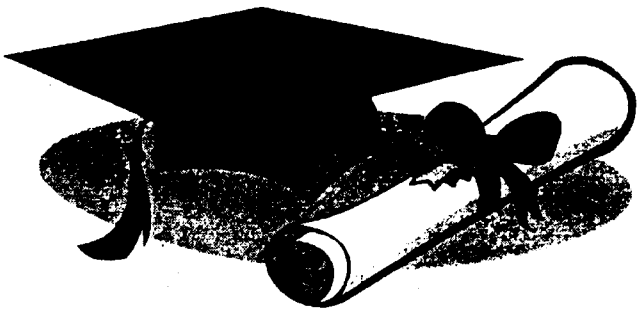
4th INTERNATIONAL CONFERENCE OF PHD STUDENTS

University of Miskolc, Hungary

11-17 August 2003



AGRICULTURE

THE RESISTANCE OF VEGETABLE PLANTS AGAINST *MELOIDOGYNE INCOGNITA* (KOFOID ET WHITE, 1919) CHITWOOD, 1949

Tímea Ács [1], ***Béla Pénzes*** [2], ***Zoltán Mándoki*** [3] ***and József Fail*** [4]

[1, 4]MSc, PhD student; [2]CSc, associate professor; [3]undergraduate student

Department of Entomology, Faculty of Horticultural Sciences, Szent István University, H-1118 Budapest, Ménesi út 44, Hungary.

ABSTRACT. Eighteen species belonging to the *Cucurbitaceae* family were evaluated for their resistance to *M. incognita* under greenhouse conditions. Galls were counted on the roots to assess damage. Variance analysis was used for statistical analysis. All tested plants were infected with *M. incognita*, but the resistance of species differed significantly. The number of galls formed on the roots of *C. metuliferus* was significantly (P=0,01) lower than on any other species.

INTRODUCTION

In Hungary, the medium used for vegetable forcing is almost exclusively soil. In the greenhouses and under plastic tunnel pests such as *Meloidogyne* species brought in from countries with a warm climate, find their essential conditions due to the continuous utilisation of greenhouses.

In Hungary, cucumber is among the most important vegetable species with an area of approx. 600 hectares used for its forcing. The major pest of cucumber grown by forcing is *Meloidogyne incognita.* Above ground symptoms are poor growth, wilting and clorosis whereas below ground symptoms are the root galls. Growers take different –mainly chemical– protective measures against the pest. However, due to the phaseout of methyl bromide, multiple alternative control measures are required [7]. Exploiting the genetic resistance of plants offers a nonchemical, environmentally friendly alternative.

Much effort has been made to find resistance in cucumber [3]. Forty-seven cucumber varieties were tested by Amin [1]. However, to date, there are no known cucumber varieties resistant against *M. incognita.* Although much progress in breeding for root-knot resistance has been made in many important horticultural crops, no success has been reached with cucumber due to incompatibility problems [9]. Therefore, the use of cucumber plants grafted onto tolerant cucurbit species offers a highly effective means of control. Two cucurbit species – *Sycios angulatus* 'Harry' and *Cucurbita ficifolia* – have been used by Hungarian growers as rootstock for cucumber.

The aims of our research were to test the resistance of these two species along with other cucurbit plants against *M. incognita* and search for potential rootstock-species for cucumber among them.

MATERIAL AND METHODS

The resistance of eighteen *Cucurbitaceae*-species (Table 1.) against *M. incognita* was tested under greenhouse conditions at Szent István University, Hungary in 2003. Seeds were obtained from seed companies. The susceptible *Cucumis sativus* 'Kínai kígyó' was used as the control species. Seeds were sown individually into polystyrene trays filled with sand which was obtained from a sand-mine and contained only saprophagous nematode species. After reaching the 2 true-leafed stage, eight plants of each species were transplanted into plastic pots (11 cm in diameter), filled with sand from the same source described as above. Two days after transplantation, each plant was inoculated with a suspension of approx. 800 *M. incognita* second-stage juveniles, which were pipetted around the roots in each pot.

The inoculum source was established from a single egg mass of *M. incognita*. The population was originally collected from a pepper plant obtained from Cserkeszőlő and was identified by the perineal pattern [5]. Pure stock culture of the inoculum was increased on the roots of `Kecskeméti jubileum` tomato plants in greenhouse as described by Hussey and Janssen [4]. To obtain the inoculum for the test, eggsacs were handpicked from the tomato roots and hatched in tapwater at room-temperature. Inoculated plants were kept on benches in a plastic house at an average temperature of 26 °C and were watered and fertilized daily.

After 7 weeks each root system was removed from the pots, washed free of soil and preserved in 2% formaldehyde. Out of the eight plants, six with the most vigorous roots were chosen for evaluation. As a strong correlation existed between galling and the number of eggsacs, only galls were counted on the roots under a stereoscopic microscope. Data was analysed by Games-Howell test [8] to determine whether there is a significant difference in the resistance of the tested species against *M. incognita*.

RESULTS AND DISCUSSION

During our research we observed that galls induced by *M. incognita* occurred on the roots of all tested species (Table 1). However, on the basis of the statistical analysis it can be established that there is a significant difference in the resistance of the tested species against *M. incognita* at 99% significance level.

The most infected species was the control species, *C. sativus* `Kínai kígyó` (Fig. 1). No significant difference was observed between the gall number of the two rootstock species -*Sycios angulatus* `Harry` and *C. ficifolia* -and *C. sativus* `Kínai kígyó` (Table 1).

This finding coincides with our previous observations in a greenhouse where cucumber forcing was accomplished on *Sycios angulatus* `Harry`and *Cucurbita ficifolia* rootstocks as well as with cucumber plants which were grown on their own roots in sandy soil severely infested with *M. incognita*. By the end of the growing season the roots of *Cucurbita ficifolia* and of *Sycios angulatus* `Harry` were severely infested with *M. incognita* yet all the cucumber plants on their own roots had died by this time.

This indicates that despite the damage occurring on the roots of the two rootstocks, the lifespan of cucumber plants grafted onto them is longer than that of cucumber plants on their own roots. This implies that although the rootstock species are susceptible to *M. incognita*, they can function well in a medium severely infested with the pest.

According to Roberts [6], the terminology of resistance is used to describe the ability of a plant to suppress development or reproduction of the nematode. Tolerance, on the other hand, is used to describe the ability of the plant to withstand nematode infection: tolerant plants grow well despite nematode infection. According to Wallace [9], host tolerance to nematodes is a general nonspecific phenomenon, originating from abiotic stresses. He also suggests that plants that are tolerant to particular stresses caused by abiotic factors may also be tolerant to nematodes that induce similar stresses. The high tolerance of the two rootstock species mentioned above is probably due to their strong, vigorous root system.

The number of galls formed on the roots of *C. metuliferus* was significantly lower than on any other species. This data confirms the works of Walters [10] and Fassuliotis [3], who found *C. metuliferus* highly resistant to *M. incognita*. However, attempts to develop interspecific hybrids with cucumber cultivars have failed.

Barker [2] suggests that in addition to developing nematode-resistant and nematode-tolerant (limited nematode reproduction and host damage) varieties, considerable effort should be made in deploying "tolerant-susceptible" varieties (limited host damage and uninhibited high nematode reproduction). On the basis of this and our observations it can be established that *Cucurbita ficifolia* and *Sycios angulatus* 'Harry' are suitable rootstocks for cucumber.

Other species such as *C. moschata* 'Orange', *Lagenaria siceraria*, Rootstock 'Ojakkyo' F1, *C. melo* PI 140471 and *C. metuliferus* should be tested against *M. incognita* in the fields as well as for their compatibility with the scion.

Table 1.

The tested species and the number of galls induced on the roots by *M. incognita*

	Species	Mean no. of galls	Significance*
1.	***Cucumis sativus*** **`Kínai kígyó`**	257, 83	**ab**
2.	**Rootstock No 80**	238,83	**a**
3.	**Rootstock No 6**	232,33	**a**
4.	***Cucurbita pepo*** **`Sárga óriás`**	214,00	**ab**
5.	***Cucurbita ficifolia***	209,83	**ab**
6.	***Cucurbita pepo*** **var.** ***patissonina*** **`Óvári fehér`**	207,00	**ab**
7.	**Rootstock No3**	206,67	**abcd**
8.	***Sycius angulatus*** **`Harry`**	195,33	**b**
9.	***Cucurbita lagenaria*`Emphasis`** F_1	164,17	**bcd**
10.	***Cucurbita pepo*** **`Alba`**	156,50	**c**
11.	***Cucurbita maxima*** **`Nagydobosi`**	147,00	**cd**
12.	***Cucurbita pepo*** **`Indátlan fehér`**	126,00	**d**
13.	***Cucurbita moschata*** **`Orange`**	115,67	**de**
14.	**Rootstock No7**	115,33	**de**
15.	***Lagenaria siceraria***	94,33	**e**
16.	**Rootstock `Ojakkyo`** F_1^+	93,83	**e**
17.	***Cucumis melo*** **PI 140471**	87,17	**e**
18.	***Cucumis metuliferus***	31,67	**f**

*Significance: There is no significant difference (P= 0,05) between the mean no. of galls in species which are given the same letter

+variety under testing

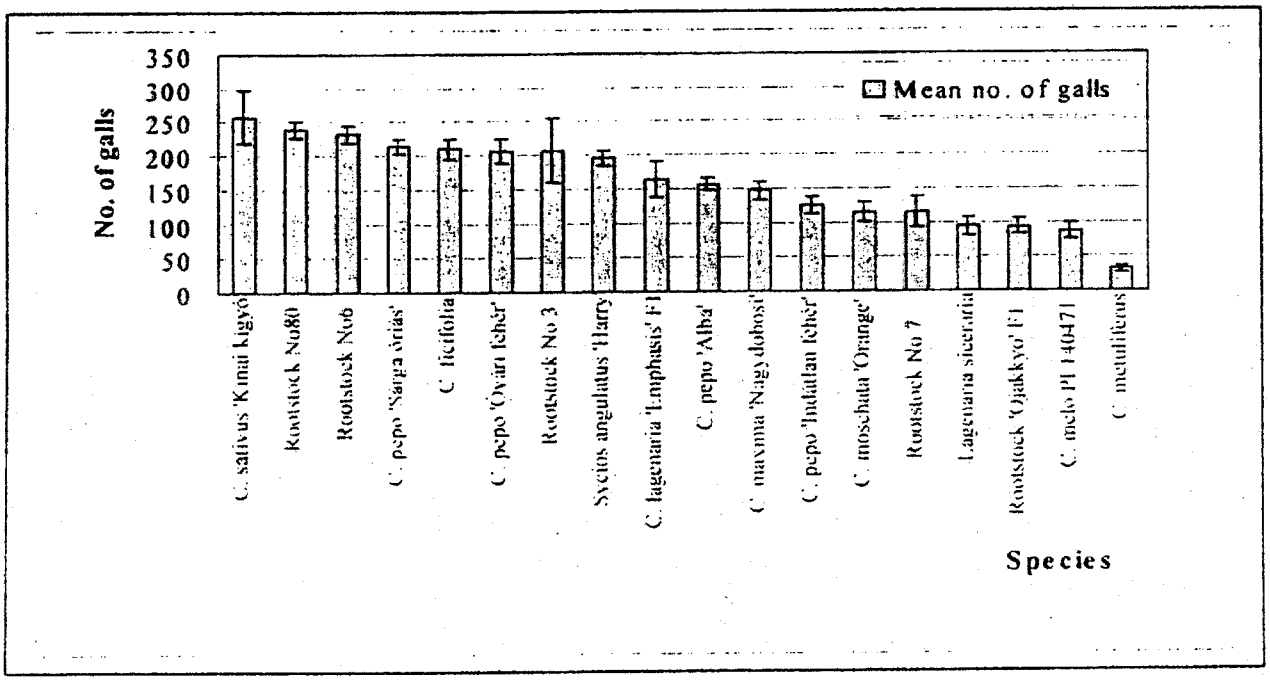


Fig. 1. The damage caused on the roots of the tested species

ACKNOWLEDGEMENT

Many thanks to the staff of the Department of Entomology and of Soroksár Research Station for their assistance in the research. Special thanks to Péter Szungyi for his invaluable contribution.

REFERENCES

[1] AMIN, W. A. (1994): Ecological and biological studies for the control of root-knot nematodes, *Meloidogyne* species in Hungary. Candidate Thesis. p. 68-69.
[2] BARKER, K.R. (1993): Resistance/Tolerance and Related Concepts/Terminology in Plant Nematology, Plant Disease , 77.:2, 111-113.
[3] FASSULIOTIS, G. (1967): Species of *Cucumis* resistant to the root-knot nematode, *Meloidogyne incognita acrita.* Plant Disease Reporter, 51: 9, 720-723.
[4] HUSSEY, R.S. and JANSSEN, G.J.W. (2001): Root-knot nematodes: *Meloidogyne* species, p. 43-70. In: J.L. Starr, R.Cook and J. Bridge (eds.) Plant resistance to parasitic nematodes. CABI Publishing
[5] JEPSON, S. B. (1987): Identification of root-knot nematodes (*Meloidogyne* species) Oxon, Wallingford, CAB International
[6] ROBERTS, P.A: (2001): Concepts and Consequences of Resistance, p. 23-41. In: J.L. Starr, R.Cook and J. Bridge (eds.) Plant resistance to parasitic nematodes. CABI Publishing
[7] UNEP Report (2001): Results of Survey on National Methyl Bromide
[8] VARGHA, A. (2000): Matematikai statisztika pszichológiai, nyelvészeti és biológiai alkalmazásokkal, Pólya Kiadó, Budapest
[9] WALLACE, H.R. (1987): A perception of tolerance. Nematologica 33:419-432.
[10] WALTERS, S. A., WEHNER, T.C. and BARKER, K.R (1993): Root-knot nematode-resistance in cucumber and horned cucumber. HortScience 28(2): 151-154.