

## Determination of Root-Knot Nematodes, *Meloidogyne* spp. (Tylenchida: Meloidogynidae) in Greenhouse Areas in Simav District of Kütahya Province

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### Abstract

One of the most important factors threatening vegetable production is the plant parasitic nematodes in greenhouses. The determination of the infection rate of root-knot nematode, *Meloidogyne* spp. (Tylenchida: Meloidogynidae) was aimed in existing greenhouse areas of Simav district. A total of 60 greenhouses were examined randomly in surveys carried out in 2015 and 2016. Thus, the rate of vegetables roots infection with nematodes were investigated. A total of 81.7% of greenhouses made grounded agriculture was determined to be infected with root-knot nematodes. Some farmers have been forced to soilless agriculture because greenhouse is infected with especially these nematodes and soil-borne diseases. It was observed that 26.7% of the total greenhouses made soilless agriculture.

**Key words:** Greenhouse, Kütahya, *Meloidogyne*, root knot nematode, Simav

### 1. Introduction

Simav is a district with a thermal source in Kütahya Province in Turkey. In this district, greenhouses have developed due to the presence of heating facilities in the winter using thermal sources. Farmers have turned to agriculture in greenhouses in recent years. In total 567 decares of greenhouse area in Kütahya Province, 425 decares are located in Simav district due to the presence of thermal water sources (Anonymous, 2017). Vegetable cultivation in the greenhouses especially tomato, cucumber and pepper is important source of livelihood for the people of the region. Greenhouses have many factors that cause damage to plants due to the appropriate humidity and temperature. One of the most important of these is root-knot nematode, *Meloidogyne* spp. (Nematoda: Meloidogynidae). Greenhouse conditions is intense, not only for plants also offers optimum environmental possibilities for root-knot nematodes. It is known that there are more than 90 root-knot nematode species in the world (Karssen & Moens, 2006; Palomares Rius et al., 2007). *Meloidogyne arenaria* (Neal) Chitwood, *Meloidogyne incognita* (Kofoid & White) Chitwood and *Meloidogyne javanica* (Treub) Chitwood are reported to be the most common and economic importance in my country (Kaşkavalcı & Öncüer, 1999; Söğüt & Elekcioglu, 2000; Özarslandan & Elekcioglu, 2010).

Root-knot nematodes known to cause significant yield losses even at low population densities prevent the intake of water and nutrients from the soil by damaging the root system with the gal formations they cause due to their feeding in the roots. Furthermore, it is reported that the damage of many other soil-borne diseases such as *Fusarium* wilt in soil contaminated with nematodes has increased (Wang and Roberts 2006).

Root-knot nematodes are polyphag. 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). These nematodes are more harmful in tropical and subtropical areas. These nematodes spend the winter in the swelling of the plant roots and in the soil as eggs or larvae. 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 cause the characteristic root galling. As a result of this problem in the root system, typical above-ground symptoms such as stunting, wilting and yellowing, and consequently yield reductions occur. It has been reported that the yield loss caused by root-knot nematodes in vegetables is between 50.0-80.0% (Siddiqi,1986; Çıkman, 2013).

The aim of this study is to determine the root-knot nematode infection rate in the greenhouse areas in Simav district of Kütahya Province. In addition, due to the nematode and soil-borne disease problems in greenhouses, the rate of turning to soilless agriculture in greenhouses in this region is determined.

## 2. Material and Method

The study was carried out in the greenhouse areas of Simav district of Kütahya Province in 2015 and 2016. In the months of June and September, the rates of infected plant with *Meloidogyne* sp. (Figure 1) in the harvest period were investigated. Nematode damage was observed for this purpose in plant roots in 60 greenhouses. Among them, no samples were taken from 16 greenhouses which made agriculture without soils because of the high concentration of nematodes and they were accepted as positive.



**Figure 1.** Infected plant with *Meloidogyne* sp. (original)

In each greenhouse examined, a different number of samples were taken from the roots of the plants, depending on the size of the greenhouse. They were taken randomly from greenhouses containing healthy-looking plants. After the samples were labeled, they were put in polyethylene bags. The samples were brought to Uşak University Research Laboratory in an ice box. Then 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 were firstly cut into small pieces 1-2 cm in length after being washed gently. They were divided into small pieces by running 3 times for 5 seconds using the blender. Then, 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 prepared and the rest were stored in TAF (Triethanolamin + 40% Formalin + Distilled water). Nematode preparations were prepared by using these females and diagnosed by the author at the genus level.

## 3. Results and Discussion

In this study carried out in Simav district of Kütahya, it was determined that 81.7% of the total 60 greenhouses selected randomly was found to be infected with root-knot nematodes. It was given in Table 1. As seen here, infection rate with nematode was found to be high.

**Table 1.** Total number of greenhouses, numbers and infection rate (%) of greenhouses and host plants in the district

District	Total number of greenhouses	The number of infected greenhouses	The infection rate (%)	Host plant
Simav	60	47	81.7	Tomato and cucumber

In this study, 26.7% of the examined greenhouses were observed to be doing soilless farming. It was given in Table 2. During my interviews with the farmers, I was told that they had to move to soilless agriculture because of nematodes.

**Table 2.** The total number of greenhouses, the soilless greenhouses number, the rate (%) of soilless agriculture and host plants in district

District	Total number of greenhouses	The number of soilless greenhouses	The rate (%) of soilless agriculture	Host plant
Simav	60	16	26.7	Tomato and cucumber

When It was examined the researches about root-knot nematodes in my country, it is observed that there is a high rate of infection with nematode especially in greenhouses. In a study conducted by Mennan *et al.* (2009) in Samsun Province, they stated 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 and also in Central Anatolia Region, Karaman, Eskişehir and Ankara Province have been reported to be infected with root-knot nematodes and infection rate in plants is between 10.0-94.0% (Gürdemir and Ağdacı, 1975; Enneli, 1980; Çıkman, 2013). Due to the presence of thermal water resource areas in Simav district, in addition to tourism, greenhouse cultivation will increase in the future and will continue to be an important source of income for the people of the region.

The economic losses caused by these nematodes and diseases of soil origin, which are very difficult and costly to control, are increasing day by day. In this district, soil-borne fungal diseases in greenhouses that are heavily infected with nematodes are also a major problem and increase the cost of production. For this reason, farmers in this region had to turn to soilless agriculture of vegetable (Figure 2) like many farmers who have grown vegetables in greenhouses in the world and in my country.



Figure 2. Soilless agriculture of vegetable

Looking at the opinions of the local farmers, the number of those who had to do soilless farming is increasing every year. The fact that the input costs are much higher in this cultivation method is a problem for our producers who have limited financial resources and who are farming in small areas. It was observed that some farmers in this district completely gave up agriculture and their greenhouses are empty. For this reason, it is important to educate and financially support the farmers in order to take measures to prevent transmission of these nematodes to clean greenhouses. It is thought that measures should be taken from now in order to avoid further problems with nematodes in the following years.

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