

Root-knot Nematodes Infection Status in the Greenhouse Areas of Uşak Province in Turkey

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Abstract: Plant parasitic nematodes in vegetable production in greenhouses around the world, including in Turkey is one of the most important limiting factor. Until today there are no many studies on infection of nematodes in greenhouses in Uşak province. In this study, the determination of infestation rates with the root-knot nematodes in greenhouse areas was investigated in Uşak in 2013. The contamination status of root-knot nematodes in the roots of vegetable was investigated in greenhouses. The infection rate of greenhouses was determined to be 33.3%. Also Gal Index (GI) in the roots of cucumber plants taken randomly in a greenhouse contaminated heavily in at the end of harvest were determined according to the scale of 0-10 Zeck in the district of Sivashlı. As result of this, the GI average of galling in total of 119 samples was calculated as 6.4 in the greenhouse.

Key words: Cucumber, greenhouse, *Meloidogyne*, root-knot nematode, Uşak

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I. Introduction

The rapid growth of human population in the world and consequently food consumption is increasing. Vegetables have an important amount among the foods need that increase day by day. Due to the increasing demand for food, producers have turned to new techniques to produce more food in the unit area. Therefore, greenhouse areas and their production amounts are increasing over the years. At present, 8688 ton vegetables and fruits are produced in 574 decares greenhouses in Uşak province in 2017 (Anonymous, 2017). More than half of them are located in the district of Banaz. The underground hot water sources have been discovered in recent years in this region will increase the importance of agriculture in greenhouses in the near future. But the production of intensive vegetable productive systems in greenhouses brings with it many problems due to the appropriate humidity and temperature. Among them, one of the most important is root-knot, *Meloidogyne* spp. (Nematoda: Meloidogynidae) nematodes.

There are more than 90 species of *Meloidogyne* genera in the world (Karssen and Moens, 2006; Palomares Rius *et al.*, 2007). *Meloidogyne arenaria* (Neal) Chitwood, *Meloidogyne incognita* (Kofoid & White) Chitwood and *Meloidogyne javanica* (Treub) Chitwood have been reported to be the most common and most economically important nematodes in vegetables in our country (Elekcioglu and Uygun, 1994; Mennan and Ecevit, 1996; Kaşıkavalcı and Öncüer, 1999; Söğüt and Elekcioglu, 2000; Özarslandan and Elekcioglu, 2010). In Turkey, 9 different species have been found in the studies conducted on various culture plants in various regions up to now (Evlice and Bayram, 2016). *Meloidogyne ethiopica* Whitehead was detected in Turkey on eggplant, *Solanum melongena* L. and nightshade, *Solanum nigrum* L. and was only found in greenhouses in Samsun, Sinop and Ordu province in the Middle Black Sea Region (Aydınlı and Mennan, 2016). The females of the root-knots nematodes causing galls in the root system of the host plant. With suitable temperature and humidity, they have, especially the greenhouse areas are ideal living spaces for them (Pehlivan, 1995). They are obligate plant parasites that feed on roots of hosts and are able to parasitize almost every species of vascular plants (Jones *et al.*, 2013). They can move both horizontally and vertically within the soil and live for 2 years without their host plant (Çıkman, 2013). The attack of the nematode on the roots results in an altered root shape. The most noticed morphological change is the characteristic root galling. Therefore, the water and nutrient intake of the plant is affected. As a result of the problem in the root system, typical above-ground symptoms include wilting, stunting and yellowing and consequently yield reductions occur. Yield losses were reported between 10.0% and 80.0% depend on nematode species, population level and plant species (Siddiqi, 1986; Stirling, 1991; Collangeet *al.*, 2011; Çıkman, 2013). In addition to the direct damages of root nematodes by absorbing the plant juice and being directly associated with the nutrients of the plant, it is also known as the indirect damages that cause the entry of microorganisms from the wounds they opened while entering the root and weakening the plant against the fungus and bacterial diseases (Sasser and Carter, 1985; Stirling, 1991; Çıkman, 2013).

The aim of this study is to determine the infection status with root-knot nematode in the greenhouse areas of Uşak Province.

II. Materials and Method

The study was conducted in 2013 in Banaz, Sivaslı and central districts in Uşak. In October-November, the rate of infection plants with *Meloidogynespp.* in the harvest period in greenhouses where tomato, cucumber and pepper were grown was investigated. In the greenhouse, the second year sampling was not carried out due to the measures taken by the producers to reduce the population of nematodes and the fact that the contamination did not increase rapidly in the following years according to our previous observations. Blender-Sieve method was used to obtain adult female individuals from infectious plant roots brought from greenhouses (Coolen and D'Herde, 1972). The infected plant roots with *Meloidogynespp.* (Figure 1) were cut into small pieces 1-2 cm in length after being washed without damage. They were divided into small pieces by running 3 times for 5 seconds using the blender. This solution was filtered through 50 and 100 mesh sieves and the female individuals were collected from the 100 mesh sieves (Hooper, 1987). Female individuals were stored in TAF (Triethanolamin + 40% Formalin + Distilled water). Preparations of nematodes were prepared using these females and on the level of genus were made by the author.



Figure 1. The infected plant roots with *Meloidogynespp.*

In addition, in a greenhouse in Sivaslı, which was found to be intensively infested with plant pathogen nematodes, soils were gently removed from roots of randomly selected cucumber plants. Nematode damage was observed in these roots.

Then, according to the Root Gal Index (GI) by using the 0-10 Zeck scale (1971), the total gal rate in the roots of a total of 119 cucumber plants was determined.

III. Results and Discussion

As a result of the studies carried out, greenhouse numbers by districts, numbers and infection rate (%) with host plants obtained from the studies were given in Table 1. As seen here, it was determined that 33.3% of the selected randomly 18 greenhouses with plants already in were found to be infectious with root-knot nematodes. It is also determined that the greenhouses in the central district of Uşak are infested by 40.0%, in Banaz district by 27.3% and in Sivaslı district by 50.0%. In a study conducted in Samsun province, Mennan *et al.* (2009) reported that 65.0% of vegetable greenhouses were infected with root-knot nematodes. 76.0% of the vegetable greenhouses in Antalya and 23.0% of those in Mersin are infested with root-knot nematodes and also 10.0-94.0% of plants in vegetable greenhouses in Karaman, Eskişehir (Sarıcakaya district) and Ankara (Nallıhan district) in Central Anatolia Region have been reported to be infected with root-knot nematodes (Gürdemir and Ağdacı, 1975; Enneli, 1980; Çıkman, 2013).

Table 1. The greenhouse numbers by districts, numbers and infection rate (%) with host plants

Districts	The number of greenhouses	The number of infected greenhouses	The infection rate (%)	Host plant
Uşak	5	2	40.0	Tomato, cucumber, pepper
Banaz	11	3	27.3	Tomato, cucumber, pepper
Sivaslı	2	1	50.0	Tomato, cucumber, pepper
TOTAL	18	6	33.3	

Nematodes are most commonly found in greenhouse areas in Sivaslı district. There are very few studies in this area except the greenhouse areas. Mısırlıoğlu and Ulutaş (2011) reported that one sample from 143 samples was infected with root-knot nematodes in potato fields in Sivaslı and central districts in Uşak. In addition, the GI average rate of galling in total of 119 samples was determined 6.4 in the greenhouse which is heavily contaminated at the end of the harvest in Sivaslı district. Greenhouse cultivation has recently started in our districts. With the increase in the number of thermal water resources especially in agricultural areas, greenhouse cultivation will become widespread in the future. In order to prevent this nematode problem, which is likely to increase in the following years, measures should be taken already.

Economic losses due to these pests or diseases which are quite difficult and costly to be taken under control are increasing gradually. For this reason, it is inevitable that regional producers turn to landless agriculture like many manufacturers producing vegetables in greenhouses for many years in our country and in the world. The fact that the input costs are much higher in this cultivation method will cause problems in our producers who have limited financial resources and who produce in small areas. Therefore, great importance should be given to the training of farmers in order to take measures to prevent this pest from getting into clean greenhouses.

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