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Research article

Management of citrus nematode (*Tylenchulus semipenetrans*) by certain plant species

Aida M. El-Zawahry*, A. M. A. Mahran and M. A. Sallam

Department of Plant Pathology, Faculty of Agriculture, Assiut University, 71526 Assiut, Egypt

Abstract

The effect of five plant species (*Tagetes erecta* L., *Datura stramonium* L., *Nerium oleander* L., *Ipomea palmata* L. and *Santolina chamaecyparissus* L.) on severity of *Tylenchulus semipenetrans* on citrus rootstocks (*Citrus sinensis, C. reticulate* grafted on *C. aurantium* and *C. sinensis* grafted on *C. aurantium*) was investigated in greenhouse and laboratory conditions. All plant species reduced the larval population of *T. semipenetrans* and their effect increase as the period increase. *I. palmata* gave the highest percentage of reduction when intercropped with *C.sinensis* and *C. reticulate* grafted on *C. aurantium* 20.5 and 25% respectively. *N. oleander* and *D. stramonium* came next when intercropped with *C. reticulate* grafted on *C. aurantium* 13.5 and 11% respectively, While *D. stramonium* gave the highest percentage of reduction when intercropped with *C. sinensis*grafted on *C. aurantium*. and *T. erecta* gave the lowest percentage of reduction when intercropped with the three rootstocks. Root extracts of *D. stramonium* gave the highest effect on juvenile mobility of citrus nematode at 5% dilution after 48 hrs with only 50% mobility followed by 55%, 64%, 71.7% and 73.3% for *T. erecta, S. chamaecyparissus, N. oleander* and *I. palmata* respectively. Leaf extracts of *D. stramonium* at 5% concentration, for 48h exposure showed the highest toxicity for nematode larvae mobility 45.3% followed by 51.3%, 55.3%, 60 and 67% for *T. erecta, S. chamaecyparissus*, *N. oleander* and *I. palmata* respectively.

Key words: Biological control, Root extracts, *Tylenchulus semipenetrans*, citrus

* **Corresponding author. E-mail:** aaelzawahry@yahoo.com

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Introduction

Citrus nematode *Tylenchulus semipenetrans* Cobb (1913) is one of the most important root nematodes of plant trees, it has been found in every citrus growing region of the world Milne (1977) and Duncan (2005). It is causing immense damage and serious disease known as slow decline to citrus trees. Affected trees exhibit reduced vigor, chlorosis, leaf fall, die back and reduced production and quality of fruit Cohn (1969). Eighty species and varieties of the genus citrus were found to be susceptible to citrus nematode Baines et al. (1948). Taking into account of the worldwide distribution of citrus nematode, it is necessary to find out the most effective and feasible control measure. The use of chemicals for nematode control on large scale is an expensive and impracticable operation. This situation demands the search for cheaper alternative control measure which can be made available to small growers. There are reports that certain plant parts and extracts possess nematicidal properties Nadal and Bhatti (1983), Awan et al. (1992), Sharma and Trivedi (1992). Application of the plant parts or extracts to nematode infested soil affects nematode directly and stimulates soil microbes that reduce nematode populations Nandal and Bhatti (1986), Reddy et al. (1996), Ahmad et al. (2004). In this context, the use of plant extracts with nematicides property is effective, cheaper, healthier and safer control measure than nematicides.

In Egypt, citrus nematodes are widely spread in citrus orchards, is an important and destructive pest of citrus trees, causing symptoms of dieback, less efficiency roots, less vegetative growth, yellow leaves and reducing yields Oteifa and Shaarawi (1964), Otifa and Tarjan (1965). Later it has been investigated by several workers Ahmed (1974), Abou-EL-Naga et al. (1984), Abd-EL-Gawad et al. (1994), Amen and Hassabo (1995), EL-Nagdi et al. (2010), Bakr et al. (2011), Montasser et al. (2012). Therefore this work was designed to study the effect of some plant species on citrus nematode disease severity under greenhouse and laboratory conditions and nematode population.

Materials and methods

Laboratory Experiment: Aqueous leaf and root extracts of the tested five plant species were prepared by grinding 50 grams of plant leaves or roots with 50 ml distilled water using a warring blender. Dilution of 1 and 5% were prepared from each standard. Five milliliters of solution and 100 second stage juveniles of *T. semipenetrans* placed in 5- cm Petri dishes. Water was served as a control, and each treatment replicated 5 times. Separate sets of Petri dishes were maintained for each period of observation (12, 24 and 48 hrs.). Percentage of mobility was assessed and confirmed by touching the juvenile with fine needle.

Greenhouse Experiment: Three nematode free seedlings of citrus rootstocks (*Citrus sinensis*, *C. reticulate* grafted on *C. aurantium* and *C. sinensis* grafted on *C. aurantium*) were grown in

60 cm clay pots filled with sterilized sandy loam soil. Inoculation of *T. semipenetrans* was taken from the stock culture and was added around the system of each seedling (2 Kg soil to each seedling). Five plant species (*Tagetes erecta* L., *Datura stramonium* L., *Nerium oleander* L., *Ipomea palmata* L. and *Santolina chamaecyparissus* L.) were used to study their effect on population density of citrus nematode. They were obtained from the Department of Horticulture, Faculty of Agriculture, Assiut University. After 45 days from nematode inoculation, three seedlings (four weeks old) of each plant species were planted in each pot around the citrus seedling. Each treatment was replicated three times. Pots were arranged in a completely randomized block design in the greenhouse. The experiment was maintained in the greenhouse for 60 days and soil sampling was taken. Soil samples were kept in polyethylene bags to prevent water drying and sent directly to the laboratory for nematode extraction and counting. Population density of second stage larvae /250g soil were estimated as previously mentioned.

Results and Discussion

Laboratory experiment: Data presented in Fig. (1, 2) revealed that, juvenile mobility decreased as the concentration of root and leaf extracts and exposure period were increased. Root extracts of *D. stramonium* gave the highest effect on juvenile mobility of citrus nematode at 5% dilution after 48h with only 50% mobility followed by 55%, 64%, 71.7% and 73.3% for *T. erecta, S. chamaecyparissus, N.oleander* and *I. palmata*, respectively. The effect of leaf extracts of plant species on the mobility of citrus nematode larvae showed that the highest toxicity with 45.3% mobility at the 5% concentration, 48h in the extract of *D. stramonium*, followed by 51.3%, 55.3%, 60 and 67% for *T. erecta, S. chamaecyparissus, N. oleander* and *I. palmata*, respectively.

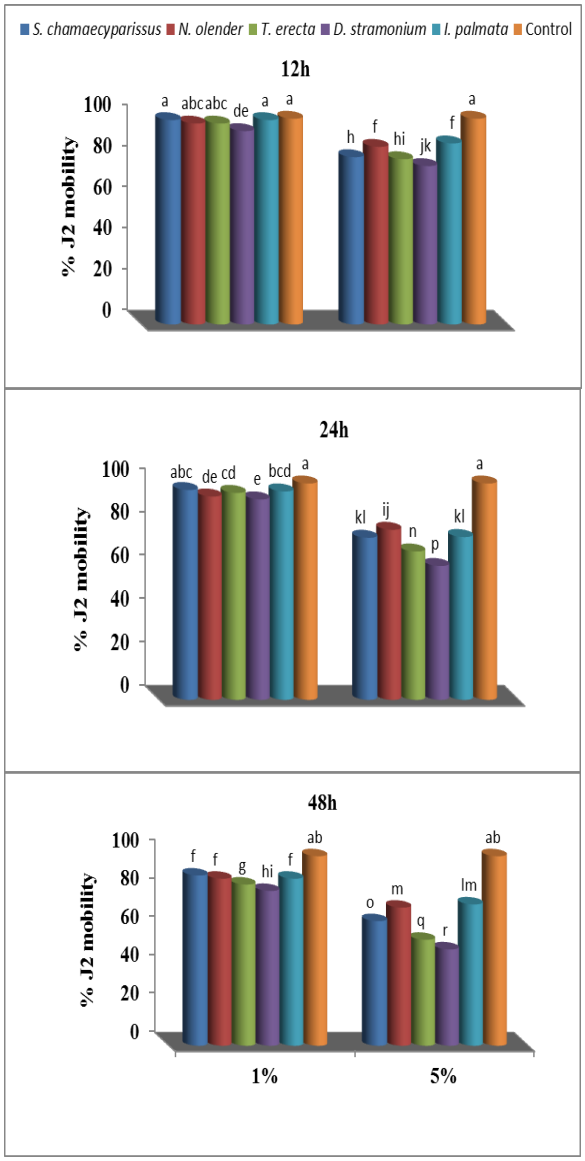

Fig.1. Effect of root extracts of some plant species on juvenile mobility of *T. semipenetrans* under laboratory conditions.

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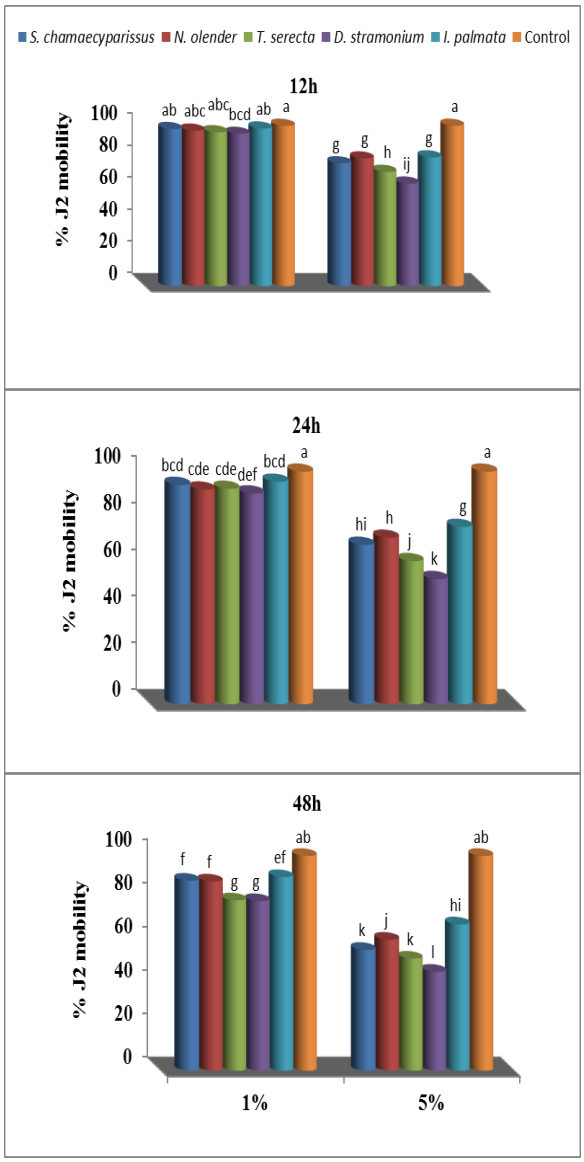

Fig.2. Effect of Leaf extracts of some plant species on juvenile mobility of *T. semipenetrans* under laboratory conditions.

Greenhouse Experiment: Data presented in Fig. 3 revealed that all the plant species reduced the larval population of *T. semipenetrans*. *I. plamata* gave the highest percentage of reduction when intercropped with *C. sinensis* and *C. reticulate* grafted on *C. aurantium* 20.5 and 25%, respectively. *N. oleander* and *D. stramonium* come next when intercropped with *C. reticulate* grafted on *C. aurantium* 13.5 and 11%, respectively. While *D. stramonium* gave the highest percentage of reduction when intercropped with *C. sinensis* grafted on *C. aurantium*. And *T. erecta* gave the lowest percentage of reduction when intercropped with the three rootstocks 2.5, 3.0, 6.0, respectively. Such results are in agreement with those reported by Kumari et al. (1986), Mani et al. (1986), Mani (1988), Verma et al. (1989), Awan et al. (1992), EL- Zawahry (1994 and 1998), Amen and Hasabo (1995), Vats et al. (1996), Ahmad et al. (2004), Ayazpour et al. (2010), Faheem et al. (2010), Meira et al. (2010), Mousa et al. (2011), Tibugari et al. (2012). The inhibition of *T. semipenetrans* population in this investigation may be due to the accumulation of toxic by products of decomposition and/or to increase phenolic contents which result in host resistance. Alam (1991), Sivapalan (1972) mentioned that, the nematicidal compound in marigold have been identified as α-terthienyl and its analogues, which kill nematodes that enter the root.

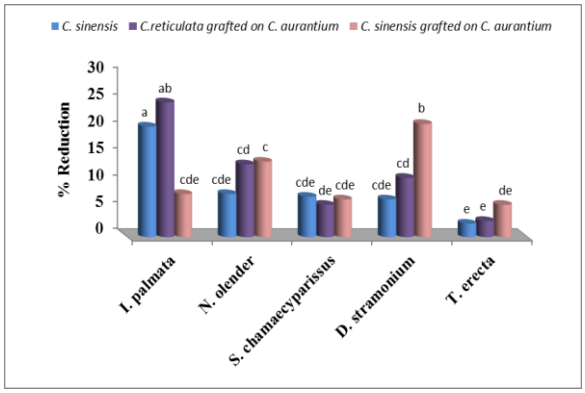

Fig 3. Effect of some plant species on severity of *T. semipenetrans* infecting three citrus rootstocks under greenhouse conditions.

These results indicate that the nematicidal plants can prove helpful in the control of plant parasitic nematodes. Application and use the intercultural plants and plant extracts will be easy and economical as compared to chemical treatment. The ability of plant extracts to inhibit and control the plant disease is due some natural compounds such as sterols, saponins, tannis, alkaloids and flavonoids Mousa et al. (2011). Thus, it can be concluded that plant extracts could be considered as a bio-control agent that could decrease the nematode population densities below the threshold level. Moreover, they seem also to be safer and relatively low cost method for nematode management.

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