Mycopath (2015) 13(1): 33-36 **Research Article**

Effect of inoculum density of root-knot nematode *Meloidogyne incognita* on damage potential in eggplant

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Abstract

Many crops including eggplant (*Solanum melongena* L.) are attacked by root-knot nematode [*Meloidogyne incognita* (Kofoid and White) Chitwood] resulting in heavy yield losses. Losses caused by nematodes are influenced by inoculum levels. In the present study, the effect of three inoculum levels of *M. incognita* [500, 1000 and 2000 second stage juveniles (J2s) per kilogram of soil] was tested against eggplant cv. Pusa purple long. All the inoculum levels affected differently various growth parameters of eggplant. Minimum reduction in growth parameters was recorded at a level of 500 J2s while maximum reduction was obtained at an inoculum level of 2000 J2s. Reduction in different growth parameters viz. root length, shoot length, shoot weight and increase in root weight and number of galls at three inoculum levels was found to be directly proportional to the latter. On the other hand, reproductive factor was found inversely proportional to inoculum levels.

Keywords: Eggplant, inoculum density, *Meloidogyne incognita*, reproductive factor.

Introduction

Eggplant (*Solanum melongena* L.) is one of the most important solanaceous crops and grows best in warm climate. It has both nutritive and medicinal value. Hundred grams of edible part of eggplant contains carbohydrates 2.2 g, protein 1.8 g, fat 2.2 g, vitamin 520 mg, iron 0.9 mg, calcium 28 mg, water 92.4 mL, ash 1.3 g and carotene 850 mg (Meah, 2003). It holds 18th position in world ranking (FAO, 2009). The production and economy of crops is affected in a variety of ways by plant parasitic nematodes particularly in terms of quality and quantity. Various types of pests are responsible for low yield. The vegetables are attacked by many pests including root-knot nematodes especially *M. incognita*. *M. incognita* stands out the dominant group of plant parasites. More than 300 plant species are attacked by *M. incognita* resulting in severe damage and losses (Anwar *et al.*, 2009; Hussain *et al.*, 2012; 2014; Kayani *et al.*, 2013; Mukhtar *et al.*, 2013a,b,c). Instead of various control strategies (Hussain *et al.*, 2011a; Kayani *et al.*, 2012; Mukhtar *et al.*, 2013d; 2014), the nematode continues to damage eggplant at higher inoculum levels. Different symptoms are produced by root-knot nematodes like formation of root galls, stunted growth, and increased wilting with reduced uptake of water and nutrients and ultimately low yield from infected plants.

Root-knot nematodes survive well in appropriate hosts. Nematode populations increase to the maximum level in susceptible plants (Shurtleff and Averre, 2000) resulting in death before maturity (Singh and Khurma, 2007). Damage caused by the nematodes can be determined by measuring reductions in growth and yields of annual crops. In the present study the effect of three inoculum levels of *M. incognita* was assessed on different growth parameters of eggplant and the rate of multiplication of the nematode on the host.

Materials and Methods

The experiment was carried out in Plant Pathology Lab and greenhouse of Regional Agricultural Research Institute, Bahawalpur, Pakistan. The effect of different inoculum applications of *M. incognita* was assessed on eggplant cv. Pusa purple long. The seeds of eggplant were sown in pots containing formalin sterilized soil. The pots were arranged in a completely randomized design in the greenhouse at 25±2 °C. The pots were watered when required. Ten days after emergence, the pots were inoculated with *M. incognita* freshly hatched second stage juveniles at 500, 1000, and 2000 per kilogram of soil by drenching around the stem. The untreated plants were used as control. Each treatment was replicated five times. Six week after inoculation, plants were removed from pots and the data were recorded regarding root and shoot weight and length, number of galls and reproductive factor. Percentage reduction or increase in growth parameters over controls were calculated (Iqbal *et al*., 2014). The linear relationships between inoculum densities as independent variable (x) and growth parameters and nematode infestations as dependent variables (y) were calculated in Microsoft Excel 2003 to draw a "best-fit" straight line. Regression equations, trend lines and correlation coefficient (R^2) were also calculated in Microsoft Excel 2003. The closer R^2 is to 1.00, the better the fit.

Results and Discussion

All the inoculum levels of *M. incognita* caused significant reductions in growth parameters over their controls. Maximum reduction in root and shoot lengths and shoot weight were recorded at an inoculum level of 2000 J2s followed by 1000 and 500 J2s. Mean reductions in these parameters were 13, 9 and 11% at 1000 and 24, 25 and 29% at 2000 J2s, respectively. Minimum reductions of 9, 3 and 4% were recorded at a level of 500 J2s, respectively. Reductions in these parameters increased with an increase in inoculum level. These relationships have been shown by trend lines and equations as shown in Fig. 1A, B, and D.

Maximum increase of 17% in root weight was observed at an inoculum level of 2000 J2s, while minimum increase was noticed in pots where 500 J2s were applied. Increase in root weight was found to be directly proportional to inoculum levels and relationship has been shown by trend line and equation in Fig. 1C.

Similarly, significant increase in number of galls was observed at all inoculum levels. Maximum galls were produced at a level of 2000 J2s followed by 1000; while the galls were minimum in plants inoculated with 500 J2s. Direct relationship was observed between inoculum levels and number of galls as represented by regression equation in Fig. 1E.

All the inoculum levels varied significantly regarding reproductive factor (Rf). Maximum Rf (13-fold) was found at the lowest inoculum level and minimum (10-fold) at the highest inoculum level. An inverse relationship was found between levels and Rf (Fig. 1F).

Progressive destruction in plant growth confirms the damage potential of *M. incognita* on eggplant. Different studies were carried out by different workers to check the effect of various inoculum densities of different *Meloidogyne* species on various hosts (El-Sherif *et al.,* 2007; Neog and Bora, 2007; Jiskani *et al.,* 2008; Hussain *et al*., 2011b; Irshad *et al*., 2012). It was observed in the findings of these workers that reduced crop yield, physiological responses and other manifestations of pathogenic effects are directly proportional to increase in population of nematodes while concentration of potassium, iron, copper, sodium and zinc are directly related to initial density of nematodes in soil (Wallace, 1973; Haseeb *et al.,* 1990).

It was observed during the study that the younger plants were more vulnerable to *M. incognita* as compared to older ones. This was because of succulence of tissues and tenderness of younger plants making them more attractive and highly susceptible to nematodes while older plants with stronger and harder tissues were non-vulnerable. It was also observed during the study that increased levels of inoculum resulted in progressive increase in number of gall formation as well as an increase in nematode populations and ultimately the host infestation by *M. incognita*. On the other hand, multiplication of nematodes was found inversely proportional to increase in inoculum densities (Fig. 1A-F).

Destruction of root system by plant parasitic nematodes led to competition for nutrition and food among emerging nematodes within root system (Ogunfowora, 1977). High rate of multiplication of nematodes with low level of inocula might be due to encouraging factors like plenty of food, reduced competition level and the ability of hosts to support these populations (Haynes and Jones, 1976; Bendezu and Starr, 2003). Salares and Capasin (1988) found that percent yield reduction of ampalaya (*Momordica charania*) was higher on 2-4 and 6-week old plants when inoculated with different inoculum densities of *M. incognita* as compared to 8-week old plants. Initial densities of *M. incognita* affected the rate of nematode multiplication; higher rates were observed where initial densities were lower. This might be due to destruction of root system. As *M. incognita* is pathogenic and damaging at higher densities, the larvae of subsequent generations fail to locate new infectious sites (Ogunfowora, 1977).

According to Oostenbrink (1966), initial density of nematodes is responsible for subsequent reduction in yield of crops and increase in nematode populations. In the present studies final nematode populations and gall formations proportionally affected plant growth variables which corroborated the findings of Oostenbrink (1966). Nematode multiplication and progressive decrease in plant growth with increased inocula of *M. incognita* on different crops have also been reported by Khan *et al.* (2006). From the present study, it is concluded that *M. incognita* is pathogenic to eggplant at higher inoculum levels (2000 J2s kg^{-1}) and warrant suitable control strategies to minimize crop losses and subsequent nematode populations.

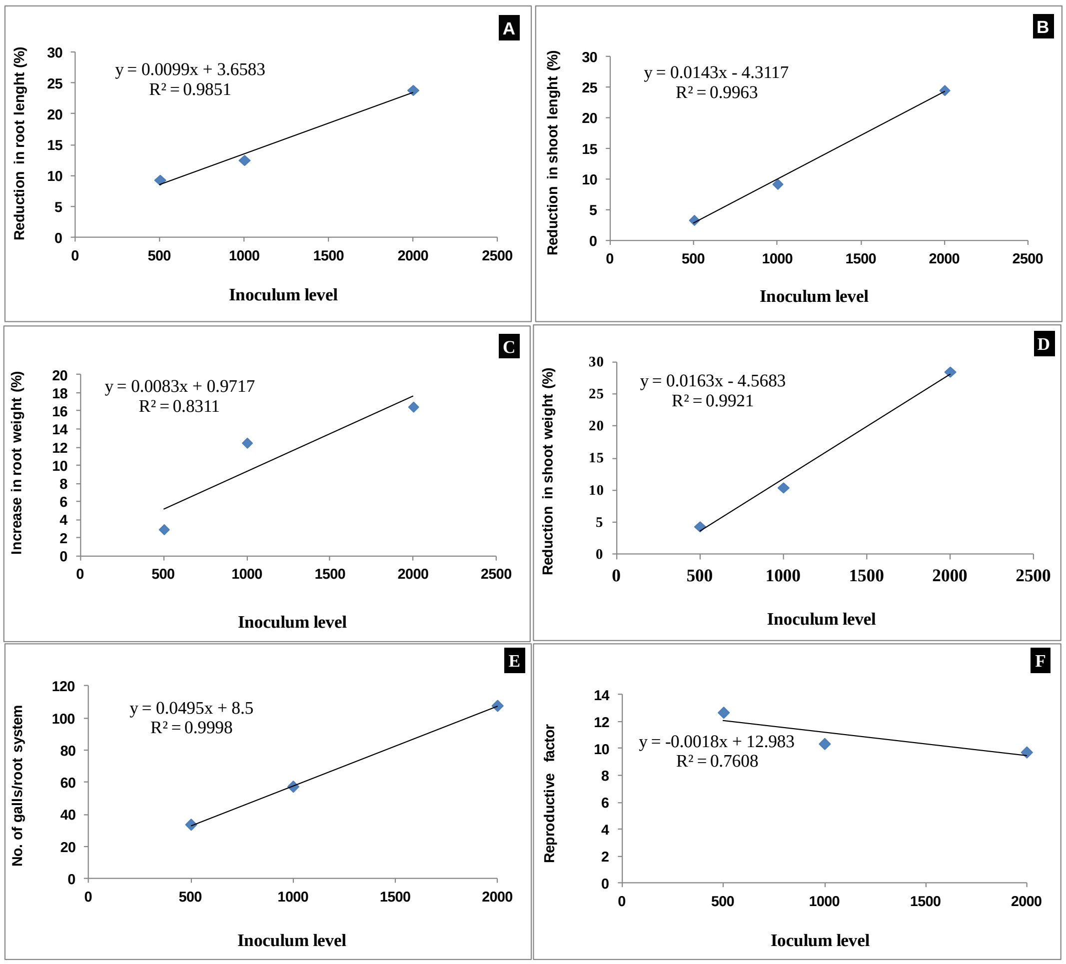

Fig. 1 (A-F): Effect of inoculum level on various plant growth parameters, number of galls and reproductive factor.

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