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Host status of some imported sugar beet varieties to *Meloidogyne incognita* in Egypt

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Abstract

Ten sugar beet *Beta vulgaris* L., varieties were tested for their susceptibility/resistance against root-knot nematode *Meloidogyne incognita* under screen house conditions. All the tested varieties varied in their degree of susceptibility/resistance according to nematode damage index. Host vigor calculated as an average of percentages root weight potential and the tested technological characteristics (total soluble solids %) were used as a new scale to assess host reaction. The combination between the degree of susceptibility/resistance and host vigor of each variety gave a better evaluation and clear relationship between nematode infection and sugar beet variety yield quality and quantity. On this basis, sugar beet varieties were categorized into one variety as highly susceptible (BTS303), four varieties as susceptible (BTS 237, Gazelle, Meridi and SN627), one variety as highly resistant (Panther), three varieties as resistant (BTS301, BTS302 and SN626) and one variety as tolerant (Tenor). It is concluded that the tested sugar beet varieties differed in their susceptibility/resistance to root-knot nematode *M. incognita* depending on their damage index in combination with their plant vigor. The highly resistant or resistant sugar beet varieties determined in this study could be recommended for breeding programme and could be introduced in integrated pest management program of root-knot nematode.

Key words: Sugar beet varieties, *Meloidogyne incognita*, damage index, host vigor.

Sugar beet *Beta vulgaris* L., is the second source of sugar production after sugar cane. The local consumption of sugar increased every year due to the continuous increase in population. The root-knot nematode *Meloidogyne* spp., are considered the main nematode pathogen attacking sugar beet in Egypt (Oteifa & El-Gindi, 1982). Maareg *et al*., (1998) evaluated some sugar beet varieties as highly susceptible, susceptible and moderately resistant to the root-knot nematodes, *M. incognita* and *M. javanica* depending upon number of galls or egg-masses. El-Nagdi *et al*., (2004) evaluated thirty varieties of sugar beet infected by *M. incognita* which were categorized as highly susceptible, susceptible or moderately resistant to the root-knot nematode *M. incognita* depending on their vigor and combination between host vigor and degree of susceptibility/resistance based on damage index (DI) suggested by Sharma *et al*., (1994). Abd-El-Khair *et al*., (2013) also reported that *Meloidogyne* spp., were the most common plant parasitic nematode in sugar beet roots in certain governorates in Egypt and evaluated five sugar beet varieties as highly susceptible and susceptible to *M*. incognita on the basis of their damage index. The present research focuses on the evaluation of new ten imported sugar beet varieties against root-knot nematode *M. incognita* under screen house conditions.

Materials and Methods

Ten sugar beet *Beta vulgaris* varieties, seed type and origin were tested in this study mentioned in Table 1. Seeds of these varieties were sown in 30 cm diam., clay pots filled with 3 kg solarized clay loam soil in Novmber, 2013. Each pot was inoculated with 2500 newly hatched *Meloidogyne incognita* juveniles one month after planting with five replications for each variety. All pots were arranged in a randomized

complete block design in a screen house at 20 ± 5 ºC air temperature. The pots were watered as needed. Seven months after nematode inoculated plants harvested in May, 2014. The nematodes in soil of each pot were extracted by sieving and decanting method (Barker, 1985). The roots were gently washed to avoid the adhering soil. The evaluation of sugar beet varieties depended on the scale suggested by Sharma *et al*., (1994) based on damage index (DI) which is an average of gall index, gall size and gall area. The percentage root weight potential was calculated for each variety by dividing root (tuber) weight of each variety on the highest root weight observed of a given one multiplied by 100. Total soluble solids percent (TSS %) was measured in fresh weight of roots by using hand refractometer. Plant vigor was calculated as an average of percentages root weight potential and total soluble solids (TSS).

Table 1. Varieties of sugar beet used in the study.

S. No.	Variety	Seed type	Origin
1.	BTS 237	Multigerm	Germany
2.	BTS301	Multigerm	Germany
3.	BTS302	Multigerm	Germany
4.	BTS303	Multigerm	Germany
5.	Gazelle	Multigerm	Denmark
6.	Meridi	Multigerm	Germany
7.	Panther	Multigerm	Germany
8.	SN626	Monogerm	Netherlands
9.	SN627	Monogerm	Netherlands
10.	Tenor	Multigerm	Germany

Results

The susceptibility/resistance of 10 sugar beet varieties belonging to monogerm and multigerm to root-knot nematode *M. incognita* is shown in Table 2. The tested varieties were classified according to scale suggested by Sharma *et al*., (1994) based on damage index (DI). They were classified into 5 categories as susceptible, (BTS 237, BTS303, Gazelle, Tenor and SN627), 1 variety as highly resistant (SN626), three as moderately resistant, (BTS301, BTS302 and Panther) and one as highly susceptible (Meridi). Table (3) showed tuber weights, the percentages root potentials and total soluble sugars (TSS %) of the various varieties. Based on the percentages plant vigor calculated as an average percentages tuber (root) potential + total soluble solids (TSS%), the tested varietal reaction were classified into one variety as highly affected (BTS303), seven varieties as moderately affected (BTS237, BTS301, BTS302, Gazelle, Meridi, SN626 and SN627), two varieties as less affected (Panther and Tenor). Depending on combination between degree of host susceptibility/resistance and host reaction mentioned before, the tested sugar beet varieties were categorized into one variety as highly susceptible (BTS303), four varieties as susceptible (BTS 237, Gazelle, Meridi and SN627), one variety as highly resistant (Panther), three varieties as resistant (BTS301, BTS302 and SN626) and one variety as tolerant (Tenor) (Table 4).

Table 2. Relative susceptibility of ten sugar beet varieties again *Meloidogyne incognita* under screen house conditions.

Sugar beet varieties	No. of galls	Gall index (GI)	Gall size (GS)	Gall area (GA)	Damage index (DI)	Host susceptibility/ resistance
BTS 237	42	6.2	5.4	5.4	5.7	susceptible
BTS301	58	6.8	6.6	6.6	3.8	moderately resistant
BTS302	20	4.4	3.4	2.2	3.3	moderately resistant
BTS303	61	7	6.2	6.2	6.5	susceptible
Gazelle	40	6	4.6	4.6	5.1	susceptible
Meridi	87	8	7.4	7.8	7.7	highly susceptible
Panther	25	4.8	3.4	2.2	3.5	moderately resistant
SN626	41	6.2	4.2	4.2	2.9	highly resistant
SN627	44	6.4	5.8	5.8	6	susceptible
Tenor	41	6.2	5.8	5.4	5.8	susceptible

Table 3. Tuber weights and TSS% of ten sugar beet varieties infected by *Meloidogyne incognita* under screen house conditions.

Varieties	Root(Tuber) weight (g)	Tuber weight potential (%)	Total soluble solids (TSS%)	Plant vigor (%)
BTS 237	153.8	83.2	16.7	50
BTS301	119.7	80.3	15.3	48
BTS302	152.3	82.4	13.7	48
BTS303	49.4	26.7	17.3	22
Gazelle	86.8	46.9	14.7	33
Meridi	123.1	66.6	11.3	39
Panther	184.9	100	15.3	57
SN626	145.2	78.5	13.7	46
SN627	135.5	73.3	16.7	45
Tenor	175.0	94.6	14.7	54

Table 4. Different host susceptibility/resistance, reactions and categories of ten sugar beet varieties to *Meloidogyne incognita* under screen house conditions.

Varieties	Nematode parameters		Host parameters		Host category
	Damage index (DI)	Host susceptibility/ resistance/	Host vigor %	Host reaction	
BTS 237	5.7	S	50.0	MA	S
BTS301	3.8	MR	48	MA	R
BTS302	3.3	MR	48	MA	R
BTS303	6.5	S	22	HA	HS
Gazelle	5.1	S	33	MA	S
Meridi	7.7	HS	39	MA	S
Panther	3.5	MR	57	LA	HR
SN626	2.9	HR	46	MA	R
SN627	6.0	S	45	MA	S
Tenor	5.8	S	54	LA	T

-Host category: HS or S+HA = HS; HS or S + MA = S; HS or S + LA = T; HR or MR or R + HA = MR; HR or MR or R + MA = R; HR or MR or R + LA = HR. HS = Highly susceptible, S = Susceptible, HR = Highly resistant, MR = Moderately resistant, R = Resistant, T = Tolerant.

Discussion

In this study, different sugar beet varieties either monogerm or multigerm varied in their susceptibility/resistance against root-knot nematode *M. incognita* infection. These varieties were evaluated according to damage index (DI) suggested by Sharma *et al*., (1994) the percentage vigor plant was calculated as an average of percentages tuber yield potential + total soluble solids (TSS) as suggested by El-Nagdi *et al*., (2004a). It is interesting to note that four varieties (BTS237, Gazelle, Meridi and SN627) were classified as moderately affected (MA) depending on the basis of plant vigor scale and host reaction, but they were categorized as susceptible to root-knot nematode on the basis of host category. On the other hand, Tenor variety was rated as susceptible to root-knot nematode depending on the scale of DI, but it was less affected according to plant vigor scale and host reaction and was categorized as tolerant to this nematode on the basis of host category. The present results agree with those obtained by Abd-El-Khair *et al*., (2013). Plant susceptibility/ resistance could be attributed to the prevailing nematode species or strain, some physiological and chemical factors of the plant (Winstead & Barkan, 1957; Riggs & Winstead, 1959; Mohamed *et al*., 1999) and soil temperature (Ammati *et al*., 1986; Griffin & Gray, 1995).

Conclusions

The tested sugar beet varieties differed in their susceptibility/resistance to root-knot nematode *M. incognita* depending on their damage index in combination with their plant vigor. The highly resistant or resistant sugar beet varieties determined in this study could be recommended for breeding programme and could be introduced in integrated pest management for controlling root-knot nematode.

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References

Abd-El-Khair, H., Abd-El-Fattah, A.I. & El-Nagdi, M.A. 2013. Evaluation of five sugar beet varieties for root-knot nematode and root-rot fungal infection. *Archives of Phytopathology and Plant Protection* 46, 2163-2173.

Ammati, M., Thomason, I.J. & Mckinney, H.E. 1986. Retention of resistance to *Meloidogyne incognita* in *Lycopersicon* genotypes at high soil temperature. *Journal of Nematology* 18, 491-495.

Barker, T.R. 1985. Nematode extraction and bioassays. In: Barker, T.R., Carter, C.C. & Sasser, J.N. (Eds.). *An Advanced Treatise on Meloidogyne Vol. II*. North Carolina State University, USA, 19-35 pp.

El-Nagdi, W.M.A., Youssef, M.M.A. & Mostafa Z.R. 2004. Reaction of sugar beet varieties to *Meloidogyne incognita* root-knot nematode based on quantitative and qualitative yield characteristics. *Pakistan Journal of Nematology* 22, 157-165.

Griffin, G.D. & Gray, F.A. 1995. Biological relationship of *Meloidogyne hapla* populations to alfalfa cultivars. *Journal of Nematology* 27, 353-361.

Maareg, M.F., Hassanein, M.A., Allam, A.I. & Oteifa, B.A. 1998. Susceptibility of twenty six sugar beet varieties to root-knot nematodes, *Meloidogyne* spp., in the newly reclaimed sandy soils of Al-Bostan region. *Egyptian Journal of Agronematology* 2, 111-125.

Mohamed, M.A., Youssef, M.M.A. & Abd-Elgawad, M.M. 1999. Measuring reaction of tomato cultivars to *Meloidogyne incognita* through plant appearance and enzyme activity. *International Journal of Nematology* 9, 174-180.

Oteifa, B.A. & El-Gindi, D.M. 1982. Relative susceptibility of certain commercially important cultivars to existing biotypes of *Meloidogyne incognita* and *M. javanica* in Nile-Delta. In: *Proceedings of the Third Research and Planning Conference on Root-knot Nematodes Meloidogyne* spp. Region VII, Coimbra, Portugal, 157-160 pp.

Riggs, R.D. & Winstead, N.N. 1959. Studies on resistance in tomato to root-knot nematodes and on the occurrence of pathogenic biotypes. *Phytopathology*, 49, 716-724.

Sharma, S.B., Mohiuddin, M., Jain, K.C. & Remanandan, P. 1994. Reaction of pigeonpea cultivars and germplasm accessions to the root-knot nematode, *Meloidogyne javanica*. *Journal of Nematology* 26, 644-652.

Winstead, N.N. & Barkan, W.S. 1957. Inheritance of resistance in tomato to root-knot nematode. *Phytopathology* 47, 87-88.

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