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Evaluation of Some Sugarbeet Varieties for Their Susceptibility to Root- knot Nematode, *Meloidogyne incognita*, According to Modified Host Parasite Index (MHPI) Scale

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Abstract

The host suitability of the ten sugarbeet varieties of monogerm (i.e., Estaban, Francescan, Sander, Sible and Univers) and multigerm (i.e., Heba, Lilly, Mammut, Mirados and Oscarpoly) to *M. incognita* infection was conducted under greenhouses condition. Results revealed that all yield characters (root, top and sugar yields) and quality characters, (sucrose, total soluble solids and purity %) of such screened sugarbeet variety were obviously diminished by *M. incognita* infection to great extort. The degree of susceptibility/ resistance of these sugarbeet varieties evaluated according to modified host parasite index (MHPI) scale which was used as a new and suitable scale (special technique) to assess host (sugarbeet plant) reaction. The MHPI is calculated by dividing a gross average of reduction percentages in all yield and quality characters by the susceptibility rate. It could be ranked as standardization of host suitability technique and reporting of resistance of sugarbeet to root- knot nematodes. On this basis, the screened sugarbeet varieties are categorized into three groups, two varieties are as tolerant host (Heba and Sible), four as low susceptible (Estaban, Lilly, Mirador and Sandor) and four as moderately susceptible (Francescan, Mammut, Oscarpoly and Univers) against root- knot nematode, *M. incognita*. So, they could be Heba (as multigerm) and Sible (as monogerm) varieties recommended as excellent commercial varieties in Egypt, and could be introduced in integrated pest management (IPM) for controlling root-knot nematodes.

Key words: damage index, host parasite, *Meloidogyne incognita*, root- knot nematodes, resistance, sugarbeet varieties, susceptibility and susceptibility rate.

Introduction

Sugarbeet plant is attacked by certain pathogens and weeds in all sugarbeet growing in Egypt which affected its growth, yield and quality. In this context, the root- knot nematode, *Meloidogyne incognita* Kofoid and White (Chitwood), is considered the most significant yield and quality limiting pathogen **(Abd El- Massih,**

1985; Maareg *et al.*, 1988a; Ismail *et al.*, 1996; Maareg and Hassanein, 1999; Gohar, 2003; Gohar and Maareg, 2005 and Maareg *et al.*, 2005). Yield losses of sugarbeet production caused by *M. incognita* as much as 50.8 and 68.4% in roots yield and sugar yield, respectively, have been observed in heavily- infested sites of certain sugarbeet fields in the West Nubariya district **(Gohar and Maareg, 2005)**. Control strategies for *M. incognita*, root- knot nematode in Egypt have primarily relied on the use of chemical nematicides. Crop rotation and cultural practices method have also been employed. No resistant varieties have yet been imported.

Many investigators evaluated some sugarbeet varieties against root- knot nematodes, *Meloidogyne* spp., **Maareg *et al.,* (1988b and 1998)** classified some sugarbeet varieties into highly susceptible, susceptible and moderately resistant against the root- knot nematode, *M. javanica* and *M. incognita* based on numbers of galls or eggmasses. However, **Maareg *et al.,* (2005)** evaluated twenty one sugarbeet varieties infected by *M. incognita* according to root damage index (DI) which was calculated as an average of gall index (GI), gall size (GS) and gall area (GA) according to **Sharma *et al.,* (1994).** Also, **Abd- El- Khair *et al.*, (2013)** evaluated five sugarbeet varieties exhibited various degrees of susceptibility to *M. incognita* depending on their damage index. **El- Nagdi *et al.*, (2004) and Youssef *et al.,* (2016)** screened certain sugarbeet varieties for their susceptibility/ resistance against root- knot nematode, *M. incognita* according to their damage index (DI) and percentage host vigor which were combined together to evaluation of the tested varieties. **Gohar *et al.,* (2013)** evaluated some sugarbeet varieties for their susceptibility/ resistance against *M. incognita* based on combination between gall index and reproduction factor (P_f/ P_i) according to **Canto- Saenz and Brodie (1986).** The host parasite index (HPI) as a susceptibility/ tolerance value was used to evaluation of imported sugarbeet varieties for root- knot nematodes, *Meloidogyne* spp. In this scale, **Ismail *et al.,* (1996)** used the reduction in characters of plant growth (dry weight of root and leaves per plant and diameter of root) and quality in tested plants for comparing the effects of root- knot nematodes. However, **Maareg *et al.,* (2009)** used the reduction which occurs in characters of sugarbeet yield (roots yield, top yield and sugar yield) and quality to be a better characters for comparing pathogenic effects of nematodes. The modified host parasite index (MHPI) scale according to **Maareg *et al.,* (2009)** is more suitable because of generally high correlation between these characters and crop damage. This reduction in roots and sugar yields as well as sucrose% are very important as its affects the suitability of sugarbeet varieties for both farmers and sugar industry. The main aim of this research is to evaluating the sensitively of new imported sugarbeet varieties against root- knot nematode, *M. incognita* using MHPI scale according to **Maareg *et al.,* (2009).**

Materials and Methods

The ten imported sugarbeet varieties used in this study were obtained from

Sugar Crops Research Institute (SCRI), Agriculture Research Center (ARC), Egypt. Seed type and origin of sugarbeet varieties used tabulated in Table (1). Seeds of these varieties were planted separately in 30 cm diameter earthen pots filled with stem sterilized sandy loam soil (the soil was heat- sterilized at 60°C for 45 minutes) in the first week of October, 2015. At four leaves stage, seedlings were thinned to one vigorous plant per pot. For each sugarbeet variety, ten pots with similar in their growth were selected, five of those were inoculated with 2000 newly hatched action second stage juveniles (J_{2s}) of *M. incognita* into four holes 3 - 5 depth around the sugarbeet root which were immediately covered and mixed with soil. Inoculum of *M. incognita* was prepared following the methods of **Hussey and Barker (1973)** by extracting nematode eggs from previously infected tomato grown on pure culture using a 1.5% NaOCl solution. The other five pots were kept without inoculation as control. All pots were arranged in a completely randomized block design in a glasshouse at 20 ± 5°C and 65 ± 5 RH. All pots were managed throughout the growing season by standard agricultural practices and were irrigated as needed. Six months after nematode juveniles inoculation, the soil of each pot was well irrigated before removing the plant. Roots were washed in a gentle flow top water. Fresh weights of leaves and root plant^{-1} were recorded. Infected plant root were examined for determine the number of galls.

Table (1). Seed type and origin of sugarbeet varieties used in the study.

Variety	Seed type	Origin
1. Estaban	Monogerm (z)	Germany
2. Francesca	Monogerm (Nz)	Netherland
3. Heba	Multigerm	Denmark
4. Lilly	Multigerm (Nz)	Denmark
5. Mammut	Multigerm (z)	Denmark
6. Mirador	Multigerm (Nz)	Denmark
7. Oscarpoly	Multigerm (N)	Denmark
8. Sandor	Monogerm (Nz)	Germany
9. Sibel	Monogerm (Nz)	Belgium
10. Univers	Monogerm (En)	Netherland

Root gall index (GI), gall size (GS), gall area (GA) and nematode damage index (DI) were estimated according to **Sharma *et al.,* (1994).** The number of developmental stages in root system was determined after staining by lactic acid-fuchsin **(Byrd *et al.,* 1983)** and recorded. Number of *M. incognita* juveniles in pot soil was also determined by extracting through sieve and modified Baermann- pan technique **(Goodey, 1957)** and recorded. The technological characters on the basis of total soluble solids (T.S.S) percentage was measured in the fresh roots by hand refractometer, sucrose percentage was determined according to **Le Docte** as described by **Mc Ginnis (1982)** and purity percentage was calculated as a ratio between sucrose% and T.S.S.%. Sugar yield plant-^{1} was calculated by multiplied sucrose% × root weight.

The susceptibility or tolerance degree of screened sugarbeet varieties was determined by modified host parasite index (MHPI) scale according to **Maareg *et al.,* (2009)** as a new susceptibility/ resistance value which states the amount of reduction in yield and technological characters caused by nematode infection accorded to following formula:

$$MHPI = 2\,[R_{yi} + R_{tech}] \div (SR \times P_{yi\,+\,tech})$$

Where:

R_{yi}	=	Total reduction in yield characters
R_{tech}	=	Total reduction in technological characters
$P_{yi+tech}$	=	Number of yield and technological characters
SR	=	Susceptibility rate
	=	(RF + DI)/2

Where:

RF = Reproduction factor = final population (P_f) / initial population (Pi) according to **Oostenbrik (1966)**

DI = (GI + GS + GA)/3 according to **Sharma *et al.,* (1994).**

Sugarbeet varieties with MHPI ≤ 4.0 is considered as tolerant (T), 4.1- 6.0 as low susceptible (LS), 6.1- 8 as moderately susceptible and ≥ 8.1 as highly susceptible (HS). Least significant differences (LSD) and a paired T- test at 0.05 and 0.01 were performed for all data.

Results

The host suitability of the ten sugarbeet plant varieties of five monogerm i.e., Estaban, Francescan, Sandor, Sible and Univers, and five multigerm i.e., Heba, Lilly, Mammut, Mirador and Oscarpoly to *M. incognita* root- knot nematode infection was conducted under greenhouse condition (20 ± 5°C and 65 ± 5RH). Results revealed that all yield and quality characters of such screened sugarbeet plant varieties were obviously diminished by *M. incognita* infection to great extent as shown in Tables 2 and 3.

Significant differences (P = 0.05 and 0.01) are found between infected and non infected plants within screened sugarbeet varieties in yield characters i.e., root, top and sugar yields plant^{-1}. All the evaluated sugarbeet varieties had significantly decreased in all yield characters except, for Univers variety only in top yield plant^{-1} and Heba variety in both top and sugar yields which were not significantly decreased. The percentage reduction in root yield ranged from 7.0 in Heba variety to 40.5 in Mirador variety. The top yield plant^{-1} reduction ranged from 3.1% in Heba variety to 49.8% in Mirador variety. In sugar yield plant^{-1}, the ranged reduction varied from 15.9% in Heba variety to 48.5% in Mirador variety, and in total reduction of yield characters from 26.0% in Heba variety to 138.0% in Mirador variety, also, the Sandor and Francescan varieties recorded 108.1 and 89.3% in total reduction%, respectively. Generally, the Mirador variety attained the highest reduction in root, top and sugar yields as well as total yields, but Heba variety had the lowest ones (Table, 2).

Also, significant differences (P = 0.05 and 0.01) are found between infected and non- infected plants within tested sugarbeet varieties in quality characters (sucrose%, total soluble solids% (T.S.S%) and purity%). All the tested sugarbeet varieties had significantly decreased in all quality characters, except, for Sandor, Sible and Heba varieties which were not significantly decreased only in T.S.S%. The ranged reduction in sucrose% was 9.9% in Heba variety to 31.2% in both Francescan and Oscarpoly varieties, and in T.S.S% from 2.8 in Mirador variety to 20.7% in Francescan variety. Reduction in purity% ranged from 3.5% in Lilly variety to 16.7% in Oscarpoly variety. The total reduction of quality characters ranged from 20.0% in Heba variety to 65.2 and 65.1% in Oscarpoly and Francescan varieties, respectively, (Table, 3).

Significant differences were found in J_{2s} in soil, developmental stages in root system, total numbers (P_f), reproduction factors (RF), GI, GS, GA, DI and SR. The J_{2s} in soil range was 7903- 14732 with Heba variety having the lowest and Sandor, Francescan and Mirador the highest values. The different stages in root system values ranged from 1594 in Heba variety to 8000 in Estaban variety, and in total nematode (P_f) values from 9497 in Heba variety to 21485 in Mirador variety. The values of RF ranged generally, from 4.7 for Heba variety to 10.7 for Mirador variety. Eventually, the varieties, Mirador, Estaban and Lilly attained the highest RF, and Heba, Sible and Mammut varieties had the lowest RF values. The GI value ranged from 6.0- 9.0 with Heba variety having the lowest and Francescan and Mirador varieties the highest values. The GS range was 5.5- 90, with Heba variety having the lowest and Sible and Mirador varieties the highest values. The GA values ranged from 5.0 in Univars, Heba and Mammut varieties to 9.0 in Francescan and Mirador varieties. The DI range was from 5.5 to 8.9 with Heba variety having the lowest and Mirador and Francescan the highest values. The SR values ranged from 5.1 in Heba variety to 9.8 in Mirador variety. Eventually, the variety, Heba attained the lowest P_f, RF, GI, DI and SR values and Mirador variety had the highest ones (Table, 4).

Table (2): Root, top and sugar yields of the screened sugarbeet varieties as influenced by the infection of root- knot nematode, *Meloidogyne incognita.*

Sugarbeet varieties	Root yield plant^{-1} (g)			Top yield plant^{-1} (g)			Sugar yield plant^{-1} (g)			Total reduction of yield characters
	Control	Infected	R%	Control	Infected	R%	Control	Infected	R%	
Monogerm										
Estaban	835.3	689.8**	17.4	333.7	262.1*	21.5	125.9	81.5**	35.3	74.2
Francescan	761.2	622.6**	18.2	312.8	227.3*	27.3	129.6	72.8**.	43.8	89.3
Sandor	772.5	550.0**	28.8	320.0	195.0**	39.1	127.6	76.3**	40.2	108.1
Sible	865.6	730.7*	15.6	297.9	262.0	12.1	153.0	113.7*	25.7	53.4
Univers	689.2	564.4**	18.1	296.5	259.6	12.4	116.1	68.2**	41.3	71.8
Multygerm										
Heba	637.8	592.9*	7.0	314.4	304.8	3.1	108.8	91.5	15.9	26.0
Lilly	788.1	652.2**	17.2	372.9	304.8*	18.3	158.1	104.2*	34.1	69.6
Mammut	865.7	642.5**	25.8	322.5	212.6**	34.1	153.1	92.3**	39.7	99.6
Mirador	747.8	445.0**	40.5	340.3	170.7**	49.8	136.0	70.0**	48.5	138.8
Oscarpoly	798.3	650.0**	18.6	347.8	257.3**	26.0	148.2	83.3**	43.8	88.4

*and ** significant at 0.05 and 0.01 probability levels, respectively. R%= Reduction%

Table (3): Sucrose, total soluble solids (T.S.S) and purity percentages of the screened sugarbeet varieties as influenced by the infection of root- knot nematode, *Meloidogyne incognita.*

Sugarbeet Varieties	Sucrose%			T.S.S%			Purity%			Total reduction of quality characters
	Control	Infected	R%	Control	Infected	R%	Control	Infected	R%	
Monogerm										
Estaban	15.1	11.8**	21.9	20.3	17.3**	14.8	74.4	68.2*	8.3	45.0
Francesca	17.0	11.7**	31.2	22.2	17.6**	20.7	76.6	66.5**	13.2	65.1
Sandor	16.5	13.9**	15.8	20.8	19.2	7.7	79.3	72.4**	8.7	32.2
Sible	17.5	15.6**	10.9	20.2	19.3	4.5	86.6	80.8*	6.7	22.1
Univers	16.8	12.1**	28.0	20.1	16.6**	17.4	83.6	72.9**	12.8	58.2
Multygerm										
Heba	17.1	15.4*	9.9	20.3	19.4	4.4	84.2	79.4*	5.7	20.0
Lilly	20.1	16.0**	20.4	22.8	18.8*	17.5	88.2	85.0*	3.5	41.4
Mammut	17.7	14.4**	18.6	20.7	18.4*	11.1	85.6	78.3**	8.2	37.9
Mirador	18.2	15.7*	13.7	21.3	20.7*	2.8	85.4	75.8**	11.2	27.7
Oscarpoly	18.6	12.8**	31.2	25.5	21.1**	17.3	72.9	60.7**	16.7	65.2

* and ** significant at 0.05 and 0.01 probability levels, respectively. R%= Reduction%

Table (4): The population density, reproduction factor, root galling symptoms, damage index, susceptibility rate, modified host parasite index and host category of root- knot nematode, *Meloidogyne incognita* on the screened sugarbeet varieties.

Sugarbeet varieties	juveniles number (J_{2s}) in soil	Different stages in root system	Total nematode (P_f)	reproduction Factor (RF)	Gall Index (GI)	Gall Size (GS)	Gall Area (GA)	Damage index (DI)	Susceptibility Rate (SR)	Modified host parasite index (MHPI)	Host category
Monogerm											
Estaban	10249d	8000a	18249b	9.1b	7.0d	6.0d	7.7bc	6.9c	8.0b	5.0	LS
Francescan	13475b	2997e	16472c	8.2c	9.0b	8.3b	9.0a	8.7a	8.5b	6.1	MS
Sandor	14732a	1929e	16661c	8.3c	7.7b	8.0b	7.3c	7.7b	8.0b	5.8	LS
Sible	9362ef	3962d	13324e	6.7d	8.7a	9.0a	6.3d	8.0b	7.4c	3.4	T
Univers	9189f	5279c	14468d	7.2d	7.3d	6.1d	5.0e	6.1de	6.7c	6.5	MS
Multygerm											
Heba	7903g	1594e	9497f	4.7e	6.0e	5.5e	5.0e	5.5e	5.1f	3.0	T
Lilly	9787de	7281b	17068b	8.5c	8.0cd	6.3cd	6.1d	6.8cd	7.6bc	4.8	LS
Mammut	9479de	4122cd	13601e	6.8b	7.8b	6.5c	5.0e	6.4d	6.6e.	6.9	MS
Mirador	13637b	7848ab	21485a	10.7a	9.0a	8.7a	9.0a	8.9a	9.8a	5.7	LS
Oscarpoly	11151c	5501c	16652c	8.3c	8.0b	8.0b	8.2b	8.1b	8.2b	6.2	MS

LS= Low susceptible MS= Moderately susceptible T=Tolerant

The data cleared that the different sugarbeet varieties have a great variation in their susceptibility/ resistance to infection with *M. incognita*. Thus, could be classified according to MHPI scale **(Maareg, 2009)** into there significantly separated groups, two varieties, Heba and Sible are considered as tolerant, four varieties, Esteban, Lilly, Mirador and Sandor are considered as low susceptible and four varieties, Francescan, Mammut, Oscarpoly and Univers are considered as moderate susceptible.

Discussion

In this study, statistical differences (P = 0.05 & 0.01) are found between infected and non- infected plants within varieties of sugarbeet in various yield and quality characters. Results revealed that the yield and quality characters of such screened sugarbeet plant varieties were obviously diminished by *M. incognita* infection to great extent. Also, the screened varieties which were infected with *M. incognita* showed significant differences in symptoms of root galling, damage index, final population, reproduction factor and susceptibility rate. These results are in accordance with those reported by **Ismail *et al.,* (1996) and Maareg *et al.,* (2009).**

Concerning categorization of imported sugarbeet varieties as affected by root- knot nematode, *Meloidogyne* spp. In Egypt, **Maareg *et al.,* (1988b and 1998)** classified some sugarbeet varieties into different degrees of susceptible against *M. incognita* and *M. javanica* based galls and / or eggmasses numbers. Also, **Maareg *et al.,* (2005) and Abd- El- Khair *et al.,* (2013)** evaluated some sugarbeet varieties exhibited various degrees of susceptibility to *M. incognita* depending on their damage index. However, **Gohar *et al.,* (2013)** assessed certain sugarbeet varieties against *M. incognita* based on combination between gall index and reproduction factor. In spite of the importance of the scales in expressing the differences in the degrees of nematode development, reproduction factor and damage index, the results indicated that these scales not take into consideration the evaluation of real damage occurring in plant growth, yield and quality characters of nematode infected sugarbeet plant.

On the other hand, **El- Nagdi *et al.,* (2004) and Yussef *et al.,* (2016)** evaluated some sugarbeet varieties for their susceptibility/ resistance against *M. incognita* according to percentage host vigor which was calculated as an average of percentages root and leaves weight potentials (total yield potential) and quality characters (where: % total yield potential = (total yield of each variety/ the highest total yield of given variety multiple by 100) and % host vigor = an average of % total yield potential + % sucrose + % purity + % total soluble solids). In this scale, the resistance degree of a variety varies according to the group items in it. **Ismail *et al.,* (1996)** assessed some sugarbeet according to host parasite index (HPI) which is express the amount of damage rather than nematode symptoms, in both plant growth (in dry weight of leaves and roots and in diameter of root) and quality characters caused by nematode infection. Also, these scales does not consider the real damage which accurse in roots, top and sugar yields and production characters in tested varieties. Hence, a new scale, modified host parasite index (MHPI) according to **Maareg *et al.,* (2009)** is more suitable because of the generally high correlation between the reduction% in both total yield and quality characters and crop damage, which where record low economic value of farm production.

Also, using the reduction in roots and sugar yields as well as sucrose, T.S.S and purity percentages in this respect, are very important as its affects the suitability of sugarbeet varieties for both farmers and sugar companies.

In conclusion, the MHPI scale could be ranked as standardization of host suitability method and reporting of resistance of sugarbeet to root- knot nematodes.

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تقييم بعض أصناف بنجر السكر لمدى قابليتها للإصابة بنيماتودا تعقد الجذور " *Meloidogyne incognita* " باستخدام Modified Host Parasite Index (MHPI) Scale

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الملخص العربي

تم تقييم عشرة أصناف من بنجر السكر (خمسة أصناف وحيدة الأجنة وخمسة أصناف أخرى عديدة الأجنة) لمدى قابليتها للإصابة بنيماتودا تعقد الجذور "ميليدوجين إنكوجينيتا":

وأوضحت النتائج عمومًا أن جميع الأصناف المختبرة تختلف فيما بينها في أعداد وتطور وتكاثر النيماتودا عليها. كما وجد أن هناك فروق جوهرية بين نباتات بنجر السكر المعداه بالنيماتودا والغير معداه داخل كل صنف في مكونات المحصول وصفات الجودة. حيث قل جوهريًا محصول الجذور ومحصول السكر ومحصول العرش في النباتات المصابة باستثناء الصنف "يونيفرس" لم يتأثر في محصول العرش والصنف "هيبا" لم يتأثر في محصولي العرش والسكر.

كما وجد أن جميع صفات الجودة (نسبة السكروز ونسبة النقاوة ونسبة المواد الصلبة الذائبة الكلية) قلت جوهريًا في النباتات المصابة داخل كل صنف باستثناء الأصناف "ساندوز وسيبل وهيبا" لم تتأثر في نسبة المواد الصلبة الذائبة الكلية فقط. وقد قيمت هذه الأصناف بطريقة دليل العلاقة ما بين العائل والطفيل المستحدثة– MHPI وهو يعبر عن العلاقة ما بين قيم الفقد الكلى في كل مكونات المحصول (محصول الجذور ومحصول السكر ومحصول العرش) وصفات الجودة (نسبة السكروز ونسبة النقاوة ونسبة المواد الصلبة الذائبة الكلية) والضرر الناتج عن إصابة الجذور بالنيماتودا وتكاثرها عليها.

وهذا المقياس أو النظام المستحدث هو أفضل الأنظمة ويعتبر المقياس المتخصص لتقييم قابلية أصناف محصول بنجر السكر للإصابة بالنيماتودا لأنه يحقق العلاقة الفعلية ما بين الفقد الكلى في مكونات المحصول والجودة والضرر الناتج عن الإصابة بالنيماتودا– ويختلف عن باقي الطرق أو المقاييس الشائعة المستخدمة لأن معظم هذه المقاييس تهتم بالضرر الناتج عن الإصابة (دليل التعقد، وعدد العقد وصفاتها، وتعداد وتضاعف النيماتودا) فقط والقليل منها يهتم بمقياس الضرر وصفات النمو (الوزن الجاف للجذر والأوراق وقطر الجذر) فقط، كما يوجد بعض الطرق تهتم بالمحصول المتوقع فقط وفى هذه الطرق تختلف فيها درجة مقاومة الصنف باختلاف مجموعة الأصناف المختبرة الذي يقع فيها هذا الصنف. وجميع هذه الطرق تتجاهل الفقد الفعلي الناتج في مكونات المحصول وصفات الجودة نتيجة لحدوث الضرر الناتج عن الإصابة وهذا ما يهم المزارع وشركات السكر وما ينعكس على الدخل القومي.

ونتيجة لتطبيق هذا المقياس أو النظام كمقياس خاص بتقييم أصناف بنجر السكر وجد أن الأصناف المختبرة تقسم إلى ثلاث مستويات للحساسية فهناك صنفان "سيبل" (وحيد الأجنة) و"هيبا" (عديد الأجنة) من الأصناف المتحملة، وأربعة أصناف "إستبان وساندور" (وحيدة الأجنة)، "ليلى وميرادور" (عديدة الأجنة) من الأصناف المتوسطة الحساسية، وأربعة أصناف أخرى "فرانسيسكان ويونيفرس" (وحيدة الأجنة)، "ماميوت وأوسكار بولي"

(عديدة الأجنة) من الأصناف المنخفضة الحساسية. ومن هذه النتائج يوصى بتسجيل "سيبل" و"هيبا" ضمن الأصناف الموصى بزراعتها في مصر في المناطق شديدة الإصابة. كما يوصى باستخدامها كعنصر من عناصر برامج المكافحة المتكاملة لنيماتودا تعقد الجذور.