masses of uniform size were collected from the root surface, placed into a vial containing 20 ml of sodium hypochlorite NaOCL (0.5%) and vigorously shacked for 3 minutes. The suspension was then poured through a 500 mesh sieve, and eggs were gently washed with a slow water stream of tab water to rinse off the residual NaOCL. Eggs were then collected into 250 ml beaker. An amount of 1 milliliter was withdrawn after the suspension was stirred well and dispensed onto a Hawksley counting slide, and examined under a compound microscope. The counted number was then referred to the whole volume and divided by 10 to get the number of eggs per single egg-mass.

D- Total eggs, final population and rate of reproduction

Total eggs/root system were also counted by multiplying the mean number of eggs/egg-mass by number of egg-masses/root system for each replicate. The final population (FP) was calculated by summation of soil population+ developmental stages+ mature females+ egg-masses+ total eggs and the rates of nematode, reproduction or build up (RB) were calculated by dividing the nematode final population by the nematode initial population [nematode population = Pf/Pi].

RESULTS AND DISCUSSION

RESULTS

Results in table (1) showed that Eggplant genotype kaser abiad is the most highly susceptible (HS) to RKN as it supported the highest rate of nematode reproduction (41.1), and significantly different compared with all tested eggplant genotypes, followed by Ordony (32.8). Arosy2 was possessed the half reproduction factor (22.2) of the highest one. Kaser abiad also recorded the highest values of soil juveniles/pot, root population, egg-masses, eggs/egg-mass and total eggs. The two genotypes; Arosy1 and Amrikey showed the minimum RB (15.1& 18), but the differences between Arosy2, Arosy1 and Amrikey are not powerful, also Arosy1 recorded the lowest number of galls, root population and egg-masses and total eggs per roots. Similarly, insignificant differences in final population were observed between the four genotypes viz. Guwar, Ordony, Classic and Romey. The lowest number of galls was formed by Arosy1 (135) also root population (267 individuals) and egg-masses/root system. Amrikey was possessed the lowest fecundity rate and it ranked in second category after was Arosy1. It was noted that total eggs are the main criterion effect on the final population.

On Pepper, all tested genotypes were susceptible to RKN hence its reproduction was satisfied on them. The maximum reproduction rate was gained by P77 (8.9) followed by three genotypes (P44, Arishy and Aspaney) without cogent differences. Other two were viz. Osama and Balady harbored relatively similar populations (4.3& 4.1 respectively). The rest three was possessed the lowest reproduction rate; Shata S, C55 and Romey 3.9, 3.6 and 3.5, successively). The galls number were peaked in Romey (133) followed by Aspaney (130) while the differences between tow genotypes and also P77, Balady, Osama, Shata S were insignificant, from another side the lowest number of galls was achieved by P44 (103.3). Soil population was maximized in P77 (3970.7 individuals) and minimized in Arishy (3454.3). P44 was recorded the highest root population pursued by Osama, Aspaney (234.3, 226.7 and 225.7, respectively) without noticeable differences, the lowest root population was possessed by Arishy (187) and Balady (193.7), all the rest tested genetic resources were not significantly different in their root population. Maximum fecundity was watched in Arishy (205) ensued by P77 (186.7), while the minimum was attained by Osama (108). Egg-masses numbers was peaked in P77 (96.7) and greatly diminished in (43) Arishy.

Table 1. Development and reproduction of *Meloidogyne incognita* infection on some solanaceous plants under greenhouse conditions.

Crop	Plant genotypes	No. galls/roots	Nematode population								RB	Host Category
			No. soil juven./ pot	No. devlop. Stages /roots	No. Adult females /roots	Root Pop.	No. egg-masses/ roots	No. eggs/ egg-mass	Total eggs	Nematode final Population		
Eggplant	Guwar	253.0 b	3943.3 ab	193.3 b	207.3 b	400.7 bc	236.3 ab	291.7 bc	69170.0 cb	73750.0 bc	29.4	H.S
	Ordony	361.0 a	3546.0 cd	265.3 a	250.0 a	406.7 b	255.0 a	306.7 a-d	77967.0 b	82174.0 b	32.8	H.S
	Amrikey	235.0 c	3618.0 b-d	220.0 b	186.7 c	406.7 b	181.7 c	225.0 d	40900.0 d	45106.0 d	18.0	H.S
	Arosy 1	135.0 e	3716.7 b-d	152.0 c	115.0 e	267.0 f	110.0 d	306.7 a-d	33633.0 d	37727.0 d	15.1	H.S
	Arosy 2	151.0 de	3401.7 d	149.7 c	148.0 d	297.7 e	143.3 d	360.0 ab	51900.0 cd	55743.0 cd	22.2	H.S
	Classic	167.0 d	3713.7 b-d	138.7c	238.3 a	377.0 cd	231.7 ab	265.0 cd	61608.0 bc	65931.0 bc	26.3	H.S
	Kaser abiad	237.7 bc	4114.3 a	265.3 a	251.7 a	517.0 a	253.3 a	386.7 a	98150.0 a	103035.0 a	41.1	H.S
	Romey	235.0 bc	3756.7 bc	154.3 c	215.0 b	369.3 d	211.3 ab	315.0 a-c	66555.0 bc	70892.0 bc	28.3	H.S
Pepper	Arishy	110.0 b-d	3454.3 b	137.0 b	50.0 c	187.0 b	43.0 de	205.0 a	8840.0 b	12524.3 bc	5.0	H.S
	Aspaney	130.0 ab	3706.7 ab	160.7 a	65.0 c	225.7 a	128.3 c	128.3 c	8103.7 bc	12099.0 b-d	4.8	H.S
	Balady	123.0 a-d	3626.7 ab	137.0 b	56.7 c	193.7 b	116.3 cd	116.3 cd	6411.7 ce	10287.0 de	4.1	H.S
	C55	109.0 bc	3558.0 ab	162.3 a	51.7 c	214.0 ab	48.3 de	110.0 d	5323.3 d	9205.7 e	3.6	H.S
	Osama	119.0 a-d	3750.7 ab	161.7 a	65.0 c	226.7 a	161.7 a	108.0 d	6762.0 cd	10802.3 c-e	4.3	H.S
	P44	103.3 d	3710.0 ab	151.3 ab	83.0 b	234.3 a	78.3 b	124.0 c	9720.0 b	13743.7 b	5.4	H.S
	P77	125.0 a-c	3970.7 a	137.0 b	101.7 a	213.0 a	137.0 b	186.7 b	18058.3 a	22364.3 a	8.9	H.S
	Romey	133.0 a	3416.7 b	162.3 a	50.0 c	212.3 ab	108.3 d	108.3 d	5240.0 d	8917.3 e	3.5	H.S
	Shata S	117.3 a-d	3340.0 b	162.3 a	51.7 c	214.0 ab	162.3 a	129.0 c	6240.3 cd	9843.7 e	3.9	H.S
Tomato	Alisa	250.0 b-d	3223.7 fg	142.3 f-h	170.0 cd	307.3 g-i	165.0 cd	371.7 b	61342.0 b	65083.0 bc	26.0	H.S
	Allia	283.0 b-d	3213.3 fg	143.0 f-h	151.0 c-g	294.0 g-i	145.0 c-g	225.0 ih	32608.0 h-k	36261.0 h-l	12.2	H.S
	A1	186.3 cd	3556.7 b-f	273.00 bc	148.3 d-g	421.3 b-e	147.7 c-e	376.7 ab	55540.0 b-d	59666.0 b-e	23.9	H.S
	Baraka	250.0 b-d	3347.7 d-g	269.33 bc	143.3 d-h	412.7 c-e	141.7 d-h	351.7 bc	49817.0 c-e	53718.0 d-f	21.5	H.S
	Castel- R	148.7 cd	3373.3 d-g	145.7 f-h	127.3 f-i	273.0 ih	123.3 e-i	208.3 i	25750.0 ij	29520.0 jk	11.8	H.S

In each column, values followed by the same letter(s) are not significantly different, according to Duncan's multiple range test, *Significant at P = 0.05

On the basis of potential reproduction (Pf/Pi): ≥ 3 = HS, 2-3 = S, 1-2 = MS, 0.5-1.0 = MR, 0.3-0.5 = R and ≤0.3 = HR

Table 1. Cont.

Crop	Plant genotypes	No. galls /roots	Nematode population								RB	Host Category
			No. soil juven./ pot	No. devlop. Stages /roots	No. Adult females /roots	Root Pop.	No. egg-mass/ roots	No. eggs/ egg-mass	Total eggs	Nematode final Population		
Tomato	C3	143.67 d	3720.7 b-d	370.7 a	123.3 gh	984.0 b	120.0 f-i	303.3 c-e	36383.0 f-j	40718.0 g-k	16.3	H.S
	D.K	125.00 d	3654.0 b-e	187.67 e-g	116.7 hi	304.3 g-i	115.0 hi	303.3 c-e	35300.0 f-j	39373.0 g-k	15.7	H.S
	G.S	116.3 d	3240.3 e-g	165.3 gh	125.0 f-i	290.3 g-i	120.0 e-i	260.7 e-i	31133.0 g-j	34784.0 h-k	13.9	H.S
	Fayroz	290.0 b-d	3116.7 g	160.3 gh	173.3 cd	333.7 f-h	170.0 bc	242.0 f-i	41177.0 e-h	44797.0 f-i	17.9	H.S
	H.S	214.3 b-d	3489.3 c-g	301.7 bc	176.7 b	489.0 ab	179.33 b	360.0 b	64703.0 b	68861.0 b	27.5	H.S
	Karmen	223.3 b-d	3266.7 e-g	165.7 f-h	148.3 d-g	314.0 g-i	146.3 c-f	366.7 b	53647.0 c-d	57374.0 c-e	22.9	H.S
	Super- A	211.3 b-d	3370.0 d-g	143.0 f-h	180.0 bc	322.3 f-i	175.0 b	240.0 f-i	42017.0 e-g	45884.0 f-h	18.4	H.S
	Super S. B	245.3 b-d	4164.0 a	282.0 bc	219.7 a	501.7 a	216.7 a	425.0 a	92075.0 a	96957.0 a	38.8	H.S
	W6	121.3 d	3810.0 a-c	302.2 bc	163.3 b-e	465.5 a-c	161.0 b-d	352.0 bc	56287.0 bc	60723.0 b-d	24.3	H.S
	47	125.0 d	3930.0 ab	255.0 b-d	136.7 e-i	391.7 d-f	138.3 d-h	293.3 d-f	40660.0 e-h	45120.0 f-i	18.0	H.S
	056	214.7 b-d	3367.7 d-g	114.3 h	151.7 c-g	266.0 hi	124.7 e-i	296.7 d-f	36987.0 f-j	40754.0 g-k	16.3	H.S
	262	328.0 bc	3380.0 d-g	153.7 f-h	150.0 e-g	303.7 hi	145.0 c-g	275.0 e-g	39858.0 e-h	43687.0 h-k	17.4	H.S
	284	326.3 bc	3273.3 e-g	148.3 f-h	125.0 f-i	273.3 hi	120.0 f-i	266.7 e-h	32200.0 g-j	35867.0 h-k	14.3	H.S
	330	501.7 a	3312.0 d-g	184.0 e-h	107.0 i	291.0 hi	103.3 i	380.0 ab	39333.0 e-h	43040.0 f-i	17.2	H.S
	341	175.0 cd	3438.0 c-g	125.0 gh	125.0 f-i	250.0 i	123.0 e-i	331.7 b-d	41273.0 f-i	45084.0 f-i	18.0	H.S
	450	378.0 ab	3346.7 d-g	205.0 d-f	108.3 i	313.3 hi	108.3 i	273.3 e-g	29592.0 g-i	33360.0 i-k	13.3	H.S
	820	257.7 b-d	3133.3 g	237.3 c-e	121.7 g-i	359.0 e-g	118.3 g-i	215.7 ih	25450.0 j	29061.0 k	11.6	H.S
	930	190.3 cd	3816.7 a-c	270.7 bc	180.0 cb	450.7 a-d	179.0 b	208.3 i	37282.0 f-i	41728.0 g-i	16.7	H.S
	01010	134.7 d	3825.0 a-c	302.7 bc	146.3 e-h	449.0 a-d	147.7 c-e	248.3 e-i	36795.0 f-j	41217.0 g-j	16.5	H.S
	1340	127.0 d	3628.0 b-f	315.0 ab	155.0 c-f	470.0 a-c	153.3 b-d	291.7 d-f	45000.0 d-f	49251.0 e-g	19.7	H.S

In each column, values of a crop cultivars followed by the same letter(s) are not significantly different, according to Duncan's multiple range test, *Significant at P = 0.05

On the basis of potential reproduction (Pf/Pi): ≥ 3 = HS, 2-3 = S, 1-2 = MS, 0.5-1.0 = MR, 0.3-0.5 = R and ≤0.3 = H

All Tomato genotypes were highly susceptible for *M. incognita* infection with different RB values. The most highly susceptible (HS) one was Super strain B (38.3), but the lowest reproduction rate was recorded by the hybrid 820 and Castel rock (11.6 and 11.8) and it was notice that the galls formed in the second one (148.70) are less than the first (257.67). Five tomato genetic resources viz. Karmen, A1, W6, Alisa, H.S possessed moderated RB (22.9, 23.9, 24.3, 26.0 and 27.5) compared to the highest one with no serious differences, followed by Baraka cultivar (21.5). Root-gall nematodes reproduced till approximately half or less of the highest susceptible one on eleven vegetable genotypes namely; 1340, Super- Alisa, 47, 341, Fayroz, 262, 330, 01010, 930, C3 and 056 (19.7, 18.4, 18.0, 18.0, 17.9, 17.4, 17.2, 16.7, 16.5, 16.3 and 16.3, successively) also they lacked to significance in their differences. The lowest RB was accompanied by the rest six genotypes (D.K, 284, G.S, 450 and Allia) and descendingly arranged as follow; 15.7, 14.3, 13.9, 13.3 and 12.2. Galls was minimized in G.S (116.3) cultivar and maximized with 330 hybrid (501.7). Soil population was peaked in Super strain B (41640) and reached to the bottom with G.S and 820 (3116.7 and 3133.3). Also Super strain B showed the highest number of root population (501.7) while the low populations was came with 341, 056, Castel rock and 284 with non-powerful differences (250.0, 266.0, 273.0 and 273.3, respectively). Egg-masses production was downplayed in 330, 450 and D.K (103.3, 108.3 and 115) and magnified (216.7) in Super strain B.

Similarly, fecundity was peaked with Super strain B (186.7) and became the lowest in Castel rock, 930 and 820 (280.3, 208.3 & 215.7, respectively). The highest egg production roots was escorted with Super strain B and it was extremely reduced in 820 and Castel rock (25450& 25750). Results in table 2 illustrated that Cantaloupe genotype Alhana is the most highly susceptible (HS) to *M. incognita* as it backed the highest rate of nematode reproduction, also it ranked statistically in the first grade in the soil population, galls, root population and fecundity.

The genotypes Dina, 5025 and Galia1 occupy the next category as they possess the population (11.4, 11.3 and 10.1, respectively). The lowest RB was observed in Galia 3 and Turky (7.2 and 7.5, successively), but they not significantly different. Number of knots were maximized with Alhana (195) and minimized in Turky, 5025 and Galia 3 (133.7, 135.7 and136, respectively). Soil population in all tested Cantaloupes genetic resources were not considerably different, Alhana was possessed the highest population (4170.7) and lowest one was associated with Galia1 (3513.3). Galia 3 was superior in root population (178) without forceful differences between it and others except Galia 2 and Halawa which represent the lowest cultivars in root population (150.3). Egg- masses production was topped in Alhana (143.3) and reach to the bottom (95) in Galia 2 followed by Halawa (98.3).

Fecundity was flourished in Alhana (245) and suppressed in both Galia 3 and Turky (9115&118). Egg production was also peaked in Alhana (35125.0) and shapely decreased in Galia 3 (13995.5). On Cucumber, none of the tested cultivars exhibited any resistance to *M. incognita* infection. The nematode reproduced normally on all the tested genotypes with the superiority to Aliee which harbored the highest number nematode population also other criteria of nematode. The lowest RB was found in Almanar and Rise Genotypes (6.2 and 7.2 respectively) without significant different. All genotypes of Squash, were highly susceptible but in comparison with other vegetables crops it was less susceptible. The most probable cultivar was Daha which supported nematode reproduction up to 10.1 times, but the most unsuitable one Sama, in which nematode multiplied only 4.8 times. No considerable differences between tested cultivars were noticed on gall numbers and root population, but in soil population Sakata (3473.3) was significantly differed comparing with the rest. Fecundity was peaked in Sakata (238) followed by Dahab (218.3) and minimized in Sama (108). The highest cultivar in production of egg-masses was Dahab (95), while the lowest one was Eskndarani (70).

All Squash genotypes reproduced normally on all the tested genotypes with the superiority to Aliee which harbored the highest reproduction rate also other criteria of nematode; galls, root population, egg-masses and total number of eggs. The minimum reproduction was found in Almanar and Rise Genotypes (6.2 and 7.2 respectively) without significant differences. On Squash, all cultivars were highly susceptible but in comparison with other vegetables crops tested it was less susceptible. The most probable cultivar was Daha which support reproduction up to 10.1 times (also occupied the first category in all nematode criteria expect root population and fecundity-without significant differences-) and the most unsuitable one Sama, which nematode multiplication on it was 4.8 times only. No significant differences between tested cultivar were noticed on gall numbers which ranged from (112.3-129.7) also root population, but in soil population Sakata (3473.3) was significantly differed comparing with the rest three cultivars. Fecundity was peaked in Sakata (238) and minimized in Sama (108). The highest cultivar in production of egg-masses was Dahab (95), while the lowest one was Eskndarani (70) but the four cultivars were not significantly differed in this criterion. Egg production showed maximization in Dahab (20738.5) and minimization (8041.7) with Eskndarani, all tested cultivar were powerful different.

Generally, these results revealed that, within solanaceaous plants it was clearly to observe that eggplant were most favorable than tomato, hence it supported nematode multiplication more than tomato and its reproduction factor ranged from 15-41.1 while tomato genotypes allowed to *M. incognita* to reproduced 11.6-38.8 times (also the number of tested vegetable germplasms must be considered) and the tow vegetable crops consider highly susceptible. Pepper plants were the less susceptible to root-gall nematode infection because the nematode rate of build-up ranged from 3.5-8.9 only. Concerning cucurbitaceous plants, it was noticed that, the lower rates of *M. incognita* reproduction were possessed by Squash genotypes showed reproduction rate ranged between (4.8-10.1) and the all tested Squash genotypes were significantly different in total population. Cucumber came secondly hence the reproduction factor of nematode was ranged from 6.2- 13.8in challenged cultivars or hybrids, finally cantaloupe found to be more suitable in supporting nematode multiplication (7.2-15.8) and the last two vegetable species may considered highly susceptible compared with Squash.

Table 2. Development and reproduction of *Meloidogyne incognita* infected some cucurbitaceous plants under greenhouse conditions.

Crop	Plant genotypes	No. galls /roots	Nematode population								RB	Host Category
			No. soil juven. /pot	No. devlop. Stages /roots	No. Adult females /pot	Root Pop.	No. egg-masses/ roots	No. eggs/ eggmass	Total Eggs	Nematode final Population		
Cantaloupe	Alhana	195.0 a	4170.7 a	49.0 a	110.0 cd	159.0 ab	143.3 a	245.0 a	35125.0 a	39598.0 a	15.8	H.S
	Dina	156.3 cd	3653.3 a	49.7 a	116.0 bc	165.7 ab	117.0 c	210.0 b	24570.0 b	28523.0 b	11.4	H.S
	Galia 1	180.0 ab	3513.3 a	53.3 a	105.0 d	158.3 ab	105.0 d	205.0 b	21525.0 c	25310.0 c	10.1	H.S
	Galia 2	161.7 bc	3696.7 a	49.0 a	101.3 d	150.3 b	95.0 e	210.0 b	19950.0 cd	23884.0 cd	9.6	H.S
	Galia 3	136.0 d	3733.3 a	51.3 a	126.7 a	178.0 a	121.7 bc	115.0 d	13995.5 e	18033.0 e	7.2	H.S
	Halawa	143.7 cd	3875.3 a	49.0 a	101.3 d	150.3 b	98.3 de	185.0 c	18185.5 d	22324.0 d	8.9	H.S
	Turky	133.7 d	3758.3 a	46.0 a	125.7 a	171.7 ab	125.3 b	118.3 d	14822.9 e	18862.0 e	7.5	H.S
	5025	135.7 d	3641.3 a	58.0 a	122.3 a	180.3 a	118.3 bc	205.0 b	24251.5 b	28173.0 b	11.3	H.S
Cucumber	Aliee	105.0 ab	3996.7 a	140.0 b	146.3 a	299.0 a	145.0 a	208.3 a	30183.0 a	34611.0 a	13.8	H.S
	Almanar	1030.0 b	3703.3 a	141.3 b	105.0 e	286.3 ab	101.7 d	115.3 c	11725.0 e	15421.0 e	6.2	H.S
	Wafeer	106.7 ab	3874.0 a	171.3 a	127.7 b	280.3 b	123.3 b	181.7 ab	22392.0 b	26688.0 b	10.7	H.S
	Aspaney	99.3 b	3860.0 a	132.0 b	117.7 c	249.7 b	113.3 c	170.0 b	19483.0 bc	23706.0 bc	9.5	H.S
	Rise	115.0 a	3770.0 a	165.3 a	115.0 cd	249.7 b	110.0 cd	125.0 c	13740.0 de	17902.0 de	7.2	H.S
	Roket	98.0 b	3703.3 ab	145.0 a	108.3 de	253.3 c	105.0 cd	167.0 b	17543.0 cd	21605.0 cd	8.6	H.S
Squash	Dahab	129.7 a	4200.0 a	145.0 a	101.7 a	246.7 a	95.0 a	218.3 ab	20738.5 a	25258.0 a	10.1	H.S
	Eskandrani	122.3 a	3763.3 ab	111.0 a	74.3 b	185.3 a	70.0 b	215.0 b	15041.7 c	19060.0 c	7.6	H.S
	Sakata	115.0 a	3473.3 b	140.0 a	81.0 b	221.0 ab	76.7 b	238.0 a	18193.3 b	21964.0 b	8.8	H.S
	Sama	112.3 a	3603.3 ab	138.0 a	78.0 b	216.0 ab	75.0 b	108.3 c	8041.7 d	11936.0 d	4.8	H.S

In each column, values followed by the same letter(s) are not significantly different, according to Duncan's multiple range test, *Significant at P = 0.05

On the basis of potential reproduction (Pf/Pi): ≥ 3 = HS, 2-3 = S, 1-2 = MS, 0.5-1.0 = MR, 0.3-0.5 = R and ≤0.3 = HR

Growth of tested vegetable genotypes was negatively responded by nematode infection generally. In family Solanaceae, all examined genotypes was showed reduction in all growth parameters except in root length of 341 and shoot length of 1340 which showed slight increase after infection. No significant reductions of eggplant genotypes could be observed as a result of *M. incognita* infection in the shoot length. The highest reduction (95.2%) was come with Guwar and minimum reduction was found in kaser abiad (11.1%). Root lengths in all eggplant genotypes restricted in infected plants, the maximum reduction (4.1%) recorded by Guwar and the maximum reduction (20.2%) was found in Arosy 2. It was noticed that all differences between healthy and infected plants were non-significant except in Ordony. Fresh shoot weight showed reductions varied between 6.8% (Ordony) - 31.6% (Romey) as influenced by nematode infection. Dry shoot weight take another trend as the lowest reduction (27.3%) was recorded by Kaser abiad and the highest reduction (47.5%) possessed by Guwar. Root weight showed minimum reduction (11.5%) in Ordony and maximum in Romey (38.4%) without significant differences in all tested genotypes except in Romey (Table.3).

Pepper genotypes showed non-significant reduction in shoot length except for P44 which recorded the highest reduction (27.5%). Root length in all genotypes was significantly reduced in infected plants. The maximum reduction in fresh shoot weight was recorded by Arishy and S. Shnoda (78.6%) and lowest reduction (11.7%) achieved by Balady. Dry shoot weight in most cases was insignificant reduced in infected plants. Root weights in all genotypes were diminished in infected plants, but in three genotypes (Arishy -61.1%-, Balady -64.6%-, S.Shnoda -61.1 %-) only showed significant differences between healthy and infected ones (Table.3).

Also data showed in Table 3 illustrated that Tomato genotypes for shoot length Castel R recorded the highest reduction (37.8%) and the lowest reduction was recorded by W 6 (1.2%) on contrary, the hybrid 1340 showed increase after infection shoot fresh weight. It is noticeable that most tomato genotypes showed insignificant differences between infected and healthy plants. Twenty of twenty five genotypes showed insignificant reductions in root length, the maximum reduction (48.9%) possessed by 930, and the lowest (6.5%) recorded by A1 hybrid, on the contrary 341 hybrid showed insignificant increasing after infection (-18.3%). Fresh shoot weight in all tomato genotypes showed reduction varied between 8.6% (H.S-W6-930) to 44.2% (330). About half of tomato genotypes showed significant reduction in dry shoot weight, the highest reduction (60.9%) recorded by 284 and the lowest reduction (0.8%) gained by 341. Root weight in Baraka showed minimum reduction (8.3%), while the Super- A possessed the highest reduction (66.4%).

Table 3. Effect of *Meloidogyne incognita* infection on plant growth of some solanaceous plants under greenhouse conditions.

Crop	Plant genotype	Length (cm)						Weight (g)								
		Shoot			Root			Fresh Shoot			Dry Shoot			Root		
		Infected	Healthy	%R	Infected	Healthy	%R	Infected	Healthy	%R	Infected	Healthy	%R	Infected	Healthy	%R
Eggplant	Guwar	54.3 ab	60.3 a	95.2	16.3 c	17.0 c	4.1	44.6 a-d	53.4 a	16.5	2.1 e	4.0 a-d	47.5	15.5 a-d	18.1 a-c	14.4
	Ordony	42.0 cd	50.3 a-c	24.6	25.0 c	30.3 a	17.5	41.1 b-e	44.1 d-g	6.8	2.9 cd	4.1 a-d	29.3	17.7 a-c	20.0 a	11.5
	Amrikey	45.0 b-d	55.7 ab	19.2	16.3 c	17.7 c	7.9	27.7 g	35.1 d-g	21.1	2.8 c-e	4.6 ab	39.1	9.1 f	11.4 d-f	20.2
	Arosy1	50.0 a-c	56.7 ab	11.8	18.3 c	21.3 bc	16.4	39.2 c-f	45.2 a-c	13.3	2.7 de	4.3 a-c	37.2	12.1 d-f	14.6 b-e	17.1
	Arosy2	41.3 cd	51.0 a-c	19.0	17.0 c	21.3 bc	20.2	41.0 b-f	50.4 ab	18.7	3.3 b-e	4.5 ab	33.3	12.1 d-f	14.4 b-e	16.0
	Classic	50.0 a-c	59.3 a	15.7	17.7 c	19.7 bc	10.2	33.0 e-g	43.3 b-d	23.8	2.5 e	3.6 a-e	33.3	13.3 c-f	17.0 a-c	21.8
	kaser abiad	40.0 cd	45.0 b-d	11.1	21.0 bc	25.0 ab	16.0	27.0 g	31.7 fg	14.8	2.4 e	3.3 b-e	27.3	10.3 ef	13.3 c-f	22.6
	Romey	37.7 d	45.7 b-d	17.5	25.7 ab	30.0 a	14.3	26.0 g	38.0 c-f	31.6	3.3 b-e	4.9 a	32.7	11.7 d-f	19.0 ab	38.4
Pepper	Arishy	44.7 cd	51.0 a-c	12.4	14.3 cd	28.3 a	49.5	7.7 h	36.0 b-e	78.6	2.5 b-d	3.5 a-c	28.6	5.6 d-f	14.4 a	61.1
	Aspaney	44.7 cd	51.0 a-c	12.4	14.3 cd	28.3 a	49.5	22.2 fg	36.0 b-e	38.3	1.6 cd	3.4 a-d	52.9	11.3 ab	14.4 a	21.5
	Balady	45.7 cd	51.0 a-c	10.4	21.0 b	28.3 a	25.8	31.8 c-f	36.0 b-e	11.7	1.4 d	3.9 ab	64.1	5.1 d-f	14.4 a	64.6
	C55	45.0 cd	51.0 a-c	11.8	23.3 b	28.3 a	17.7	25.6 ef	36.0 b-e	28.9	2.2 b-d	4.7 a	53.2	5.6 d-f	6.8 c-e	19.0
	Osama	46.7 b-d	51.0 a-c	8.4	11.3 d	28.3 a	60.1	26.2 d-f	36.0 b-e	27.2	2.8 a-d	4.1 ab	31.7	8.4 b-d	9.4 bc	10.6
	P44	37.0 d	51.0 a-c	27.5	16.7 c	28.3 a	41.0	15.4 gh	36.0 b-e	57.2	1.8 cd	3.6 a-c	50.0	2.1 f	4.7 ef	27.7
	P77	50.7 abc	57.7 a	12.1	16.0 cd	28.3 a	57.2	46.7 ab	53.8 a	13.2	1.4 d	3.2 a-d	56.3	3.6 ef	4.9 ef	26.5
	Romey	45.0 cd	51.0 a-c	11.8	23.3 b	28.3 a	17.7	25.6 ef	36.0 b-e	28.9	2.2 b-d	4.7 a	53.2	5.6 d-f	6.8 c-e	19.0
	S.Shnoda	44.7 cd	51.0 a-c	12.4	14.3 cd	28.3 a	49.5	7.7 h	36.0 b-e	78.6	2.5 b-d	3.5 a-c	28.6	5.6 d-f	14.4 a	61.1
Tomato	Alisa	43.7 e-h	45.0 d-h	2.9	23.0 c-g	31.7 a	27.4	32.1 m-s	49.9 e-k	35.7	1.6 no	2.6 h-n	38.5	10.2 g-l	11.4 c-j	10.5
	Allia	44.7 e-h	48.0 c-g	6.9	23.7 c-g	30.7 ab	22.8	53.6 d-i	67.2 a-d	20.2	1.4 o	2.7 f-n	37.0	9.9 g-m	12.6 b-g	21.4
	A1	43.3 e-h	54.7 a-e	12.8	18.7 f-i	20.0 f-i	6.5	36.8 k-q	54.7 c-h	34.1	3.1 c-m	4.2 a-c	26.2	12.5 b-g	16.5 a	24.2
	Baraka	44.7e-h	48.3 c-g	7.5	19.0 f-j	21.7 f-j	12.4	68.5 a-c	76.8 a	28.6	1.8 l-o	3.5 b-j	48.6	11.1 e-j	12.1 b-i	8.3

R%= Reduction percent
In each column, values followed by the same letter(s) are not significantly different, according to Duncan's multiple range test, *Significant at P = 0.05

Table 3. cont.

Crop	Plant genotype	Length (cm)						Weight (g)								
		Shoot			Root			Fresh Shoot			Dry Shoot			Root		
		Infected	Healthy	%R	Infected	Healthy	%R	Infected	Healthy	%R	Infected	Healthy	%R	Infected	Healthy	%R
Tomato	Castel R	28.0 i	45.0 d-g	37.8	18.7 f-j	28.0 a-c	33.2	27.0 o-u	38.3 i-q	29.5	2.5 i-o	3.9 a-h	35.9	7.3 k-p	10.7 e-k	31.8
	C3	47.7 c-h	50.0 a-f	4.6	17.0 g-j	20.3 f-j	16.3	27.7 o-s	51.8 e-j	38.9	3.1 c-m	4.7 a	34.0	4.5 p-r	10.9 g-m	58.7
	D.K	45.0 d-g	49.7 c-g	9.5	20.0 f-i	22.3 d-g	10.3	27.9 o-t	46.6 f-m	40.1	2.6 g-o	4.1 a-e	36.6	6.7 l-q	12.3 b-h	45.5
	G.S	36.3 hi	49.7 b-f	27.0	14.0 ij	18.7 f-j	25.1	9.7 v	15.0 t-v	35.3	1.8 l-o	3.3 c-j	45.5	2.7 r	4.3 p-r	37.2
	Fayroz	47.7 c-h	51.3 a-f	7.0	18.3 f-j	31.0 ab	41.0	58.0 b-f	71.4 ab	18.8	1.7 m-o	2.7 g-n	37.0	10.8 e-k	12.4 b-h	12.9
	H.S	47.7 c-h	50.0 a-f	4.6	19.0 f-i	21.7 c-g	12.4	50.4 e-k	56.2 c-h	8.6	2.9 c-n	4.0 a-g	27.5	11.1 c-j	14.7 a-c	24.5
	Karmen	49.7 b-f	58.0 a-c	14.3	17.7 g-j	19.3 f-i	8.3	47.7 f-k	67.6 a-d	29.4	1.4 o	2.8 d-n	39.3	6.4 m-q	12.0 e-j	46.7
	Super- A	44.0 e-h	55.0 a-e	20.0	12.7 j	17.3 g-j	26.6	12.0 uv	15.3 t-v	19.6	1.7 no	2.0 k-o	15.0	3.8 qr	11.3 c-j	66.4
	Super S.B	18.3 j	29.3 i	4.4	15.7 h-j	21.3 d-h	26.3	14.0 t-v	24.0 q-v	41.7	2.3 j-o	3.6 a-j	36.1	11.0 d-j	13.0 b-g	15.4
	W 6	45.7 d-g	48.3 c-g	1.2	15.7 hj	18.7 g-j	16.0	44.7 k-q	48.9 e-l	8.6	2.1 l-p	3.3 b-k	36.4	8.6 i-o	14.2 a-e	39.4
	47	45.0 d-h	51.3 a-f	12.3	17.0 g-j	20.3 e-h	16.3	33.9 l-p	53.7 g-n	36.9	2.3 j-o	3.5 a-j	34.3	6.9 l-q	12.4 b-h	44.4
	056	37.3 g-i	54.0 a-e	30.9	20.0 f-i	22.7 c-f	11.9	10.5 uv	17.3 t-v	39.3	1.7 m-o	2.7 g-o	37.0	3.6 qr	7.4 k-p	51.4
	262	60.3 ab	61.3 a	1.6	18.3 f-j	20.3 e-i	9.9	19.8 r-v	25.2 q-u	21.4	2.8 e-o	3.7 a-i	24.3	4.4 p-r	6.5 m-r	32.3
	284	50.0 a-f	56.7 a-d	11.8	20.3 e-i	25.0 c-f	18.8	15.0 t-v	18.7 s-v	19.8	1.8 l-o	4.6 ab	60.9	4.5 p-r	6.1 m-r	26.2
	330	47.7 c-h	55.0 a-e	13.3	18.7 f-i	20.7 e-i	9.7	39.5 i-p	55.3 c-h	44.2	2.8 e-o	4.0 a-h	30.0	8.8 h-n	10.5 f-j	16.2
	341	45.0 d-h	53.3 a-e	15.6	23.3 c-g	19.7 f-i	-18.3	13.3 t-v	16.0 t-v	16.9	1.4 o	3.9 a-h	0.8	3.6 qr	5.2 o-r	30.8
	450	40.0 f-h	45.3 d-h	11.7	18.3 f-j	27.0 a-d	32.2	35.4 k-q	63.4 a-e	10.3	2.2 j-p	3.9 a-h	43.6	9.4 g-n	15.1 a-c	37.7
	820	45.0 e-h	49.3 b-f	8.7	20.7 d-i	23.3 c-g	11.2	42.6 g-m	55.6 c-h	26.4	2.8 d-m	4.1 a-f	31.7	6.9 l-q	9.9 g-m	30.3
	930	50.0 a-f	53.3 a-e	6.2	18.3 f-i	44.7 k-q	48.9	36.0 e-m	54.6 c-g	8.6	2.9 c-m	4.2 a-e	31.0	11.3 c-j	13.8 a-f	18.1
	01010	41.0 f-h	46.7 c-h	12.2	18.7 f-i	21.0 d-g	11.0	36.2 k-q	49.2 e-k	36.9	2.4 i-o	4.1 a-e	41.5	8.6 i-o	11.6 c-j	25.9
	1340	49.0 b-f	46.7 c-h	-4.9	19.3 f-i	22.3 c-g	13.5	35.3 k-q	57.8 b-g	40.1	3.0 b-m	4.2 a-d	28.6	8.6 i-o	14.4 a-d	40.3

R%= Reduction percent
In each column, values followed by the same letter(s) are not significantly different, according to Duncan's multiple range test, *Significant at P = 0.05

Cucurbitaceous genotypes also negatively reacted to nematode attack, in Cantaloupe cultivars to the Root-knot nematode, data in table 4 showed that nematode infection significantly reduced plant growth parameters generally, but sometimes did not result in significant reductions in cultivars growth. The maximum reduction in shoot weight (43.3%) was observed in 5025 hybrid and the minimum reduction (5%) was possessed by Turky hybrid. On the other hand, the differences between cultivars and hybrids as a result of nematode infection showed variability in tolerance nematode challenge; Gallia 2 recorded the highest shoot length followed by Gallia 3 and Gallia 1, 94.3, 91.3 and 89.0 cm respectively). 5025 was the most affected genotype while it recorded 51 cm. Root length also significantly diminished by nematode infection in all genotypes except in Dina, 5025 was extremely affected and its reduction percent was 67.1% compared with healthy plant. The fresh shoot weight of Cantaloupe was peaked in Alhana and Halawa infected plants (49.1 g) achieving minimum reduction percentage (10.9%) and minimized in infected Gallia 1 (10.9 g) achieving maximum reduction percentage (79.0%) with significance between healthy one (50.4 g), but the arrangement was different in dry weight as found the highest reduction possessed by Turky (66.7%) and the minimum reduction (15.0%) was recorded by Gallia 2. Gallia 3 was recorded the highest reduction (64.6%) in roots weight as response to nematode attack and reached to the bottom in Turky cultivar (5%). Cucumber genotypes also negatively responded to nematode infection in all growth parameters; Aspaney and Roket showed the maximum reduction (25.9)% in shoot length and differences between healthy and infected cultivar was significant, Rise was possessed the minimum reduction (5.2%) also without significant differences. The reduction in root length was significantly peaked (30) in Aliaa and deeply lowered (17) in Rise without significance followed by Aspaney and Roket (17.7 cm). The highest reduction of fresh shoot weight (47%) was came with Rise with significant difference between healthy and nematized one and the lowest (17.5%) was attached to Wafeer. Dry shoot weight not behaves similarly in Aspaney as it possessed the maximum reduction (48.4%) and Roket recorded the lowest (31.8%). Aliaa showed maximum significant reduction (42.9%) in root weight, while Almanar recorded the minimum reduction (9.7%) without significant differences between healthy and infected plants. In Squash genotypes, shoot length was reduced affecting by nematode infection without significant difference in all tested genotypes except Dahab which possessed the maximum reduction (30.0%). Root length in Sama was showed maximum reduction (50.9%) and the lowest (24.5%) recorded by Sakata. Fresh shoot weight in Sama possessed the minimum reduction (7.7%) but the highest reduction was found in Dahab and Sakata, also dry shoot weight similarly behaved. Root weight found in Sama was greatly reduced (11.2%) as a result of infection, while Eskandrani showed maximum reduction (27.7%).

Table 4. Effect of *Meloidogyne incognita* infection on plant growth of some cucurbitaceous crops.

Crop	Plant genotype	Length (cm)						Weight (g)								
		Shoot			Root			Fresh Shoot			Dry Shoot			Root		
		Infected	Healthy	%R	Infected	Healthy	%R	Infected	Healthy	%R	Infected	Healthy	%R	Infected	Healthy	%R
Cantaloupe	Alhana	70.0 e	75.0 e	6.7	17.3 b-d	28.3 a	38.9	49.1 a-c	55.1 a	10.9	1.7 d	4.0 ab	57.5	16.2 a-c	19.1 a	15.2
	Dina	82.7 c-e	94.7 a	12.7	23.3 ab	28.3 a	17.7	27.6 e	40.1 cd	31.2	2.3 d	4.0 a-c	42.5	5.6 d	14.4 bc	61.1
	Gallia 1	89.0 b-d	108.3a	17.8	15.0 c-e	27.7 a	45.8	10.9 f	50.4 ab	79.0	1.7 d	2.7 cd	37.0	5.5 e	14.4 bc	16.8
	Gallia 2	94.3 bc	110.0 a	14.3	14.3 c-e	28.3 a	49.5	26.1 e	50.4 ab	48.2	1.7 d	2.0 d	15.0	3.1 d	14.4 bc	36.5
	Gallia 3	91.3 b-d	98.0 ab	6.8	21.0 bc	28.3 a	25.8	26.9 e	50.4 ab	46.6	1.4 d	2.3 d	39.1	5.1 d	14.4bc	64.6
	Halawa	76.0 e	91.0 b-d	16.5	11.3 de	28.3a	60.1	49.1 a-c	56.1 a	12.5	2.8 b-d	5.1 a	45.1	12.9 c	14.1 c	10.4
	Turky	76.0 e	80.0 de	5.0	16.0 c-e	28.3 a	43.5	42.4 b-d	54.1 a	21.6	1.4 d	4.2 ab	66.7	17.2 a-c	18.1 ab	5.0
	5025	51.0 f	90.0 b-d	43.3	9.3 e	28.3 a	67.1	37.7 d	50.4 ab	25.2	1.8 d	4.6 a	60.9	12.5 c	14.2 bc	11.8
Cucumber	Aliaa	83.3 cd	105.0 a	20.6	18.7 c	26.7 ab	30.0	4.7 d-f	6.6 a-c	29.0	1.8 e	3.4 a	45.7	3.8 bc	6.6 a	42.9
	Almanar	73.3 de	100.0 ab	27.0	18.7 c	26.0 ab	28.2	5.4 c-f	7.7 ab	30.0	1.6 e	2.7 a-d	41.9	5.0 ab	5.5 ab	9.7
	Wafeer	80.0 cd	100.0 ab	20.0	18.7 c	26.0 ab	28.2	4.9 c-f	5.9 b-e	17.5	1.9 c-e	2.9 ab	34.5	5.4 ab	6.1 a	11.3
	Aspaney	66.7 e	90.0 bc	25.9	21.7 bc	26.3 ab	17.7	4.9 c-f	6.2 a-d	21.6	1.4 e	2.8 a-d	48.4	4.9 ab	6.2 a	21.6
	Rise	90.7 bc	95.7 ab	5.2	24.3 ab	29.3 a	17.0	4.2 e-f	7.9 a	47.0	1.7 e	2.8 a-d	38.6	2.6 c	3.9 bc	34.0
	Roket	66.7 e	90.0 bc	25.9	21.7 bc	26.3 ab	17.7	4.9 c-f	6.2 a-d	21.6	1.9 b-e	2.8 a-c	31.8	3.7 bc	5.6 ab	33.2
Squash	Dahab	28.0 b	40.0 a	30.0	27.3 de	45.3 a	39.7	11.0 ab	13.3 a	17.5	1.7 d	3.3 a	49.4	2.8 d	4.7 a-c	17.8
	Eskandrani	27.0 b	29.0 b	5.0	28.0 de	37.7 bc	25.7	8.0 b	11.0 ab	27.3	2.1 cd	3.0 a-c	30.7	3.3 cd	4.5 bc	27.7
	Sakata	24.7 b	26.3 b	6.30	24.0 ef	31.7 cd	24.5	11.0 ab	13.3 a	17.5	2.1 cd	3.2 ab	34.7	2.7 d	3.5 cd	23.7
	Sama	24.3 b	27.7 b	12.1	19.3 f	39.3 ab	50.9	12.0 ab	13.0 a	7.7	2.5a-d	3.1a-c	21.1	5.3 ab	6.0 a	11.2

R%= Reduction percent
In each column, values of a crop cultivars followed by the same letter(s) are not significantly different, according to Duncan's multiple range test,
***Significant at P = 0.05**

Discussion

Root-knot nematodes infect a wide range of important crop plants and are particularly damaging to vegetable crops in tropical and subtropical countries (Sikora and Feranandez, 2005). The short life cycle of 6-8 weeks enables root-knot nematode populations to survive well in the presence of suitable host and their populations build up to a maximum usually as crops reach maturity (Shurtleff and Averro, 2000). Host plants have varying degrees of susceptibility, with some plants being highly while others are less susceptible or resistant to the root-knot nematodes. The highly susceptible host plants allow the juveniles to enter the roots, reach maturity and produce many eggs, while the resistant plants suppress their development and thus do not allow reproduction (Sasser and Taylor, 1978; Karssen and Moens, 2006).

Host plant resistance arrested or prevents nematode reproduction by enhancing defense mechanisms in reaction to nematode invasion. On the opposite, susceptible plants miss resistance or tolerance or both, converting them favorable hosts for pathogen reproduction (Trudgill, 1991). Resistance that prevents root-gall nematode can include pre- or post-infection mechanisms (Huang, 1985). Pre-infection resistance may happen at the root surface or within the rhizosphere thereby affecting nematode penetration. Root exudates can also attract or repel root-gall nematodes. Post-infection resistance mechanisms can involve physiological operations within the roots which: 1) forbid nematode feeding; 2) deter the initiation of feeding sites, 3) retard or prevent nematode development, or 4) suppress reproduction (Trudgill, 1991).

The susceptibility of a plant to root-knot nematode depends on the ability of its juveniles to penetrate their roots and formation of giant cells which appears as knots (galls) on the roots (Chen *et al*., 2004). The juveniles feed and molt twice (third and fourth stages) before developing into the adult stage (Siddiqi, 2000). The adult female of root-knot nematode stays inside the giant cells and continues to feed and produces egg mass in a gelatinous matrix protruding out of the root gall. The egg- masses (after hatching the eggs) give rise to infective juveniles (J_2) which may infect other roots of the same plant or move and infect the nearby plants. In case of a plant resistant to root-gall nematode, the juveniles are either unable to penetrate the roots, or die after penetration or are unable to complete their development, or females cannot reproduce.

It preferable to mentioned that, any plant that survives and grow well giving satisfactory yield at level of inoculation that equal or above the economic threshold, which causing losses in other varieties of the same plant species, consider tolerant. The efficient host that possessed suffers statistically insignificant growth and yield reduction (the efficiency of host measured by root gall index or index of nematode reproduction) considers as tolerant host according the definition of Canto-Saenz (1985).

Management of nematode populations using resistant cultivars or hybrids is considered an important strategy. In the present study, reactions of selected cultivars and hybrids to *M. incognita* were assessed on the basis of galls formed on the roots and rate of nematode buildup. Significant variations were noticed among the 60 tested genotypes in their response to the nematode. None of them was found immune or resistant but all tested varieties and hybrids were susceptible with varying degrees against *M. incognita*. In eggplants Arosy1 and Amrikey consider less susceptible compared to other tested Eggplant genotypes, while Arosy 2 ranked at moderate susceptible based on reproduction factors, while the most susceptible one was Kaser abiad as root-knot nematode population folded on it to 41.1times. Tomato also had not shown any resistance reaction, super strain b was the reference variety as it supports nematode reproduction till 38.8, while hybrid 820 and cultivar Castel rock and found to be less susceptible hence *M. incognita* population was diminished to 11.6&11.8 respectively) this finding are supported with Ibrahim *et al*., (2014), they also found that Castel rock but Super steern B were susceptible to *M. incognita,* also El-Ansary, (2013) reported that Castel rock and GS was highly susceptible to *Meloidogyne* spp. The rest testes genetic resources possessed reproduction rate ranged from 12.2 (Allia) and 27.5 (H.S). Pepper was had the lowest susceptibility in all solanaceous vegetable species, it allowed on to Root-gall nematode to reproduce in a narrow range (3.5-8.9), P77 consider more susceptible infection, while Romey and C55 found to be less suitable for *M. incognita*. Within Cucurbitaceae, the low susceptibility appeared in Squash cultivars; hence the reproduction factor was varied between 4.8-10.1. Cucumber and cantaloupe were support more nematode multiplication, Aliee was most susceptible Cucumber genotype that possessed 13.8 reproduction factor, while the lowest susceptible was Almanar it only allowing to *M. incognita* to manifold 6.2 times. Cantaloupe cultivars and hybrids recorded reproduction rate ranged between 15.8 in Alhana cultivar and 7.5 in Galia 3. The highest fecundity and egg production, in general, was observed in Cantaloupe cultivar (Alhana) and the lowest was recorded by Squash cultivar (Sama). Previous reports were in according with obtained results, Abd-Elgawad *et al*. (2007) found all the cucumber and squash cultivars were susceptible to *M. javanica* except Alzaeem (cucumber) and Arlika (Suuash) cultivars were tolerant without significant differences between infested and non-infested plants in all plant growth parameters.

Theoretically, based on number of galls (rate of invasion of juveniles) on roots, if galls are a few the multiplication rate will decreased also and subsequent suppression of nematode development resulting into low a fecundity rate. However, there are contradictory reports regarding differences between resistant and susceptible cultivars in rates of invasion by J2s of root-knot nematodes. A number of scientists (Fassuliotis *et al*., 1970; Reynolds *et al*., 1970; Griffin and Elgin, 1977) reported that host status made no difference to rate of invasion whereas Sasser (1954) found that the roots of resistant plants were not invaded as rapidly as that of susceptible ones. Dropkin and Nelson (1960) reported that resistant cultivars contained fewer developed nematodes than susceptible plants.

This study obviously revealed that, eggs produced was the main factor affecting of nematode population, hence it was found positive correlation between number of total eggs per roots and final nematode population, so we recommend in testing and evaluation the reaction of such germplasm toward root-gall nematode egg production must be recorded and considered. The importance of this study is acquired from the point of view that, farmers/growers do not have practical solution, nowadays integrated nematode management (INM) is gaining importance in which *resistance* against plant parasitic nematodes is given top priority coupled with eco-friendly approaches for management of nematode diseases. However, the tomato varieties usually cultivated in Sinai are highly susceptible to root-knot nematode and thus provide substrate for build-up of population of root- knot nematode in vegetable field. These varieties should be replaced in order to reduce the population of this nematode. However, identification and use of RKN resistant and tolerant varieties can still be a viable means of minimizing loss caused by RKN. The use of resistant varieties to manage the population of nematode is very cost effective method to control the plant parasitic nematodes. Employ resistant genotype with methods of nematode control will shift the farmer from the concept of control to the concept of management. The cultivation of moderately resistant and resistant genotypes would help to minimize the losses caused by RKNs. Further screenings of other germplasms (including wild genotypes) are needed for seeking resistant or less susceptible to root-knot nematodes and may offer solutions to endemic of root-knot disease of vegetables in tropical areas in order to militate against losses. Concerning plant growth, it was obviously that, all cultivars and hybrids were negatively affected with root-gall nematode infection. In general, the significant reductions in growth parameters of any vegetable hosts are indicator about the intolerance of these cultivars and hybrids towards *M. incognita* infection.

CONCLUSION

It can concluded form tested 60 vegetable cultivars and hybrids that, Pepper in general, was less susceptible to root- knot nematode compared with Tomato and Eggplant, as it deter nematode reproduction, the genotypes viz. Romey and C55 was the best tow in suppress nematode reproduction. In Tomatoes; super strain B ranked as most susceptible one while 820 and Castel rock was less susceptible to *M. incognita* infection. Kasr abiad consider highly susceptible Eggplant cultivar that possessed highest rate of build-up but Arosy1 and Amrikey were the lowest susceptible. Squash was low sensitive comparing with Cantaloupe and Cucumber genotypes. Sama (Squash) cultivar showed the lowest reproduction rate in all cucurbitaceous plants followed by Almanar (Cucumber), and Turky (Cantaloupe). Pertaining plant growth, it was detected that *M. incognita* quelled the vegetable growth development with boost in inoculum. This study was gained specific value which supplied from some findings; firstly, egg production showed to be important factor in assessing vegetable resistance to Root-gall nematodes, secondly, guide the farmer to used lowest sensitive vegetable cultivars to minimized nematode injury and thirdly, helps the plant breeders in developing the less susceptible genotypes to produce more resistance hybrids and cultivars for combating Root-knot disease. It advisable to vegetable growers to avoid planting susceptible solanaceous or cucurbitaceous plants in the previously root-gall nematode infested fields. It is also recommended that such field should be planted with non or low susceptible hosts before planting solanaceous or cucurbitaceous cultivars.

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إستجابة بعض التراكيب الوراثية من الخضر للإصابة بنيماتودا تعقد الجذور

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تم تقييم مقاومة ستون تركيب وراثي من الخضر (أصناف و هجن) لنباتات الباذنجان والفلفل والطماطم والكنتالوب والخيار والكوسة ضد الإصابة بنيماتودا تعقد الجذور *Meloidogyne incognita*. بالنسبة للعائلة الباذنجانية أظهرت النتائج أن عروسي1 من تراكيب الباذنجان حقق أدني معدل تكاثر (15.1) بينما أعلي معدل حقق بواسطة كاسر أبيض (41.1). وجد أن تراكيب الفلفل المختبرة بصورة عامة أقل حساسية للإصابة بنيماتودا تعقد الجذور مقارنة بالباذنجان أو الطماطم، حيث تراوح معامل التكاثر ما بين 3.5 (رومي) و 8.9 (P77). كل تراكيب الطماطم المختبرة كانت عالية الحساسية للإصابة بالنيماتودا، كان أكثر تراكيب الطماطم حساسية هو سوبر استرين بي حيث تضاعفت عليه 38.3 مرة بينما كان أقل معامل تكاثر مصاحباً للتركيب 820 (11.6) و الصنف كاسل روك (11.8). في العائلة القرعية وجد أن كل التراكيب المختبرة منها أيضاً حساسة، كما هو الحال في الباذنجانيات لنيماتودا تعقد الجذور. حاز التركيب الهنا من الكنتالوب أعلي معدل تكاثر (15.8) بينما سجل جاليا 2 معامل التكاثر الأدني (7.2). أما في الخيار فقد كان التركيب المنار الأقل ملاءمة لتكاثر النيماتودا (6.2) في حين كان الأكثر ملاءمة هو التركيب عالية (13.8). سجل التركيب الوراثي للكوسة سما أقل معامل تضاعف (4.8) أما أعلى معدل تكاثر فقد تحقق بواسطة دهب (10.1). تأثر نمو النبات في معظم الأحيان سلبياً بالإصابة بالنيماتودا، وكانت الفروق بين النباتات المصابة والسليمة غير واضحة في كثير من الحالات. وبناء على النتائج السابقة نوصي بإستخدام التراكيب الوراثية الأقل حساسية كوسيلة في إدارة النيماتودا، وكذلك التوصية بضرورة إجراء تجارب إضافية علي مستوي الحقل لإستخدام تلك التراكيب المنتخبة وذلك لإدراجها في برامج التربية لتحسين صفاتها و خصوصاً المقاومة لنيماتودا تعقد الجذور.