

Short Communication

Tomato spotted wilt virus in vegetable growing areas in the west mediterranean region of Turkey

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This study was carried out to determine the presence of Tomato Spotted Wilt Virus (TSWV) in vegetable growing areas, during growing seasons of 2006 and 2007 in the West Mediterranean Region of Turkey. Survey studies were conducted in vegetable areas and tomato, pepper, potato, lettuce, squash and cucumber leaves, showing typical TSWV symptoms, were collected. Totally 337 samples from 12 locations were collected and tested by DAS-ELISA using TSWV specific polyclonal antibody. According to the results of ELISA tests, 157 samples were found to be infected by TSWV. Incidence of TSWV in samples was 46.58%. Among the samples, TSWV infection rates of pepper, lettuce, tomatoes and squash were 67.16, 66.66, 46.94 and 16.66%, respectively. During the two years it was observed that thrips were predominantly present in vegetable growing areas and they also were collected from the locations. Thrips were identified as *Frankliniella occidentalis* Pergande. Inoculation with extracts from TSWV-positive plants produced systemic mosaic and leaf deformation on *Catharanthus roseus*, severe stunting and death on *Pelargonium zonale*, vein yellowing, mosaic, necrotic local lesions and leaf deformation on *Nicotiana glutinosa* and *Nicotiana tabacum* White Burley. As a result, presence of TSWV were found on vegetable growing areas in the West Mediterranean Region of Turkey.

Key words: Vegetable, tomato spotted wilt virus, DAS-ELISA.

INTRODUCTION

Turkey produces approximately 20 million tonnes of vegetables annually on 800 000 ha land, and is an important country for vegetable production. With about 8.5 million tonnes annual production, tomato (*Lycopersicon esculentum* Miller) is the most the important vegetable crop in Turkey. Climatic conditions and soil structure of West Mediterranean region of Turkey are well sufficient for vegetable production and one of the important region for production (Anonymous, 2001).

Diseases are the main problems in vegetable growing areas and the production of crops is limited because of viral diseases. Among viral diseases Tomato Spotted Virus is one of the most widespread and economically important plant viruses (Golbach and Peters, 1994). Virus infects at least 900 plant species, with the number of recorded natural host species, steadily increasing (Peters,

1998). The virus is probably distributed worldwide and is now one of the 10 most economically destructive plant viruses with worldwide losses exceeding one billion dollars annually (Adkins, 2000). TSWV is one of the most important plant viruses infecting some hundreds of plant species among which are many vegetables and ornamentals (Mason et al., 2003). TSWV limitation of the production of tomato was first described in 1915 in Australia (Adkins, 2000).

Afterwards the presence of the virus was reported from several other vegetable areas of the world. The principal vegetable host crops for TSWV are tomatoes, peppers, lettuces, celery, eggplant, faba beans, potatoes and artichokes (Sikora, 2004). Infection rates of 50-90% lead to major losses in commercial vegetable crops (Adkins, 2000).

Of the TSWV insect vectors cited, the most important vector is *Frankliniella occidentalis* Pergande (The Western Flower Thrips) which transmits TSWV in a persistent propagative fashion (Mound, 1996; Gera et al., 2000). TSWV is not reported to be true seed transmitted. Virus

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is transmitted by vectors in a propagative manner; only larval stages can acquire the virus and then it replicates in the adult insects and sometimes also 2nd instar larvae can transmit virus (Mason et al., 2003).

The almost global spread of TSWV epidemics can be related to the world-wide dispersal of the *F. occidentalis*, its most efficient vector. Control of these thrips is very difficult because of its reproduction rate, localisation in flowers, the underground pupal stages and its capacity to develop resistance to insecticides rapidly (Mason et al., 2003).

Symptoms vary with the host plant, time of year and environmental conditions and include stunting, necrosis, chlorosis, bronzing, ring spot and line patterns affecting leaves, stems and fruits (Adkins, 2000). In addition, plant appear wilted, tips dieback and dark streaking of terminal stems, raised bumps on fruit, reduced fruit quality and yield are frequently present on infected plants.

TSWV is an economically important virus in Turkey, causing damage on tomato and pepper plants. TSWV has previously been detected in Şanlıurfa, Mersin, Samsun and Çanakkale regions of Turkey (Güldür et al., 1995; Güldür, 1997; Turhan and Korkmaz, 2006; Arli-Sokmen and Şevik, 2006). Even though the West Mediterranean region is an important vegetable production area, viral diseases of vegetables in this region are largely unknown, because of a lack of attention to viral diseases and the absence of any virus diagnosis and screening programme in the region. A virus detection programme is initiated to determine the common viral diseases in vegetable growing areas of the region. In this research, occurrence, incidence and detection of TSWV in vegetable fields in the West Mediterranean region, in 2006-2007 growing seasons were studied, by using biological indexing and DAS-ELISA. This is the first record of TSWV and its vector *F. occidentalis* from the West Mediterranean region in Turkey.

MATERIALS AND METHODS

The survey was conducted in the region during May-September in 2006-2007 years. A total of 337 vegetable samples showing TSWV-like symptoms were collected from 12 locations. Suspected vegetable leaves and fruit samples were collected and photographed in the fields and greenhouses. Thrips on these samples were also collected and maintained for further transmission studies. Samples were tested for TSWV by DAS-ELISA using a commercial kit supplied from Agdia (Reagent set kit, Elkhart, United States) using the previously reported DAS-ELISA method (Clark and Adams, 1977). Absorbance values were measured at 405 nm with a microplate reader (EL X 800 Universal Microplate Reader, Bio-Tek Instruments, Inc. B-2610 Wilrijk, Belgium). Samples with DAS-ELISA values at least twice those of the healthy control were considered as positive (Stellmach, 1985). DAS-ELISA positive sample which is obtained from tomato field in Eğirdir was used as the inoculum source. The extract were inoculated to young, tender leaves of indicator plants. *Catharanthus roseus*, *Pelargonium zonale* and *Nicotiana glutinosa*, *N. tabacum Xanthii*, *N. rustica* and *N. tabacum* White Burley were used as indicator plants. After inoculation, plants were kept in greenhouse below 20°C.

RESULTS AND DISCUSSION

During growing seasons of 2006-2007, TSWV-like symptoms were collected from 12 locations. As a result of survey studies, 213 tomatoes, 67 pepper, 18 potatoes, 15 lettuce, 12 squash and 12 cucumber leaves showing typical TSWV symptoms were collected. Severe stunting, wilting and death, necrosis, ringspot on leaves and raising bumps and deformations on fruits were observed. All samples were tested for TSWV by DAS-ELISA. Totally 157 samples were found to be infected by TSWV. Incidence of TSWV in samples were 46.58%. During two years, thrips were observed predominantly present in vegetable growing areas and the occurrence of TSWV in vegetable plants are likely to be related to the abundance of the thrips in this region.

Among the samples, 67.16% of peppers, 66.66% of lettuce plants, 46.94% of tomatoes and 16.66% of squash plants were found to be infected with TSWV, while 12 cucumber and 18 potato samples were not infected with TSWV. Systemic mosaic and leaf deformation on *C. roseus*, severity stunting and death on *P. zonale*, vein yellowing, mosaic, necrotic local lesions and leaf deformation on *N. glutinosa* and *N. tabacum* White Burley were observed 10-12 days after the inoculations with the extracts from TSWV-positive tomato leaves (Eğirdir isolate). These symptoms were similar to those that were described previously for this virus (German et al., 1992; Mumford et al., 1996; Adkins, 2000; Sikora, 2004).

Thrips collected from these areas were identified as *F. occidentalis* Pergande (Golbach and Peters, 1994; Mound, 1996; Webb et al., 1998). TSWV has previously been detected in other regions of the country, however this is the first time that it was determined on tomato, pepper, lettuce and squash growing areas in the West Mediterranean region, the most important vegetable-growing region in Turkey.

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REFERENCES

- Adkins S (2000). Tomato spotted wilt virus-positive steps towards negative success. *Mol. Plant Pathol.* 1(3): 151-157.
- Anonymous (2001). Agricultural structure, production, price and value. Government Statistic Institute: Ankara, Turkey.
- Arli-Sokmen M, Sevik M (2006). Viruses infecting field-grown tomatoes in Samsun province, Turkey, *Arch. Phytopat. Plant Protection*, 39(4): 283-288.
- Clark MF, Adams AN (1977). Characteristics of the microplate method of enzyme linked immunosorbent assay for the deduction plant viruses. *J. Gen. Virol.* 34: 475-483.
- Gera A, Kritzman J, Cohen J, Raccach B, Antignus Y (2000). Tospoviruses infecting vegetable crops in Israel. *EPPO Bull.* 30: 289-292.

- German TL, Ullman DE, Moyer JW (1992). Tospoviruses: diagnosis, molecular biology, phylogeny and vector relationships. *Ann. Rev. Phytopathol.* 30: 315-348.
- Golbach R, Peters D (1994). Possible causes of the emergence of tospovirus diseases. *Sem. Virol.* 5: 113-120.
- Güldür ME, Marchoux G, Yurtmen M, Yılmaz MA (1995). A new virus destructive on tomatoes growing in Mersin and its provinces: Tomato spotted wilt virus. 7th Congress of the Phytopathology, Adana, Turkey, pp. 303-305.
- Güldür ME (1997). A New Virus in Şanlıurfa: Tomato spotted wilt virus. Harran University, J. Agric. Faculty, 1(3): 71-76.
- Mason G, Roggero P, Tavella L (2003). Detection of tomato spotted wilt virus in its vector *Frankliniella occidentalis* by reverse transcription-polymerase chain reaction. *J. Virol. Meth.* 109(1): 69-73
- Mound L (1996). The Tysanopteran vector species of tospoviruses. *Acta Horticult.* 431: 298-307.
- Mumford RA, Barker I, Wood KR (1996). The Biology of the tospoviruses. *Ann. Appl. Biol.* 128: 159-183.
- Peters D (1998). An updated list of plant species susceptible to tospoviruses. Abstr. Fourth International Symposium on tospovirus and thrips in floral and vegetable crops, Wageningen, pp. 107-110.
- Sikora E (2004). Tomato spotted wilt virus in tomato in pepper. www.aces.edu/timelyinfo/PlantPathology/2004/June/pp569.pdf
- Stellmach G (1985). ELISA testing of grapevine rootings reared from nepovirus-infected mother plants forced to rapid growth. *Phytopathologia Mediterranea*, 24: 123-124.
- Turhan P, Korkmaz S (2006). Determination of tomato spotted wilt virus using serological and biological methods in tomatoes grown in Çanakkale Province. *J. Agric. Sci.* 12(2): 130-136.
- Webb S, Tsai J, Mitchel F (1998). Bionomics of *Frankliniella bispinosa* and its transmission of tomato spotted wilt virus. In: The Fourth International Symposium on Tospovirus and Thrips in Floral and Vegetable Crops, Wageningen, pp. 67-68.